An investigation into the performance of different group communication modes : using soft systems methodology to investigate factors

Author:
Shaw, Gregory John

Publication Date:
2007

DOI:
https://doi.org/10.26190/unsworks/18080

AN INVESTIGATION INTO THE PERFORMANCE OF DIFFERENT GROUP COMMUNICATION MODES: USING SOFT SYSTEMS METHODOLOGY TO INVESTIGATE FACTORS

By

GREGORY JOHN SHAW BBus MSc

A thesis submitted for the degree of
Doctor of Philosophy

School of Information Technology and Electrical Engineering
University College
The University of New South Wales
at the Australian Defence Force Academy, Canberra, Australia

2007

Certificate of Originality

I hereby declare that this submission is my own work and to the best of my knowledge it contains no material previously published or written by another person, or substantial portions of material which have been accepted for the award of any other degree or diploma at UNSW or any other educational institution, except where due acknowledgement is made in the thesis. Any contribution made to the research by others, with whom I have worked at UNSW or elsewhere, is explicitly acknowledged in the thesis. I also declare that the intellectual content of this thesis, except to the extent that assistance from others in the project's design and conception or in style, presentation and linguistic expression is acknowledged.

....
(Gregory John Shaw)
/ / 2007

ABSTRACT

This thesis has two distinct research threads. One thread examines the effectiveness of technology support on the performance of focus groups. Unlike previous research, the work described in this thesis addresses the fundamental issue that groups are social systems, and that comprehensive measurement of the effectiveness of group activities requires assessment of both the task-oriented and social aspects of the group activity. In this research, four different communication modes are used to compare group effectiveness.

The second research thread in this thesis is the use of Systems Thinking, and specifically Soft Systems Methodology (SSM), as the framework for inquiring into the effects of technology support on group effectiveness. The strategy in this thesis for developing and evaluating hypotheses extends the general descriptions and guidance in the literature on using SSM for hypothesis testing.

Systems thinking also provides the basis for examining the prevailing ‘profile deviation’ view that the better the fit between the group task and the technology support the greater the group performance. Using the six perspectives of fit developed by Venkatraman (1989), the most common GSS models and other models developed to examine Task-Technology Fit (TTF) are analysed. The results show that group performance models are most often tested from a ‘profile deviation’ perspective and TTF models developed from a profile deviation perspective claim to have predictive and descriptive validity for assessing the level of group performance.

To assess whether an SSM based approach can improve the predictive and/or descriptive analysis of the impact of technology support on group work, a field experiment was conducted at the Australian Defence Force Academy. Twenty focus groups of officer cadets assessed their military training program using a GSS in one of four communication modes.

The results showed little predictive or descriptive support for the profile deviation perspective of TTF when measuring the group’s overall effectiveness, task effectiveness, participant satisfaction or group relations. The alternative ‘gestalt’ perspective, operationalised in this research by using SSM, provided a more comprehensive approach to examining the effectiveness of technology support for group work.

Acknowledgments

I am indebted to my supervisors, Emeritus Professor Charles Newton and Dr Ed Lewis, for their guidance, advice and patience as I struggled with completing this research while also completing a number of demanding military postings and deployments. They both allowed me to develop and refine my ideas in a supportive environment.

There were also a number of academics that provided me with feedback, encouragement and support. Early discussions with Distinguished Professors Murray Turoff and Roxanne Hiltz helped shape my interest in technology support for group work, as did my discussions with Dr Dennis Hart. Ms Mariam Fergusson collaborated with me to refine my thinking on what might be the characteristics of relevant research. The anonymous academics that refereed the papers developed and presented during the course of this research also contributed to greater rigour and refinement of my ideas.

Finally, but most importantly, I must acknowledge the sacrifices made by my family so that I could complete this research. Over the years, my wife Kate has attended many events without me and has had to endure the stresses that this type of research effort generates. I would not have completed this research without her constant support and encouragement to continue when it all looked too hard. Edward and William also saw less of me than they should have. It is now time to redress the balance.

PREFACE

This thesis deals with the relationship between focus groups undertaking real world activities and the technology support they use to complete their activities, and the effect of this relationship on the task-oriented and social aspects of group performance.

In completing this research, two distinct research threads are pursued. One thread examines the effectiveness of technology support on the performance of focus groups. What separates this research from other research examining the impact of technology support on group performance is the recognition that focus groups are social constructs and that analysis of performance focussed solely on the task performed by the group is not comprehensive enough. A comprehensive assessment must include an assessment of task-oriented outcomes and the social aspects of the group work.

The second research thread in this thesis is the use of Systems Thinking, and specifically Soft Systems Methodology (SSM), as the framework for inquiring into the effects of technology support on group effectiveness. The strategy in this thesis for developing and evaluating hypotheses extends the general descriptions and guidance in the literature on using SSM for hypothesis testing.

Using Soft Systems Methodology as the framework for this investigation, the key research questions addressed in this dissertation are:

- What is the effect of different combinations of technology support on focus group performance, where focus group performance is measured in terms of impact on task-related activities and on the group social system?
- Can Soft Systems Methodology be used as the basis for exploring the relationships between technology support, task and social influence and the effect of these aspects on focus group performance?

In Chapter One, the need for the study of group communication is discussed. The concept of ‘fit’ as a match between technology support and group activities is introduced, and the existing theories and literature on the elements of group performance and measuring group performance are outlined. Finally, the concept of viewing group work as Human Activity System is developed.

Chapter Two details the design and methodology of the research. In this chapter, the use of Soft Systems Methodology for hypothesis testing is introduced, as is the organisation from which the focus groups were drawn (the Australian Defence Force Academy), and the learning expectations from conducting this research.

Chapter Three documents the theoretical development of SSM as the basis for 'soft' hypothesis testing. Extensions and enhancements to the comparison and monitoring and control stages are developed and documented, and an original model for 'soft' hypothesis testing is defined.

In Chapter Four, the theories and current research about group performance and the concept of the fit between technology support and group activities is reviewed. Using six different perspectives of fit, the current models for assessing the effect of technology support on group performance are evaluated. Chapter Five uses the same six perspectives to examine the current models and research on the technological and social approaches task-technology fit.

Chapter Six is the review of the focus group literature, examining the potential and actual use of technology support. The advantages and disadvantages are outlined, and the case made that the body of knowledge is currently too limited to draw definitive conclusions, and there is an opportunity to complete investigation in this area.

Chapter Seven takes the general model for using SSM for hypothesis testing developed in Chapter Three, and applies it to the area of interest in this dissertation – technology support for ADFA focus groups. A model is developed that can be used to structure hypothesis testing for the ADFA focus groups undertaking an evaluation of their Army, Navy or Air Force training.

In Chapter Eight, the SSM framework developed in Chapter Seven is used to conduct a field experiment at ADFA. The findings are analysed and consolidated, and the results of the predictive and descriptive validity of one perspective of the fit between the focus group activities and the technology support are presented. A new model, extending the traditional task-technology fit model to include social influences is suggested as being more comprehensive.

Chapter Nine summarises the findings of the research study, discusses the practical implications of this research, and makes recommendations for further research. The results of this study suggests an alternative approach to assessing the impact of technology support on group performance using systems thinking, SSM as the methodology, and viewing groups as Human Activity Systems provides a more comprehensive examination of the relationship between technology support and the activities undertaken by focus groups and the impact of this fit on group performance.

Contribution to Knowledge

This dissertation contributes to knowledge in two areas:

- A contribution to the body of work on the use of Soft Systems Methodology by extending its use in hypothesis testing.
- A contribution to the body of work on the effects of technology support on group work by extending the understanding of the effects of four different communication modes on the effectiveness of focus groups.
- Identification and description of a third element (Social Influence) that has the potential to increase both the predictive and descriptive validity of the TTF construct.

Referred Papers

During the development of this thesis, a number of refereed papers were developed and presented. The reviewers' comments, and the discussion with fellow researchers that these papers generated, were invaluable in the formulation and refinement of the ideas presented in this thesis. The refereed publications were:

Fergusson, M., and Shaw, G.J. "Information Systems Research: A Question of Relevance," Proceedings of the 7th Australasian Conference on Information Systems, University of Tasmania, Hobart, 1996, pp. 219-229.

Shaw, G.J. "Are GSS Users Really Satisfied? A Preliminary Meta-analysis of the Experimental Research," Proceedings of the 8th Australasian Conference on Information Systems, University of South Australia, University of South Australia, Adelaide, Australia, 1997, pp. 366-377.

Shaw, G.J. "User Satisfaction in Group Support Systems Research: A Meta-Analysis of Experimental Results," Proceedings of the Thirty-First Annual Hawaii International Conference on Systems Sciences, IEEE Computer Society Press, Hawaii, 1998, pp. 360-369.

Shaw, G.J., and Fergusson, M. "Literature Reviews in IS Research: A Guide for Students," Proceedings of the 9th Australasian Conference on Information Systems, University of New South Wales, UNSW, Sydney, Australia, 1998, pp. 594-605.

Shaw, G.J. "Assessing the effectiveness of Group Support Systems using a Soft Systems Methodology approach," Group Decision and Negotiation Conference, Perth, Australia, 2002a.

Shaw, G.J. "Technology supported Focus Groups: Using Group Support Systems for Evaluating a Military Training Program," Group Decision and Negotiation Conference, Perth, Australia, 2002b.

Final Note on Completion Time

One question likely to arise when reading this thesis is the length of time from the initial field experiment and refereed papers to the final submission on the thesis. As a part-time student, there is always a balance between the demands of full-time work and those of completing the research in a timely manner. In my case, as a full time military officer, I was posted overseas in 1999 and 2000 on operational duties and had little time to further this research. Additionally the period between 2000 and 2004 was punctuated by frequent periods of absence due to operational activities, including a 12 month deferment of my studies when I was deployed to the Middle East. This information is provided as a clarification.

Table of Contents

FIGURES

TABLES

Defining Terms

One complexity in reviewing the literature on technology support for group work is the plethora of terms and terminology. Terms such as Group Support Systems (GSS), Group Decision Support Systems (GDSS), Group Communication Support Systems (GCSS), Electronic Meeting Systems (EMS), Computer Supported Cooperative Work (CSCW), and Computer-Mediated Communication (CMC) are often used interchangeably. So that there are no definitional problems, the conventions and definitions used in this research are clarified at the outset.

The most generic term for technology support is probably *groupware* which has been defined by Ellis, Gibbs and Rein (1991) as:

> "…computer-based systems that support groups of people engaged in a common task (or goal) and that provide an interface to a shared environment"

A narrower definition can be developed by identifying the primary focus of the technology support: facilitating communication between group members, or providing support for decision-making. As an example of a communication-focused definition, *Computer-Mediated Communication* is:

> "any system where the computer is used to mediate communications between and among humans as individuals or as groups" (Turoff 1989)

Compare this to a definition focussing on technology support for decision-making - *Group Support System* :

> "... combines communication, computer and decision technologies to support intellectual, goal-directed, collaborative work" (Jessup and Connolly 1993)

Figure 1 illustrates the general classification of some more common names and types of groupware by its primary emphasis. For a thorough discussion on the different definitions in this field, and another possible classification scheme, see Pervan (1994).

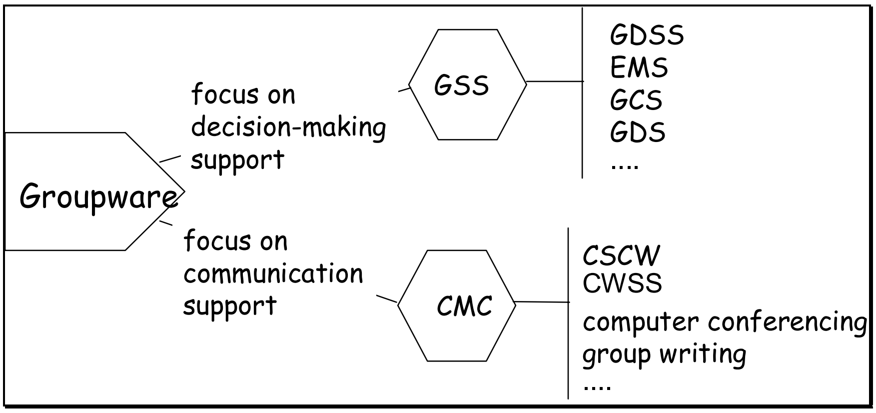


Figure 1 - General Classification of Groupware by major function

In this thesis, I adopt two terms to describe technology support for group work and the communication between group members. Firstly, I have used the term *Group Support System* (GSS) ' as described by Nunamaker (1997, p.357):

> "A group support system (GSS) is a set of techniques, software and technology designed to focus and enhance the communication, deliberations and decision making of groups"

Similar definitions for GSS can be found in Huber (1984) and DeSanctis and Gallupe (1987).

Secondly, I have used the term *technology supported* or *technology support* where I have wanted to generalise about the hardware and software only and *group processes* where I refer to group processes and procedures.

GLOSSARY

Abbreviation	Description
ADF	Australian Defence Force
ARA	Australian Regular Army
Asynchronous	In referring to groups or group members in this experiment, group members meet together with no spatial or temporal restrictions.
CM	Conceptual Model. An SSM term (see Annex A).
CMT	Common Military Training
COMTW	Commanding Officer, Military Training Wing, Australian Defence Force Academy.
COSC	Chiefs of Staff Committee. A committee comprising of Chief of Air Force, Chief of Navy, and Chief of Army as the three principals.
DCOMDT	Deputy Commandant, Australian Defence Force Academy
Distributed groups	Group members are separated by space and time. In this study, distributed groups are supported by using a GSS and meet asynchronously.
Face-to-Face (FtF)	Group members are not separated in time or space from other group members. In this study, FtF groups are supported by a GSS and meet synchronously.
Group Support System (GSS)	A set of techniques, software and technology designed to focus and enhance the communication, deliberations and decision making of groups.
MM1	Mixed Mode 1. Groups conduct the idea generation phase of the focus group synchronously, and the program evaluation phase asynchronously.
MM2	Mixed Mode 2. Groups conduct the idea generation phase of the focus group asynchronously, and the program evaluation phase synchronously.
RAAF	Royal Australian Air Force
RAN	Royal Australian Navy
RD	Root Definition. A SSM term. (see Annex A)
SSM	Soft Systems Methodology (see Annex A)
SST	Single Service Training
Synchronous	In referring to groups and group members in this experiment, group members meet in the same place and at the same time (FtF).
TDO	Training and Development Officer, Australian Defence Force Academy.

Abbreviation	Description
TTF	Task-Technology Fit is a theory which asserts that the better the match between the task and the technology used to complete the task the more effectively the task will be completed.

Chapter 1 Need for study of group communication

> *As a primary tool of social action, communication mediates the effects of traits, knowledge, preferences, task characteristics and scores of other influences on decision making. (Hirokawa and Poole 1996, p. 7)*

With the increasing use of technology as an enabler for telecommuting, distributed and virtual organisations, and as an alternative for replacing or augmenting traditional non-technology supported face-to-face meetings, research into the impact of technology on group performance is becoming more important. In this chapter, the main themes of the thesis are introduced, the contribution of this work to knowledge is stated and the outline and structure of the thesis is presented.

The Study of Technology support for Group Work

Groups are pervasive structures in organisations

There is no doubt that one of the most pervasive structures in an organisation is the 'group'. In business settings, group work is seen as integral to the operation of most organisations (Migliarese and Paolucci 1995; Nunamaker 1997) and as the building blocks of new organisational forms (Drucker 1988; Peters 1988; Alavi and Keen 1989; Fried 1995; Nunamaker 1997). Analysis by Romano and Nunamaker (2001) on the influence and importance of meetings in organisations found that managers and knowledge workers spend between 25% and 80% of their work time in meetings. Similarly, Pollard (1996) reported managers spending about 50% of their time in meetings.

The amount of time spent in meetings is also increasing. Romano and Nunamaker (2001) cited research by Green and Lazurus (1991) that 71.9% of US executives spent more time in meetings than they did five years before and 49.3% expected the trend of spending more time in meetings to continue. Interestingly, while the amount of time spent in meetings is increasing, the amount of unproductive time in meetings has been assessed as between 11% and 73% (Romano and Nunamaker 2001, p 585).

With a high percentage of time being spent in meetings and the perception that a significant proportion of this time is unproductive, and the costs of meetings to business in the US alone reported at between $30 million and $100 million, it is no surprise that there has been an increasing amount of research into the role that technology support can play in assisting work groups to complete their tasks and improve their performance.

The study of technology support for groups

The study of the effects of technology support on group work began in the late 1960s (Engelbart and English 1968; Chapanis 1972; Turoff 1972; Turoff 1973; Turoff 1975; Short, Williams et al. 1976a; Hiltz and Turoff 1978) and as technology has become more pervasive in the workplace, research into technology support for group work has increased. Particular events that have driven research efforts are the proliferation of the PC in the workplace, the spread of the Internet and increasing access to technology at all organisational levels.

Attempting to categorise what constitutes technology support for group work is not straightforward. Although there is no generally agreed taxonomy in the GSS research community for classifying the types of technology support available to groups, one of the most popular is Johansen's (1991) spatial and temporal dispersion matrix. This taxonomy provides the foundation for classifying technology support according to its ability to cater for particular temporal and spatial conditions.

In Johansen's matrix, groups can meet in one of four conditions: same time and same place; same time but different place; different time but same place; or different time and different place. Table 1, adapted from Johansen (1988) and Ocker, Fjermestad, Hiltz and Turoff (1997), illustrates the main types of technology support available in each condition.

While there has been research into technology support in all four conditions, the main focus has been on technology support for same time/same place meetings (Nour and Yen 1992; McGrath and Hollingshead 1994; Fjermestad and Hiltz 1998b) or comparing technology supported groups with non-technology supported (manual) groups in the same time/same place condition. The reason that same time/same place meetings have received such attention is not documented although Keisler and Sproull (1992) have speculated "The standard of comparison is face-to-face meetings, not because they are always preferable to other forums but because they are ubiquitous". Kock, Davison, Wazlawick and Ocker (2001) succinctly identified and summarised the existing body of research on technology support for group work as:

> "… it would be fair to say that it has largely been US-centric, fairly light on theory (in comparison to the amount of empirical research generated), focused on either the solution of technological problems associated with e-collaboration (CSCW research) or the support of same-time/same-room e-collaboration (GDSS research), and centered on experimental research in controlled settings, mostly in the laboratory and, less frequently, in the field" (p. 4)

Place & Time	***Same Place***	***Different Place***
Same Time	Synchronous GSS/CMC Copyboards PC Projectors Facilitation Services Group Decision Rooms FtF meetings Polling Systems	Distributed GSS/CMC Interactive video Telephone Conferences Graphics and audio Screen sharing
Different Time	Asynchronous CMC Non-interactive video Voice messages E-mail Shared Files Kiosks Group Displays Team-room Paper messages	Asynchronous CMC Non-interactive video Voice messages E-mail Fax Surface mail Group Writing Conversational Structuring

Table 1 – Types of technology support applied to group work

There is a need, therefore, to examine the other conditions and assess the impact of technology support on groups working in the other conditions and for more research comparing different conditions of technology support. In particular, technology support for groups working in the different place/ same time and different place/ different time conditions as the use of these systems will "…fit in well with the work styles of already "wired" professionals, who use e-mail and the world wide web to accomplish many of their non-meeting tasks" (Fjermestad and Hiltz 1998b).

With modern GSS also capable of supporting groups in more than one condition, the potential also exists for groups to conduct their activities in more than one communication mode. For example, technology supported groups may meet in the same place/same time condition in a meeting room to generate ideas about a topic, and then continue the meeting in the different place/different time condition via the Internet to rank those ideas. Few GSS studies have addressed this intra-meeting alignment of task and the communication mode and those studies that have addressed this alignment have reported inconclusive results (Fjermestad and Hiltz 1998b; Ocker, Fjermestad et al. 1998; Ocker 2002).

Although there is four decades of research into technology support there is still little agreement about whether technology supported groups are more productive, effective or produce a better output than traditional meetings (Dennis and Wixom 2002). In on-going research , Fjermestad and Hiltz (1993; 1997; 1998a; 1998b) have analysed the findings from approximately 200 controlled experiments that examined over 1582 hypotheses and used 29 unique independent variables and 120 unique dependent variables, have clearly shown this lack of agreement. In their 1998b summary they state that:

> “Overall, the results suggest that there is an overwhelming tendency to find ‘no significant differences’ between unsupported face-to face modes and the types of group support systems that have been studied this far.”

They go on to conclude that even though the findings have been ‘disappointing’ there is evidence to support the notion that task type does moderate GSS use, and note:

> “Adding task type as an additional control variable, we observe more positive results when CMC systems (technology support in the different place/ same-time and different place/ different time) with task type 4 (decision making), and GSS (same-time/same place) with task type 2 (idea generation), are compared to face-to-face conditions” (Fjermestad and Hiltz 1998b).

The findings indicate that some benefit can be gained from matching the task with appropriate technology support, and add weight to the argument that this topic is worthy of further investigation.

Technology support for focus groups

While technology support for group work has been explored for a range of tasks and activities, there is little research to date on the use of technology specifically with focus groups (Parent, Gallupe et al. 2000; Newby, Soutar et al. 2003; Kontio, Lehtola et al. 2004). A focus group interview is a structured group process where groups of between 3 and 10 people normally meet only once for no more than two hours to discuss a particular issue, topic, or product (Krueger 1994; Clapper and Massey 1996; Morgan 1997).

The key characteristic of focus groups is that they make explicit use of group member interactions to produce information and insights that would not be possible without the interaction of a group (Stewart and Shamdasani 1990). They differ from other types of groups in that they are not expected to be on-going, and are not expected to have a past history. Focus groups are an example of 'non-repeating group behaviour' (Zmud 1988; Clapper and Massey 1996).

The literature examining the potential and/or actual use of technology support with focus groups suggests that focus groups can be improved by the application of technology (Parent, Gallupe et al. 1997; Sweeney, Soutar et al. 1997; Lewis and VanSchoorl 1998; Parent, Gallupe et al. 2000; Newby, Soutar et al. 2003). Technology supported groups can use the anonymity feature to encourage participants to be more critical and probing in their analysis and interactions with each other (Walston and Lissitz 2000; Newby, Soutar et al. 2003). Technology supported groups also generate more ideas (Parent, Gallupe et al. 2000; Easton, Easton et al. 2003) and better quality ideas than manual groups (Parent, Gallupe et al. 2000). The findings on satisfaction with the meeting process are mixed with Parent et. al. (1997; 2000) finding technology supported groups either as satisfied, or less satisfied, than traditional groups, and Easton et al (2003) reporting technology supported groups were significantly more satisfied in the process than manual focus groups.

It has also been reported that technology supported groups reach consensus more readily, and that less focus groups are needed because using the anonymity features means that heterogeneous groups can be used. This can lead to reductions in the time and cost of conducting focus groups and improvements in the range, quantity, and quality of ideas.

While there are promising signs that technology supported focus groups can be more effective than manual focus groups, the body of knowledge is too limited to draw definitive conclusions. So far, research has focused on comparing manual and technology supported focus groups in one or two different meeting conditions (normally same time/same place and/or different time/different place).

Because of the limited and mixed findings, there are a number of potential advancements that can be made to our understanding of the effects of technology support on focus groups. If, as Parent et. al. (2000) contend, introducing technology support changes the group's social network and leads to participant dissatisfaction, this is one area that requires further investigation. Secondly, observations by the focus group practitioners, coupled with limited research, suggests further research is required into the effects of technology support on focus group performance across a range of technology support conditions.

This thesis is the first attempt to examine the potential of technology support for focus groups and the effects on focus group performance over four technology support conditions through a field experiment.

Matching Technology support and Group Activities – the Concept of 'Fit'

The motivation in trying to match appropriate technology support to group work is to maximise group effectiveness. In organisations, meetings are a primary mechanism used to try to solve problems, reach decisions or judgements, or reconcile conflict (Romano and Nunamaker 2001). By supporting group activities with an appropriate level of technology support it is anticipated that groups will be more productive or have higher levels of performance (McGrath and Hollingshead 1994; Zigurs and Buckland 1998). Conversely, if appropriate technology support is not employed, group and individual performance and productivity can be hampered (Vessey 1991b; McGrath and Hollingshead 1993; Dennis 1996; Ngwenja and Keim 2001).

The concept of 'fit', that is the matching of the characteristics of the meeting or the problem representation and the approach to addressing the problem, is an accepted concept in the organisational theory literature (Drazin and Van de Ven 1985; Venkatraman 1989). GSS researchers have also used an allied notion of task-technology fit (TTF) to examine the effect of technology support on group performance (Goodhue and Thompson 1995; Zigurs and Buckland 1998; Dishaw and Strong 1999; Wilson and Morrison 2000; Ngwenja and Keim 2001). TTF has been defined by Zigurs and Buckland (1998, p. 23) as "ideal profiles composed of an internally consistent set of task contingencies and GSS elements that affect group performance" and they contend that the better the fit between task and technology the higher the productivity or the greater the performance of the group. The basic structure of TTF is shown in Figure 2.

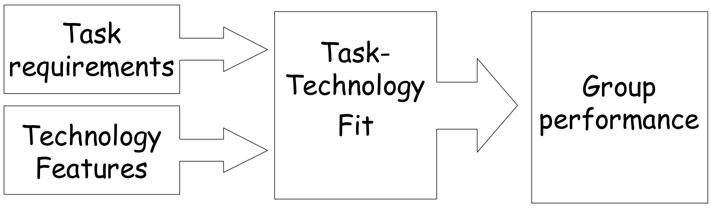


Figure 2 - Basic Task-Technology Fit Model

Experiments testing the validity of TTF have shown that there is a relationship between task requirements, the technology support the group uses, and the resulting performance of the group, and there is general support for the TTF model (see, for example Hollingshead, McGrath et al. 1993; Straus and McGrath 1994; Goodhue and Thompson 1995; Dishaw and Strong 1998; Zigurs and Buckland 1998; Wilson and Morrison 2000; Shepherd and Martz 2001). Experimental results also indicate that for specific activities, using more than one communication mode during the meeting process can increase member satisfaction and group performance (Ocker, Fjermestad et al. 1997; Ocker, Fjermestad et al. 1998; Ngwenja and Keim 2001; Ocker 2001). These findings support the hypothesis that an appropriate fit between the task and the technology support can provide the basis for more productive or effective group work (Hollingshead, McGrath et al. 1993; Straus and McGrath 1994; Zigurs and Buckland 1998).

TTF does not, however, consistently and fully explain group performance. For example, Straus and McGrath (1994) showed that a fit between task and technology support resulted in face-to-face groups being more productive than distributed groups, however this result was not consistent over all their experiments. One experiment reported that the face-to-face groups were more productive than distributed groups across all task types. Other experiments showed no differences in a group's effectiveness on idea generation and intellective tasks, but distributed groups were significantly less effective than face-to-face groups for judgement tasks. The research of Hollingshead, McGrath and O'Connor (1993) also showed that given sufficient time to complete tasks there was no significant difference in the quality of the final outcomes between the groups.

Raman, Tan, and Wei (1993) also showed that TTF has limited predictive validity. They found that a mismatch in TTF does reduce group efficiency and/or effectiveness, but that some types of mismatch have no effect on decision satisfaction, the group's ability to reach consensus or the group decision making process itself.

Overall, the findings reported in the literature suggests general support for the premise that combining the task requirements and technology support does impact on the effectiveness of the group but there are conflicting findings on the type and size of the changes in effectiveness. More research is required to examine alternative explanations of why observed differences (or non-differences) are occurring (Fjermestad and Hiltz 1998a).

Including Social Influences in Determining Group Performance

Inconsistent results from experiments based on TTF led to examination of other factors that may influence group performance. Kock (2001a) identified the four factors that need to be considered in any theoretical construct as:

- The task carried out by groups with technology support.
- The technology support (including the communication media and software systems) used by the group when undertaking group work.
- The social environment surrounding technology supported groups.
- The information processing schemas held by the group members when undertaking group work.

The impact of social influence, according to Kock (2001b, p.3), is that:

> "past environment and social information processing schemas evolve over time and build on each other. That is, past social environments in which an individual has lived or worked may influence the formation of current social information processing schemas".

Enhancing TTF with the impact of the social influences of fit addresses some of the issues raised in the literature. For example, in their literature review of the effect of technology support on group work, McGrath and Hollingshead (1994, p. 94) state:

> "It is unlikely that computer-mediated groups will be superior to face-to-face groups for all tasks and in all circumstances, and it is equally unlikely that they will be inferior on all tasks and in all circumstances. It is far more likely that communication media and task will interact with each other, and with other facets as well, so that the proper question has to do with the set of conditions under which one or another technology will yield best results."

Similar sentiments are expressed by Hirokowa and Poole (1996) who believe that:

- Decisions are social products of groups, and communication processes and communication media are the primary means of creating and maintaining the social realities of group work.
- It is only through communication between group members that they can work out the form and content of decisions.

Explicitly identifying social influence when addressing group performance also reinforces that fit is not solely a rational decision made by examining the objective features of the technology support and the task requirements. Social aspects such as the individual's subjective perceptions of the technology and the task, situational factors and their own experiences (Fulk, Schmitz et al. 1990) have a part to play in the selection and application of technology support for group work, and in group performance.

The work done by researchers into Adaptive Structuration Theory (Poole and DeSanctis 1989; Poole and DeSanctis 1990; Chin, Gopal et al. 1997; George and Jessup 1997) and the Technology Acceptance Model (Davis 1989; Davis, Bagozzi et al. 1989; Mathieson 1991; Malhotra and Galletta 1999) and other approaches that emphasise that technology support is selected, used and accepted in group processes in a subjective, dynamic and complex way.

Alternative theories, such as Critical Social Theory (CST) have also been developed to include social aspects of communication. Rather than take social aspects as an input or moderating variable in a causal way, CST proposes that communication richness flows from the communication properties of the medium used and also the "interactions between people in the social context" (Ngwenyama & Lee 1997 p152).

Studies that have included reference to the impact of the social aspects of individuals and groups on their findings include Fulk, Schmitz and Steinfield (1990); Mathieson (1991); DeSanctis and Poole (1994); Markus (1994); Galletta and Malhotra (1999); Trauth and Jessup (2000); and Wilson and Morrison (2000).

A recent study by Trauth and Jessup (2000) used data on the social aspects of group work to complement findings from a quantitative analysis of technology supported group work. They found that taking an interpretative perspective on GSS sessions showed that participants not only exchanged task-oriented information about the topic but also emotional and behavioural information. Their description of the GSS sessions as "emotionally charged events" highlighted the social or normative aspects of the meetings. Their conclusion was that while positivist analysis provided useful information in analysing the results of the meetings, an interpretative analysis on the same information provided another viewpoint on the outcome of the sessions and the combination provided a more complete picture.

The Elements of Group Performance

Groups can be formed, either naturally or under direction, for any number of reasons. This research focussed on groups formed under direction for the specific purpose of evaluating a military training program. Bostrum, Anson and Clawson (1993, p.148) describe this type of group work as "a goal or outcome directed intervention between two or more people (teams, groups)" and the general process used as "moving from the group's present problem state into its desired future state (accomplishing specific meeting outcomes) through a series of action steps (agenda)".

In general terms, research on technology supported group work tend to focus on either the group's information processing structure or its social aspects. Viewing groups exclusively in either way leads a researcher to make a number of assumptions about issues such as the appropriateness of particular research designs and the purpose of the research, the determination of what makes the group 'effective' and what performance measures are appropriate in the circumstances.

Groups as information processing structures

Viewing a group as an information processing system leads to experimental designs that attempt to optimise the outcome of group work. A typical description of group work that illustrates this view is one by Gray (1987) who describes a group as an entity that retrieves or generates information, shares information among members and/or uses information to reach consensus or a decision. Introducing technology support and optimising the links between the technology support and the group's activities leads to more effective group work.

An emphasis on information processing may be appropriate in laboratory studies where the task is clearly defined, variables can be manipulated to assess the changes in effectiveness and social aspects of group work can be controlled. In most real-world organisations, however, groups have multiple aims and objectives (whether stated or not). As Churchill (1990, p. 12) observes "The decision-making group can be a cauldron of competing values, views and objectives".

Groups as social constructs

The other view in the GSS research literature, although not nearly as prevalent, examines groups as social constructs. One possible explanation of why there is less GSS research on groups as social constructs is that viewing groups in this way does not lend itself to deterministic analysis. Another explanation could be the large amount of laboratory work conducted into technology support for groups compared with the only a small amount of fieldwork (Zigurs 1993; Pervan 1998). If we view group work and technology support from a social construct viewpoint then the experimental design and outcomes tend to explore the learning ability and processes of the group and group member interactions. As an example of the difference in emphasis, Guzzo (1986,p. 35) defines a work team as:

> "…a group of individuals who see themselves and are seen by others as a social entity, which is interdependent because of the tasks performed by the members of the group. They are embedded in one or more larger social systems, performing tasks that affect others".

The assumption made when describing groups as social constructs is that the complex interplay of task, technology support, and social influences that contribute to the group performance is impossible to measure using only quantitative techniques. Rather, effectiveness is seen as a combination of achieving the explicitly stated outcomes of the group meeting, and some additional positive social interactions between group participants.

In this research, I take the position that work-oriented groups will invariably undertake activities that require information processing and at least the maintenance of social constructs, and any systemic analysis of group performance will require analysis and discussion of both elements. This position in not new, as group psychology researchers such as Bales (1970), and McGrath (1991) have developed group development models based on the contention that groups try to balance their time allocation and work effort between task-related needs and socio-emotional needs.

Measuring Group Performance

Current approaches to measuring process and social outcomes

Even if most GSS research focuses on information processing (task-related aspects) most GSS researchers acknowledge that group performance theoretically covers both task-related and socio-emotional (or social influence) activities (Mennecke, Hoffer et al. 1992; Benbasat and Lim 1993; McGrath and Hollingshead 1994; Dennis and Wixom 2002), although there is no standard approach to measuring the performance of technology supported groups (Zigurs 1993; Fjermestad and Hiltz 1998a; Pervan 1998; Morton, Ackermann et al. 2003; Arnott and Pervan 2005).

One result of the many measurement approaches is that different researchers have attempted to create taxonomies which they have then used to classify GSS outcomes. Most of these taxonomies follow the input-process-output model of IS research (e. g. Pinsonneault and Kraemer 1989; Finholt and Sproull 1990; Whitworth 1997; Fjermestad and Hiltz 1998b). The outcomes are often separated into process and satisfaction variables.

Dennis and Wixom (2002) define performance in terms of effectiveness (defined by number of ideas generated and/or decision quality), efficiency (time to complete the task), and participant’s satisfaction (with the process and outcome). Bostrum, Anson and Clawson (1993) identify two related outcomes: 'task outcomes' and 'relational outcomes'. Relational elements such as interpersonal feelings, interactions of group members and self-esteem are all interrelated, and these relationships affect the task-related outcomes of the group.

In their meta-analysis of the GSS literature, Benbasat and Lim (1993) reported that although there were a number of different schemes that existed in the literature for classifying dependent variables, most researchers agreed on “two consensual categories” of satisfaction and performance. To these two, they added the category of ‘structural products’ and assign the social influence variables of ‘consensus’ and ‘equality of participation’ to this category.

Taking a different approach in their evaluation of the GSS research, McGrath and Hollingshead (1994) described three ‘organising concepts’ through which groups could be viewed and their performance assessed. These concepts are:

- Groups as information-processing systems (producers).
- Groups as consensus-generating and conflict-resolving systems (group well-being).
- Groups as vehicles for motivating and regulating behaviour (member support).

The outcome factors associated with these organising concepts are clustered into the three categories of Task Performance Effectiveness, User Reactions (satisfaction with the process and the outcomes), and Member Relations.

The authors go on (p. 119) to summarise what they believe is an “agenda for strategically crucial research in this domain”. The first agenda item is that GSS researchers should use multiple criteria in their research covering task performance, user reactions, group interaction and performance processes. The objective of using multiple measures is so that there might eventually “develop a criterion system of theory of group performance that inter-relates all of those sets of indices”.

Dependent variables

The most comprehensive summary of variables used in GSS research is contained in the meta-analysis of Fjermestad and Hiltz (1998b). They provide detail of the dependent variables used in GSS research and group them under 5 separate categories. The range of dependent variables, and the categories themselves, illustrate both the lack of consensus on the key variables that should be measured and reinforces the fact that to examine technology support both task and the social influence outcomes need to be considered. The meta-analysis also supported the earlier comments of McGrath and Hollingshead (1994) that an integrated theory or criterion system is yet to be developed. The variables and categories identified by Fjermestad and Hiltz (1998b) are reproduced at Table 2.

Efficiency	***Effectiveness***	***Satisfaction***	***Consensus***	***Usability***
Decision time	Communication	Participation	Decision agreement	Learning time
Number of decision cycles	Number of comments	Cohesiveness	Commitment	Willingness to work together again
Time spent in activities	Idea quantity	Conflict management		System utilisation
Time spent waiting for responses	Decision quality	Influence		Number of errors
Time to consensus	Decision confidence	Confidence		Design preference
	Process quality	Attitude		
	Creativity/ innovation	General satisfaction		
	Level of understanding	Decision satisfaction		
	Task focus			
	Depth of evaluation			
	Commitment to results			

Table 2 - Categories of outcomes and dependent variables

Measurement instruments

Just as there is no consensus on dependent variables, there are no standard or generally agreed measurement instruments in GSS research (Davison 1997). Getting agreement or consistency has not been assisted by the large number of papers that have either not reported any formal evaluation (Pinelle and Gutwin 2000) or have provided little or no information on the instrument used or the validation of the instrument (Zigurs 1993). Zigurs (1993), McGrath and Hollingshead (1994) and Davison (1997), argue that this makes it difficult to compare studies. Davison (1997) does, however, acknowledge that any generalised instrument would require a large number of questions to address the technology, social influence, task-related, participant characteristics, and meeting process attributes.

Summarising the current state, there is agreement that group performance is a multi-dimensional construct and that the categories of group outcomes cover both task-related and social influence aspects. There is no agreement, however, on what variables best measure the impact of technology support on group work, on the outcomes of the group work, or the impact on group member relations.

In this thesis, an assessment of the effect of technology support on focus groups is made using the three views of Task Effectiveness, Participant satisfaction and Group Relations. Combining research instruments from other researchers into a single multi-dimensional instrument creates "a set of variables that reflect subsequent conditions – for the group, for its task, and for its members – that result from the group's work. Methodologically, these outcome factors are explicit or implicit criteria for the evaluation of the effectiveness as a performance system" (McGrath and Hollingshead 1994, p. 96).

Group Work Viewed as a Human Activity System

Accepting that the level of group performance will be impacted by the fit between social influence, technological support and task-related activities, an approach to studying group performance that caters for both task related and social elements is required. Drawing on the work of systems theorists and systems thinking is one novel approach to addressing the obvious complexities of assessing the effects of technology support on group performance.

This section provides a brief overview of the development of systems thinking, Soft Systems Methodology (SSM), and the Human Activity System (HAS) construct used in some soft systems thinking.

Systems thinking

Systems Thinking is defined by Checkland (1981, p. 318) as "An epistemology which, when applied to human activity is based upon four basic ideas: emergence, hierarchy, communication and control as characteristics of systems. When applied to natural or designed systems the crucial characteristic is the emergent properties of the whole".

This definition identifies two classes of system: natural and designed. Benathy (2001) describes natural systems as including formations such as living things from subatomic level to the highest order creatures, and astronomical systems including the planet, solar system and the Universe). Designed systems are those systems contrived by humans and include:

- Physical systems (bridges, buildings etc).
- Abstract systems (theories, mathematics, languages, philosophy etc).
- Human activity systems (humans undertaking purposeful activity such as learning, producing a product, completing in groups to complete a task, or writing a thesis).
- Social and cultural systems (examples include a family, a community, a social club).

The second part of Checkland's definition states that systems thinking is "founded upon two pairs of ideas, those of emergence and hierarchy, and communication and control" (Checkland 1981, p. 75). Expanding these two pairs of ideas:

- Emergent properties are those properties that only become apparent when the system is viewed as an entity and are not discerned if the activities or the relationships between activities are examined individually.
- Hierarchy is the principle by which systems are built from entities, and these entities are themselves systems built from smaller entities. At any level in the hierarchy, emergent properties exist and each level is fundamentally different from the level above and below it because of the complexity at that level and the emergent properties.
- Communication is the transfer of information within a system and between a system and its wider environment for the purposes of regulation or control.
- Control is the process by which the system "retains its identity and/or performance under changing circumstances" (Checkland 1981, p. 313). Control activity ensures that the outcomes or output from the system is aligned with the purpose or set levels of performance of the system.

Human Activity Systems

The HAS is one of the 'bald terms' in systems thinking (Checkland and Scholes 1990, p. 25). A HAS is a set of activities that describe humans undertaking purposeful activity connected together to meet the requirements of emergence, hierarchy, communication, and control. It has " proved to be of value in the analysis of management problem situations" (Wilson 1984, p. 26), IS problem situations (Checkland and Scholes 1990; Avison and Fitzgerald 1995; Checkland and Holwell 1998) and in thinking about information system provision (Wilson 1984; Galliers 1992b; Gregory 1995; Stowell 1995; Gregory and Pong 1999).

A comprehensive HAS includes the task-related activities that directly contribute to the accomplishment of the task, and the social aspects that contribute to the quality of group life and the increased satisfaction of group members. HAS are not seen as existing in the real-world but are intellectual constructs or ideal types that are typically used in the debate about possible changes to the real-world problem situation (Checkland 1981). Figure 3, from Wilson (1984, p. 28), illustrates the elements and characteristics of a HAS

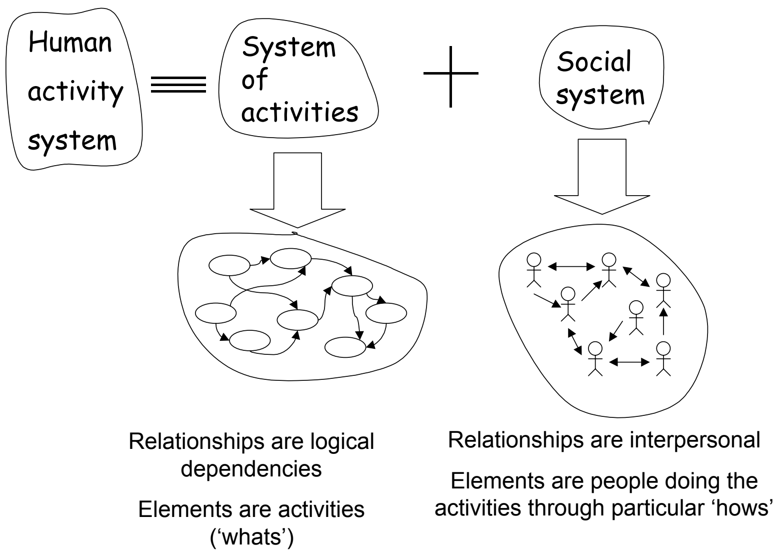


Figure 3 - Human Activity System

As group work is dependent on the interplay of both the technical and social activities (Fulk, Schmitz et al. 1990; Majchrzak and Davis 1990; Fulk, Schmitz et al. 1995; Kock, Davison et al. 2001) the intellectual construct of the HAS is an appropriate vehicle for examining this interplay. In technology supported group work the conduct of the technical and social activities and the resultant group outcomes are founded on four main interacting elements: the task, the technology support, the group members and the meeting structure (Emery 1970; Dennis, George et al. 1988; Scott-Morton 1990; Nunamaker, Dennis et al. 1993; McGrath and Hollingshead 1994; Kock 2001b).

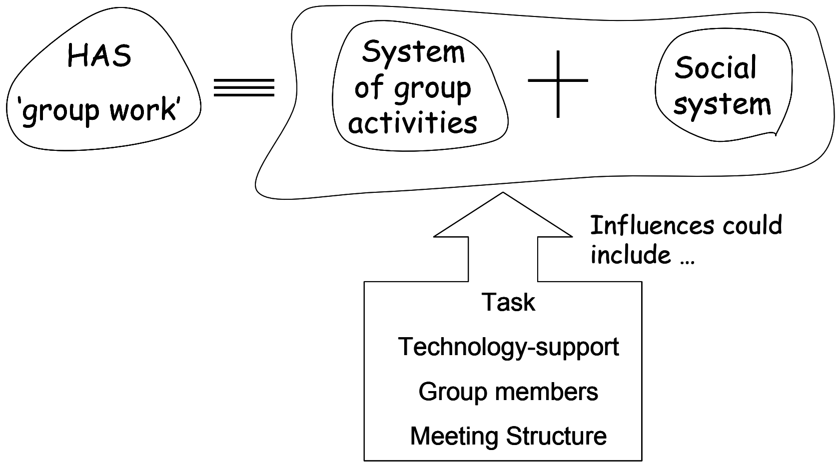


Figure 4 - Group work from a HAS perspective

Compared to the basic TTF theory illustrated in Figure 2, this initial conceptual model of group work developed from a HAS perspective (Figure 4) includes the social aspects of group work and participant interactions as a broader basis for an holistic examination of group performance. The task, technology support, participants and meeting structure are influences on group performance that affect both the task-related activities and the social system that exists when groups meet to undertake their activities. In Chapter Eight, this model is reviewed.

Soft Systems Methodology

One systems thinking approach that uses the HAS concept in analysing situations and treats information systems as a "cultural rather than technological phenomenon" (Checkland and Scholes 1990, p. 54) is Soft Systems Methodology (SSM). SSM was developed by Checkland and his colleagues at the University of Lancaster (Checkland 1972; Checkland 1981; Wilson 1984; Checkland and Scholes 1990; Checkland and Holwell 1998; Checkland 2000). As a methodology for examining real world situations, SSM has a number of strengths including:

- SSM recognises that in any situation the participants will have different perceptions of the situation, and it is likely they will also have different preferable outcomes. SSM explicitly attempts to take these into account from the outset to ensure that the results of the analysis are acceptable to all parties concerned.

- The structure of SSM facilitates the addressing of "messy" problems that occur when objectives are unclear, multiple objectives exist, and where there may be several different perceptions of the problem.
- SSM does not attempt to define a single prescriptive method of action. Rather, through an iterative process of systems thinking and debate, an acceptable set of improvements is agreed between stakeholders.

SSM is usually considered a methodology for analysing "ill-structured problem situations which managers of all kinds and at all levels have to face" (Checkland and Holwell 1998). While this has been the primary use of SSM, it has been applied in a number of different areas including problem solving, hypothesis testing and information systems development. The various uses of SSM are outlined in Chapter Three.

The traditional shape of SSM is illustrated in Figure 5 (Checkland and Scholes 1990, p. 27). Checkland describes seven stages and presents them in a chronological sequence, although he stated that it is not essential, or even desirable, to progress from stage 1 to stage 7 (Checkland 1981, p. 162).

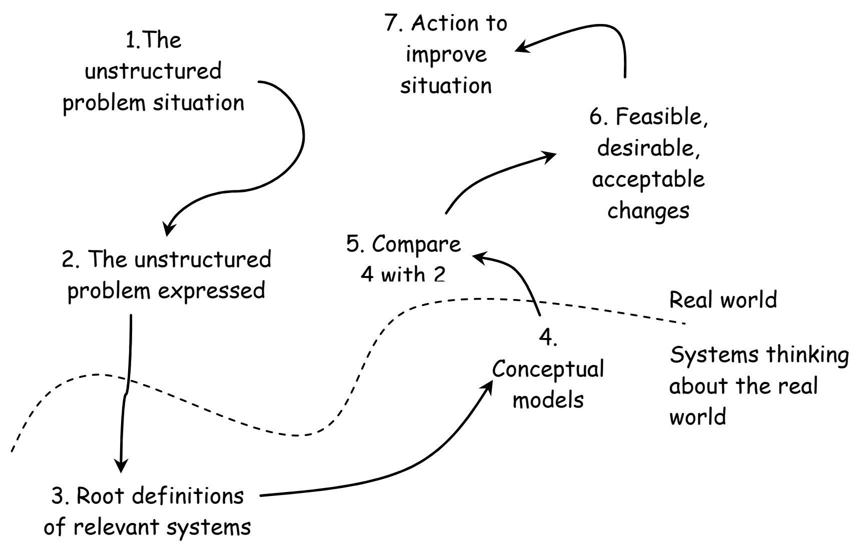


Figure 5 - Basic shape of SSM

More detail on the traditional SSM is given in Chapter Three, but in summary:

- Stages 1 and 2 are concerned with the problem situation as it is perceived by some 'would-be improvers of the problem situation'.

- Stages 3 and 4 result in a definition, known as a Root Definition (RD), of one or more ‘relevant’ systems and an associated conceptual model (CM) of the activities that make up that system. Stages 3 and 4 require the researcher to understand the concept of the ‘Human Activity System’ (HAS).
- Stage 5 is where the CM is compared to the perception of the real world (stage 2) and from this comparison a debate can be generated.
- Stage 6 takes the results of the debate generated by the comparison at Stage 5, and tempered by the cultural elements of the problem situation identified in Stage 1 and Stage 2, develops a set of culturally feasible and systematically acceptable changes that can improve the problem situation.
- Stage 7 is the implementation of Stage 6 changes. By implementing changes the problem situation is recast and the result may be another situation where SSM can be used to improve the situation.

The ‘modern’ form of SSM (Checkland and Scholes 1990, p. 309; Checkland 2000), illustrated at Figure 6, explicitly recognises two interacting streams to any analysis:

- The logic-driven approach of traditional SSM, labelled as activities 1 through 6, where models are built and then compared to the real-world so that a debate about desirable and feasible changes can occur.
- The cultural stream, labelled as activities 7a, 7b and 7c in Figure 6 which is an exploration of the problem situation from a cultural perspective where the social and political aspects of the problem situation are examined. This analysis informs the logic-driven stream and the debate about changes to the problem situation.

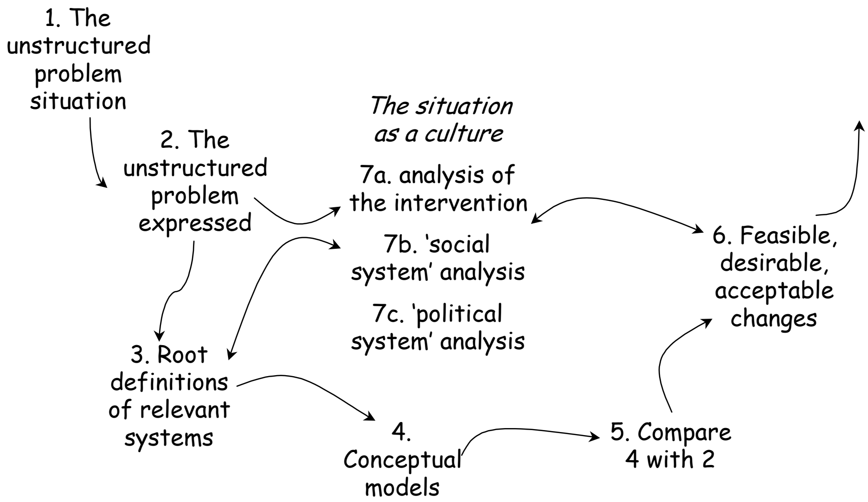


Figure 6 - The 'modern' shape of SSM

Further detail on the modern form of SSM is provide in Chapter 3, and more information on SSM in general is provided in Annex A.

Research Questions

Soft Systems Methodology, with its focus on Human Activity Systems, is one approach that can be used to examine the interplay of task, technology support and social influence and the effects of these aspects on group performance. This leads to the first research question:

> *Can Soft Systems Methodology be used as the basis for exploring the relationships between the type of technology support, task and social influence and the effect of these aspects on focus group performance, and, if so, how does it need to be extended or modified in order to be used in this way?*

The preceding discussion also shows that technology support does affect group performance but there is no general agreement on whether matching task and technology support has predictive or descriptive validity when assessing group performance. The research literature also indicates that social aspects of group work also play a part in group performance, and that group performance can be analysed in terms of task-related features (task effectiveness) and social influence features (participant satisfaction and group relations).

These considerations lead to the following second research question:

What is the effect of different combinations of technology support on focus group performance, where focus group performance is measured in terms of impact on task-related activities and on the group social system?

Summary

This Chapter has introduced the main themes of the thesis, detailed the two general research questions and used SSM to outline the structure of the thesis. The next chapter outlines the research strategy, and introduces the use of SSM for hypothesis testing.

CHAPTER 2 RESEARCH APPROACH

The first rule for designing a project or research program is to start at the beginning. Attempts to hurry things forward by skimping on the groundwork will always produce a mess (Hakim 1997, p. 119).

This chapter uses a framework developed by Checkland (1981) and reported in Stowell (1995) to outline the research strategy for the study. The framework of ideas underpinning the choice of methodology (the research philosophy), the methodology chosen for the study and the links between the methodology and the area of application (the Australian Defence Force Academy) are explained. As the Information Systems discipline is drawn from a number of reference disciplines (Lewis 1994a; Fjermestad and Hiltz 1998a) there is a range of research philosophies and approaches that could be adopted for this research, and these are discussed. A number of methodological issues are also covered in this Chapter.

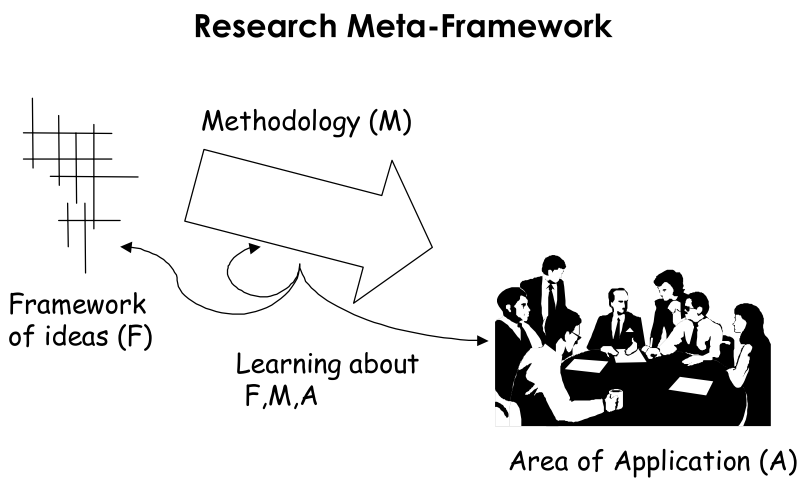


Figure 7 - Research Meta-Framework

To bring structure to the discussion of the philosophical basis, the methodology, and the methodological issues surrounding my research I have chosen to use a research meta-framework designed by Checkland and presented in Stowell (1995) and Checkland and Holwell (1998). The FMA model is based on the interrelationship between the four main elements of a research project or program, and these are pictorially illustrated in Figure 7 and outlined in more detailed in Table 3.

Element	*Characteristics/Observations*
Framework of ideas (F)	▪ **Applies to both research threads** o Influenced by a researcher's understanding of the general field of research. o The viewpoint of the audience and the researcher is important o Guides the selection of M. o Makes explicit the assumptions made when examining the validity, scope and methods in relation to the phenomena being studied. o Helps define (or make explicit) what is and is not achievable in terms of knowledge acquisition and potential for learning from the study. ▪ **Applies to technology support thread** o Theories about IS and GSS are based on these frameworks. ▪ **Applies to SSM thread** o Issues of validity can be identified and assessed using structured thinking, including that of Wilson (1984), Oates and Fitzgerald (2001) and Champion and Stowell (2003).
Methodology (M)	▪ **Applies to both research threads** o Sympathetic to, and built on, F. o Leads to the selection of research instruments for each research thread. o Selection needs to be made on the basis of what primary learning outcomes are desired (F, M, A or a mix). ▪ **Applies to each research thread** o Are separate methodological approaches required for each research question?
Area of application (A)	▪ **Applies to both research threads** o The methodology chosen for the research thread is applied to a specified A. The formal research questions – who, what, where and how are answered and analysed. o The area of application for one research thread is technology support for focus groups, and the area of application for the second research thread is SSM for soft hypothesis testing.
Learning about F,M,A	▪ **Applies to both research threads** o What can I learn and what can I not learn from the data

Table 3 - Elements and characteristics of research

In summary, the methodology (M) selected by a researcher is based on a framework of ideas (F) that may be explicitly or implicitly used by the researcher in the methodology selection process. The methodology is then used to explore an area of application (A). The fourth element of the model is the learning about F, M and A that is achieved by examining the area of application through the lens of the selected methodology.

In this research, as there are two interrelated research threads, they will both be addressed during the discussion of each element.

Checkland's meta-framework can be used in a number of ways. It can be used to explain why researchers, who each have a different F, when examining the same area of application, approach the study from different perspectives. It can also be used to structure an analysis of the alternative methodologies and frameworks of ideas so that the researcher can maximise the opportunities for learning about F, M or A (Checkland and Holwell 1998). Thirdly, it can be used for structuring the researcher's thinking about what methodologies would be appropriate, and the implications of making a particular choice of research methodology and design.

I have chosen to use the FMA model in the latter two forms. The meta-framework provides structure for thinking about different methodologies and the basis for selecting an appropriate research approach based on an explicitly declared framework of ideas. The FMA meta-framework is then used to identify opportunities for learning about the Framework, the Methodology and the Area of Application, and these are discussed in Chapter Nine.

Finally, by declaring the F, M and A in advance those reading the research can make sense of the learning about the problem situation and also make judgements about the validity of the results (Checkland and Holwell 1998).

Framework of Ideas

By clearly identifying the Framework, the assumptions made when examining the validity, scope and methods used to study a particular phenomenon or address a particular research question are clarified. This identification also assists in guiding the selection of a methodology or methodologies sympathetic to the F and appropriate to the situation under investigation. This is because a researcher's understanding of the general field of research influences their approach to a research question, and their experiences and prior learning often determine their preferred approach to a problem. Making the Framework explicit aids both the researcher and the reader of the research.

Identifying the underlying framework can also clarify the researcher's objectives, and can define the potential audience for the researcher's work (Fergusson and Shaw 1996; Klein and Myers 1999; Champion and Stowell 2003). Finally, one pragmatic outcome of examining the underlying philosophy of the research is that it can assist the researcher in defining (or making explicit) what is and is not achievable in terms of knowledge acquisition and potential for learning from the study.

Philosophical Positions in IS and SSM Research

There are a number of different frameworks for outlining the range of philosophical research positions in any research endeavour. One of the most comprehensive summaries is provided by the social science researcher Norman Blaikie (1993; 2000). The seven philosophical positions identified by Blaikie are:

- Positivism.
- Critical rationalism.
- Interpretivism.
- Critical theory.
- Realism.
- Structuration theory.
- Feminism.

Blaikie also details four discrete types of research strategies: induction, deduction, retroduction and abduction.

Philosophical Positions in IS Research

GSS research has its genesis in a number of different reference disciplines. Lewis (1994a) describes GSS research as a convergence of three reference disciplines: behavioural sciences, decision sciences and information systems. Fjermestad and Hiltz (1998a) believe that "GSS is an interdisciplinary field, spanning the boundaries of information systems, management, computer science, social psychology, and communication". As these reference disciplines each have their own research traditions it is not surprising that there are varied research approaches used to assess the impacts of technology support on group work.

There have been may attempts to clarify and reconcile the philosophical positions of IS research (e.g. Lee 1991; Hirschheim, Klein et al. 1995; Hirschheim, Iivari et al. 1997; Lee and Liebenau 1997; Myers 1997b; Winder, Probert et al. 1997; Fitzgerald and Howcroft 1998; Klein and Myers 1999; Mingers 2004).

One of the most common classifications is the separation of philosophical positions into two or three classes. Lewis (1994b), for example, describes the epistemological positions of positivism and interpretivism, and the ontological positions of realism and nominalism. Similarly, Shanks, Rouse and Arnott (1993) state that research methods in the IS field are characterised by "two competing theoretical frameworks or paradigms that are based on different philosophical assumptions about the nature of science and the nature of social reality". The two competing paradigms to which they refer are positivism and interpretivism. Klein and Myers (1999) and Orlikowski and Baroudi (1991) argue for three classifications (positivism, interpretivism and critical theory) and Guba and Lincoln (1994) describe positivism, post-positivism, critical theory, and constructivism as the four underlying "paradigms" for qualitative research.

As this summary shows, there is no agreement among IS researchers about what taxonomy of philosophical positions is appropriate for IS research. For the purposes of this research, I have adopted the positivist/interpretivist dichotomy and support the contention of Walsham (1995a, p. 377) that "the epistemological choice between interpretivism and positivism is an important issue for IS researchers".

Philosophical Position of SSM

SSM has been developed out of the recognition that management and 'real world' situations often do not have a clear problem definition, and are 'messy'. Addressing these problems requires, according to SSM researchers, a consideration of both the events and the ideas surrounding the events (Checkland and Scholes 1990, p.282). There is agreement among IS and SSM researchers that SSM falls into the interpretivist philosophical position (Gregory 1993; Jayaratna 1994, p.176)

Broadly, SSM is part of the group of methodologies commonly referred to as 'qualitative methodologies', and that it aligns with the philosophical position taken by the social sciences that "the causal determinants of the objects of the social sciences always include human intentions, while those of the natural sciences do not" (Caws, 1988 ,p.1 as quoted in Checkland and Scholes 1990, p.2).

Specifically, Checkland agues that SSM is based on "… a model of social reality such as is found in the ...(phenomenological) tradition deriving sociologically from Weber and philosophically from Husserl." (Checkland 1981). Checkland (1981. p18) also notes that SSM is comparable to Habermas' 'Critical Sociology' and this correlation has also been examined by others (e.g. Ho and Sculli 1994; Mingers 2000).

Positivist and Interpretivist Research

Checkland (1981) defines a positivist stance as a "philosophical position characterised by a readiness to concede primacy to the given world as known through experimental evidence". Research based on a positivist position is characterised by a view that reality can be objectively described and that this reality can be observed independently by the researcher (Levin 1988). The emphasis in positivist research is on establishing facts, defining relationships and identifying causes and effects. The positivist approach has dominated GSS research to date (Pervan and Atkinson 1995; Benbasat and Weber 1996; Pinelle and Gutwin 2000; Kock, Davison et al. 2001; Chen and Hirschheim 2004).

A positivist position draws on the scientific tradition of reduction, refutation and replication (Checkland 1981). As a problem domain is often seen as too complex or 'messy' to consider as a whole, the complexity is reduced by separating the domain into smaller, simpler parts. Hypotheses are made about the operation of these parts or the outputs from them and the hypotheses tested to either confirm or refute them. By examining a set of small, simple parts and controlling as many of the other experimental influences as possible, the researcher can create conditions where the experiment can be replicated by other researchers.

The main criticism of positivist research in GSS is that by controlling many elements of the problem situation, the results cannot be generalised to the 'real world' (Cook and Campbell 1979; Avison 1993; Mandviwalla and Gray 1998; Trauth and Jessup 2000). Positivist research has also been criticised for ignoring the political, social and cultural contexts of the variables studied (Kaplan and Duchon 1988; Hart 1999).

Interpretivist approaches, on the other hand, are seen as context-specific and the main emphasis of the research is on understanding the social phenomena of the problem situation rather than the causes and effects or relationships between individual variables (Fitzgerald and Howcroft 1998; Klein and Myers 1999). As stated by Holloway (1997), interpretivist research is a "form of social enquiry that focuses on the way people interpret and make sense of their experiences and the world in which they live".

In essence, the interpretivist researcher is seen as part of the problem domain where they both participate in the research and influence the problem situation with their presence, their observations and their interventions. Because of this, an interpretivist study is generally not bound by the a priori hypotheses. Zigurs (1993) believes there is much that GSS research could gain from more interpretive studies.

Interpretivist research has been criticised for not being sufficiently rigorous compared with positivist based research (Nissen, Klein et al. 1991). Interpretivism has also been criticised as it is difficult to generalise the results because of the context-specific nature of the research.

Adapting the table from Trauth and Jessup (2000), two philosophical positions are summarised in Table 4. I have defined these two positions as philosophical boundaries so that each position is defined in terms of the goal of the research, the predominant approach to data collection and analysis and the main assumptions associated with each position.

	Positivist	*Interpretivist*
Viewpoint	Context free	Context dependent
Goal	To optimise a situation or achieve an 'objective and complete' account.	To learn more about the problem situation.
Data Collection	Typically statistical or empirical. Testing a priori hypotheses or constructs.	Typically qualitative data is collected from interviews, observations, document reviews, case studies or action research. Developing an interpretive understanding of the situation being studied. Based on approaches as

	Positivist	*Interpretivist*
		Grounded Theory, Social constructionism, phenomenology, Symbolic interactionism and hermeneutics.
Pre-research assumptions	Reality is stable and can be observed and analysed from an objective viewpoint. Reduction of complexity aids analysis. The researcher or observer is independent, and does not influence, the problem situation. More closely aligned with deductive processes.	Phenomena should be studied in its natural environment. Understanding comes through subjective intervention in, and interpretation of, reality. The researcher is part of the situation and influences the results. More closely aligned with inductive processes.
Predominant analysis approaches	Quantitative	Qualitative

Table 4 - Summary of Philosophical Boundaries

Combining the Two Positions

Early efforts to combine positivist and interpretivist positions were reported in the social science literature (Campbell and Fiske 1959; Denzin 1978). Incorporating both positions in the one experiment was aimed at reducing the bias of research from only one position, and the combination strategy was to use tables of correlation coefficients to determine the degree of convergence between results obtained with the different approaches. In this early work, convergence was seen as an indicator of the validity of research results (Campbell and Fiske 1959, p. 81). Since that time, the use of multiple methodologies in the field of social science research has been subject to considerable debate (see, for example Lincoln and Guba 1985; Cresswell 1994; Mingers 2003).

IS researchers have debated on the efficacy of combining these two positions and there is some agreement that while there are differences between positivism and interpretivism, combining positions is both possible and beneficial. Mingers and Brocklesby (1996), Fitzgerald and Howcroft, (1998), Baskerville and Myers (2002) and Mingers (2001; Mingers 2003; 2004) provide summaries and arguments in favour of combining these positions. Pollack (2006) also discusses the relationship between positivism and interpretivism, and provides some alternative models for looking at how Critical Systems Thinking (Jackson 1991a; Jackson 2001) can be used to explore extensions and combinations of these positions.

If positivism and interpretivism are seen as the end points on a continuum of research positions; the possible methodological approaches available to the researcher can be summarised in the following four conditions:

- Positivist approaches only.
- A combination of positivist and interpretivist approaches but from a positivist perspective.
- A combination of positivist and interpretivist approaches but from an interpretivist perspective.
- Interpretivist approaches only. (Falconer and Mackay 1999)

An example of combining approaches when analysing technology supported meetings was reported by Trauth and Jessup (2000). They concluded that while positivist analysis provided useful information on the effects of technology support, using an interpretative approach on the same information provided another useful viewpoint on the effect of technology support on the outcome of the sessions. The study illustrates that looking at the same situation and data from multiple philosophical positions can provide the researcher with different and richer perceptions of the impact of technology support on group outcomes.

While Trauth and Jessup's analysis used the two approaches to complement each other, there was no attempt to integrate these positions in any way. Rather, they were used to 'compare and contrast' viewpoints as a form of triangulation. If the data set is to be seen holistically rather than using a 'compare and contrast' approach, the analysis needs to be 'integrated and complementary'. Kaplan and Duchon (1988) argue that rather than being incompatible, quantitative and qualitative approaches should be used in an integrated manner so that a richer picture of the problem situation can be developed.

The 'compare and contrast' and the 'integrated and complementary' approaches illustrate that there are different perspectives on combining the two approaches.

Researchers such as Kelle (2001) discuss three, rather than two, different approaches: complementary, convergence and triangulation and in their opinion triangulation is the "central concept of model integration".

The complementary approach used by Trauth and Jessup (2000), took two different philosophical positions to compare and contrast results, thereby producing a more complete picture of the research area. The convergence approach uses the analysis from the different philosophical positions to assess the level of convergence of results. If there is convergence this confirms the validity of a 'single reality' (akin to the work of Campbell and Fiske 1959; Maxwell 1998).

The third approach is a literal and restrictive use of the term 'triangulation' (Kelle 2001). Mathematically, the position of one point on a triangle can be determined if the distance is known between two other points of observation (the other two points of the triangle), the angles between those points and the position you are trying to determine. Kelle (2001) points out that using the mathematical approach is difficult to translate to social science research because "qualitative and quantitative method designs would have to be combined in order to produce sound sociological explanations" but that this description most appropriately describes the combination of the complementary and convergent approaches because one approach needs to be combined with another to provide a more complete picture. As Flick (1998, p. 280 as quoted in Kelle 2001) notes: " Triangulation is less a strategy for validating results and procedures than an alternative to validation … which increases scope, depth and consistency in methodological proceedings".

An understanding of these three approaches provides a basis for the researcher to assess the efficacy of research results produced from a study that uses two or more approaches. For example, if the research objective is to obtain convergence and the results do not lead to convergence, the researcher is left to consider whether either one of the approaches was invalid or the results are invalid. Similarly, if the objective is to use multiple approaches in a complementary way, then results that converge are seen as nugatory.

The triangulation approach leads the researcher to develop a strategy that includes both qualitative and quantitative positions. Two positions *have to be* combined before the results are meaningful. One way this combination can occur is to construct a research model which is 'cyclical' where "hypotheses relating to a particular problem are generated and refined through qualitative research, and passed to quantitative research for testing, and back again to qualitative research if the test fails to perform as expected" (Morton, Ackermann et al. 2003, p. 122).

Based on the preceding discussion, the key findings can be summarised as:

- Researchers need to be aware of the different philosophical boundaries of positivist and interpretivist approaches to research.
- Researchers should choose a research approach based on a Framework of Ideas that is appropriate to the research question rather than making a unilateral decision based on some other influence.
- Where value can be derived from combining approaches at the methodological level, consideration should be given to deriving a combined research design.

The argument for a multi-method approach for GSS research is given succinctly by Zigurs (1993):

> "In the end it is the judicious combination of multiple methods that has the most potential. Although the popularity (and accompanying prestige) of certain methods waxes and wanes, a consensus is forming that a multi-methodological approach provides the greatest power of understanding the complex socio-technological issues with which GSS research deals." (p. 115)

Another view on the ability to combine the positivist and interpretivist positions has been stated by Bryman (1992). Bryman makes the point that when discussing integration of these two positions, or triangulation of these two positions, positivism is often equated with quantitative approaches and interpretivism is equated with qualitative approaches. Bryman states the position that:

> "… quantitative and qualitative research are [not] forever rooted to their original epistemological positions (i.e. positivism or interpretivism). Instead, the two approaches can have and do have an independence from their epistemological beginnings"

Whether the discussion is on the integration of the philosophical approaches, or the integration of the approaches typically aligned with the philosophical approaches, the challenge is how to combine the positions or approaches into a multi-method approach and how to operationalise the combination to produce a research design for examining the first research stream.

Methodological Approaches

After building the framework of ideas for both the research threads, a methodological approach needs to be developed. When selecting a methodology, consideration should also be given to the primary learning outcomes desired. This research has two primary learning outcomes. Firstly, in examining technology support for focus groups, the outcome is an assessment of four communication modes on group effectiveness, and assessing how group members felt about their group's performance. Secondly, learning about the Framework and the use of SSM in assessing group performance will be the result of investigating the effectiveness of SSM for hypothesis testing.

For the examination of how to apply SSM as a hypothesis testing method, an interpretivist approach will be used.

Selecting an appropriate methodological approach to investigating technology support for focus groups is less straightforward. Investigation of technology support Previous research on group effectiveness has shown that social factors can, and do, influence the effectiveness of groups so a purely positivist approach would be too narrow for this type of study. Combining positivist and interpretivist methods would be appropriate to capture task-related and social outcomes.

Finally, the methodology selection leads to the selection of research instruments. In this research, existing research instruments and questions were used where appropriate so that comparisons of results could be made between this study and the other studies employing the same research instrument. Because of the specific Framework of Ideas, a research instrument or instruments catering for data on both positivist and interpretivist aspects of the Area of Application needs to be used.

Research methods or approaches

Methodology selection should be guided by the underlying philosophical position, and should be selected because it meets the researcher's objectives. A methodology should also be selected because it is the best methodology for examining the research question, and is rigorous in its operationalisation (Davison 1998).

Typically, between ten and twenty different research methodologies are identified in the literature as either used, or appropriate for use, in IS (including GSS) research (Alavi and Carlson 1992; Galliers 1992a; Pervan and Atkinson 1995; Zhang and Li 2004). While any framework could be chosen to classify the research methodologies available, Galliers (1992a) separates approaches by their underlying philosophy. Table 5 (from Galliers 1992a, p. 149) lists those research approaches applicable to Information Systems research and those in bold italics are the approaches (or methods) chosen in this thesis for investigating the effects of technology support on group work.

Interpretivist	*Positivist*
Reviews	Laboratory Experiment
Action Research	***Field Experiment***
Subjective/Argumentative	Surveys
Case Studies	Case Studies
Descriptive/Interpretive	Forecasting
Role Playing/Game Playing	Theorem Proof
Futures Research	Simulation

Table 5 - Research Methodologies

Galliers (1992a) also addresses the likely suitability of each approach in Table 5 in the context of the focus of the research and the stage of research. The research focus could be either at the society level, the organisation/group level or the individual level, and the stages of research, are characterised as theory building, theory testing and theory extension.

Approach for examining SSM as a hypothesis tool

SSM has been used as a methodology aligned with a number of approaches identified by Galliers. For example, SSM has been used within "the tradition of Action Research" (Fennessy and Burstein 2000), in case studies (e.g. Taylor and DaCosta 2000; Bergvall-Kåreborn 2002) and as a descriptive/interpretive approach (Rose 1997).

In this research, the investigation is SSM as a hypothesis testing tool requires an approach based on the interpretive philosophical position that allows the researcher to establish an argument for the use of SSM in this way, to present a structured discussion on what extensions or enhancements to SSM might be required, and to convince the reader that this particular point of view is credible.

Chapter Three presents the development of an argument that SSM is an appropriate approach for 'soft' hypothesis testing.

Approach for examining technology support for focus groups

As the second research thread focuses on assessing the performance of focus groups undertaking a task using different technology support is a group-level investigation, the approach should be applicable to the 'organisation/group' level. An assessment also needs to be made of the stage of research the researcher wishes to focus on.

Chapters Four, Five and Six describe the main theories that have been used to try and explain the impact of technology support and task on group effectiveness. The progression suggested by, among others, Jarvenpaa (1988) and Galliers (1992a) is from theory building to theory testing and finally to theory extension. The mixed research results using these theories, presents an opportunity to progress from the theory building stage to greater understanding.

This thesis is initially concerned with testing the theory that a fit between task and technology will result in a positive impact on focus group effectiveness. It then proceeds, by applying an interpretivist approach, to examine the results in more depth. Those approaches in bold in Table 5 are appropriate for studying groups and are aimed at theory testing and extension.

Methods and approaches

Identifying the key features of the range of methodologies, and aligning them with the Framework of Ideas should provide justification for the choice of methodologies.

Laboratory experiments are used to examine the relationships, causes and effects of a small number of variables on each other. Generally a small number of variables are examined using quantitative techniques and the setting is "non-stakeholding participants solving an artificial problem" (Pervan and Atkinson 1995, p.476). This type of research allows for close examination of the variables under consideration, but is often criticised because it does not reflect the real world and therefore has limited generalisability.

While the strengths of laboratory experiments in theory building are recognised, many GSS researchers believe that this research approach becomes less applicable during the theory testing stage. Mandviwalla (1998) notes that while the laboratory experiment is the predominant research approach in GSS, it is not necessarily the most appropriate research method and that field studies would provide more useable results for organisations. Similar comments have been made by Dennis (1990), Nunamaker (1993), and Zigurs (1993).

Field experiments involve actual stakeholders in dealing with a real-world problem. Like laboratory experiments, they focus on the measurement and analysis of usually a small number of factors or variables, and the number of uncontrolled variables is normally small. Unlike laboratory studies, however, the conditions are more realistic (Stowell, West et al. 1997). One of the main limitations on conducting field experiments is finding an organisation willing to participate. Another is that it is almost impossible to accurately replicate the study, as a real life setting is used.

Surveys are used to obtain data about practices, opinions, views or situations. They are a snapshot and are usually conducted with the use of questionnaires or interviews. Normally the data are analysed quantitatively. Surveys allow the researcher to study more variables than laboratory or field studies, and the data collected are from the real world. Additionally, if a large sample of a population is surveyed and analysed, it may provide the researcher with generalisable results. Surveys have the limitation of possible bias in the results due to non-response by particular sections of the sample, the interviewer's own biases (in the case of interviews) or when and how the survey is administered. Surveys also do not probe the processes or causes of the phenomena under examination.

Case studies are investigations of relationships that exist in reality. They are 'focused investigations' of normally a single organisation or group with little or no control in a statistical sense. Because of this, their strengths are seen as a greater level of realism than the laboratory or field experiments, the ability to go into more depth in investigating the phenomena, and the ability to analyse more variables than the previous approaches. Like field experiments, case studies are difficult to replicate and because they are often restricted to a single organisation or group they are also limited in their ability to generalise. Case studies can also be investigated from a positivist, interpretivist or critical position (Cavaye 1996; Klein and Myers 1999), and there is a continuing debate on the relative merits of taking a specific philosophical position (for detailed discussions see Walsham 1995b; Myers 1997a; Yin 2002).

Simulations are abstractions of the real world that attempt to mimic the behaviour of the system under investigation. A simulation is designed with random variables and controlled variables but not with the same research restrictions as laboratory experiments. Simulation has the advantage of allowing researchers to examine situations that might be difficult, dangerous or technically impossible to analyse in the real world. The limitation of this approach is the same as other experimental approaches; how does the researcher construct a simulation that accurately represents the real world?

Descriptive/Interpretive approaches are based on the researcher's speculation, opinion or interpretation of events and the meanings that people assign to the phenomena under investigation rather than empirical data collection and examination of variables (Klein and Myers 1999). Proponents of interpretive approaches argue that this research is aimed at improving the researcher and readers understanding of the context of the information system, and the process by which the information system is both influenced, and influences, the system under investigation (Walsham 1995b). These characteristics mean that descriptive/interpretive approaches are often used in the theory building stages because they can create new ideas and concepts. The main limitation cited for this research approach is the influence of the researcher's biases on the final outcome of the study. A number of these approaches are also 'unstructured' so establishing any quality control on this type of research is difficult.

Subjective/Argumentative discourse covers uses methods including 'inference, logic, and procedural rules' to reach conclusions through logical reasoning. (van Eemeren, Grootendorst et al. 1996) Subjective/Argumentative approaches cover both debate with the objective of reaching mutually acceptable conclusion with others, and debate in which victory over an opponent is the primary goal. The argumentative epistemology is characterised by the construction of a rational argument which in turn suggests what is appropriate supporting evidence to reach the conclusion put forward by the argument(Cohen 1987). The form of the argument counts for as much as the context of the argument, even though the context often affects the persuasiveness of the argument (Crosswhite 1996; Tindale 1999) Typically the use of subjective/ argumentative approaches in IS have concentrated on constructive discourse leading to better IS requirements definition or systems development (Hirschheim, Klein et al. 1994; Metcalfe and Powell 2000).

Action Research is an approach in which the researcher is explicitly involved in the intervention. The aim of this approach is to improve the problem situation (or develop some results for the organisation, group or individual) while also developing theoretical knowledge about the problem or situation. The strength of this approach that the researcher's influence and biases are identified and made explicit in the research so that it can be factored into the analysis. The researcher is not a detached observer in Action Research. Like case studies, action research is generally constrained to investigating a single organisation or group so generalisability can be difficult, and there can be problems when the practical and theoretical outcomes conflict.

Chosen approaches

Having outlined the range of approaches, I have adopted what Mingers (2001) calls a 'pluralist' approach in this research.

For the investigation of the application of SSM to hypothesis testing I have chosen to use the Subjective/Argumentative approach.

For examination of the effect of technology support on group performance, the investigation was a combination of a field experiment and an interpretivist/descriptive field study. In selecting a pluralistic approach I have also taken into consideration Zigurs' (1993) summary of the main recommendations for GSS research measurement and method selection:

- Continue with laboratory studies while increasing the number of field studies to 'validate' experimental findings in a semi-controlled environment.
- Triangulate by using multiple methods so that the richness of the data can be exploited.
- Where appropriate, increase the depth of qualitative analysis and employ longitudinal research strategies.

- Share measurement instruments to facilitate more accurate comparison between experiments and provide more measurement information in publications and reports.
- Revalidate instruments when applying them to different units of analysis.

Subjective/Argumentative

This approach provides the flexibility to incorporate previous discussion on the use of SSM to test hypotheses or clarification of theoretical constructs, a presentation of the argument for the use of SSM for ‘soft’ hypothesis testing, and explicit identification of the premises from which the conclusion that SSM is an appropriate method for hypothesis testing is derived.

Field experiment

The purpose of this research is to compare the effect of technology support on focus group performance, and previous research into TTF has focused on laboratory and field experiments so to provide an ability to compare results, an experimentation approach would be appropriate. Because of the paucity of field study research in the GSS area (Pervan 1998; Kock, Davison et al. 2001), ADFA’s willingness to support the study, and the involvement of real stakeholders in the organisational problem, a field experiment was chosen.

One of the implications of using any form of experimentation is, as stated by Galliers (1992a), that “Essentially, the value given to those variables excluded from the experiment is zero, which is probably the one value they do not have!” Rather than being an argument for the discounting of experimentation for IS research, this can be seen as an argument for the inclusion of other approaches in a study to improve the richness of the analysis, as introducing other methodological approaches allows the researcher to give value to other variables and elements outside the scope of the statistical analysis.

Another strength of using a field experiment in this research is that, as Zigurs (1993) identified, more field research is needed to try to validate the laboratory research in this area and to provide a transition mechanism where laboratory research can be 'retested' and possibly refined.

Descriptive/ Interpretive

The field experiment design could have been based on any one of the four views identified by Falconer and Mackay (1999). Because the qualitative analysis aims to increase the richness of the overall analysis and tease out some of the issues raised in the statistical analysis, the research design combines positivist and interpretivist approaches “from an interpretivist perspective”. Mingers (2001, p.13), while analysing the work of Trauth and Jessup (2000), states that in their study interpretive analysis was “… aimed to surface and understand the meaning of the various interactions to the individual participants themselves within their particular organisational context”. The main aim of the interpretivist approach taken in my research is to provide a richness and context to the statistical analysis and suggest alternatives to a priori assumptions and hypotheses.

Summarising the methodological approaches

Summarising the methodological approach, and aligning it with the two research threads and research questions detailed in Chapter One:

- A subjective/argumentative approach has been taken to develop the case for SSM being used as the basis for exploring the relationships between technology support, the activities of the focus groups and the effect of the interaction between the technology support and the focus group tasks on group performance.
- A combination of a descriptive/interpretive case study and a field experiment has been used to examine the effect of different combinations of technology support on the performance of the ADFA focus groups.

The relationship between the research approach and the research questions is illustrated in Figure 8. SSM is first extended and modified using a subjective/argumentative method to make it suitable as a research approach for looking at the effect of technology support on focus groups. After developing the ‘soft’ hypothesis approach it needs to be tested, and the it is applied to the second research question - investigation of different combinations of technology support on focus group performance. If the application of SSM is successful then it will be possible to answer the second research question.

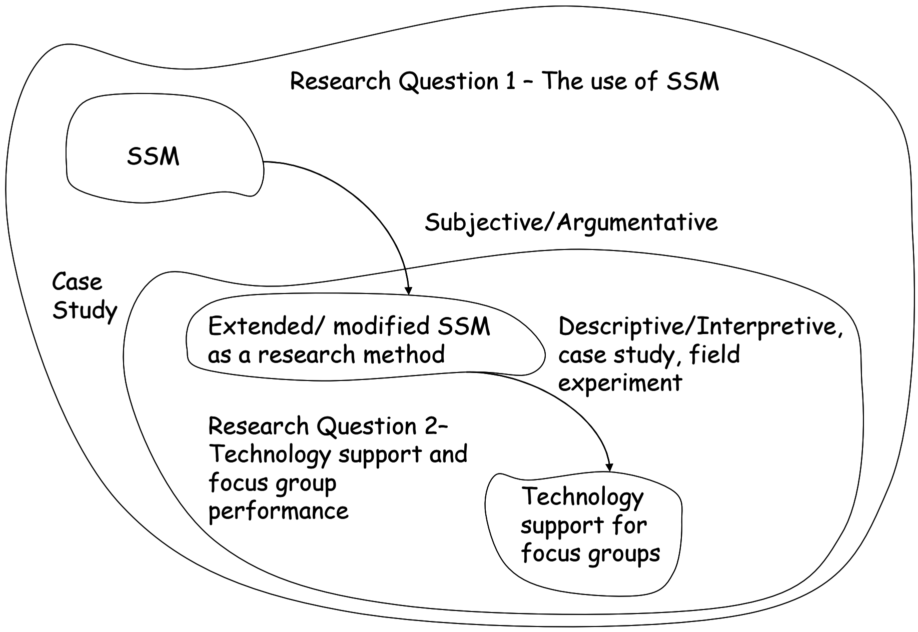


Figure 8 – Relationship of research approaches and research questions

The use of the extended SSM and completion of the examination of the focus groups is also a case study in it own right, and regardless of the outcome of this part of the research, the act of completing the assessment of the focus groups using soft hypothesis testing will provide an answer for research question one – can SSM be used in this context.

Using SSM for hypothesis Testing

One feature of this research that differs from previous analysis of technology support for focus group work is that in this research the effectiveness of technology support has been viewed through a framework and methodology based on Soft Systems Methodology. To date, the use of SSM to explore the effectiveness and efficiency of GSS has been limited (Galliers, Klass et al. 1991) There has been some discussion in the literature on the interaction between SSM and GSS, although this has concentrated on the use of a GSS to support groups using SSM to investigate complex problems (Venable, Travis et al. 1996; Venable and Travis 1999)

The SSM literature provides the following summary of the uses and application of SSM:

- SSM is a problem structuring and solving methodology (Checkland and Scholes 1990; Patching 1990).

- SSM has been used to structure improvements and debate about problem situations.
- There is one example of the use of SSM in hypothesis testing (Wilson 1984) and one example of its use in 'clarifying a theoretical concept' (Checkland 1981, p. 202-205).
- SSM oriented research is normally applied rather than pure (Wilson 1984; Rose 1997).

SSM's philosophical position means it is normally defined as an approach to interpretive studies. (Jackson 1991b; Rose 1997).

The motivation for adopting SSM as the framework for this research was:

- Traditional approaches to hypothesis testing concentrate on the scientific approach, and results are normally based on statistical analysis of quantitative data. In recent years, however, there has been in increase in the use of interpretivist or social science approaches including SSM to explore issues in GSS and other IS contexts (Kaplan and Duchon 1988; Lee 1991; Checkland and Holwell 1998; Klein and Myers 1999; Trauth and Jessup 2000).
- Group Support System (GSS) research, based on the reference disciplines of computer science, behavioural science and management science is concerned with analysing both quantitative and qualtitative data, and often the richest analysis is obtained when data is combined (Kaplan and Duchon 1988; Zigurs 1993; Trauth and Jessup 2000) .

The theoretical development of using SSM for hypothesis testing is detailed in Chapter Three**,** but the high level model that was used in this research is shown in Figure 9.

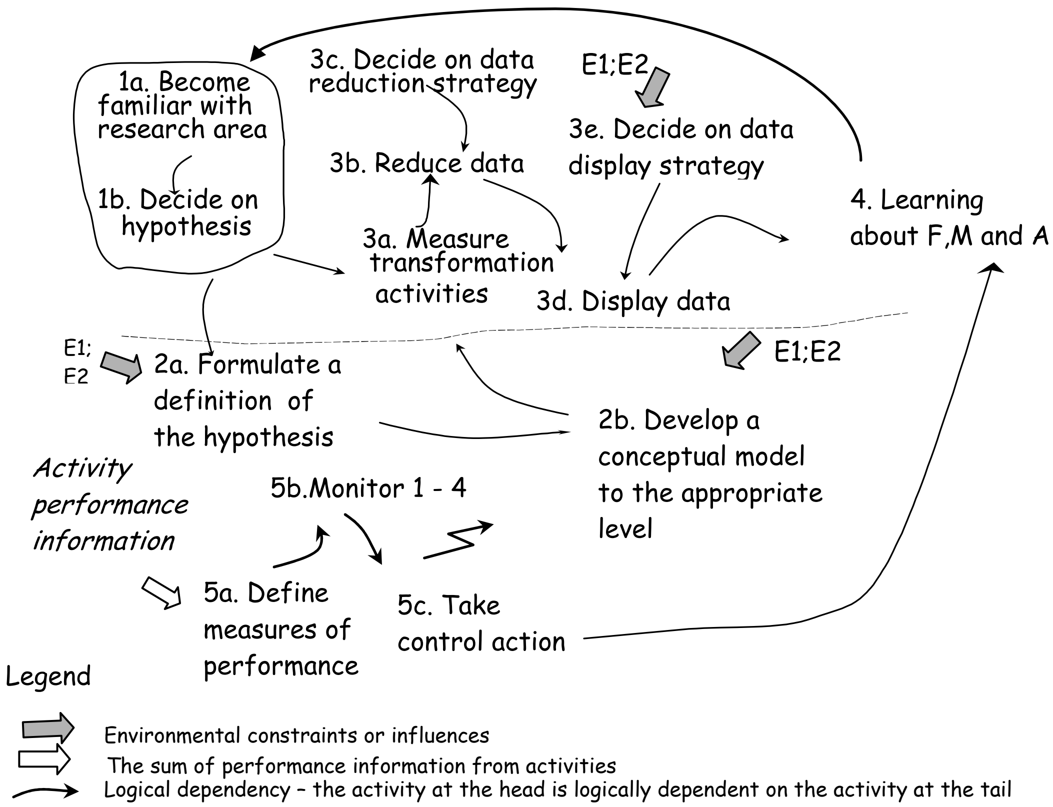


Figure 9 - SSM model for hypothesis testing

The model in Figure 9 makes a distinction, from the tradition of Checkland (1981), between the 'real world' and 'systems thinking about the real world'. Real world activities include becoming familiar with the research area and deciding on a research question and hypothesis that addresses a real world problem or problem situation, through to the data reduction and data display strategies to the ultimate learning that is garnered from the study. The systems thinking supporting the learning about the real world involves the formation of logically valid root definitions and conceptual models through which the impact of technology support for group work can be measured and assessed.

Data collection

Data were collected from a number of sources. ADFA cadets participating in the focus groups completed a questionnaire during and after the meeting and a number of cadets participated in post focus group interviews. Those cadets that met for all or part of their focus group in the meeting room were observed by the researcher who compiled a field notebook with observations. A selection of those cadets that met on-line for all of their focus groups had both unstructured and structured interviews.

Area of Application for the technology support research thread

The area of application (A) is the 'real world problem situation' that the researcher wishes to learn more about. The area of application (A) for the research thread examining the effect of technology support on focus groups is an evaluation of the Single Service Training (SST) program at the Australian Defence Force Academy (ADFA).

Australian Defence Force Academy

Military and Academic Components

ADFA is an organisation comprised of two parts. The military component of ADFA provides military education and training to officer cadets to prepare them for entry into the Australian Defence Force (ADF). The other part of ADFA is the academic component where University of New South Wales (UNSW) staff provide a "balanced and liberal university education in a military environment" as a foundation to their future careers as Defence Force officers (ADFA 1998, p. 14).

The majority of officer cadets at ADFA are drawn from the three Services; the Royal Australian Navy (RAN), the Australian Army (ARA), and the Royal Australian Air Force (RAAF). Cadets from a number of other countries are also represented at ADFA. As a tertiary institution in Australia, ADFA is unique because it provides "concurrent tertiary education and vocational education" (Warn, Tranter et al. 1997, p. xiv).

Military training

A section of the ADFA military component (Military Training Wing) is responsible for planning, coordinating and implementing of the military training program at ADFA. Military training is conducted throughout the academic year, and in blocks during academic breaks. ADFA cadets spend about three months per year completing military training, and the two types of military training they are required to complete are Common Military Training (CMT) and SST.

SST, the program examined in this research is aimed at providing cadets with instruction on military aspects peculiar to their chosen Service. SST is conducted by the Services away from ADFA. For example during Year 1 all RAAF cadets attend RAAF College at Point Cook, and Navy cadets spend time at the Naval College at

HMAS Creswell. Over three years at ADFA, cadets can expect to spend up to 16 weeks, depending on their Service, on SST.

The curriculum for SST is determined by each Service, and Military Training Wing ensures that, wherever possible, this training is coordinated and integrated with the CMT program conducted at ADFA. There are annual evaluations of SST, and the results indicate that most graduates were less than satisfied with the SST they received prior to graduation from ADFA. The evaluations that had been conducted were, in the main, not very detailed. What the Training and Development Officer (TDO) required was a detailed examination of SST to assess if it was meeting the objectives of the training and the expectations of the cadets themselves. This was the primary reason for selection of SST as the 'problem situation' in the field experiment.

Evaluating SST is an appropriate application area for my research for a number of reasons. Firstly, having completed SST the cadets were familiar with the syllabus. They were not privy however to the underlying objectives of the training. The SST evaluation provided a good opportunity to examine the gap between the stated objectives of SST and the perceptions of the cadets on whether those objectives were met. Secondly, cadets often discussed amongst themselves about their experiences on SST, the syllabus content and the performance of the military instructional staff but had few outlets for formal comment. They were enthusiastic about being provided with an outlet for their ideas, criticisms and suggestions. Thirdly, the cadet population had access to computers at ADFA in the academic areas and in their living quarters. This meant that access to technology support was not an issue.

SST also provided an appropriate topic from the researcher's perspective because it was familiar to the cadets, and was not a contrived task. Assessing SST was also achievable in one focus group session so more focus groups could be completed in the time available.

More information on ADFA and SST can be found at Annex B.

Learning about F, M and A

The final element of the research meta-framework centres on the learning expectations from conducting this research.

Learning about using SSM for soft hypothesis testing

The main learning outcome from this research thread is can SSM be used for soft hypothesis testing. Evaluation will consist of examination of five factors proposed by Oates and Fitzgerald (2001), and an additional two factors suggested by Champion and Fitzgerald (2003). The seven factors are summarised as:

- Definition of the research paradigm (Paradigm).
- Defining the purpose, and the F, M and A (Purpose).
- Identification of participants and research motivation (Participants).
- Integration of action and research (Process).
- Judgment of success and leaning outcomes (Product)
- Making evident the methods and tools to engage people (Engagement).
- Judging the authenticity of the enquiry (Authority).

Learning about focus group effectiveness

The learning outcome from this research thread is, as the thesis title states, an investigation into the effectiveness of different group communication modes. In this research four different communication modes are compared, including two modes which mix both same time/same place and different time/different place communication. This extends the current body of knowledge which has focused primarily on a single mode or comparison of two modes.

In defining what effectiveness means, I have divided the outcomes into the following separate elements:

- The effectiveness of the group in completing the tasks assigned to them (*Task Effectiveness*).
- The level of satisfaction that the group has after completing the task (*Participant Satisfaction)*.
- The degree to which the group felt they were a unit rather than a collection of individuals, and their attitudes towards other group members (*Group Relations*).

- The group's rating of their overall satisfaction with the group process and results (*Overall*).

The learning strategy for the ADFA Focus Groups covered the analysis of both quantitative and qualitative data. Table 6 summarises the variables used in the quantitative analysis and the elements used in the quantitative and qualitative analysis. The quantitative variables are common dependent variables used to measure group performance, and have been used in other studies. More detail on which researchers have used these variables, and the justification for their use in this research, are presented in Chapter Seven and Chapter Eight.

Element	*Variable*
Task Effectiveness	Number of ideas generated
	Confidence with the idea generation process
	Confidence with the evaluation process
	Idea Efficiency
	Efficiency of evaluation
Participant Satisfaction	Satisfaction with the idea generation process
	Satisfaction with the evaluation process
	Satisfaction with the idea generation results
	Satisfaction with the evaluation results
Group Relations	Group cohesiveness
	Equality of participation
Overall	Satisfaction with the focus group process
	Satisfaction with the focus group results
	Perceived focus group effectiveness

Table 6 - Summary of learning about focus group effectiveness

Learning about the Framework and the Methodology

This thesis provides another example of research that combines the two philosophical positions of positivism and interpretivism. In this case, the primary contribution to knowledge about the Framework and the Methodology will be the use of SSM to integrate qualitative and quantitative information into an interpretive analysis of the effect on technology support on the performance of ADFA focus groups.

The positivist statistical analysis will be used as the method of assessing the existing TTF theory and comparing it to previous research. At the end of the research an evaluation of the usefulness and efficacy of this approach from the researcher's perspective will be made.

Learning about the Area of Application - ADFA

The results of the focus group as they relate specifically to the SST program is one element of learning but is outside the scope of this thesis. The data gathered from the focus groups and learning about SST was to provide an input to the military evaluation of SST.

The learning about the focus groups that is the focus of this thesis is:

- The impact of different task and technology support combinations on the effectiveness of the focus groups. Prior studies have shown that technology support can improve focus group effectiveness although these studies have been restricted to single modes of technology; either synchronous or asynchronous.
- The impact of factors other than task and technology support on the effectiveness of focus groups.

Learning limitations of the ADFA field experiment

While there are learning opportunities in this research, there are also some limitations. Firstly, because the ADFA focus groups meet only once, there was no opportunity to see if groups would appropriate the technology and possibly use it in more effective ways than envisaged by the researcher (e.g Davenport and Travica 1995). Other studies have shown improvements in effectiveness over time (see Burke and Chidambaram 1999). For this research, longitudinal analysis was not relevant because the analysis was assessing the implications of technology support on the performance on 'non-repeating' focus groups.

Finally, because all the group participants are drawn from a reasonably homogeneous group (as noted in Stevenson 1995; Warn, Tranter et al. 1997), there is no scope for an examination of cultural issues such as power distance, gender bias, or cross-cultural aspects of GSS use.

Summary

In this chapter I have presented the research approach, strategy and methodology within the research meta-framework provided by Checkland (1991). By looking at the underlying philosophy, the research can be described as a combination of positivist and interpretivist from an interpretivist perspective. The methodology is to use a field experiment to gather both qualitative and quantitative data, and the data collection techniques of questionnaire, post-meeting interview, researcher field notes and informal discussion are used. The Area of Application is ADFA officer cadet focus groups evaluating their SST programs using different combinations of technology support.

The primary learning outcome from this research is a better understanding of the impact of particular combinations of social influences, task and technology support on the performance of a focus group. SSM will provide the structure for the integration of quantitative and qualitative data. First, a statistical analysis of the ADFA focus groups will be conducted to provide a positivist view about the effects of technology support as the basis for comparison with the other studies in this area. Second using qualitative data collected through researcher field notes and critical reflection, interviews with cadets, and the qualitative questions on the post-focus group questionnaire. The aim of the SSM study is to illustrate the ‘thick’ description that is available to GSS researchers when they use interpretivist approaches. While not producing a 'complete and objective' analysis, this research goes further than any previous studies on the impact of technology support for focus groups and provides more insights into this area.

The next chapter reviews Soft Systems Methodology (SSM), and then develops SSM as a framework for soft-hypothesis testing.

CHAPTER 3 SOFT SYSTEMS METHODOLOGY FOR HYPOTHESIS TESTING

Introduction

This chapter begins by describing and reviewing SSM, and then develops an argument for using SSM as a framework for hypothesis testing. An enhanced SSM model is developed for use in the focus group field experiment.

Traditional approaches to hypothesis testing have concentrated upon a scientific approach, and results are normally based on statistical analysis of quantitative data. In recent years, however, there has been in increase in the use of interpretivist or social science approaches to explore issues in GSS and other IS contexts (Kaplan and Duchon 1988; Lee 1991; Checkland and Holwell 1998; Klein and Myers 1999; Trauth and Jessup 2000).

Group Support System (GSS) research, based on the reference disciplines of computer science, behavioural science and management science is often concerned with simultaneously analysing quantitative and quantitative data gathered during the meeting. One approach that has been used in the IS community as the basis for exploring complex problems and `situations, but has received little attention in the GSS community, is Checkland's Soft Systems Methodology (SSM). The limited interaction between GSS and SSM has been concentrated on the development and use of a GSS to support groups using SSM to investigate complex problems (Venable, Travis et al. 1996; Venable and Travis 1999)

In examining the utility of SSM to theory testing, this chapter aims to make a contribution in two areas. Firstly, this chapter extends the early work of Wilson (1984) and shows that the use of SSM constructs are a viable method of testing theory-in-practice. Secondly, it adds to the body of knowledge about research approaches based in the social science traditions that have utility in GSS and IS research.

Soft Systems Methodology

Systems thinking, Soft Systems Methodology (SSM) and the concept of a Human Activity System (HAS) were introduced in Chapter 1.

In summary, the body of literature identifies the following uses and applications of SSM:

- SSM is a problem structuring and solving methodology (Checkland and Scholes 1990; Patching 1990; Crawford, Costello et al. 2003).
- SSM has been used to structure improvements in, and debate about, problem situations (West 1995).
- There is one example of the use of SSM in an hypothesis testing context (Wilson 1984) and an example of its use in 'clarifying a theoretical concept' (Checkland 1981, p. 202-205).
- Information systems development (Wilson 1984; Galliers 1992b; Avison and Fitzgerald 1995; Stowell 1995; Winter, Brown et al. 1995; Checkland and Holwell 1998; Bustard, He et al. 2000; Vat 2004).
- Information requirements analysis (Checkland and Holwell 1993; Mingers 1995; West 1995).
- SSM-based research is normally applied research rather than purely theoretical (Wilson 1984; Rose 1997).
- SSM's philosophical position means it is normally identified as an approach to interpretive studies. (Jackson 1991b; Rose 1997).

Traditional SSM

The basic shape of SSM is illustrated in Figure 10(Checkland and Scholes 1990, p. 27). Checkland described seven stages and presented them in a chronological sequence, although he stated at the time of its formulation that it is not essential, or even desirable, to progress from stage 1 to stage 7 (Checkland 1981, p. 162).

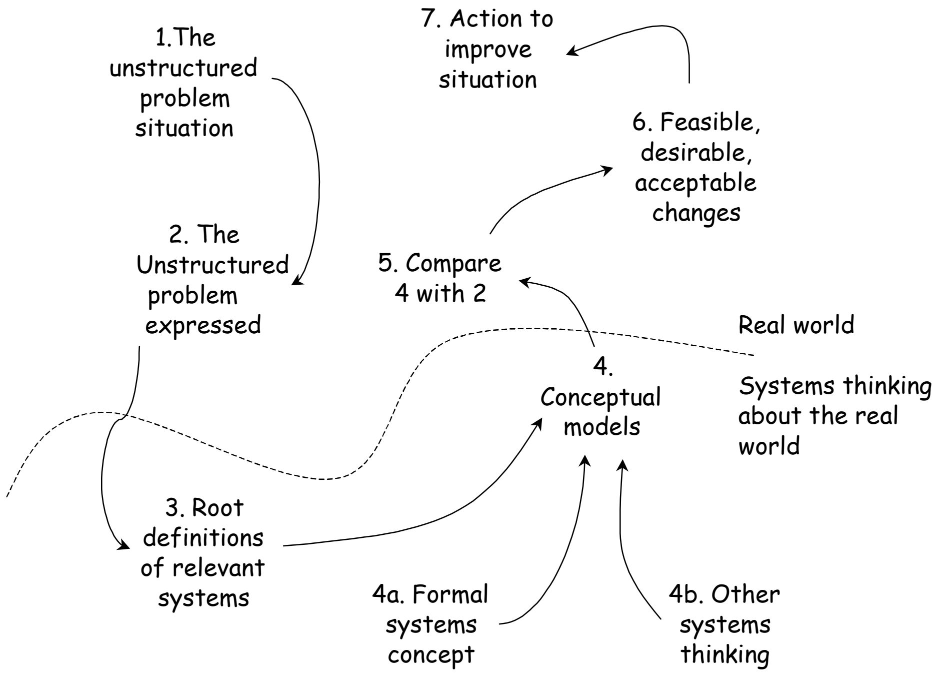


Figure 10 – The traditional shape of SSM

In totality, the seven stages represent a set of 'mental acts' that the analyst engages in when observing, structuring and hopefully improving the problem situation (Checkland 1981; 1990). These mental acts:

- Perceiving.
- Predicating.
- Comparing.
- Defining.

Perceiving. Stages 1 and 2 are concerned with the problem situation as it is perceived by some 'would-be improvers of the problem situation'. In SSM the normal process of expressing the problem situation is for the elements of the problem situation and relationships between them to be displayed pictorially in a Rich Picture(RP). The key feature of this mental act is to "display the situation so that a range of possible and, hopefully, relevant choices can be revealed" (Checkland 1981, p. 166).

Predicating. In Stages 3 and 4 one or more 'relevant' systems and an associated conceptual model of the activities that make up that system are defined. Both stages require the researcher to understand the 'Human Activity System" (HAS). The HAS is a way of thinking holistically about human activity and covers the set of logical activities undertaken and the social and cultural activities that surround the undertaking of the logical activities (Wilson 1984).

Stage 3 requires the selection of a 'relevant' HAS from the problem situation and the development of a definition of that system (a Root Definition or RD). In it's most rudimentary form, a Root Definition is a structured way of describing a human activity system that transforms inputs to outputs by some action in order to achieve a particular outcome (Checkland and Scholes 1990, p. 36).

Developing a RD requires an awareness of 6 essential elements in the problem situation (Checkland and Scholes 1990, p. 288). Firstly, the transformation process (*T*) needs identification. The other five elements put the transformation into context, and are:

- The set of "Customers" (C) or clients who are effected (positively or negatively) by the *T*.
- The set of 'actors' (A) who perform the *T*.
- The viewpoint (or weltanschauung) (*W*) which makes the *T* meaningful.
- The set of 'owners' (*O*) who could abolish the system or stop the *T*.
- The set of environmental constraints (*E*) which shape the operation of the system.

As a minimum, any RD must contain a description of the *T* process , the means of performing the *T* and the outcome the Owner wishes to achieve.

Stage 4 is the development of conceptual models (CM) that describe what activities need to occur for the system to be the one named in the Root Definition. The activities in the conceptual model are linked logically with the links indicating the *dependence* of one activity on another. The CM is not a description of what actually exists but is a "logical expansion of a particular idea" (Mingers 1995, p. 22). The key measure of the usefulness of the RD and CM in examining a problem situation is its relevance; that is, developing the CM and then comparing it with the real world, is "likely to lead to illumination of the problems and hence to their solution or alleviation" (Checkland 1981, p. 167).

Comparing. Stage 5 is where the CMs are compared to the perception of the real world (stage 2) and this comparison is used "to interrogate or investigate real-world purposeful action"(Checkland, Forbes et al. 1990, p.30). This stage is not a comparison of like with like but a comparison is used where "intuitive perceptions of the problem are brought together with the systems constructs which the systems thinker asserts provide an epistemologically deeper and more general account of the reality beneath surface appearances" (Checkland 1981, p. 177-178). The four methods offered in the traditional SSM literature for comparing the problem situation and RD/CM combination and generating debate about possible improvements to the problem situation are:

- Informal discussion about the nature of the models and their differences with reality.
- Formal questioning about whether the activity exists in the real world, how is it currently done and to what standard, and who currently performs the activity.
- Historical reconstruction of a sequence of events according to a CM and then comparing this sequence with what actually happens.
- Model overlay – where the CM is structured so that it closely reflects what exists in the real situation and then overlaying the CM on the 'real world' model. Any differences between the two models can then be seen (Checkland 1981; Wilson 1984; Checkland and Scholes 1990).

Deciding. The fourth mental act is covered by Stage 6 and Stage 7 of the traditional SSM model. Stage 6 takes the results of the debate at Stage 5 and, tempered by the cultural and systematic elements of the problem situation identified in Stage 1 and stage 2, a set of culturally feasible and systematically acceptable changes that can improve the problem situation are developed. Three types of changes are possible: structural changes, procedural changes and attitudinal changes. Stage 7 is the actions taken to implement the actions agreed from Stage 6. In SSM, completing Stage 7 is not the completion of the process. By implementing changes, the problem situation is recast, and the result may be another situation where SSM can be used to improve the situation.

One feature that differentiates SSM from other approaches is that the focus is not on the problem itself but the problem situation. As Braithwaite, Hindle et al. (2002, p. 195) state: "Contrary to stand-alone scientific studies, the focus is not on problems but on problem situations (that is, on the social and organizational circumstances in which problems exist and which may continually generate new problems and solutions)”

Modern SSM

The ‘modern’ form of SSM, illustrated at Figure 11, explicitly recognises two interacting streams to any analysis (Checkland and Scholes 1990, p. 309).

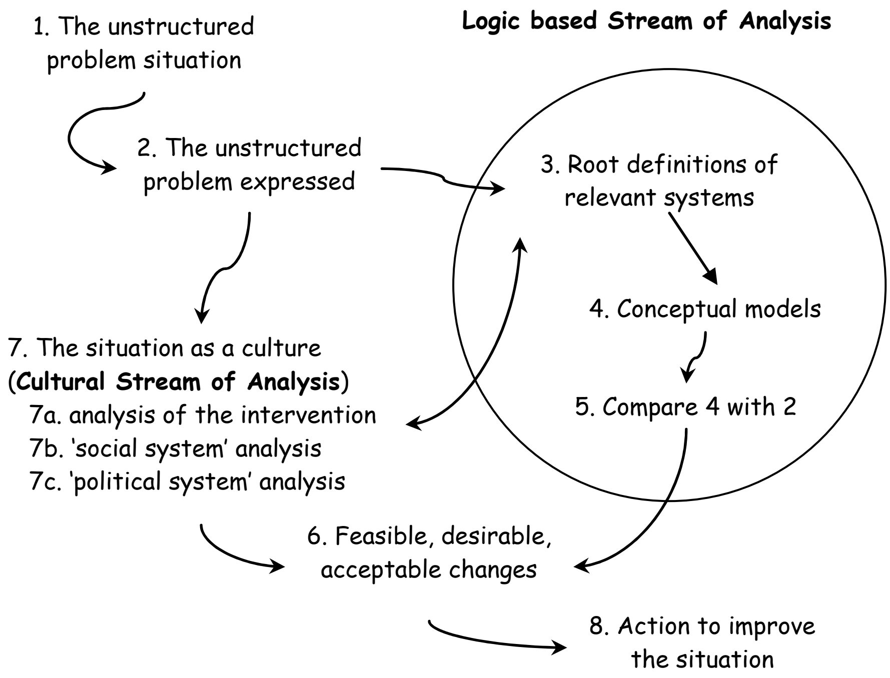


Figure 11 - The 'modern' shape of SSM

One stream is the traditional logic-driven SSM approach where models are built and then compared to the real-world so that a debate about desirable and feasible changes can occur. The second stream is a cultural analysis of the problem situation. The social and political aspects of the problem situation are explored and this analysis informs the development and choice of relevant HAS and the debate about change. The cultural stream also includes an analysis of the roles in the intervention: the client, the problem solver, and the problem owner. The problem owner is a ‘plausible’ role from which the situation can be viewed (Checkland and Scholes 1990, p. 288).

Checkland and associates (see, for example Checkland and Scholes 1990, p. 27; Checkland and Holwell 1998) have categorised the cultural stream into three distinct, but linked, analyses:

- **Analysis of the intervention.** Analysis One is an examination of the social structures and roles in the situation. It identifies the client(s), problem owners, and the role of the problem solver. In most SSM studies, Analysis One is presented in the form of a Rich Picture. In this study, Analysis One will be developed in a narrative form.
- **Social system analysis.** Analysis Two examines the cultural dimension; that is, the relationships between the roles identified in Analysis One, behavioural norms and cultural values in the group. Checkland and Casar (1986) argue that a social system is in continual change because of the interaction between the roles, the behavioural norms and the values or beliefs ascribed to by the group.
- **Political system analysis.** Analysis Three is the political dimension of the situation. Politics, as described by Checkland and Scholes (1990, p. 50), is the "process by which differing interests reach accommodation". In Analysis Three, the problem solver looks at the power relationships in the situation, how power is represented and power is obtained and used.

While recognising that the stream of cultural enquiry is "equal in importance to the logic-driven thinking" (Checkland and Scholes 1990, p. 44), how to conduct this analysis is not fully developed and has not changed since Stowell (1995, p.200) noted "little guidance is yet provided on how it may be conducted formally".

Mapping the four mental acts outlined by Checkland to the modern SSM, the exploration of the problem situation as a culture stream contributes to, and draws from, the mental acts of perceiving (stage 2), predicting (stage 3) and deciding (stage 6).

In the modern form of SSM, both streams explicit in the model are seen as essential for an SSM study, so the mathematical sense of triangulation described by Kelle (2001) offers the best metaphor for combining approaches . Both cultural and logical system analysis need to occur in an SSM study, and one informs the other. Rather than being complementary or convergent both analyses *have to be* combined before the results are meaningful.

Extensions and enhancements to Stages 4 and 5

Most of the published work on SSM follows the framework first articulated by Checkland (1981). There have been attempts, however, to refine, extend or enhance the SSM framework to make it more applicable to particular tasks (see, for example Galliers 1992b; Stowell 1995) or to better define stages or aspects of SSM. In using SSM for hypothesis testing, the three areas that require elaboration are the comparison stage, developing measures of performance and how to monitor system activities.

Defining the comparison stage

The evaluation actions in SSM focus on *comparing* the models with the real world situation and generating debate about changes that can improve the problem situation (Checkland and Scholes 1990). Ledington and Ledington (1999) believe that comparison is one of the three core concepts of SSM along with the problem situation and identifying relevant systems, but the SSM literature "is not helpful when it comes to the area of comparison". The difficulty that Ledington and Ledington (1999) expose in the SSM literature is that there is little explicit guidance on how to organise and conduct the comparison, how to ensure it is appropriate and rigorous, and how the reporting of SSM-based studies can be described more fully than is currently the case. Additionally, the authors believe that Checkland's discussion of *comparison* is based on whether a version of the system model exists in the real world, and whether a different version might be more superior in the circumstances. They argue that this approach is limited and is not the general case of *comparison* (p. 1156).

Ledington and Ledington (1999) have developed a three dimensional model that can be used to explore the value of comparison. They believe that models should be viewed as a social artefact and, as such, they are attributed value by those that develop and debate them. The three dimensions of value (the EDI framework) defined in the paper are:

- Importance.
- Desirability.
- Expectation.

Importance is the value of the model in the context of the problem solving activity. When the RD/CM combination is first developed, the analyst has a view on its importance in generating useful debate. When the model is compared to the problem situation, however, the ability of the model to generate that debate may change the analyst's perception of the importance of the model.

D*esirability* is a value developed as a result of comparing the model with the problem situation. If the activities in the model are seen by the analyst as *desirable*, and the activities in the real world match those in the model or suggest modification of real world activities to match the *desirable* model, then the model can be seen as desirable 'in the context of the situation'. Similarly, if the analyst believes the activities in the model are *undesirable* and these activities are then seen in the real world, the real world activities are seen as needing remedial action.

The analyst's *expectation* about the relationship between the model and the problem situation is the third value dimension. The analyst expects that when the model is developed and compared to the problem situation it will have meaning to those in the problem situation.

Using the three dimensions to define a 'comparison space' allows three separate judgements to be expressed. The analyst has an *expectation* that the model that has been developed has some meaning in the context of the problem situation, and as an expression of activity relevant to the situation the model has a level of *desirability*. Finally, the analyst can evaluate and state their perception of the *importance* of the model relative to the problem solving activity. Ledington and Ledington (1999) report that the EDI model has been used to make judgements in the 'comparison space' in three ways:

- To facilitate the identification and development of a portfolio of relevant systems.
- To help clarify in the analyst's mind the characteristics of the models they are using before they get to the comparison phase.
- Using the EDI framework aids interpretation of the results of the comparison of the CM with the real world activities.

Desirability

Expectation		Desirable	Undesirable
	High	Match (1) Mismatch (2)	Match (3) Mismatch (4)
	Low	Match (5) Mismatch (6)	Match (7) Mismatch (8)

1. Desirable and Expected – confirms assumptions; agenda is to improve operation of current activities
2. Expectation judgment unsound and undesirable activities do exist in situation - review expectation assumptions and choice of relevant systems, revise expectation or take action as in 6.
3. Undesirable but expected – develop plan to remove or modify undesirable activities in situation
4. Expectation judgment unsound, but confirms undesirable activities do not exist in situation – review expectation assumptions and choice of relevant systems
5. Expectation judgment unsound but desirable activities do exist in situation - rethink choice of relevant systems or take action as in 1.
6. System is desirable but is not operational in this situation ; the expectation assumptions cannot be determined – address strategic decision to initiate and develop such activities in the situation
7. Expectation judgment unsound, but undesirable activities do exist in situation – rethink choice of relevant systems or treat as 3.
8. Confirms undesirable activities do not exist in situation but the expectation assumptions cannot be determined - rethink choice of relevant systems

Figure 12 - Desirability-Expectation matrix

Figure 12 summarises the actions and guidelines proposed by Ledington and Ledington (1999) when using the EDI framework to interpret *comparison* results.

In this research there is no requirement to develop a portfolio of relevant systems, but there was a need to ensure that the researcher was aware of the characteristics of the models being developed. The EDI framework is also useful in this research when comparing the results of the field experiment with the research literature. Finally, the EDI framework is used and subsequently evaluated in a fourth way: to structure the reflections and evaluation of the utility of using SSM for hypothesis testing.

Improving monitoring and control actions

A second area of SSM that has attracted the attention of SSM researchers and practitioners has been in the area of monitoring and control. In Checkland's formal systems model, measures of performance are used to indicate "progress or regress in pursuing purposes or trying to achieve objectives." (Checkland 1981, p. 174) and by including monitoring and controlling activities it provides "the in-principle possibility that the (system) can adapt and survive and remain purposeful"

(Checkland, Forbes et al. 1990, p. 30). Wilson (1984) describes the inclusion of monitoring and control as coming from a view of a Human Activity System as a controlled system, and that if the HAS to achieve its objective then measures of performance must be defined and activities included in the model that use the measures of performance to improve the degree of achievement of the HAS.

Checkland (1981) defines the uses of the measures of performance, and the monitoring actions associated with these measures, as:

- To directly influence the system environment.
- To regulate the activities of the system.
- To inform the allocation and reallocation of resources of the system.

Summarising the classes of measures of performance, Checkland (1990) identifies three distinct criteria (the 3 Es) that can be used to show the successful or unsuccessful transformation of input to output:

- Does the transformation achieve an output? (efficacy)
- Does the transformation use minimum resources? (efficiency)
- Does the transformation achieve the long term aim of the system? (effectiveness)

Additionally, SSM practitioners (e.g. Atkinson 1989; Checkland and Scholes 1990, p. 39) have included two additional Es that are applicable when examining certain problem situations:

- Is the transformation a moral thing to do? (ethicality)
- Is the transformation aesthetically pleasing? (elegance)

Using SSM to analyse quality of life and continuous urban development, Graeml, Graeml, Graeml and Ehrdmann (2004) show how the transformation process articulated in the root definition can be measured in terms of the 3Es. These measures of performance align with the basic questions of ‘what, why and how’. The 3Es, the relationships to ‘what, why and how’, and the remedial action that would need to take place if the answer to any of the 3E questions is ‘no’, are illustrated in Figure 13.

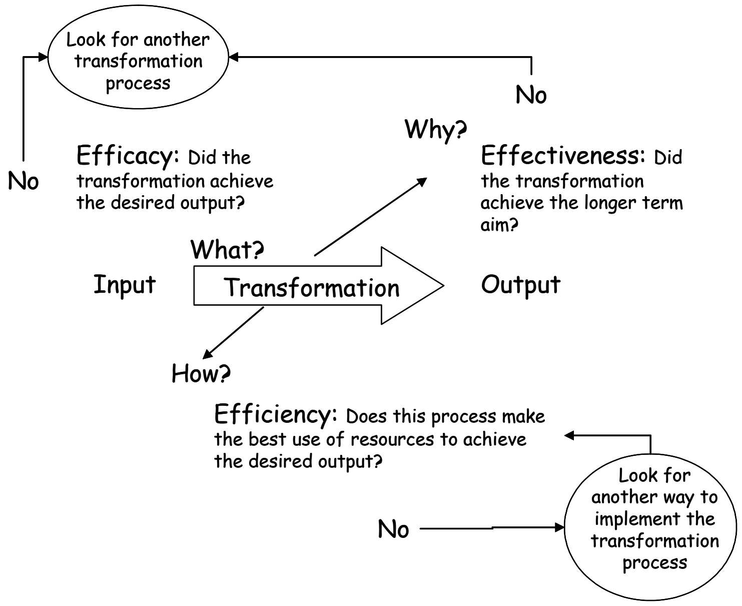


Figure 13 - Transformation and 3Es test

A detailed example of how performance and monitoring actions might be better articulated is provided by Mobach, van der Werf and Tromp (2000). While examining the use of SSM by community pharmacy practices in the Netherlands, Mobach found that the pharmacists had difficulty in using the guidelines given by Checkland (1981) and Checkland and Scholes (1990) in formulating usable HAS models. Specifically, they identified that the SSM literature paid little attention to problems that arise when trying to formulate root definitions, when describing and defining the measures of performance (effectiveness, efficiency and efficacy) and monitoring activities, or when linking the root definition to the measures of performance and monitoring activities.

Mobach et al.(2000) believe that the lack of detailed guidelines had an adverse effect on their study because in traditional SSM studies the researcher is "intensively involved as an expert in developing SSM models" (p. 3) whereas in their research there were a much lower level of interaction between the researcher and those in the problem situation. Contact between the researcher and the pharmacists was restricted to only two half days, and the pharmacists were only assisted once in the SSM modelling process. Moback et al. believe that this limited contact was one reason that the pharmacists saw their root definitions as too abstract and vague to be usable in practice.

Mobach et al. concluded that to overcome the problems experienced by SSM users, root definitions should be constructed with an explicit aim of measurability.

Ensuring the root definition is measurable also provides a link to the 3E criteria described by Checkland and colleagues. The mapping of effectiveness, efficiency and efficacy to the general form of a root definition is shown at Figure 14.

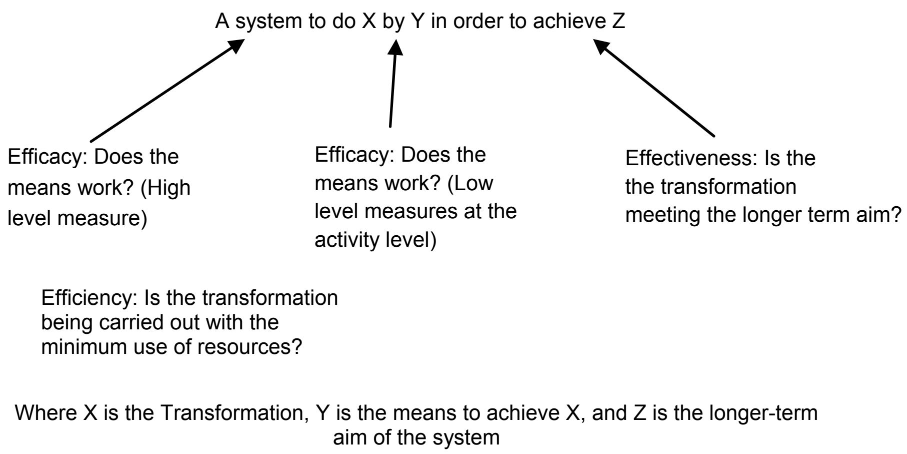


Figure 14 - Linkage between root definition and measures of performance

Increasing assistance in defining and describing monitoring and controlling activities is the second area of improvement that Mobach et al. have described in their work. Like Graeml et al. (2004), Mobach et al. believe that Checkland's 3E criteria of efficiency, effectiveness and efficacy only provides basic guidance. They propose improvements in defining monitoring and control activities by defining measures of performance in terms of a measurement instrument and a related norm. A norm for the activity is established and a set of activities is defined to capture information about the activity. Finally, a measurement instrument is developed and used to assess whether the norm is being achieved.

The third recommendation is that Vickers' (1965) judgement taxonomy can be used to develop and focus monitoring and control activities. Vickers' taxonomy differentiates between reality judgements, value judgements and instrumental judgements. Reality judgements are factual judgements about the 'state' of the system, value judgements are judgements about the significance of the reality judgements, and instrumental judgements are made about reducing the difference between the current or expected outcome and the 'desirable or expected standard'.

Mobach et al. propose that reality judgements (or judgements of fact) and value judgments (judgements about the significance of the facts) should both be used in monitoring activities to determine if an intervention is necessary. When a decision to intervene is made, an instrumental judgement is required on which control activity will best lead to a reducing the gap between actual and expected outcomes.

Logical dependency and Conceptual Model validation

Checkland et al. (1990, p. 33) summarise the basic test of conceptual model validity as:

> "In general, anyone who wishes to claim to be using SSM ought to be able to show conceptual models of the kind of (a set of activities linked to make a purposeful whole and with activities that monitor and control the system). They should be defensible in relation to root definitions and CATWOE; and for each such definition and model the user ought to be able to declare the criteria for the '3 (or 5) Es".

Wilson (2003) argues that Root Definitions and Conceptual Models can be tested for logical dependency and this provides a level of validation. Structures used to test Root Definition and Conceptual Model for completeness have been mentioned earlier in this thesis: CATWOE for Root Definition and the Formal Systems Model for Conceptual Models.

Wilson (2003, p. 23) also states that the use of CATWOE can ensure that the words used in the Root Definition are as precisely defined as possible, and that they convey the meaning the analyst means to convey. Bergvall-Kåreborn, Mirijamdotter, and Basden (2004) also argue that while the use of CATWOE focuses the SSM practitioner on defining the necessary elements that together constitute a human activity system, some of the terms have different meanings in the CATWOE analysis than they do in everyday usage, and some of the concepts are not well-defined.

When to use CATWOE is also subject to debate among SSM practitioners. Some SSM practitioners have suggested that CATWOE should be used to 'enrich' the Root Definition rather than test it, Wilson believes that this leads to a loss of the logical defensibility of both the Root Definition and Conceptual Model. The 'proper' relationship between the testing devices and the Root Definition and Conceptual Model is shown at Figure 15, and is it this structure that is adopted throughout this thesis. The RD/CM combination becomes, in effect, a working hypothesis of reality (or perceived reality) which is then used to examine the effectiveness of technology support for group work.

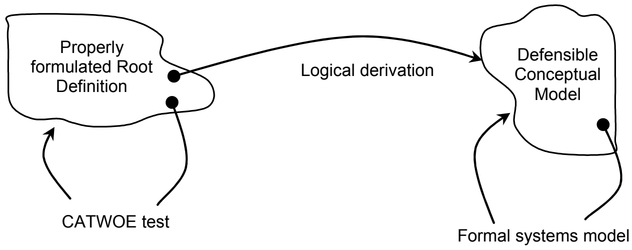


Figure 15 - The defensible intellectual relationship

The shape of SSM in my research

In my research, I have used the modern version of SSM to guide thinking about technology support for group work as this version makes explicit the two streams of inquiry: cultural and logic-driven. I have also taken the work of Vickers (1965), Ledington and Ledington (1999), Mobach et al. (2000) and Graeml et al. (2004) into consideration when developing stages 4 and 5 of the CM and monitoring and control activities.

In structuring my thinking and reporting of the ADFA field experiment, I have also used the work of Mobach et al. in constructing the measurement instrument. Checkland's 3Es form the basis of the instrument, and the focus group results are compared to the 'norms' - previous research on technology support for focus groups. The EDI framework developed by Ledington and Ledington (1999) was also useful in this research when comparing the results of the field experiment with the research literature. Finally, the EDI framework is used and subsequently evaluated in a new way to structure the reflections and evaluation of the utility of using SSM for hypothesis testing.

Hypothesis Testing

Having outlined the basic shape of SSM and some enhancements and extensions to stages 4 and 5, this section develops the theme of using SSM in hypothesis testing. Other researchers have pointed to SSM being a potential vehicle for hypothesis testing (e.g. Checkland 1981; Wilson 1984; Rose 1997). The literature, however, does not describe how hypothesis testing might be done, or how the results might be evaluated, and it is these two aspects that are developed in this section.

Scientific hypothesis testing

Kerlinger (1986) identifies two types of hypotheses. Research hypotheses, which Kerlinger calls substantive hypotheses, are 'tentative statements' about what the researcher expects to observe when examining the variables of the research study, and statistical hypotheses are those defined in quantitative terms and are tested using inferential statistics. Statistical hypothesis testing has been a predominant methodological approach in the positivist philosophy.

In the scientific tradition, a theory is one or more logically interrelated propositions from which one or more hypotheses can be deduced. Developing a hypothesis requires a researcher to define a statement about the relations between one or more variables that are empirically deniable (the null hypothesis) and testing whether the relationship between the variables can be rejected or not rejected. The expression of the expected relationship between variables, or the rules applied to empirically test the relationship, are generally statistical in nature.

Borg and Gall (1989, p. 68) define the four criteria that hypotheses should satisfy:

- The reasons for considering the hypothesis worthy of testing should be based on either theory or definite evidence.
- The hypothesis should be testable.
- The hypothesis should be as brief as possible while still remaining clear.
- The hypothesis should state an expected relationship between two or more variables.

It is the heavy reliance on statistical analysis that many academics argue limits the applicability of hypothesis testing to qualitative research and interpretive research (Hirschheim 1992). The three main limitations of this type of testing in qualitative or interpretive research are outlined by Bharadwaj (1996). Firstly, statistical hypothesis testing uses the observations from a number of 'positive instances' to generalise a 'universal statement of truth'. Secondly, scientific statistical hypothesis testing is based on the notion that reality exists and that a researcher can adopt a posture of 'pure observation' which is not biased, value-laden or subjective. Thirdly, this research approach is based on the assumption that knowledge is derived from an objective interpretation of the assumptions stated in the research proposition. There is no scope for subjective biases or a priori knowledge of the researcher.

Researchers concerned with people and the interaction of people, technology and processes will inevitably bring subjective biases and past experiences and knowledge to the research situation, it is unlikely that there will be a universal truth or that the researcher will be able to remain ‘at arm’s length’ from the research area.

Soft hypothesis testing

Having examined in Chapter 2, the potential to combine philosophical positions and outlined the features of traditional hypothesis testing and SSM, this section presents the utility of SSM in integrating these philosophical positions.

In a paper addressing the epistemological and ontological position of SSM, Rose (1997) places SSM within a taxonomy of social science research approaches but argues that although SSM is seen as an interpretivist approach, it may be employed as a tool in:

- Problem-structuring at the ‘front end’ of other approaches.
- Good-fit research used by itself.
- Triangulation tool used to amplify, confirm or challenge the findings from other methods.
- Theory-testing or generation tool used to test existing theories or for developing, for example, grounded theories.
- Coordinative or directive tool for the research activity or process as a whole.

Rose (1997) assessed there is no philosophical reason that SSM should be confined to interpretive action research and that “In principle then, there is no objection to the researcher taking a theory, or theories about an area of purposeful human activity and using the methodology to test them. Theory about A may be incorporated into the modelling, for example, and then compared to the live situation.” (p. 259). The limiting factor here is not the incompatibility of the epistemological or ontological position but that the “epistemological approach is acceptable to the research stakeholders.” (p. 262).

So if there are no philosophical reasons for a researcher using SSM for theory testing, what situations might be most suitable for its use? One classification of problems that can assist in situating where SSM might be most appropriate is given by Jackson (1991b).

Jackson classifies problem situations along two dimensions: *complexity* and *divergence of values and interests.* Complexity is the number of elements in the situation and the interactions between them are classified as follows:

- Complex situations have many elements, are dynamic, have poorly defined relationships between elements, and/or a high number of interactions between those elements.
- Simple situations have few elements, are static, have well defined often linear relationships, and/or few interactions between elements.

Divergence is measured by the level of agreement between stakeholders and can be:

- Unitary (agreement).
- Pluralistic (multiple views within a shared common core).
- Conflicting/coercive (differences in power relationships and irreconcilable views of stakeholders).

As previously discussed, SSM is most useful in considering:

- Dynamic or poorly defined interactions between elements.
- Problem situations that are often ill-structured.
- Situations where it is necessary to have a capacity to encompass alternative viewpoints from a range of stakeholders.
- An holistic examination of the situation.

The characteristics of SSM suggest it is best used to test theories in domains defined in Jackson's (1991b) matrix as 'complex- pluralist' or 'complex-conflicting/coercive'.

Soft Hypothesis Testing Models

Wilson (1984) was the first to publish a model for using hypothesis testing, although Checkland (1981, p. 202-205) did document an early study where SSM was used in 'clarifying a theoretical concept'. Checkland's report was a study exploring a concept rather than an expression of a problem situation perceived to exist in the real world, but is "an example of the use of 'soft' systems concepts in the purely theoretical context” (p. 202). For the study, SSM Stage 2 was changed because the problem situation expressed was based on personal interviews with people involved in the early discussions on the theoretical concept. At Stage 5, the comparison activity was a discussion between interested parties where the activities in the CM were compared to the outcomes of the personal interviews.

Wilson’s 1984 used SSM explicitly in a hypothesis testing mode. While recognising that in most situations hypotheses testing will not produce appropriate learning about the problem situation, Wilson (1984) notes that “there are certain instances where it is possible to formulate an hypotheses in relation to a specific situation so that learning can be achieved *in relation to that situation* rather than to the general body of knowledge with which the research is concerned” (p. 133).

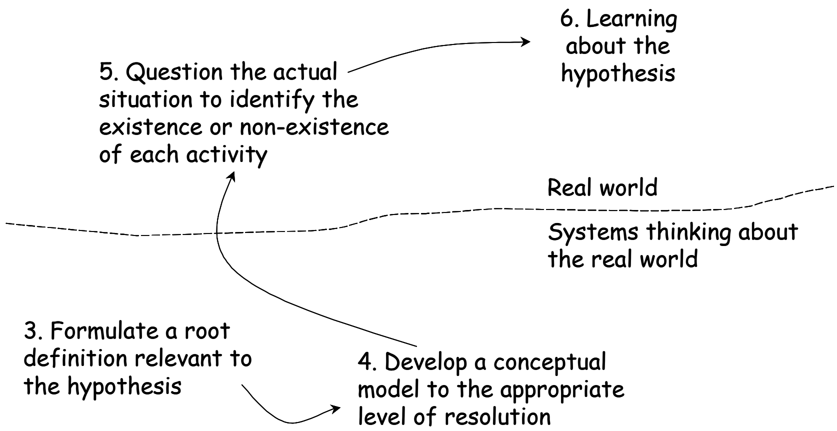


Figure 16 - Wilson's model for hypothesis testing

Wilson’s approach to theory testing, reproduced in Figure 16, deliberately avoids the mental act of perceiving the situation in the real world (SSM Stages 1 and 2) and begins with the act of predicting (SSM Stage 3). The RD is chosen based on its relevance to the hypothesis not its relevance to the situation. A CM is developed from the RD, and the model is compared to the activities in the real world as a means of testing the hypothesis in the particular situation. The learning comes through comparison, examining the implications of taking the view encapsulated in the RD, and in the debate generated by the differences between the model and the situation.

Compared with Checkland’s traditional SSM model, the model at Figure 16 has only three of the seven stages of the Checkland’s traditional SSM, iteration is not permitted and the RD you commence with cannot be changed as a result of the questioning process. Wilson’s argument is that if a RD is a reasonable representation of the hypothesis, and a defensible CM is derived from that RD, then the identification of the existence of each activity in the model will indicate that the hypothesis, in itself, is reasonable.

Wilson reports that the use of the SSM modelling techniques in this study was a useful way of structuring, or operationalising, the hypothesis. However, when trying to use the model presented by Wilson for theory testing, two limitations become apparent. By limiting the model to only four of the seven stages in the traditional SSM, Wilson has not addressed how to structure the existing research domain. This is a necessary precursor to most research, where a plethora of information from different and sometimes conflicting sources needs to be consolidated. The mental act of *perceiving* (stages 1 and 2 of SSM) is one way to accommodate this activity.

Wilson also uses questioning as the method of comparing the existence or non-existence of activities in the model and obviously there are other quantitative and qualitative techniques that could be employed during this stage. The model presented by Wilson is too restrictive in this sense and a general model needs to cater for a range of comparative techniques.

An SSM logic-based model of hypothesis testing

Using the four mental acts identified by Checkland (1990), and the model illustrated at Figure 16, a more developed system model of hypothesis testing is shown in Figure 17. The RD for the model is shown below, and the CATWOE declaration is in Table 7:

> *A researcher owned and operated system which, in light of current information about the research domain and using SSM as a framework, decides on a hypothesis, develops a system (root) definition and conceptual model to describe the hypothesis and by comparing the conceptual models with the current research, learns more about the research domain and transmits that learning to the readers of the research.*

C	Customer(s)	GSS/Academic community, Researcher, ADFA
A	Actor(s)	Researcher
T	Transformation	Current level of knowledge {on effects of technology-support on groups} → increased level of knowledge {on performance effects of technology-support on group work}
W	Weltanschauung (worldview)	It is possible to use soft hypothesis testing to capture the range of elements needed to yield a rich evaluation of the effects of technology-support on the performance of groups
O	Owner(s)	The Researcher
E	Environment	A perception of the utility of SSM for hypothesis testing (E1); the systems framework (E2)

Table 7 - Declaration of CATWOE components

Before meaningful research can begin, the researcher must have some *perception* of the research domain gathered from a number of sources (for example literature reviews, observation, interviews). The method of structuring and the researcher's perception of the research domain is not prescriptive, except that the aim is to make this expression "the richest possible picture of the situation being studied". (Checkland 1981, p. 165).

From the perception of the research area, the researcher makes a *predication* of the situation, or of a relationship of interest. This act requires the construction of a RD and CM. After developing the RD and its associated CM, the researcher then develop measures of performance for each activity and for the system as a whole.

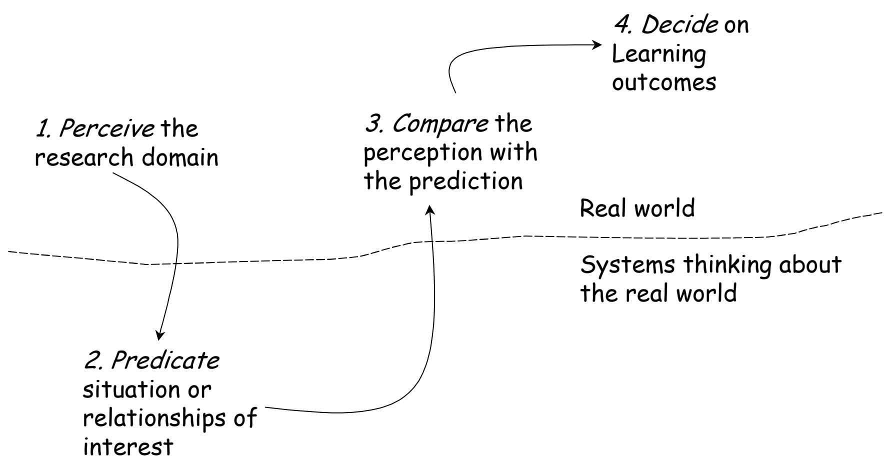


Figure 17 - A basic SSM model of hypothesis testing

The CM is then compared with the real world to give the researcher a view of the similarities and the differences between the model and the real world. The comparison is undertaken within the framework of the measures of performance defined in the *predicate* stage.

From the results of the *comparison*, the researcher *decides* the *learning* outcomes of the research effort. Rose (1997) notes that when SSM is used in applied research, as opposed to its action research role, it needs to be re-focused away from desirable and feasible change and towards the researchers learning. The researcher's learning takes the form of examining whether the hypothesis has been supported, and also includes learning about the framework used, and the methodology employed in the research.

Taking the four basic steps described in Figure 17, an enhanced SSM model usable for hypothesis testing can be derived. The complete model of the logic-based stream of analysis is shown in Figure 18 and a summary of the major activities and their relationships to the four mental acts are detailed in Table 8.

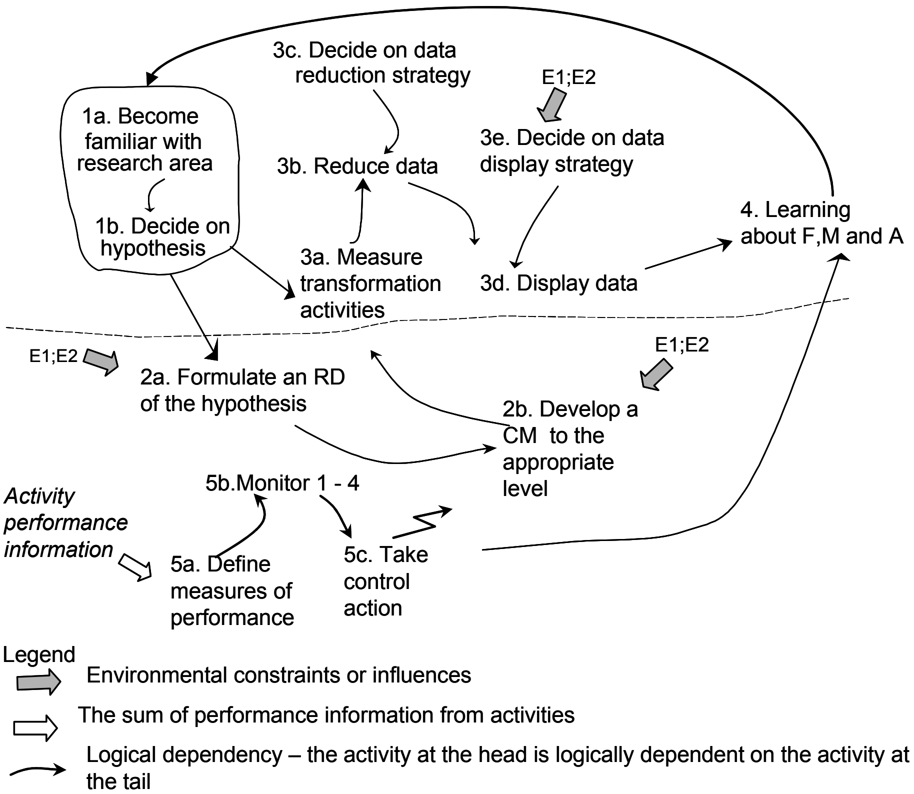


Figure 18 - Enhanced model of hypothesis testing

Stage One (perceiving) is complete when the researcher has become familiar with the research area and has decided on a hypothesis they wish to test. In Figure 18, Activity 1a will normally include an assessment of the situation as a culture (Checkland's stream of cultural analysis). Adding a cultural analysis can assist the researcher in the derivation of the hypothesis (Activity 1b), and in contextualizing the measurement of the transformation activities (Activity 3a) and learning from the research (Activity 4).

After becoming familiar with, and expressing, the research area, the researcher will decide on the hypothesis (Activity 1b). The hypothesis can be expressed either as a formal expression of the null hypothesis or a more general expression of cause and effect. Activities 2a and 2b are the traditional model development activities of SSM where the researcher selects one perspective of the domain, and proposes a RD (Activity 2a) for the HAS.

Mental Acts	**Activities**
Perceive	1a. Become familiar with the research area. In this activity, analysis of the situation as a culture informs the development of the hypothesis in Activity 2b.
	1b. Describe relevant perspective(s) on the research question and describe contradictions between perspective(s). Develop a hypothesis.
Predicate	2a. Develop a RD based on one relevant perspective of research area.
	2b. Construct a CM based on the RD and test it to make sure it is 'technically defensible'.
	Derive Measures of Performance (MOP) for the transformation achieved by completing each activity in the CM.
	5a. Derive system level MOP to assess the performance of the system as a whole.
Compare	3a. Compare CM with perception of real world and compare them based on the MOP.
	3b-e. Prepare and present the data from the measurement of the CM (activities and system).
	5b-c. Prepare and present the data from the measurement of the model of the human activity system.
Decide	4. Draw conclusions from comparison of data derived using the CM and the real world, the framework and the methodology and discuss the results of the investigation.
	In this activity, analysis of the situation as a culture can inform the results and the conclusions drawn from the logic-driven comparison in Activity 4.

Table 8 - Main activities in an enhanced SSM hypothesis testing model

Having developed a RD, a CM is built (Activity 2b) by identifying and structuring the minimum number of activities necessary to carry out the transformation activity (or activities) made explicit in the RD. Activity 2b also includes deriving measures of performance (MOP) for activities in the CM. MOP for the system as a whole are completed in Activity 5.

The difference in developing MOP for each activity and MOP for the system as a whole is that system-level MOP cater for the emergent behaviours that exist at the system level, and can provide a researcher with an additional reference point. Systems theorists believe that the system is more than the sum of its parts, and measuring activities at the system level can provide an insight to the researcher that would not be gained if measuring each activity separately and then aggregating the results.

Comparing the model with the real world can be achieved in a number of ways. The choice of comparison technique will depend on the type of research and the research approach adopted. In hypothesis testing, one approach to comparison would be to operate the model in a laboratory or field setting and compare the results from using the model in experimental conditions to the results from the research domain (previous research or predictions).

Because the amount, type and format of the data collected in this research, a strategy is required to structure potentially large amounts of initially unstructured data collected in the comparison activities. An approach described by Miles and Huberman (1994) to structure and present data has been used in this model. These steps are general enough to cover both positivist and interpretivist research and are therefore included in the model as Activities 3b, 3c, 3d and 3e.

Data Reduction (Activity 3b and 3c) is the process of 'selecting, focusing, simplifying, abstracting, and transforming the data' so that the data can be interpreted in the context of the research being undertaken. Deciding how to display the data (Activity 3d and 3e) in a form that allows the researcher to identify themes, patterns, and relationships of significance is the second level in the Miles and Huberman (1994) structure. After reducing and structuring the data and presenting it appropriately, the researcher is in a position to draw conclusions about the meaning of the data and to assess the implications of the findings for the research questions (Activity 4) and the methodology used.

Combining the results of the qualitative and quantitative assessments in a complementary way can be achieved by, for example, alternating the qualitative description and analysis with the quantitative results of the hypothesis testing, or by using the qualitative analysis to illustrate, explicate or put the quantitative findings into context. Patton (1990) says the aim is to achieve a presentation where description is balanced by analysis and interpretation: "An interesting and reasonable report provides sufficient description to allow the reader to understand the basis for an interpretation, and sufficient interpretation to allow the reader to understand the description".

The fourth mental act of *deciding* is completed when the researcher assesses the results of the research (Activity 4). Learning takes place in three areas: the research framework, the methodology employed in the research, and the specific research question. In Activity 4, the researcher moves beyond an analysis of factual data. When qualitative data is collected and analysed as part of the research effort then Miles and Huberman (1994, p. 245-262) suggest 13 "tactics for generating meaning" including noting patterns and themes, partitioning variables, making contrasts and comparisons, and clustering cases.

The final activity arrow is the feedback loop that exists between Activity 4 and Activity 1. If the research program is an active, on-going program then the learning outcomes will allow the researcher to become better informed about the research area, and can inform the development or refinement of further hypotheses.

Linking the Conceptual Model and the Evaluation Approach

Before this model can be applied to the research questions in this thesis, Activities 4 and 5 require expansion. As has been previously noted, and described in Figure 18, Measures of Performance (MOP) for the whole system are required to be defined and monitored, and control action on the system may be necessary.

In this research, the combined results of measuring the system and the efforts of the focus groups, provides the basis for learning about:

- Whether quantitative analysis is sufficient by itself to assess the effectiveness of different modes of technology support on group effectiveness (the Framework).
- The use of SSM for hypothesis testing and for examining the effectiveness of group work (the Methodology).
- The impact of technology support on ADFA focus groups undertaking a program evaluation of SST (the Area of Interest).

Building on the work of Graeml, et al. (2004) and Mobach et al. (2000) the approach taken in this thesis is to define criteria that address the 3Es and to link those criteria explicitly to an evaluation plan. The detailed evaluation plan for the Area of Interest is given in Chapter Seven, and the evaluation criteria for the Framework and Methodology are shown in Figure 19.

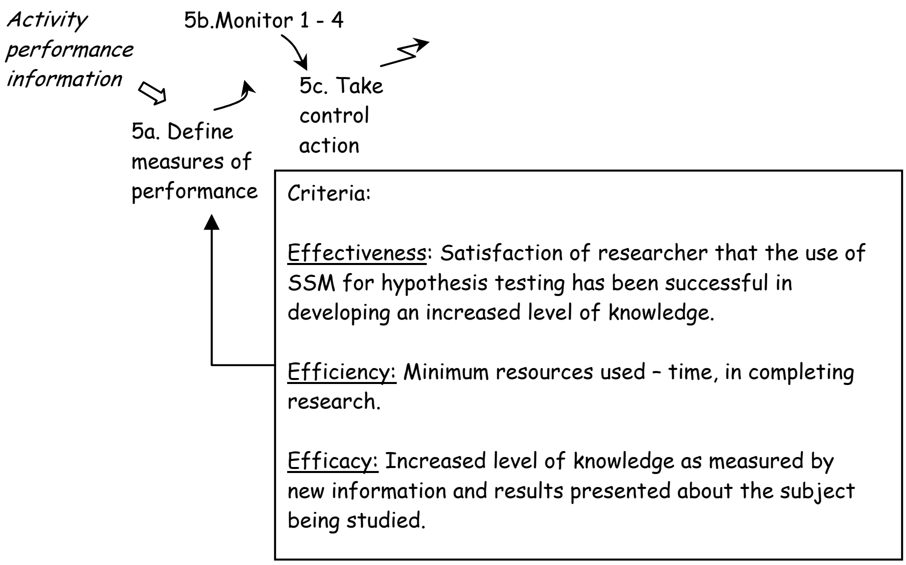


Figure 19 - Criteria for evaluation of Framework and Methodology

The 3Es in Figure 19 can all be measured and compared against a related norm derived from the body of research. The comparison will form the basis for a series of value judgements – judgements about the significance of using SSM in this type of research. These value judgements will be viewed through the values defined by Ledington and Ledington (1999): importance, desirability and expectation.

Assessing the Model Development

Using the Expectation/Desirability/ Importance 'comparison space' developed by Ledington and Ledington (1999) it is possible to assess the CM development and attribute qualities to it. The use of SSM is a key element of this research, so the CM is an *important* aspect of developing a structure for soft hypothesis testing. It is anticipated that the CM will provide the intellectual structure on which the hypothesis can be developed, the field experiment conducted and learning about the Framework, the Methodology and the Application can be analysed.

As the CM has not been compared to the problem situation it is not possible to assess the desirability of the model by assessing the results of the comparison. An alternative approach is to view the CM as a theoretical development and take Wilson's (1984) argument that if the CM is developed from a properly formulated RD then the RD/CM combination is a logically defensible construct. The logically defensible CM developed in this chapter was based on the view that all the activities in the CM were desirable, and that following the activities in the CM when structuring the field experiment will lead to a successful experiment. In this sense, the CM can be seen as *desirable*.

Finally, the third dimension (*expectation*) was made explicit from one of the general research questions in this thesis. From the research literature, it is expected that SSM could have utility in developing hypotheses and assessing the effect of technology support on group work. There is a high *expectation* that the CM developed in this chapter will provide the theoretical basis for examining the research situation.

Summary

This chapter began by describing SSM and detailing the four mental acts that SSM embodies: perceiving, predicating, comparing and deciding. These mental acts were first articulated through a seven stage SSM model that differentiated between the real world, and systems thinking about the real world. System Thinking was structured using a combination of root definitions and conceptual models. A later 'modern' form of SSM took the seven stage model and made explicit a second, interacting, stream of analysis based on viewing the situation as a culture. By combining the original logic-based stream of analysis with the cultural analysis, Checkland and others argue that a set of feasible, desirable and culturally acceptable changes to a situation can be developed, and through these changes, an improvement in the situation can occur.

The second part of the chapter of SSM reviewed three areas in SSM that have been the subject of refinement or further elaboration, as they are particularly important when developing SSM for hypothesis testing. Ledington and Ledington (1999) provided a general framework for defining and expressing the comparison stage of SSM. They argued that CMs should be viewed as social artefacts that are attributed value by those that develop and use them. Value, in this context, can be defined by the three dimensions of importance of the model, the desirability of the model in the context of the situation, and the expectation of the analyst about the relationship between the model and the situation. This framework has been used in this thesis to aid interpretation of the results of the field study and case studies (a use that Ledington (1999) have evaluated), and also in a novel way to guide and structure the reflections on, and evaluation of, using SSM for hypothesis testing.

The second area that was reviewed in more depth than the standard SSM texts, was the parts of the systems model concerned with monitoring and control. The 3E's of effectiveness, efficiency and efficacy are classes of measures of performance that Checkland offers as being able to show a successful or unsuccessful transformation of inputs to outputs. Researchers such as Graeml et al. (2004) and Mobach et al. (2000) have tried to develop clearer links between the RD, CM and the measures of performance, and this chapter has taken another step by making explicit the linkage between the MOP, the 3Es and monitoring and control. Additionally, the assessment of the criteria has been based on the judgement taxonomy described by Vickers (1965) and reported in Mobach et al .(2000)

The final section of this chapter develops an argument, and presents a model for using SSM for hypothesis testing. Although researchers have pointed to SSM being a potential vehicle for hypothesis testing and its use in this way has been described broadly in the literature of Checkland (1981) and Wilson (1984) the current body of literature, does not describe how hypothesis testing might be done, or how the results might be evaluated, so these two aspects were developed in this chapter. Starting with the basic model described by Wilson (1984), an enhanced model was derived using the four mental acts of p*erceiving, predicating, comparing* and *deciding*. The activities that cover these four acts are detailed and the link between this model and the evaluation plan is outlined.

The next chapter further develops the Framework of Ideas by defining in the context of this research what is a group and a meeting and assesses common models used to structure thinking about group performance

Chapter 4 Group performance and the concept of fit

Before any investigation into the impact of technology support on focus groups can commence, the basic elements of the research question require examination, definition and specification. This chapter begins by defining a group and a meeting in the context of this research. It then progresses to outline some of the fundamental elements of research question two. The elements of the research question that are addressed are:

- What types of technology support is available to groups.
- What tasks do groups undertake.
- Is there one perspective of the fit between the technology support and the task that groups undertake.
- What the relationship between the task, the technology support and the effect on group effectiveness.

The assessment of these elements shows that most of the current group effectiveness models and their perspective of fit have similar characteristics, and that this might have contributed to current lack of consistency in research findings.

A Definition of a Group and a Meeting

In the broadest sense, a group is any set of people who consider themselves to be a group (DeSanctis and Gallupe 1987). For this research, the focus groups can be described as a group of cadets drawn from the wider cadet population who are formed under direction to undertake work-oriented activities. In defining group work in this way, the research focus excludes groups formed spontaneously or naturally, or groups formed for other than work-orientated purposes such as social groups or support groups.

The specific work-oriented activity undertaken by groups in this research is a meeting. There are many definitions of meetings in the literature, but only a few cover both the information processing and the social elements of group work. One of these, as noted in Chapter 1, is from Bostrum, Anson and Clawson (1993, p.148) who describe a meeting as "a goal or outcome directed intervention between two or more people (teams, groups)" characterised as a "socio-technical change process" using people and technology to transform the group's "present problem state into its desired future state (accomplishing specific meeting outcomes) through a series of action steps (agenda)". This definition does not detail specific types of meetings, only the meeting characteristics. For a detailed description of the focus group see Chapter Five and ADFA focus groups in Chapter Seven.

Task Type and Complexity

The first element of TTF is the task. Regardless of whether groups are viewed as primarily information processing or social constructs, work groups are formed to complete tasks. Perhaps the most widely used classification of group tasks in the GSS literature is McGrath's "Task Circumplex" (McGrath 1984; McGrath and Hollingshead 1994) which is reproduced in Figure 20. McGrath's classification identifies eight types of tasks a group might perform when faced with a particular activity. For example, when completing a generation activity, groups will undertake either a planning task or a creativity task (generate ideas or options). Table 9 contains further descriptions of the tasks in McGrath's circumplex.

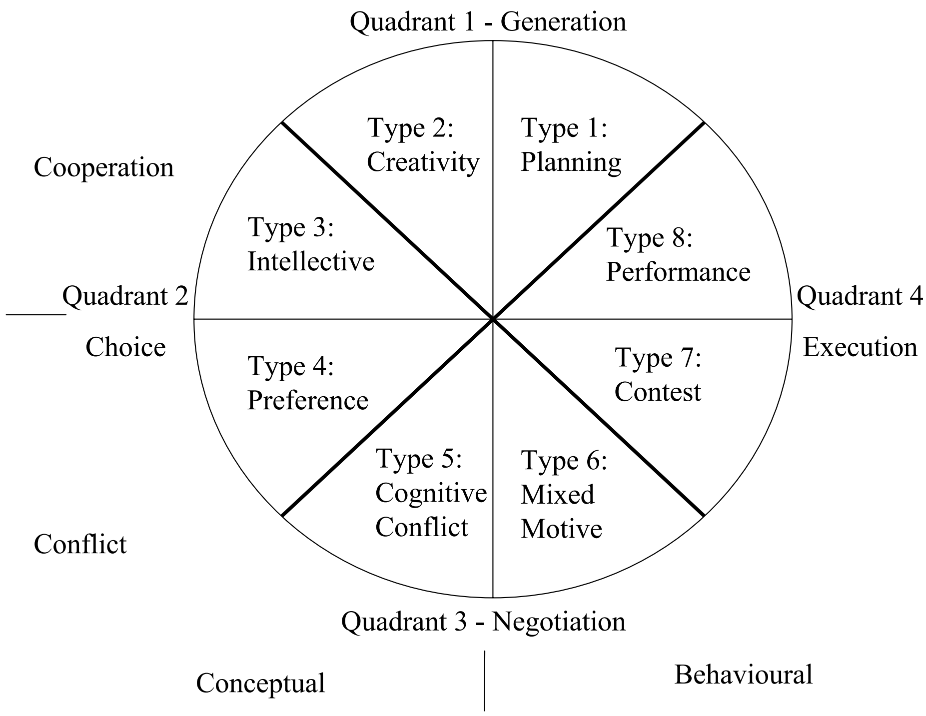


Figure 20 - McGrath's Task Circumplex

Taken simply as a classification of tasks, this model describes those information processing tasks that groups perform. By defining the tasks and the key notion aligned with each task type, performance criteria or outcomes for the task(s) can be developed. For example, an outcome measure for a creative task could be the number of ideas generated, the number of unique ideas generated, or the degree of redundancy in the ideas generated by the group.

Quadrant	*Task*	*Description*
1. Generate	Planning	Generate an action orientated plan
	Creativity	Brainstorming; Generate ideas
2. Choose	Intellective	Solving problems with correct answers
	Preference	Choosing an agreed/preferred answer
3. Negotiate	Cognitive Conflict	Resolving conflicts of viewpoint
	Mixed Motive	Resolving conflicts of interest or motive
4. Execute	Contests/Competitive	Resolving conflicts of power
	Performances/ Psycho-Motor	Performing against objective or standard.

Table 9 - McGrath's Group Tasks

The distinction between tasks is, however, only one view of this circumplex. McGrath also segments tasks horizontally and vertically. Those task types above the horizontal axis (task types 1,2,3 and 8) require cooperation or facilitative compliance among group members; those below the horizontal axis (task types 4,5,6 and 7) are characterised by conflict or contrived interdependence among group members. On the vertical axis, the left hemisphere (task types 2,3,4 and 5) are conceptual or intellective tasks and the right hemisphere (task types 1,6,7, and 8) are behavioural or action tasks. The segregation of tasks based on the level of cooperation and emphasis on conceptual or behavioural effort introduces social constructions into the circumplex.

One use of this model to researchers is in assisting with research design. McGrath states that the eight task types are mutually exclusive, collectively exhaustive, logically related to one another and useful in identifying differences between tasks and relationships among tasks. In this thesis where the research concerns the fit between technology support and task, and the resulting group performance, using McGrath’s taxonomy provides a sound theoretical basis for describing the tasks the ADFA focus groups completed.

I have also chosen this classification scheme because of its popularity with other GSS researchers. As McGrath (1984) states, the test of a taxonomy is whether it can be used "to summarise, compare and clarify the research on group performance, and whether that leads to new insights about the task performance process." (p.66). With the amount of previous research using this taxonomy, describing the tasks in this research in the same way as other researchers will allow comparison of results with other research findings.

Types of Technology support

The second element in TTF is the technology support. A wide range of technologies has been used to support the activities of groups, and even people who have not been exposed to specialised GSS are likely to have some understanding of technologies such as those in Table 1 in Chapter One. This research employs a GSS specifically developed to assist group activities and group communication, and for which there is still a large body of conflicting evidence about their usefulness in making groups more effective. The GSS used, MeetingWorks™, has been used for focus groups in other research.

General characteristics of GSS

A generic set of groupware design requirements and three dimensions of collaboration that can be used as the basis for describing the general characteristics of a GSS have been described by Mandviwalla and Olfman (1994). Analysis of the seven generic requirements and a brief description of each requirement, adapted from Mandviwalla and Olfman (1994) is presented in Table 10. Those italicised parts {my emphasis} highlight the issues of task-technology fit or social aspects of group work that are inherent in the requirements, or that impact on the selection and use of particular communication media.

	Generic Requirement
1	Support multiple group tasks. This requirement addresses the information processing requirements of the group.
2	Support multiple work methods. Because group work is made up of different tasks, different task-specific media, communication media and tools and techniques are needed *(task-technology fit)*.
3	Support the development of the group. GSS need to accommodate different group development paths. General requirements include the use of techniques to influence *behavioural processes (roles, distribution of power, interactions) and information processing (group memory and group administration).*
4	Provide interchangeable interaction methods. Group members use a mixture of interaction methods both in terms of when and how they meet to achieve the task. The interactions support different *behavioural processes and facilitate*

	Generic Requirement
	different ways of processing information.
5	Sustain multiple behavioural characteristics. Groupware should sustain the *social dimensions of group work*. These are summarised as 'member support' and 'group well-being' by McGrath (1991).
6	Accommodate permeable group boundaries. To successfully complete its task, a group will have to interact with its environment. Permeable *boundaries are determined through social and economic factors* such as its physical environment, the presence of external influence or authority or the relationship with other groups.
7	Adjustable to the group's context. As groups develop and tasks change over time, GSS must adapt to the changes in context. Mandviwalla and Olfman (1994) believe these changes require examination of "*behaviour settings: social systems such as groups that are tied to places, objects and time*".

Table 10 - Generic groupware requirements

An analysis of the current set of commercially available groupware reveals that none of the products meet all the requirements. As a set of generic requirements however, they do provide a detailed description of what is necessary from an organisational perspective to support the diverse work of groups, and for the purposes of this thesis, the requirements were used in Chapter Seven to identify which groupware was appropriate for this study. This set of requirements also serves to further illustrate that groups require support for both social and task-related activities.

In terms of communication support, GSS can provide a range of support including the provision of:

- Alternative communication media so that groups can more effectively and efficiently transmit, receive and process information.
- Process structuring for communication between group members.
- Support for the storage, organisation and retrieval of information required by the group.
- Integrated decision support tools that can assist with information processing and group processes. (Daft and Macintosh 1981).

Defining and Conceptualising Fit

The third element of TTF is what constitutes fit. Addressing fit before looking at existing frameworks and models of how technology support is conceptualised in the study of group work allows for analysis of those models from a fit perspective, and how the concept of fit can be used as an organising structure.

Defining fit

The concept of 'fit' pervades the IS literature and the GSS literature (e.g. Vessey 1991b; Iivari 1992; Goodhue and Thompson 1995; Davern 1996; Goodhue 1998; Mathieson and Keil 1998; Zigurs, Buckland et al. 1999; Murthy and Kerr 2000; Wilson and Morrison 2000; Dennis, Wixom et al. 2001). Generally, the term 'fit' refers to a relationship between two or more elements in a situation that produces an effect or level of performance. The question normally investigated is whether a fit between a task and a type of technology support results in better outcomes than a misfit (Lefebvre, Lefebvre et al. 1997; Zigurs and Buckland 1998; Dennis, Wixom et al. 2001).

The strategic management literature has led the theoretical development of what characterises fit and the different perspectives of fit (Van de Ven and Drazin 1985; Venkatraman 1989; Zigurs and Buckland 1998). In the GSS field, Zigurs and colleagues (1998; 1999) and Dennis and colleagues (2001) have examined TTF using the work of the strategic management theorists and I have also based the analysis in this chapter on the work of Miller (1981; 1993; 1999), Van de Ven and Ferry (1980), Van de Ven and Drazin (1985) , and Venkatraman (1989).

One view of fit is that it can be described in a deterministic and static way (e.g Goodhue and Thompson 1995; Goodhue 1998; Zigurs and Buckland 1998; Zigurs, Buckland et al. 1999). This view prescribes that a rational and objective match of the attributes of the task and the technology support will result in the best fit and the desired level of group performance will be achieved. The second view is that fit is reliant, at least in part, on social influences such as the effects of a group's appropriation of technology (Poole and DeSanctis 1989; Chin, Gopal et al. 1997; George and Jessup 1997) and other social influences that affect media selection and use (Fulk, Schmitz et al. 1990; Fulk and Steinfield 1990; Trevino, Lengel et al. 1990; Hirokawa and Poole 1996). Research based on the latter view highlights that the interaction of task, technology support and the individual or group social influences is non-deterministic and the relationship between them is dynamic rather than static.

Research that combines both views such as that produced by Zigurs and Buckland (1998) and Dennis, Wixom and Vandenberg (2001) is also discussed in the GSS literature. Zigurs and Buckland, for example, place their deterministic and static 'ideal profile' model within "more complex interactions of the social influences, people and institutional properties that influence and shape patterns of action" (p. 314). Dennis et. al. (2001) also extend the rational TTF view by integrating it with the social aspect of technology appropriation. Their Fit Appropriation Model recognises that a fit between task and technology support "is a necessary but not sufficient condition to improve performance…task-technology fit affects performance, as moderated by appropriation" (p. 174).

Because of the different views of what constitutes 'fit', it is important to be explicit about which definition of fit is being used. In the strategic management literature Venkatraman (1989) notes that the lack of precision in the definition of fit has made it difficult to assess whether an organisation has 'fit' or not, and the lack of definition can "alter the meaning of the theory itself" . I believe the same criticisms can be made of the GSS literature on fit, although the recent work of Zigurs and Buckland (1998) and Dennis et al. (2001) are notable examples of research that explicitly addresses the definition and reporting of fit.

Conceptualising fit

Fit can be conceptualised in a number of ways. For example, Van de Ven and Drezin (1985) divide fit into *selection* (or congruence), *interaction*, and *systems* (or internal consistency). The *selection* view of fit describes conditions where a theoretically-defined match between two variables results in optimal fit. This is a deterministic view, where the attributes of the variables are fixed and static and there is no interaction between them.

The *interaction* view describes fit in terms of the interaction of two variables and the effect of this interaction on performance. This view is less deterministic than *selection* and the outcome is not predetermined based on the theoretical fit between elements. The *systems* view sees fit as the "internal consistency of multiple contingencies, structural, and performance characteristics" p. 515 and is a situational rather than rational approach. The *systems* view is non deterministic.

An alternative classification was developed by Venkatraman (1989) and I have used these six 'perspectives of fit' to categorise the group performance models. Each of the six perspectives of fit are defined based on the three following criteria:

- Whether the particular concept of fit is 'anchored' to a specific outcome criterion or whether it has 'universal applicability'.
- The level of precision, or specificity, of the relationships between the variables that are part of the fit relationship.
- The number of variables contributing to the fit model.

Perspective of model	*Characteristics*
Moderation	**Theme**: Interaction **Description**: The impact that a predictor variable has on a Criterion variable is dependent on a third variable termed as the moderator. **Criterion**: High degree of specificity in the functional form of fit relationship. Specific Criterion met if fit is achieved. Two variables in the fit equation. **Outcome and variable relationships**: Outcome is primarily determined by the fit between predictor and moderator.
Mediation	**Theme**: Intervention **Description**: A significant intervening mechanism exists between an antecedent variable and a consequent variable. **Criterion**: Medium degree of specificity in the functional form of fit relationship. Specific Criterion met if fit is achieved. Two or more variables in the fit equation. **Outcome and variable relationships:** The outcome is determined by direct effects of a predictor and indirect effects resulting from the existence of a significant intervening variable.

Perspective of model	*Characteristics*
Profile deviation	**Theme:** Comparison to ideal profile **Description***:* The degree of adherence to an externally specified profile. **Criterion**: Low degree of specificity in the functional form of fit relationship Specific Criterion met if fit is achieved. Many variables in the fit equation. **Outcome and variable relationships***:* The outcome is assessed by specifying an ideal profile and demonstrating the systematic implications of adhering to that profile.

Table 11 - Criteria-specific perspectives of fit

Using these three criteria, Venkatraman (1989) identifies the six perspectives as *moderation*, *mediation*, *profile deviation*, *matching*, *co-variation* and *gestalts*. Venkatraman (1989) then aligns these perspectives with statistical analysis approaches.

Perspective of model	*Characteristics*
Matching	**Theme:** Matching **Description:** A theoretically defined match between two related variables without reference to a Criterion variable **Criterion:** High degree of specificity in the functional form of fit relationship Fit is achieved without reference to a Criterion variable Two variables in the fit equation **Outcome and variable relationships***:* Once a theoretical proposition on fit is developed, an outcome can be tested using an external Criterion of performance

Perspective of model	*Characteristics*
Co-variation	**Theme:** Internal consistency **Description**: A pattern of co-variation or internal consistency among a set of underlying theoretically related variables **Criterion**: Medium degree of specificity in the functional form of fit relationship Fit is achieved without reference to a Criterion variable Four or more variables in the fit equation **Outcome and variable relationships:** The outcome requires assessment of a confirmatory factor analysis and testing the impact of the factors on performance. The outcome is assessed by identifying factors based on the scores along a chosen set of variables
Gestalts	**Theme:** Internal congruence **Description:** Where many variables are examined, the degree of 'precision' must be relaxed. Gestalts, or 'clusters of attributes' are defined in terms of the degree of internal coherence among a set of theoretical attributes without reference to a criterion variable. **Criterion:** Low degree of specificity in the functional form of fit relationship Fit is achieved without reference to a Criterion variable Many variables in the fit equation **Outcome and variable relationships**: Outcomes are in two forms: the descriptive validity and the predictive validity of gestalts

Table 12 - Criteria-free perspectives of fit

The summary of the three perspectives that are anchored to specific criterion is in Table 11, and details of those perspectives that are criterion-free are in Table 12.

Models for Studying Group Performance

In this section, models that have been developed for studying the effect of technology support on group performance are presented. The intention of this summary is to illustrate that when assessed by the underlying perspective of fit, the dominant perspectives for studying the effect of technology support has been the *gestalt* perspective. This review confirms that there is general consensus among GSS researchers that group outcomes are contingent on the interaction of a large number of variables rather than the direct effects of these variables on group outcomes.

Researchers have also identified in their research models that the effects of technology support and the task are likely to be influenced by both static and dynamic group interactions and processes (including social influences) and that at this level of abstraction, the anchoring of the fit relationship has been mostly criterion-free.

Input-process-output models

The input-process-output model has been the most prevalent model in the study of group work for 40 years (McGrath 1964; Hackman and Morris 1978; Jessup and Valacich 1993). Typically, the input variables are the independent variables of the research and are present before the group work commences. The outcome variables are the dependent variables in the model, and the process variables can be either independent or dependent variables that exist for the period of the group work. See, for example Dennis et. al. (1988) and Nunamaker et al. (1989b; 1993).

As a typical example, Figure 21 illustrates a frequently used model preferred by the University of Arizona researchers to structure their research program and many of their experiments (Nunamaker, Vogel et al. 1989a). This model has also been used by other researchers (e.g Pinsonneault and Kraemer 1989; Hiltz and Turoff 1992; Burke, Chidambaram et al. 1995) and is arguably the most prevalent in the GSS literature.

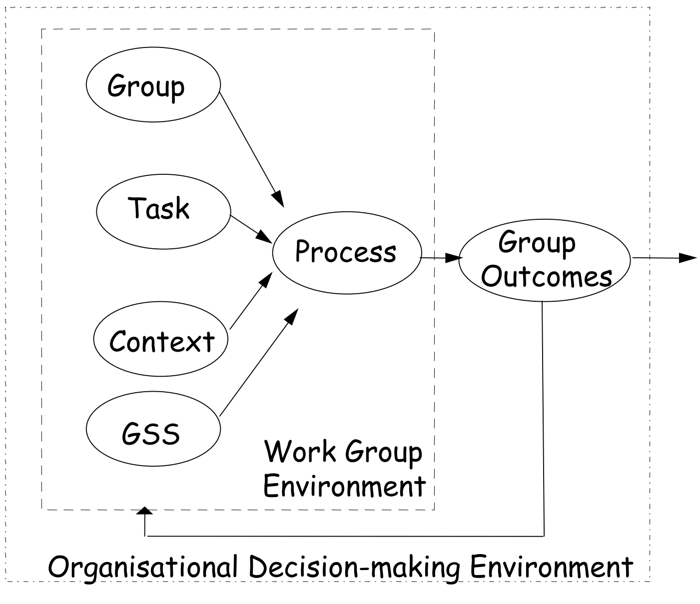


Figure 21 – Input-process-output research model

The *Group* input includes characteristics such as group size, proximity, composition and cohesion. *Task* inputs are those that describe the task type and complexity.

Context covers the reward structure (none, individual or group), organisational culture, the evaluative tone (critical or supportive) and time pressures placed on the group. Finally, the *GSS* includes the type and the characteristics of the GSS.

Process variables in this model include the degree of structure of the task, the number of group sessions, level and type of non-task behaviour and meeting characteristics such as leadership type, anonymity, level of individual participation, and levels of intra-group conflict. Finally, the *outcomes* are measured in terms of changes (normally improvements) to variables such as the quality, quantity, speed or cost of producing ideas, level of perceived group cohesion or participation equality.

While the example in Figure 21 sets the group work in a wider organizational-level environment, the basic input-process-output model does not necessarily include this linkage, particularly if the model is used with a laboratory experiment.

In terms of fit, Nunamaker et al. (1993, p.127) state that "We contend that the effects of GSS use are contingent on a myriad of group, task, context and technology factors that differ from situation to situation" and "To understand these interactions we need to examine group processes at a lower level of detail". The model does show a general causal relationship between the inputs, group processes and group outcome*s* but does not provide specific relationships between the four inputs or the congruence between the variables. In the 1988 model (Dennis, George et al. 1988) there was also a direct link between the input variables and the outcomes but this was removed in later versions. This model exhibits a low to medium degree of specification of the fit relationship and the model does not anchor the product of the interaction of input and/or process variables to a specific outcome criterion so in this sense it is criterion-free. The input-process-output model has a *gestalt* perspective of fit.

Mediation model

Pinsonneault and Kraemer (1989) developed a 'mediation' model to analyse the empirical findings on the impact of technology support on groups. The model, illustrated at Figure 22, follows the input-process-output structure. Inputs, or *contextual variables*, include technology support, task characteristics, conceptual variables, personal and situational factors. The contextual variables "refer to characteristics of the group's interaction, and generally attempt to capture the dynamics of that interaction" (p. 200).The *process* variables are categorised into decisional, communication and interpersonal characteristics, and the structure imposed by the GSS. The *group output*, separated into task-related and group-related outcomes, include characteristics and implementation of the decision, and the attitude of group members toward the decision and the group process.

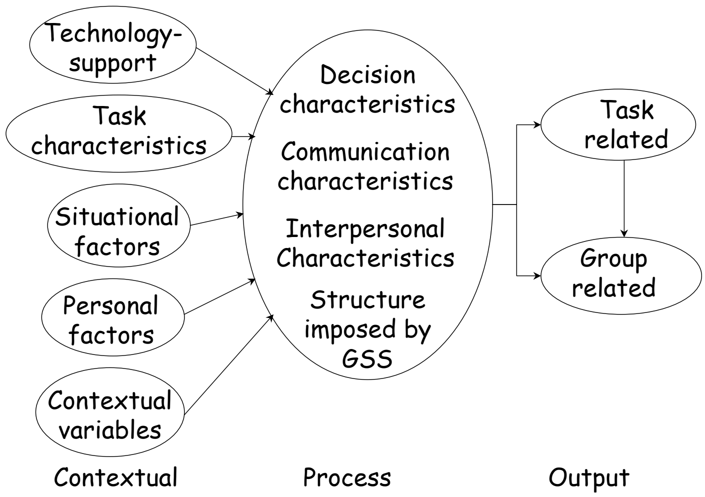


Figure 22 – Mediation model

From the perspective of fit, this model illustrates a *mediation* perspective as it includes "the most important and relevant variables for GDSS and GCSS studies" and specifically anchors the criterion (outputs) to those variables. Because it is used as a framework for a meta-analysis, the outcome criteria are defined, making this model 'criterion-specific'. Secondly, there are five classes of independent variables and a total of 19 individual variables in those classes. Finally, the relationship between the inputs, process and outputs is shown as causal but no a priori comment is made on the specific nature of the fit between variables. In fact, Pinsonneault and Kraemer (1989) state that "The framework does not include relationships between independent variables" (p. 199). The functional form of this relationship is therefore assessed as having a medium to low level of specificity.

Adaptive Structuration model

Adaptive Structuration Theory (AST) developed by Poole and DeSanctis (1989; 1990) and Poole and Jackson (1993) is based on the assertion that the impact of technology support can be understood by viewing the group as a system, and by examining the structures that support and sustain this system. In AST, the *system* is the group as a social entity pursuing a goal and *structures* are the rules and resources that group members use to generate and sustain the group (Poole and DeSanctis 1990 p. 179). AST is based on the assumption that "contextual and technology effects on group processes and outcomes are mediated by the interactive structuring process as reflected in the group's mode of appropriation" (Poole and DeSanctis 1990, p.185).

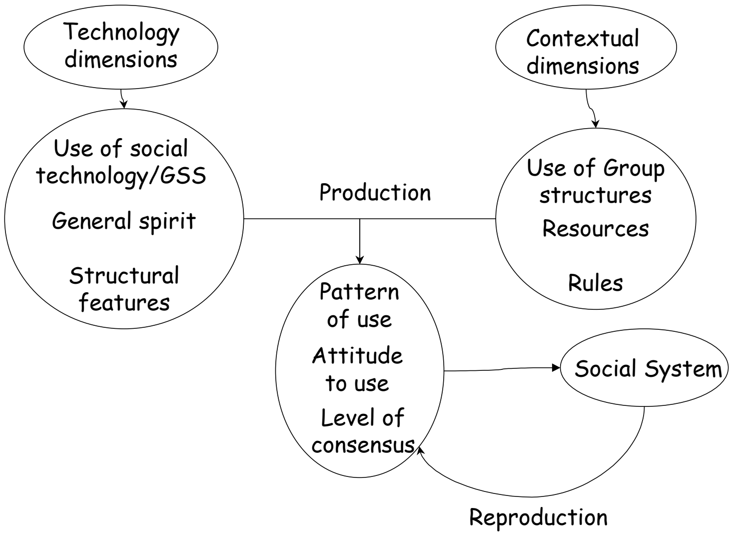


Figure 23 - Adaptive Structuration model

Figure 23 illustrates the elements of AST, and further guidance can be found in Poole and DeSanctis (1990). *Technology Dimensions* include the communication mode (FtF or dispersed), the level of sophistication of the groupware (communication support, decision support tools or sophisticated information structuring and filtering support), the degree of structure imposed on the meeting by the groupware and the degree of control the meeting participants have over the system. *Contextual dimensions* include the task, whether the participants agree on standards for judging acceptable choice, leadership, group composition and power structures, and time to complete the task.

The production of a system that contains the contextual and technology dimensions centres on the *use of the social technology/GSS* and the *use of the group structures.* The *use of the social technology/GSS* is influenced by the specific structural characteristics of the GSS and the general intent the use of the GSS is meant to meet (the spirit). The *group structures* are those rules and the resources used to generate and sustain the system, and also contribute to producing the system. The production of a system (a group) is only part of AST however. It is the appropriation process that determines how groups use the technology and group structures. The three dimensions of appropriation are the *pattern of use* (whether groups use the GSS consistent with the intended spirit and structure or one or both of these are modified by the group), the *attitude* the group has toward the GSS (productive or counterproductive) and the *level of consensus* among group members about appropriation.

Examining AST from the perspective of fit, the contention by Poole and DeSanctis that the theory is a 'mediation' theory is borne out in two of the three dimensions. There are many variables that can be examined in the technology and contextual dimensions, and in the appropriation of these dimensions into the group (the social system). AST also has a medium to low specificity of the fit relationship. The technology and context are affected by group interaction (appropriation and decision processes) and depending on the GSS design, the nature of the contextual variables and the suitability of the appropriation processes to the GSS and the context, expected group outcomes may be achieved. The AST model does not, however anchor the relationship to a specific criterion. "Adaptive structuration theory implies that predictions about the effects of GDSSs, positive and negative, on group outcomes are not determinate"(Poole and DeSanctis 1990, p. 188). Because of this criterion-free stance, I would view this model, in terms of fit, as being from the *gestalt* perspective.

Organising concept model

The model developed by McGrath and Hollingshead (1994) after a systematic review of technology support on group work is shown at Figure 24. The aim of the model was to assist researchers in formulating empirical studies and as a rationale for relating disparate empirical studies. McGrath and Hollingshead agree with other GSS researchers that "there are a plethora of potentially relevant factors, far too many to incorporate in any given study as design variables, or as factors to control statistically or experimentally" (p. 94). They also believe that the most important effects are likely to be the interaction effects of a number of variables rather than the direct effects of a few variables.

The model follows the input-process-output framework but includes the 'organising concept'. The three organising concepts are the motivation for conducting the group work, and they align with the functions specified in McGrath's (1991) TIP theory: information processing (production), consensus building (well-being) and regulating and motivating behaviour (member support). The role of looking at the group work through one of these organising concepts is that they can "act as bases for interpretation of how input factors lead to process and outcome variables" (p. 88).

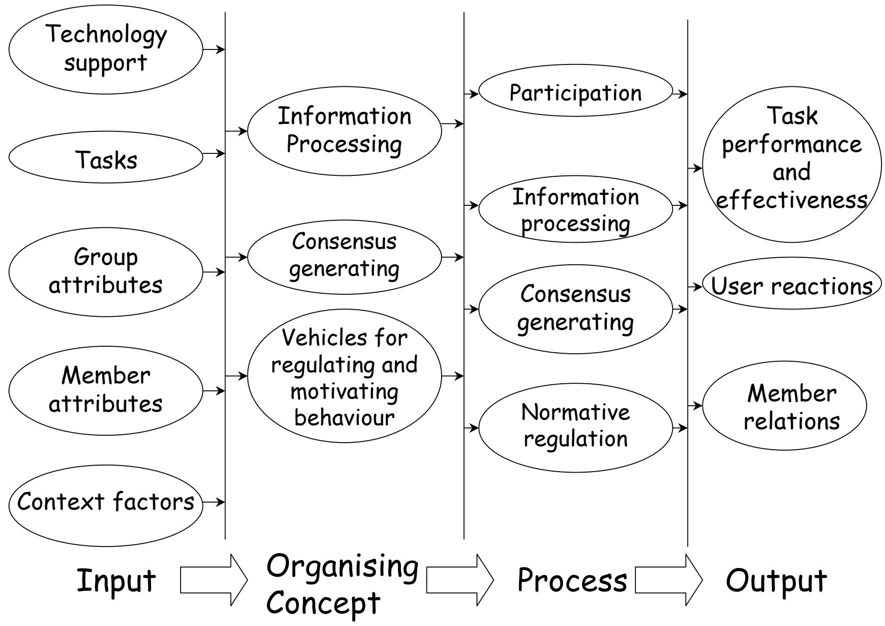


Figure 24 – Organising concept model

From the perspective of fit, McGrath and Hollingshead's model is a *gestalt* model. It does not specify the set of variables that make up the inputs, organising concepts, processes, or outputs, although McGrath and Hollingshead do provide descriptive comments on the inputs and examples of particular variables. For example, *technology support* includes "properties of any technological system (both hardware and software) used in the group communication, for information input, and for task support" (p. 105). As there is no explicitly defined relationships between the elements in the model, or any variables given as examples, this specification of the fit –based relationship is also assessed as low.

Also, the outcomes of the group work are segmented into effects on *task performance and effectiveness*, *user reactions* and *member relations* and there is no anchoring of the variables to these outcome criteria. This model can be seen as 'universally applicable' and as being criterion-free in terms of the anchoring relationship between input and process variables and the outcome criteria.

Factors oriented model

Another model developed from a review of the empirical literature was originally presented by Fjermestad, Hiltz and Turoff (1993) and has since been used to systematically examine the body of GSS literature (Fjermestad and Hiltz 1998a). The model, shown at Figure 25, incorporates elements of AST and the conceptual framework of McGrath and Hollingsworth (1994) but separates contextual and intervening factors because the authors argue that these factors are often treated by GSS researchers as 'black boxes' and this oversimplifies human communication and GSS design issues.

Contextual factors are those factors that characterise the environment in which the group operates, and are static or constant over the meeting. Included in this factor are group characteristics and composition, individual participant's characteristics, task type and structure, type of problem validation process (deductive, inductive, relative, negotiated or conflictual), environmental and organisational context and the technology. As part of the technology subset, the communication medium, tools, method, level of GSS and GSS design are included.

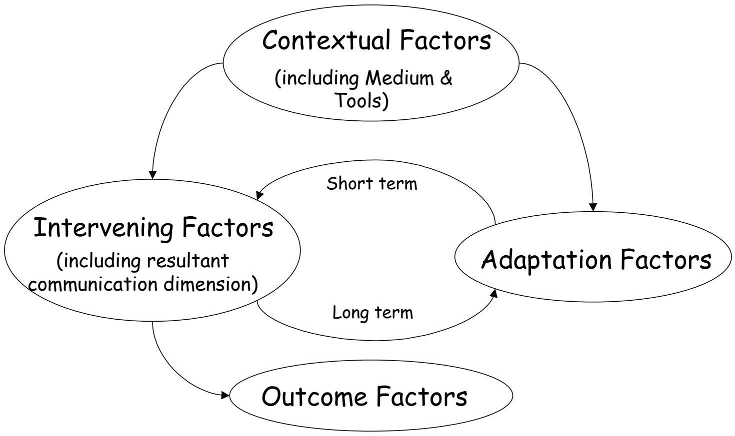


Figure 25 – Factors oriented model

Intervening factors are those components of the system which Fjermestad et. al. (1993) believe can be used to investigate in detail the two dynamic elements of group interactions - the regulation of the process (*Intervening Factors*), and control and influence by individuals and groups (*Adaptation Factors*). Measuring the *intervening factors* allows a researcher to identify the level of influence of the contextual factors and adaptation factors on the outcome factors. The set of intervening factors includes the resulting communication dimensions of bandwidth, information richness, social presence and pre-meeting training. It also includes the methods employed in the meeting, group participant's perceptions about the task, their individual needs and aspirations and their problem solving methods, the use of technology, and the group structure.

Adaptation Factors are also dynamic, as are those factors such as process losses and gains and group and individual influences. Adaptation factors are used by individuals and groups to influence and regulate group processes.

The relationship between intervening and adaptation factors is separated into the long and short term effects that occur when the process and technology used by the group influences the manner and use of the technology or the process respectively.

Finally, the *Outcome Factors* are measures of the result of the group or communication process, and are grouped into five categories:

- Efficiency Measures: decision time, and decision cycles.
- Effectiveness Measures: communications, decision quality, process quality, innovation, level of understanding, and implementation.
- Satisfaction Measures: participation, consensus, social relationships, influence, confidence and general satisfaction.
- Attitude: pre- and post-meeting.
- Usability: learning time, willingness, system utilisation, and number of errors made.

The factors oriented model is another example of a model with the *gestalt* perspective of fit. Using elements from models developed by other researchers, this integrative framework was “developed to provide complete coverage of factors present in the literature as a whole”(p.180). There are many variables identified as having been studied by GSS researchers, and the fit relationship is assessed as low to medium as “outcomes are the result of the interplay of the intervening factors and adaptation of the group with the contextual factors” (p.183) The outcomes are also assessed as criterion-free as they can be any of a large number of variables clustered into the five outcome factors.

Contingency model

The final model views fit from a different perspective. Pervan (1994) has developed a model that relates group performance to the fit between two sets of variables: contingency variables and support variables (see Figure 26). Contingency variables include organisational, task and group factors, and support variables include facilitation, level of technological support, GSS output level, GSS tools, GSS location and communication medium.

Like the other models reviewed, this contingency model can provide a framework for organising the many variables used by GSS researchers to examine group performance. Further, the model can be populated with either a set of general variables or organisation specific variables depending on the particular circumstances.

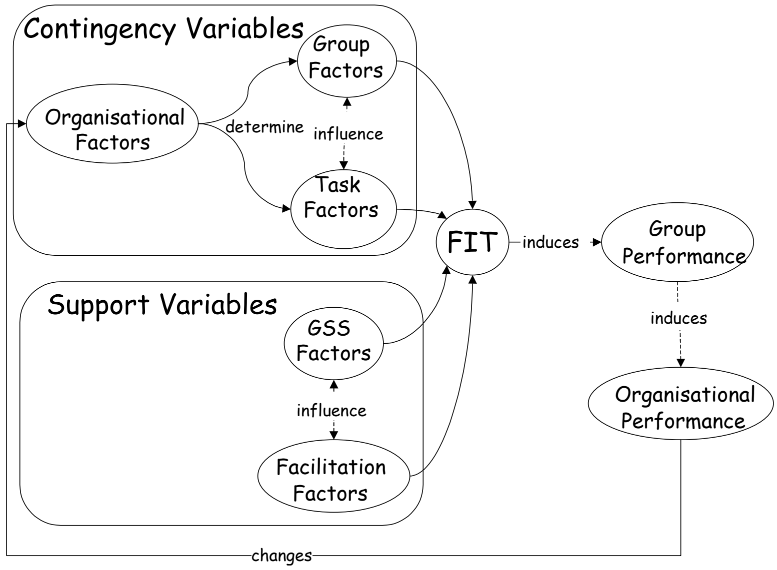


Figure 26 - Contingency model

The perspective on fit differs from other models, however, because Pervan's research intention was to use quantitative analysis of technology supported meetings to develop a 'best fit' contingency model. Using various statistical techniques, including correlation of contingency and support variables, cross tabulation and multiple regression, Pervan showed that it was possible to develop 'best fit' models for particular task types and technology support. From a fit perspective, this model illustrates 'co-variation'. The number of variables initially examined was high, but through the statistical analysis, Pervan reduced the number of variables to a minimum set. For example the 'best fit' model for 'meeting quality' showed that 52% of the variation in 'meeting quality' was explained by the fit of five variables: the GSS experience of the analyst, the degree of group commonality, the number of organisational levels in the group, the importance of the task and whether there was an intelligence phase in the meeting. I would assess that using the model in this way provides a medium degree of specificity for the fit of variables.

Pervan's research model illustrates an important aspect of the perspectives of fit and their application to GSS research. Pervan began examining the effect of TTF by clustering the many variables in GSS research into factors (organisational, group, task, GSS and facilitation), loosely specifying the fit relationship between them ("it is this fit between various influencing factors (and not the factors themselves) which induces the performance of the group in its work environment" (p. 126)) and presenting a criterion-free anchor of this relationship (best fit induces best performance). As the research continued, however, a change in perspective was required to applying the model in practice. This change in perspective was achieved by more stringent specification of the fit relationship, and reducing the number of variables through the application of statistical techniques.

Summary

This chapter has investigated the research literature to consolidate and synthesise the information on task types, group effectiveness models, and the perspectives of fit. Table 13 summarises the discussion of group effectiveness models and their perspective of fit. The conclusion that can be drawn from this review is that most of the current GSS models have the *gestalt* perspective of fit. They are focused on identifying clusters of attributes that exhibit some internal coherence. In the classification developed by Venkatraman (1989) this "fit-as-gestalts perspective within the classificatory framework is determined by its being criterion-free and minimally precise" p. 432. The majority of models described in this chapter also have a large number of variables in the fit-relationship.

Model	*No of independent variables*	*Specificity of fit-based relationship*	*Choice of anchoring*	*Perspective*	*Reference*
Input-process-output	4 clusters	Low-medium	Criteria-free	Gestalt	Dennis et. al. (1988) Nunamaker et. al. (1989b; 1993)
Mediation	5 clusters	Medium - Low	Criterion-specific	Mediation	Pinsonneault and Kraemer (1989)
Adaptive structuration	2 input clusters; 3 elements of structuration	Low – Medium	Criterion-free	Gestalts	DeSantis and Poole (1994) Poole and Jackson (1993)

Model	*No of independent variables*	*Specificity of fit-based relationship*	*Choice of anchoring*	*Perspective*	*Reference*
Organising concept	5 input clusters, 3 organising concepts	Low	Criterion-free	Gestalt	McGrath and Hollingshead (1994)
Factors oriented	4 input clusters; 5 process factors (2 intervening, 3 adaptation)	Low - Medium	Criterion-free	Gestalt	Fjermestad, Hiltz and Turoff (1993) Fjermestad and Hiltz (1998a)
Contingency	As few as possible	Medium	Criteria-free	Co-variation	Pervan (1994)

Table 13 – GSS research models from the perspective of fit

The review results also provide a possible explanation for the variation in reported results on the effect of technology support on group work. As most of the common models are based on the *gestalt* perspective, researchers are given a large set of variables to choose from, and the outcome of change in group performance is criterion-free. As Shin (2003) notes, the gestalt perspective is generally represented as an interpretive approach rather than a functional approach. In group support system research, using a gestalt perspective has led to a situation where researchers may be using the same general model, but different combinations of the variables and the definition (or lack of definition) of the anchoring criteria. The comprehensive summary of variables and combinations of variables published by Fjermestad and Hiltz (1998b) illustrates this variation.

An alterative approach that is also evident in the GSS literature is to use the fit-as-gestalt models as an exploratory model and to change to a more 'confirmatory' perspective as the research progresses. Venkatraman (1989, p.439) describes this sequence as "for a particular research stream, using exploratory perspectives that are less precise in specifying the functional form of fit may be more appropriate, but as the research stream matures, using confirmatory perspectives would be more appropriate".

The next chapter uses the six perspectives of fit to review theories and models that specifically address TTF. The intent of this review is to assess if TTF theories and models also exhibit a predominant perspective and whether viewing TTF research from the perspective of fit can explain some of the inconsistencies in the research findings.

CHAPTER 5 TASK-TECHNOLOGY FIT – TECHNOLOGICAL AND SOCIAL APPROACHES

Having examined the different perspectives of fit in models used to assess group performance, this chapter uses the same six perspectives to look at models that specifically address TTF. Addressing the current research on TTF from the perspective of fit synthesises the body of knowledge in a way that has not been done before, and provides a foundation for selecting an appropriate TTF perspective of fit for operationalising the research question on the impact of technology support on focus groups.

The theories addressing effects of technology on group work fall into two broad categories: those theories with a technological emphasis and those with a social emphasis (Kock, Davison et al. 2001). The main technology focussed theories in the literature are Social Presence Model, Media Richness Theory, the 'Gains & Losses' model, Task-Technology Fit theory, and Cognitive Fit theory. Social theories "place particular emphasis on the role of the social environment and socially constructed information processing schemas" (Kock, Davison et al. 2001, p. 7) and include the Fit Appropriation Model, Technology Acceptance Model, Channel Expansion Theory, Channel Disposition Theory and the Social Influence Model.

The analysis shows that while the theories and models are developed from a *gestalt* perspective they are often tested using another perpective. This may be a reason for the inconsistent results reported in the literature.

This chapter concludes by suggesting an alternative approach to describing group performance and task-technology based on the work of systems theorists. The systems approach is then used in Chapter Seven**.**

Technological Theories

Social Presence model

One of the earliest investigations into the relationship between the characteristics of communication media and the effect on task performance was conducted by Short, Williams and Christie (1976b). They examined the effect of social presence which was defined as the "degree to which a communication medium conveys the actual physical presence of the participants communicating" (Rice, Hughes et al. 1989). The Social Presence Model hypothesises that a communication medium can be described in terms of sociability, warmth and 'personalness' as "communication media differ in their capacity to transmit information about facial expression, direction of looking, posture, dress, and nonverbal, vocal cues" (Short, Williams et al. 1976b, p. 65).

The link between technology support and task, as seen by Short et al., is that because tasks differ, they require different levels of social presence in their requirement for rapid feedback on the reaction of others to the information. For example, audio-only communication is seen as less sociable and personal than face-to-face communication therefore audio-only has a lower level of social presence. The scale of media, from the highest level of social presence to the lowest level of social presence was FtF discussion, television, multispeaker audio, telephone, and business letter.

Short et al. (1976a) saw social presence from the fit perspective of matching where a particular task required a specific level of social presence. In this model the match of social presence and communication media can be derived without reference to a specific outcome criterion because "the appropriateness of a medium for performing certain communication tasks is determined by the degree to which the medium's characteristics of social presence fit the requirements of the tasks" (King and Xia 1997, p.885).

Initial experiments testing the fit between social presence and task used an 'external criterion of performance' (Venkatraman 1989, p. 431). Short et al. (1976a) examined whether a person is more persuasive if they are physically present, and whether physical presence improves aspects of group decision making. Audio-only and face-to-face meetings were compared to determine the nature of the interaction between group members, and the effect on the dependent variable (the level of group cohesion). The initial laboratory results provided general support for the hypothesis that a match between the theoretical level of social presence provided by the medium, and the level of social presence required for the task resulted in more cohesive groups.

Further experiments did not replicate the initial findings however. Short et al. (1976a) expressed reservations about the ability to integrate this work into a coherent structure because "owing to ambiguities of response definition, specific effects on performance in complex interactive tasks are not easy to deduce from the previous work on mere presence" (p. 79). Other researchers (for example Hayne and Smith

1996) have also commented on the inability of this model to explain technology requirements for real world tasks.

Media Richness Theory

Media Richness Theory (MRT) is the basis for much of the research into media selection and use (Rice 1992; McGrath and Hollingshead 1993; Markus 1994). MRT states that task effectiveness is dependent, in part, on the ability of the communication media to support the 'richness' required for the task (Daft and Lengel 1986; Daft, Lengel et al. 1987). Like the earlier work of Short et al. (1976b), MRT approached task-technology support from a matching perspective. MRT differs from social presence because it addresses media in terms of its ability to convey and facilitate shared meaning rather than the level of social presence the technology supports.

In MRT, richness is determined by assessing the medium against four criteria:

- The ability for instant feedback: The speed that participants can respond to others, ask questions, make corrections and receive responses.
- Support for multiple cues: Can the meaning be added or enhanced by using cues such as body language, voice tone, inflection, and visual signs.
- The amount of language variety: The ability of the technology to support the use of natural language rather than numbers to convey subtleties in the message.
- Personal focus: Whether the technology support allows the message to be infused with personal feelings and emotions.

The argument advanced by Daft and Lengel (1986) was that a rich medium and associated mechanisms to structure information were required for reducing equivocality and uncertainty. Daft and Lengel state that a rich medium is more appropriate for transmitting equivocal messages, while a medium with a low level of richness is more appropriate for unequivocal messages. Additional structuring mechanisms to present the appropriate level of information can also reduce the level of uncertainty.

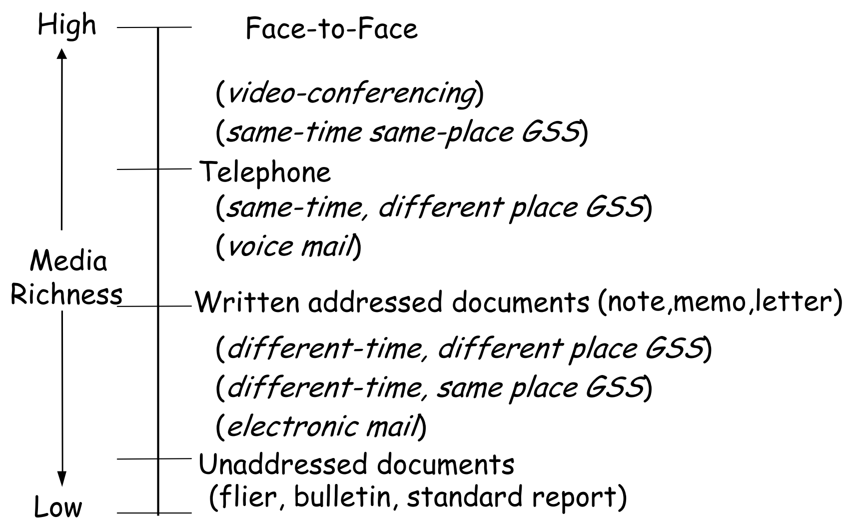


Figure 27 - Hierarchy of Media Richness

Figure 27 illustrates a scale of media richness derived from the work of Daft et. al. (1986) and others, enhanced with technology support for group work (indicated in Figure 27 by *italics*) that were not part of the initial scale. Daft, Lengel and Trevino (1987) believe that FtF is the richest form of communication so that medium occupies the top position in the hierarchy.

Placing modern technology support in the hierarchy is based on an assessment using the four criteria listed above. Technology support, in the form of a GSS, spans this hierarchy. Same time-same place GSS is leaner than FtF communication or video conferencing because communication is primarily text, and this leads to a likely reduction in the number and types of non-verbal and verbal cues and language variety. Using a same time, different place GSS reduces the media richness to around that of using a telephone, because group members are not in the same meeting room which reduces personalisation, the ability to detect cues and is likely to result in less timely feedback. These GSS are, however, richer than voice mail as synchronous communication between the parties is possible whereas voice mail is a one way communication channel.

GSS that facilitate participants meeting at different times, by their design, have limited potential for immediate feedback. Personalisation is possible in a different-time meeting, as is the use of natural language and support for some non-verbal cues. The reduced immediacy of feedback makes different time and different place, and different time and same place the leanest GSS configurations.

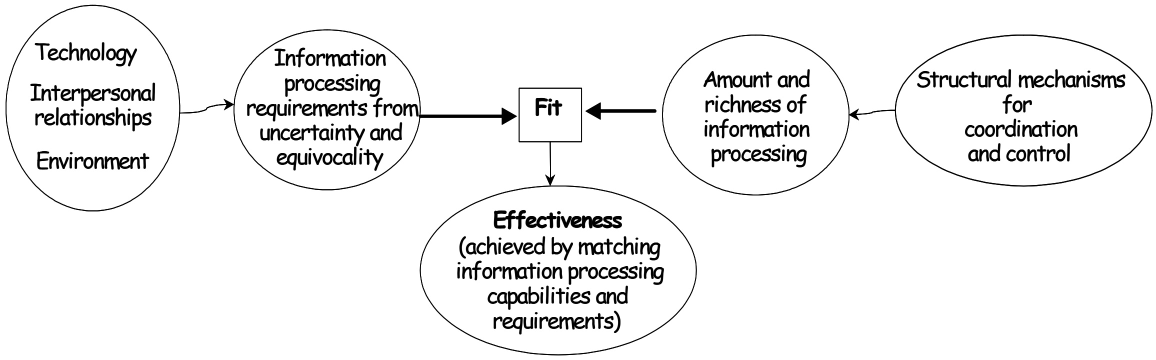


Figure 28 – Information processing model

Having developed a theoretical position on media richness from a matching perspective, Daft and Lengel (1986, p. 568) then go on to anchor this perspective to a criterion measure of effectiveness. Figure 28 summarises how they believe information processing is most effective when the information processing requirements of an organisation matches the amount and richness of the information processing structures.

Because MRT is based on a rational model of media use, it makes a number of assumptions about both media selection and media use (Fulk, Schmitz et al. 1990). Firstly, technology support have fixed, inherent properties regardless of who is using the technology support and what tasks are being performed, and users are aware of these properties. Secondly, individuals make choices that are independent to the setting in which the choice is being made. Thirdly, MRT assumes that users objectively evaluate the characteristics of the technology support and the task, and users make a rational selection of technology support based on this analysis. Fourthly, users are presumed to treat medium use as a scarce resource and attempt to optimally match task and technology support.

Studies based on MRT have shown that there is a relationship between the level of task uncertainty and equivocality, the technology support and group outcomes (Daft and Lengel 1986; Daft, Lengel et al. 1987). In this context, technology that would be appropriate to equivocal situations are those media that support different and perhaps conflicting interpretations about the work context whereas technology support appropriate for unequivocal situations is media that supports clear and specific communication, and that leads to a "single, uniform interpretation by users" (Daft and Macintosh 1981).

Specifically, Daft and Lengel (1987) found that managers preferred a rich medium for tasks where there was high level of equivocality and a low richness medium where the meeting or message content was clear. They also found evidence that a ‘lean’ medium is preferred when groups want to reduce uncertainty and a ‘rich’ medium is preferred when group members which to reduce the equivocality in a task.

Other studies, including those by Rice (1989), Markus (1994), and Hayne and Smith (1996) have also looked at the predictive and descriptive power of MRT, focussing on e-mail as the technology support. The results showed that while MRT goes some way to explaining why managers sometimes resist the replacement of FtF meetings with technology supported meetings, the results are not always consistent with the theory. In the study by Markus (1994) the results illustrated that the media richness scale was not a static continuum. The results of Rice (1989) and Lee (1994) also showed that the richness of the medium was more likely to be a dynamic attribute that depends on the communication participants’ perceptions of richness rather than on an objective assessment of richness based on rational attributes of the medium. Similar arguments about describing media richness in terms of the physical attributes of a particular medium and limitations of looking at media selection as a rational, objective process of matching technology support and task requirements are made by Fulk and colleagues (1990; 1995)

Gains and losses model

The impact of group processes, described by (Steiner 1972) as all the actual steps taken by an individual or group when confronted by a task is identified by GSS researchers as a critical element of understanding the performance of groups. Steiner’s (1972) early work on group processes and group productivity identified the likelihood of *process loss* when groups undertake tasks. Steiner believed that actual group performance would always less than the group's theoretical potential performance as there is likely to be some process loss. Potential group performance is seen as a function of member resources and task demands, where member resources are “all the relevant knowledge, skills or tools possessed by the individual(s) who is attempting to perform the task” and the task demands depend on the type of task.

Steiner defined tasks in terms of their coordination ‘overhead’ or complexity, and developed the following typology for two types of tasks – those that cannot be divided into subtasks (unitary tasks) and those that could be divided into sub-tasks (divisible tasks). The four task types were:

- Additive tasks: where the individual contributions are added up to determine the group's productivity.
- Conjunctive tasks: the group's productivity is determined by the contribution of the least able member or the input.
- Disjunctive tasks: the group's productivity is determined by the contribution of the most able member or the input.
- Discretionary tasks: the group's productivity is determined by the other types of task types or a process resulting from a weighted or unweighted average of the member's contributions.

Having determined the maximum theoretical group performance, the difference between it and the actual group performance is the process loss that occurs because of coordination and motivation problems. Coordination problems would be experienced because the coordination process between group members takes effort that could otherwise be directed towards the outcome. Motivation problems occur because individuals actions are likely to be both productive actions to produce the required outcome and counter-productive actions prompted by feelings of frustration, competing motives between group members and inadequate understanding of each other and the problem.

Building on the work of Steiner (1972), researchers have examined not only process losses but the positive effects of group work and the potential for *process gains* (Hackman and Morris 1975; Hackman and Morris 1978; Dennis and Valacich 1993; Nunamaker, Dennis et al. 1993; Pinsonneault and Barki 1999; Pinsonneault, Barki et al. 1999). *Process gain*s are elements of the group process that improve outcomes (Nunamaker, Dennis et al. 1993). The work of Steiner and others has extended thinking from group productivity being the result of *maximum potential productivity* less *process losses* to group productivity being the result of *maximum potential productivity* plus *process gains* less *process losses*.

One area of technology support research that has used the process loss and gain model has been research into electronic brainstorming or idea generation (e.g. Mullen, Johnson et al. 1991; Camacho and Paulus 1995; Dennis and Valacich 1999; Pinsonneault, Barki et al. 1999). From this research, a set of process losses and gains in both traditional and technology supported idea generation have been proposed. The process losses and gains adapted from Pinsonneault et. al. (1999) and Nunamaker et. al. (1993) are summarised in Table 14.

	Effect of Technology support on Gains and Losses
Process Gains	
Separation of task processes	Increases
Cognitive stimulation/synergy	Increases
Observational learning	Decreases (if participation is anonymous)
Social recognition	Decreases (if participation is anonymous)
Task orientation	Increases
Motivational/arousal	Increases
Process Losses	
Production blocking	Decreases
Effort redundancy	Increases
Cognitive interference	Decreases (if participation is anonymous)
Cognitive inertia	Decreases
Evaluation apprehension	Decreases
Negative productivity matching	Increases (if participation is anonymous)
Pressure for cognitive uniformity/conformity	Decreases
Personalisation of issues	Decreases (if participation is anonymous)
Social influence	Decreases
Free riding	Decreases (if participation is anonymous)
	Increases (if participation is anonymous)

Table 14 - Process gains and losses

Technology support affects process losses and gains in different ways. Pinsonneault and Kramer (1999) state that "The combined effects are contingent on the strength of the pre-existing gains and losses and the strength of the GSS effect on them". Nunamaker et. al. (1993) believe that technology support can mediate the effect of process losses and gains on group processes by affecting:

- Process Support.
- Process Structure.
- Task Support.

- Task Structure.

Process support includes the communication medium (e.g. electronic, FtF), whether parallel communication of participants is possible, whether the technology support provides a group memory function and whether the communication between group members is anonymous. *Process structure* are the rules or techniques used by the group to direct the communication pattern, timing or content of the group interactions. *Task support* is the set of features in the technology support that assist groups undertake a task. Finally, *task structures* are those techniques or models that are applied to a task for structuring and analysing task-related information. A detailed summary of the effect of these four mechanisms on specific process losses and gains can be found in Nunamaker et al.(1993).

Assessing the process gains and losses model in terms of its underlying perspective of fit, Steiner (1972) notes that "To the extent that the total sequence of behaviours corresponds to the pattern demanded by the task, actual productivity will approximate potential productivity" (p. 9). This is consistent with Venkatraman's (1989) description of the profile deviation perspective.

Task-Technology Fit

TTF focuses on the actual use of technology on group performance and is derived from work adjustment theory, and influenced by the organisational theory literature (Zigurs and Buckland 1998). Researchers including Goodhue and thompson(1995) and Dishaw and Strong (1999) believe TTF is still evolving as a theoretical and measurable construct.

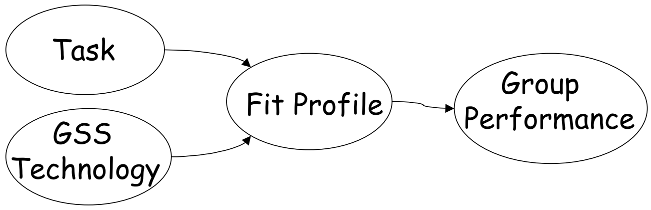


Figure 29 - Basic Task-Technology Fit model

The work by Zigurs and Buckland (1998) illustrates the basic TTF model (see Figure 29). By defining the two inputs of *task* and *GSS technology*, a *Fit Profile* can be derived. *Task* in this model does not use the task definitions in McGrath's Task Circumplex, although Zigurs and Buckland recognise that the Task Circumplex is "both useful and widely used" (p. 314). Instead *Task* is defined as either a simple, problem, decision, judgement or fuzzy task. The *GSS Technology* is described in terms of the level of communication support, process structuring and information processing the technology supports. The *Fit Profile* is the match between the theoretical requirements for the task and the dimensions of the GSS technology. Where the GSS characteristics match the fit profile for a task, it is expected that group performance will be improved. Finally, *Group Performance* is seen as a task specific measure. This model, and TTF theory in general, is "deterministic to the extent that it prescribes expectations about performance, based on characteristics of task and technology" (Zigurs and Buckland 1998, p. 314). Positioning TTF in terms of 'fit', the basic model presented at Figure 29 is an 'ideal profile' or 'profile deviation' perspective.

The results of experiments based on TTF have been mixed. Fulk et. al. (1987) reviewed the research to that time and reported that empirical results of TTF experiments showed a 'moderate' level of support. McGrath and Hollingshead (1994) also report some support for TTF and Straub and Karahanna (1998) summarised 25 studies and found that "though the issue is far from resolved, there are nearly twice as many supportive as non-supportive studies" (p. 161).

One of the documented limitations in TTF theory is the lack of social influence structures in the model, and experiments that extend TTF by introducing social elements have found that social elements can improve the explanatory power of TTF. For example, Dishaw and Strong (1999) examined whether experience with a particular technology influenced the user's perception of ease of use of the technology, or the perceived usefulness of the technology. Even introducing social elements to TTF, the model is still based on the premise that the technology and the task can be objectively defined and that fit is an objective amalgamation of these two. As the authors state: "Our integrated model posits that this knowledge comes from rational assessments of task characteristics and tool functionality, their resulting fit, and from experiences with the technology" (p. 13). Straub and Karahanna (1998) also introduced social influences (social presence and participant availability) into the basic TTF model and showed that the interaction of these two factors might be a good indicator of technology choice.

Zigurs and Buckland (1998), while using the model at Figure 29 for their research, go on to position this theory as the 'inner layer' of the more complex interactions of the social influences, people and institutional properties that influence and shape patterns of action. Zigurs and Buckland describe the “social construction perspectives that view technology as both an objective *and* emergent phenomenon” as “soft determinism” and argue that TTF can co-exist usefully as the “inner layer” to this soft determinism (p. 314).

Cognitive Fit Theory

Vessey (1991a) developed the notion of cognitive fit based on the theory of information processing described in Newell and Simon (1972). Newell and Simon argued that humans have limited capacity to process information, so if complexity in the task environment can be reduced the result should be more effective and efficient decision making. Vessey (1991a; 1991b) proposed complexity is reduced when the problem-solving elements (tools, techniques, and/or problem representations) support the task, strategies, methods or processes required to perform that task.

The model developed by Vessey and Galletta (1991b), and reproduced in Figure 30, shows problem solving as the outcome of the relationship between three problem solving elements: the problem solver’s skills, the problem representation, and the problem-solving task. The processes that act on the problem solving elements lead to the problem solver producing a mental representation of the problem, and then using processes to act on the mental representation to produce a problem solution.

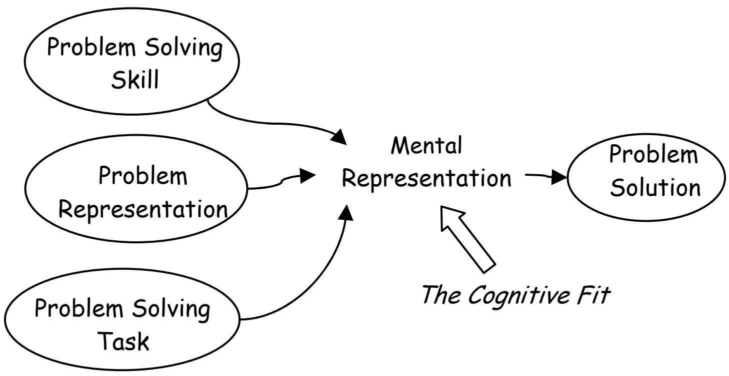


Figure 30 - Cognitive Fit Model

While the experiments conducted by Vessey and Galletta (1991b) assessed the work of individuals, this theory could equally apply to groups. Cognitive fit is achieved when the types of information in the three problem solving elements match. This allows the problem solver to use the same processes on the information from these elements to develop a consistent mental representation. This consistent mental representation leads to a more efficient and effective problem solution. Conversely, if there is a mismatch in the information from any of the elements, the problem solver will have to formulate a mental representation based on only one or two elements or transform the information from the other elements in some way to make them usable in developing a consistent mental representation. It is clear that Vessey and Galletta believe that from a fit perspective an ideal profile of problem solving elements will achieve solution effectiveness.

Theories with Social Elements

The next section of this chapter reviews those theories and models that have been developed specifically to address or incorporate social elements into task-technology fit, or have extended the technological models to so include social elements.

Fit Appropriation Model

Dennis, Wixom, and Vandenberg (2001) have proposed a model that integrates social and technological task-technology theories. In their paper, the authors use the classification of 'decision theorist' and 'institutionalist' to describe the two types of models that look at the effectiveness of technology support on group work. Decision theories are based on rational models of media selection and use, and institutional theories focus on the "social evolution that occurs as technology is adopted into social organizations" (p. 168).

The Fit Appropriation Model (FAM) developed by Dennis et al (2001), called the, attempts to integrate the main features of the technological and social models because they believe that both the decision theorist and institutionalist models address important issues but that the key to understanding group effectiveness and performance is to integrate them rather than keep them separate. The FAM is shown at Figure 31, and can be summarised as.

- GSS capabilities either fit or do not fit the task.
- If the GSS capabilities selected fit the task and the group appropriates the capabilities faithfully then group performance will be improved.
- Appropriation can be achieved by groups using their habitual routines or group norms, or if groups lack those routines or norms then external appropriation support may be needed.

- A fit between GSS capabilities and task without appropriation is less likely to lead to improved performance.
- A poor fit, regardless of the level of appropriation is not likely to lead to improved group performance. (Dennis, Wixom et al. 2001, p. 173-174)

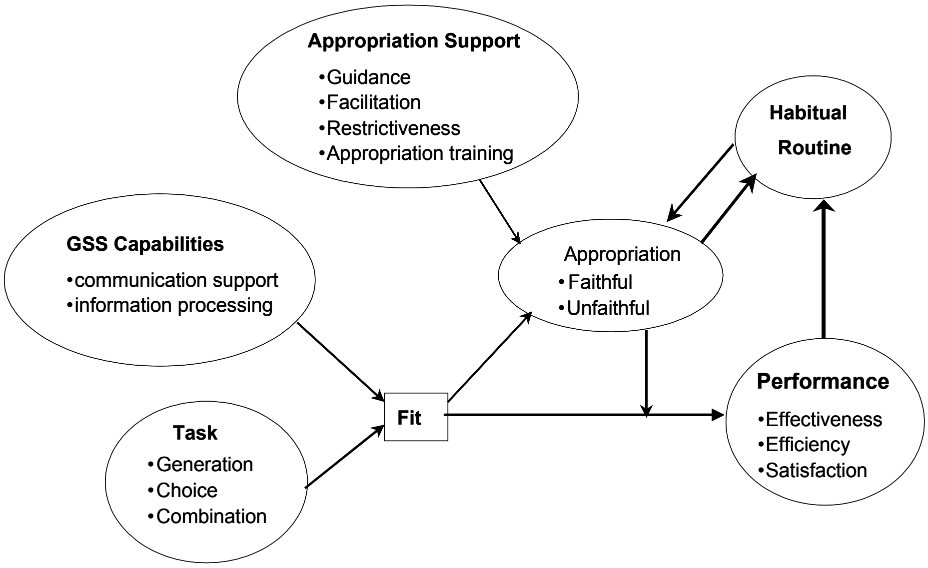


Figure 31 - Fit Appropriation Model

The meta-analysis of prior GSS research that Dennis et al (2001) conducted using this model is based on the perspective of 'ideal profiles' as proposed by Venkatraman (1989).

The results of the meta-analysis found that using this model as an organising 'lens' led to the resolution of some of the inconsistent results reported in other studies. Groups that had an ideal profile of GSS capability, task type and appropriation support had generated an increased number of ideas, were more satisfied and took less time on the task than groups without a GSS. Furthermore, appropriation support had the most effect on the time required to complete the task and process satisfaction, while the fit between GSS capability and task had the most effect on decision quality and number of ideas generated.

Dennis et al. (2001, p. 168) state that this initial construction of an integrated model sets a potential agenda for future research based on this integrated model. A number of potential research areas they identify are addressed in this thesis:

- The minimal number of published research studies on the effect of task and technology support fit from an ideal profile perspective on outcome satisfaction.
- The variance statistics in the meta-analysis, although derived from small sample sizes, suggest that in assessing the fit between GSS capability, task and appropriation support there may be other 'important and systematic moderating factors' that effect the number of ideas, outcome satisfaction, and process satisfaction that require additional investigation.

Technology Acceptance Model

The Technology Acceptance Model (TAM) proposed by Davis (1986; 1989; 1993) and Davis and colleagues (Davis, Bagozzi et al. 1989; Venkatesh and Davis 1996) addresses two particular social aspects of technology support (*perceived usefulness* and *ease of use*) and their impact on the acceptance and use of that technology. Malhotra (1999) has noted that TAM has become an important theoretical contribution toward understanding IS usage and IS acceptance behaviours.

The development of TAM (Figure 32) initially focused at deriving 'high quality' measures for key determinants of user acceptance' (Davis 1989). Davis found that *perceived usefulness* and *ease of use* are two primary determinants of technology acceptance and use. Both *usefulness* and *ease of use* determinants are by their nature social elements, but the aim of the research was to develop an empirical assessment of the impact of these determinants.

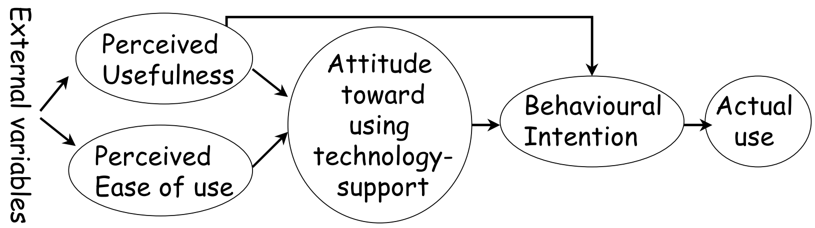


Figure 32 - TAM features

In two separate studies, Davis found that both *perceived usefulness* and *perceived ease of use* were significantly correlated with 'self-reported indicants of system use' and that *perceived usefulness* was much more strongly linked than *perceived ease of use* to *actual use* (or indications of use). Davis explained that these findings show individuals adopt technology support primarily because of the functions it can perform and the perception that the technology support can improve their performance. A secondary reason is how easy it is for the individual to get the technology support to perform those functions.

Because of the comparative strength of the relationship between *perceived usefulness* and *actual use,* Davis also speculated that *ease of use* may be an antecedent of *usefulness* rather than a direct determinant of system use. This finding was further supported by the strength of the relationship between *ease of use* and *usefulness*.

Whether the social elements of *usefulness* and *ease of use* directly or indirectly affect actual use has not been resolved. A number of studies have found that *perceived ease of use* and *usefulness* directly affect user acceptance and use of technology support. Other studies have shown that while *perceived ease of use* indirectly affects user acceptance of technology support through influencing the *perceived usefulness* of the technology (Davis 1989; Davis, Bagozzi et al. 1989; Mathieson 1991; Igbaria, Guimaraes et al. 1995; Taylor and Todd 1995).

Davis (1989) presents two perspectives of fit when developing and subsequently testing TAM. The first perspective, co-variation, is used in the development and pre-testing of the multi-item scales for *perceived ease of use* and *usefulness*. Venkatraman's (1989) description of co-variation is "…is a pattern of co-variation or internal consistency among a set of underlying theoretically related variables" (p. 435) In the initial testing and validation, discrete *perceived usefulness* and *ease of use* constructs are developed and the interaction between them is also examined. During model testing, however, Davis begins with a mediation perspective but the results suggest that, particularly after controlling for *perceived ease of use*, a moderation perspective better describes the relationship between variables. That is, the "regression and partial correlation results suggest that usefulness mediates the effect of ease of use on usage, i.e., that ease of use influences usage directly through its effects on usefulness" (p. 330).

There have also been efforts to extend TAM to cater for both TTF and social influence, and both extensions have relevance for this thesis.

Combining TAM and TTF

Dishaw and Strong (1999) believe that TAM and TTF offer different, though 'overlapping' views on the influence of technology support on the use of technology support. Both TAM and TTF have been described in some detail in this thesis, so only the additional insights from trying to combined TTF and TAM into one model will be discussed.

The overlap between the models is that both models aim to understand users choices and evaluations of particular technology support, and *actual use* (or a related variable) is the outcome variable of both models. Dishaw and Strong also believe that while there is an overlap, one difference between the TTF and TAM is that TTF focuses on outcomes of the actual use of the technology support, or the performance of individuals or groups using the technology support, whereas TAM focuses on the *intention* to use technology support or actual use. It is Dishaw and Strong's contention that a combination of models will allow researchers to better understand the impact of technology support because it will cater for both foci.

The TTF/TAM model shown at Figure 33 contains all the links between constructs of the original models with both a direct relationship between task-technology fit and actual use, and a set of integrating links from 'Fit' to *usefulness*, from technology support *experience* to *ease of use* and *usefulness*, and from *technology support functionality* to *perceived ease of use*. The argument for their inclusion is that attitudes about the *usefulness* and *ease of use* of a particular technology support are derived from individual or group beliefs which in themselves are developed from knowledge about the technology support

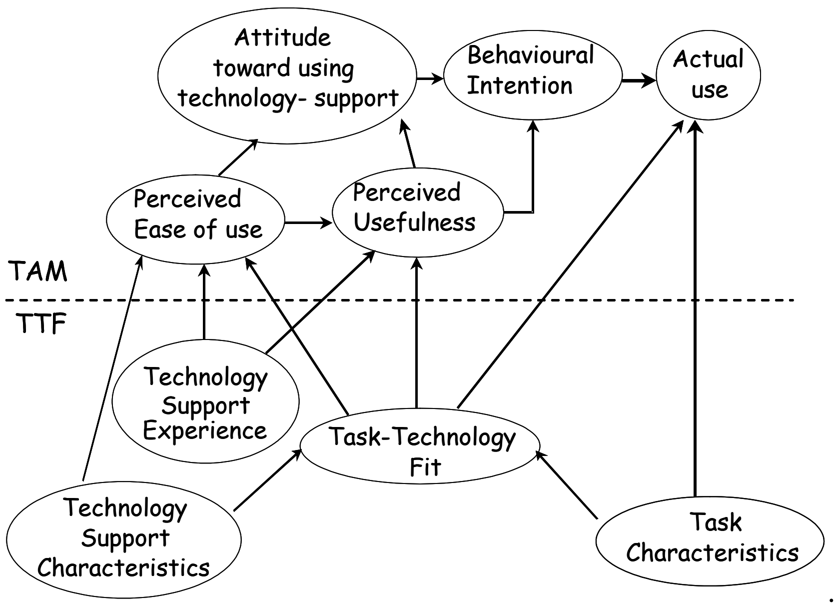


Figure 33 - Integrated TAM and TTF model

Testing the TTF/TAM model against the individual TTF and TAM models showed that using the TAM alone accounted for 36% of the variance of the dependant variable of usage, using TTF accounted for 41% of the variance, and the integrated model accounted for 51% of the variance. Because of the strong direct effect of the task characteristics on the use of technology support, the authors interpreted the results as “task requirements together with the fit between task requirements and the technology functionality, drive IT utilization”(Dishaw and Strong 1999, p. 16).

The TTF/TAM model includes a number of different perspectives of fit. Firstly, it suggests that the effect of *Task Characteristics* on usage is mediated by TFF, and that TTF is a construct seen from the traditional matching perspective. Additionally, the effect of TTF on usage is mediated to a degree by both perceived usefulness and a combination of perceived usefulness and behavioural intention.

Extending TAM with social influence

Another extension of TAM has been proposed by Malhotra and Galletta (1999) who incorporated social influence into the TAM. While Davis (1986) recognised that social influence (or subjective norm) had an impact on the use of technology support, it was difficult to discern if acceptance and use of technology support resulted from the individual’s own attitude to the technology support or because of behaviour caused by the influence of other individuals (‘referents on one’s intent’).

Malhotra and Galletta adopted the three processes identified by Kelman (1958) to explain the level of *psychological attachment* (user acceptance). The three variables are the level of *compliance* (adopting technology support based on the expectation of reward or punishment avoidance), *identification* (adopting technology support to establish or maintain relationships with other group members) and *internalisation* (adopting technology support because it aligns with the individual’s value system). Figure 34 is the revised TAM with social influence (described as psychological attachment) included.

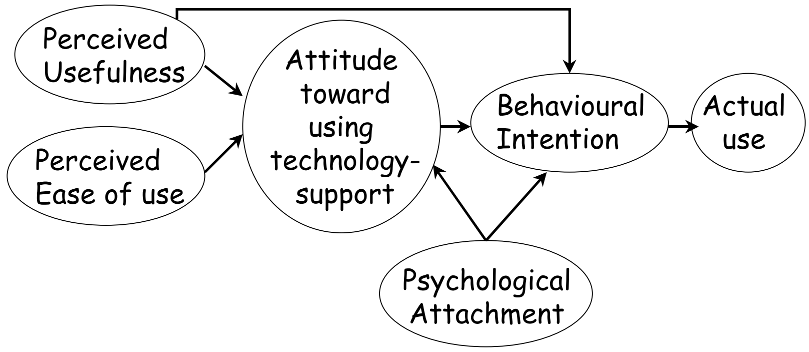


Figure 34 - TAM extended to include social influence

Testing this model showed that rather than the three processes (or factors) described by Keleman, only two factors were significant: *compliance*, and a combined factor of *identification* and *internalisation*. The results showed that social influence based on *compliance* had a negative influence on a user's attitude to the use of technology support, and social influence based on *identification* and *internalisation* had a positive influence on a user's attitude to the use of technology support. The researchers did not detail possible reasons for this finding, but I believe that the fundamental difference lies in motivation. *Compliance* is motivated by external influences, whereas the combined factor of *identification* and *internalisation* are processes motivated by influences primarily internal to the individual.

When establishing the perspective of fit that Malhotra and Galletta (1999) based their research on, the impact of social influence had two separate dimensions. Like the original TAM, a measurement instrument was developed based on the *co-variation* perspective. Once the internal consistency had been established for the *psychological attachment* factors (and they were reduced from three social influence factors to two factors), the criterion of *behavioural intention* was anchored and the researchers adopted a combination of *mediation* and *moderation* perspectives. The results of the experiment showed that the *moderation* perspective was a more accurate description of the relationship between *psychological attachment* and *behavioural intention*. The lack of a statistically significance relationship between *psychological attachment* and *behavioural intention* was explained in terms of these influences indirectly affecting *behavioural intention* through the *attitude* toward using *technology support* (Malhotra and Galletta 1999, p. 9).

Channel Expansion Theory

Another attempt at trying to explain the mixed research results seen in technology-based theories such as MRT is Channel Expansion Theory (CET) (Carlson and Zmud 1994; 1999). CET proposes that inconsistencies in research results occur because there is a dynamic interaction between media richness and media use. Rather than describing media richness in terms of fixed characteristics, the nature of the media use and the knowledge a user develops through using the media are crucial aspects to understanding an individual's perception of richness and their use of a particular medium.

Carlson and Zmud argue that there are two distinct aspects to media selection and use:

- The objective characteristics of the medium.
- The 'perceptual constructs' of the communicating individuals.

The 'perceptual constructs' include user perceptions of the medium, the task and the message, and the presumed or known experience of other communication partners. Based on the perceptual constructs, and the objective characteristics, users are able to 'expand' the capacity of the medium to communicate effectively.

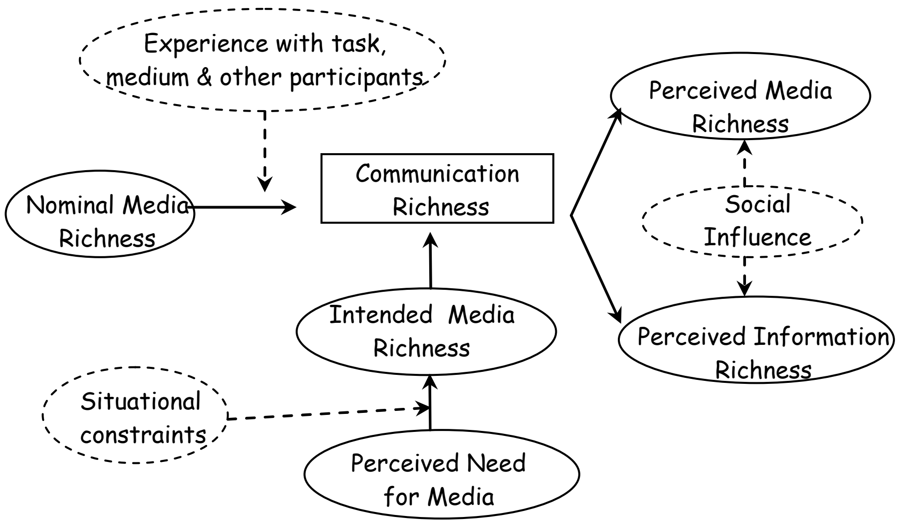


Figure 35 - Channel expansion model

Figure 35 (adapted from Carlson and Zmud 1994) illustrates the main features of CET with the dotted lines identifying those factors that can influence the perception of the richness of the medium. The decision whether a medium is rich enough to use for communicating is influenced by these perceptions and not solely by an objective assessment.

The 'output' of this model is an individual's perceptions about the richness of the media and the richness of the information. CET goes further than previous models in combining of social and rational factors but does not make any predictions about the effectiveness or efficiency of using the medium.

In two reported experiments Carlson and Zmud (1994; 1999) found general support for CET. Specifically, they found that a set of “evolving, knowledge-based experiential factors” can positively influence perceptions of media richness.

CET is developed from the perspective of a *gestalt* fit. Perceived media and information richness could be examined using many variables, and CET does not specify these variables with any degree of precision. Additionally, fit between variables is achieved without reference to a criterion variable. Like other *gestalt* models examined in this review, CET was only partly tested by taking a prescriptive approach and examining only a subset of potential variables.

Channel Disposition Theory

In Channel Disposition Theory (CDT), Swanson (1987) argued that using a particular communication medium is substantially a discretionary decision, and that prior research concluding that deciding to use a particular medium is based primarily on the rational accessibility of the medium did not satisfactorily explain why particular communication channels were selected and used by individuals.

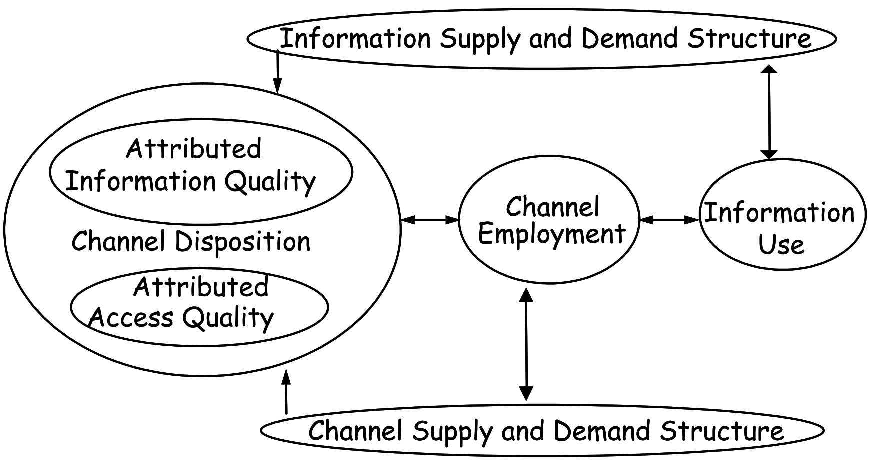


Figure 36 - Channel Disposition Theory

Channel Disposition Theory (CDT), illustrated at Figure 36, combines the concepts of the user's perceptions of the *information quality* to be transmitted and the *accessibility* of the medium into a construct called *channel disposition*. The model relates an individual's disposition toward using a particular medium to their evaluation of the information supply-and-demand structure and the medium (or *channel*) supply-and-demand structure in an organisation.

The disposition to a particular channel and the availability of the channel determines if a channel is used (*channel employment*). Finally, the procurement and dissemination of information is defined as *information use* which is the "instruction and dissemination of evidence (drawn from the information channel) into the organisational situation" (p. 134).

CDT is based on an assumption that individuals treat the communication medium as a scarce resource and attempt to select the best channel based on their disposition toward that channel. CDT also assumes there is more than one channel from which to select. However, unlike the rational models, media selection and use is not seen as solely on an objective assessment of the medium's attributes. Swanson describes channel disposition as 'favourable' to the extent that the "individual rates the quality of channel information and accessibility as high on balance" (p. 133). Effective levels of information are seen as a result of the information supplied to, or demanded by, an individual. Similarly, channels are supplied when they are made available for transmitting and receiving information, or they can be demanded by individuals or groups for this purpose.

In summary:

> "Channel disposition thus is formulated as a psychological cost-benefit utility assessment in which a user implicitly trades off the benefits of a channel's information against the associated costs of access. The trade-off is assumed to combine respective and prospective elements. It is assumed to reflect the opportunity benefits and costs of alternative substitutable channels." (p. 133)

Swanson's testing of this model showed modest support for the proposition that media selection and use is positively associated with the extent of *channel employment* and *information use* by an individual. Additionally, the results showed that for a given level of *attributed access quality*, higher reported levels of *attributed* *information quality* correlated with higher levels of *channel employment* or *information use*. There was no support for the converse proposition however; that for a set level of *attributed information quality* or value, higher levels of *attributed access quality* does not contribute to higher levels of *channel employment* and *information use*.

Although introducing some of the social aspects of media selection and use, Swanson's research showed that "the structure of channel disposition apparently is more complex than initially postulated, with more than two significant dimensions" (p. 142). A strength of this model, however, is the separation of the outcome of media selection into two separate dependent variables, *channel employment* and *information use*.

To date, this model has also only been tested on media selection by individuals. This is not limitation of the model per se but there is no indication by Swanson (1987) about the generalisability of the model to group media selection and use. What can be said is if the initial experiment found the structure of channel disposition in the model did not cater for the apparent complexity in media selection and use, it is unlikely that it would be an adequate model in its present form for theorising about media selection and use in groups.

From a fit perspective CDT is another of the models that views fit from a *gestalt* perspective. Testing of this model has only examined part of the potential set of variables, and the experiments to date have taken a *matching* or *co-variation* perspective.

Social Influence Model

The Social Influence Model (SIM) (Fulk, Schmitz et al. 1990), was specifically developed as "a guide for highlighting the social influence processes applied to media use" (p. 126). Like Channel Expansion Theory, media selection and use is not seen as a rational choice but as a choice influenced in part by subjective judgement, using retrospective information, and including information provided by others.

In the SIM, media selection is described as a learning activity, not an optimising activity. SIM is an inclusive model because it does not preclude the rational choice as a basis of media selection but includes rational choice as one of the options that emerges from the social influence processes operating when individuals or groups decide to use a particular media.

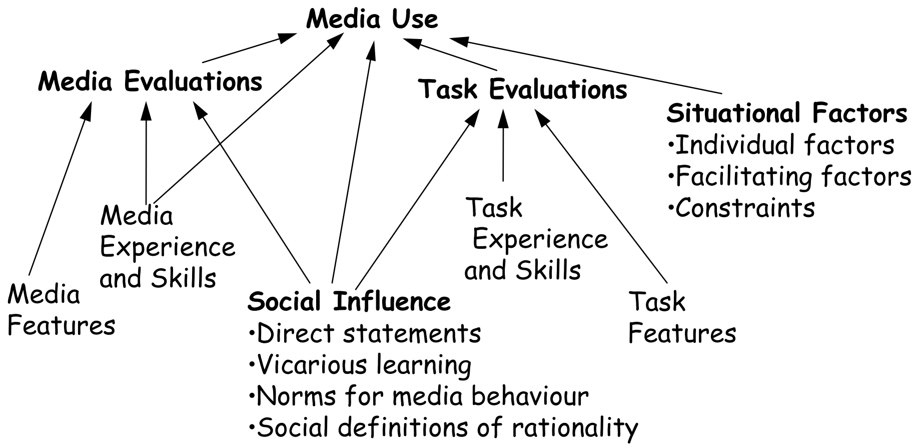


Figure 37 - Social Influence Model

Figure 37 is a diagrammatic representation of the SIM showing the main influences on media selection as:

- Evaluation of the media.
- Evaluation of the task.
- Social influences that moderate and shape the evaluations of the media and task.
- Situational factors specific to the particular situation or application of the media.

Media evaluations are the perceptions and attitudes toward a particular communication medium. These evaluations are formed by combining individual and group experiences and skills in using the medium, the objective features of the medium and *social influences* such as statements by other group members, vicarious learning, perceived norms of media use and social definitions of rationality. The influence of each of these three factors is context dependent.

Task evaluations are also impacted by a number of factors. The features of the task, the experience and skills of the group in addressing the particular task and the *social influence* aspects all contribute to the evaluation of the particular task.

The third influence are the specific *situational factors*. These can be defined as differences in the:

- Individual cognitive style and preferences of group members.

- Facilitating factors such as training support, organisational support for the medium, reliability and flexibility of the technology, and compatibility of technology with current group values.
- Direct constraints such as spatial or temporal constraints.

The SIM could help resolve the differences in research results on medium selection and use. Where rational models only cater for media selection based on objective decision making, SIM provides for the 'irrational' media selections by taking the social behaviour of groups and their experiences and skills with the communication medium into account.

The SIM is yet another example of a model developed from the *gestalt* perspective. The authors do not use the analytical schemes associated with *gestalts* or examine internal incongruence among variables, but the SIM clearly articulates a number of key clusters of variables that affect media selection and use. The strength of the SIM, according to Fulk et al. (1990), is the ability of the model to resolve some of the inconsistencies in the media-use literature. Like other models based on the *gestalt* perspective, SIM is criterion-free and the degree of specificity of the relationships between the main constructs (media and task evaluations, social influences and situational factors) and their effect on media use is low. The *media- use* variable is also not defined, and there is no differentiation between media use and *effectiveness*. The result is that it is difficult to assess if the use of a particular media or technology support leads to communication 'effectiveness'.

Summary

The importance of this chapter is to summarise and synthesise the current TTF models. Task-technology fit models attempt to explain the interaction effects of task and technology support and the impact of this interaction on group performance. As the research based on these models shows, the combination of task and technology support does directly affected the effectiveness of a group. This chapter also identifies that some of the TTF models have been extended to include some other social aspects of group work because examining the interaction between just the task and the technology support has not provided a consistent or comprehensive description. This lends weight to the consideration of research question two.

Table 15 is a summary of the task-technology fit models discussed in this chapter, categorised according to their perspective of fit. Where there is some uncertainty about the perspective, they have been listed under each perspective. Additionally, if a model was developed from one perspective but tested using another then the original perspective has been discussed in the Chapter and summarised in the Table.

Perspective	*Technology support Model*
Mediation	• Basic TTF (McGrath and Hollingshead 1994) • TAM with TTF constructs (Dishaw and Strong 1999) • TAM with Social Influence Constructs (Malhotra and Galletta 1999)
Profile deviation	• Cognitive Fit Theory (Vessey 1991a; Vessey) • Task-Technology Fit (Zigurs and Buckland 1998) • Process Loss and Gains model (Steiner 1972; Nunamaker, Dennis et al. 1993) • Fit Appropriation Model (Dennis, Wixom et al. 2001)
Matching	• Social Presence Model (Short, Williams et al. 1976c) • Media Richness Theory (Daft and Lengel 1984; Daft and Lengel 1986; Daft, Lengel et al. 1987) • TTF (Goodhue 1992; Goodhue and Thompson 1995; Goodhue 1998)
Co-variation	• Technology Acceptance Model (Davis 1989) – could also be seen as a Mediation perspective. • Technology Acceptance Model with Social Influence Constructs (Malhotra and Galletta 1999)
Gestalt	• Social Influence Model (Fulk, Schmitz et al. 1990) • Channel Expansion Theory (Carlson and Zmud 1994; 1999)– tested as co-variation • Channel Disposition Theory Swanson (1987) – tested as matching or co-variation

Table 15 - Fit perspectives in TTF literature

As Table 15 shows, different models have been developed to examine the fit between technology support and the task, and the effect of this fit on group and individual performance. The models summarised in this Chapter illustrate two broad categories: technology-focussed, deterministic models, and models that introduce social elements to the decision making process.

The conclusion from using Venkatraman's (1989) six perspectives of fit to examine the different perspectives evident in the task-technology fit literature is that while many researchers develop models from a *gestalt* perspective, thus recognising the many variables and complex relationship that exists between fit and effectiveness, the testing of these models is conducted by simplifying the relationships and changing the perspective. The most common perspective of fit in the literature is the *profile deviation* perspective. The research using models based on the *profile deviation* perspective typically have few variables and clearly defined relationships and on testing have found to be too simplistic to describe the effects of technology support. This is likely to be one of the reasons that the research to date has produced inconsistent results on the effect of TTF on group performance.

An alternative approach to describing group performance and task-technology fit is to examine group work holistically. This holds to the *gestalt* perspective of fit, but the 'testing' does not simplify relationships. I have chosen to view group work from the *gestalt* perspective, specifically as a Human Activity System, and to use a systems approach to analyse the effect of technology support on group performance. In particular, SSM has been used as the basis for structuring my work, and the use of this approach is presented in Chapter Seven. That said, to ensure the results in Chapter Eight can add to the body of knowledge about the profile deviation perspective and its usefulness in examining the effectiveness of technology support on group work, a set a set of hypotheses and sub-hypotheses are developed and used in Chapter Eight. These hypotheses allow two levels of analysis:

- A test of whether the profile deviation perspective is comprehensive enough to assess the impact of technology support on task and social aspects of focus group work, and to add to the body of research using the profile deviation perspective.
- Whether combining the quantitative results from the hypotheses and the qualitative data associated with these hypotheses to look at the research question from a gestalt perspective provides a better basis for assessing the effect of technology support and other factors on group performance.

Finally, this chapter has reviewed the TTF literature without regard for the type of work the group undertakes. The next chapter specifically focuses on the literature on technology support for focus groups.

CHAPTER 6 TECHNOLOGY SUPPORTED FOCUS GROUPS

In Chapters Four and Five, the use of technology to support group work and the concept of task-technology fit was examined. This Chapter narrows the scope of group work to a specific type of activity considered in research question two - the focus group meeting.

While technology support for group work has been explored for a range of tasks and activities, there is little research to date on the use of technology specifically with focus groups (Clapper and Massey 1996; Parent, Gallupe et al. 2000; Shaw 2002; Easton, Easton et al. 2003).

In this chapter, the characteristics of focus groups are described. Their advantages and limitations are outlined, and studies that report the use of GSS in focus group interviews are reviewed. Where possible, the perspective of fit is also identified.

The Characteristics of Focus Groups

A focus group is a group of between three and ten people who normally meet only once for no more than two hours to discuss a particular issue, topic, or product using a structured group process (Clapper and Massey 1996; Morgan 1997; Krueger and Casey 2000). Focus groups differ from other data gathering approaches because they make explicit use of group member interactions to produce information and insights that would not be possible without the interaction of a group (Stewart and Shamdasani 1990). They also differ from other types of group work because the group is not expected to be on-going, and is not expected to have a past history. Focus groups are an example of 'non-repeating group behaviour' (Zmud 1988; Clapper and Massey 1996).

Focus group methods have been used by policy-makers and social-science researchers in areas such as market research, testing the effectiveness or efficacy of policies and evaluating different types of programs (Cowley 1999; Taylor 2000). Blackburn and Stokes (2000) also showed how focus groups could be used to generate research hypotheses, test research methods and interpret research findings. While currently not widely used in military organisations, one of the original applications of focus group methods in the 1930s was to investigate ways to improve military morale (Krueger 1994).

Focus groups are still mainly conducted with little or no technological support, although GSS researchers have become increasingly interested in the usefulness of technology support for focus groups and exploring the potential benefits of applying GSS to focus group methods (Clapper and Massey 1996; Soutar, Whitely et al. 1996; Parent, Gallupe et al. 2000; Shaw 2002; Easton, Easton et al. 2003; Newby, Soutar et al. 2003; Kontio, Lehtola et al. 2004).

Morgan (1997) has categorised the main purposes of focus groups as:

- Using the insights of group members to generate hypotheses.
- Evaluating different research sites or study populations.
- Developing questionnaires or interview schedules.
- Exploring group members' perceptions and interpretations of results from other studies.

Because focus groups are used to gather qualitative data related to a specific question or problem area (including group members' experiences and reactions) and these groups probably only include the opinions of a small number of people, statistical analysis of the results may not be appropriate. These features mean that focus group research is generally regarded as exploratory research rather than conclusive research (Krueger and Casey 2000).

As a data gathering method, focus groups can be used by themselves or combined with other forms of data collection. The four approaches described by Morgan (1997) for using focus groups in combination with quantitative methods are:

- Focus groups can be used to gather qualitative information preceding a later quantitative study as the qualitative information from the focus groups can assist the researcher to develop a more effective quantitative research programme.
- Focus groups can be used in concert with quantitative methods to provide a basis for triangulation.
- Focus groups can be used to follow a quantitative study so that the findings from the quantitative study can be more deeply examined.

- Focus groups can be used without any other procedures to qualitatively explore issues.

The approach taken with the ADFA focus groups was most closely aligned with the second approach. Focus groups were used in concert with both quantitative and qualitative approaches to provide a basis for triangulation.

The Focus Group Process

There is no prescribed structure or composition of a focus group interview, although most authorities on the subject tend to agree on a basic sequence of actions (Debus 1988; Morgan 1997; Krueger and Casey 2000). For this research, the basic sequence described in these sources was included in the SSM Conceptual Model to structure the focus group and data collection activities.

In summary, once the research question had been formulated, the activities that need to be completed are:

- Generate, pre-test, and revise the meeting questions and structure.
- Translate the interview structure and questions into a technology supported meeting agenda.
- Develop the sampling frame and recruit participants from the ADFA cadet population.
- Make arrangements for the meeting room and install the equipment.
- Schedule and conduct the groups using the meeting room technology support and/or Internet-based technology support.
- Collect, collate and analyse responses to the post-meeting questionnaire, interviews and field notes.
- Report the findings.

Advantages of Focus Groups

Using focus groups to explore issues or research questions has a number of advantages to the researcher. Firstly, focus groups can be an efficient method of interviewing because all the group members are interviewed at the same time. Interviewing a group also means that, compared to individual interviews, results are often obtained in a shorter time span. Additional insights can also be gained during the focus group because of the interaction effect between group members that would be absent in individual interviews (Morgan 1997; Greenbaum 1998).

Another advantage of using focus groups is that the researcher can use the social interaction within the group to increase productivity (group synergy) and encourage more equal participation of members. In the focus group, the researcher can also probe for clarification or greater detail if participants appear to be confused, and if any unanticipated but potentially useful lines of discussion appear they can be pursued.

Finally, the results from focus groups have high face validity because of the clarity of the context and detail of the discussion and they provide some quality controls and reliability checks on the information. In the focus group, participants tend to provide checks and balances for the views of others (Morgan 1997).

Limitations of Focus Groups

Focus groups also have some limitations. Groups are often difficult to assemble, may not be as homogenous as required, and can suffer from 'drop out' of group members. There is also the possibility that because participants are not randomly sampled from the population, and the group only has a small number of participants, the research may not be generalisable. Finally, as individual responses are interdependent, this may also limit the generalisability of the results.

While not strictly a limitation, the focus group facilitator must be experienced at managing a guided group discussion. Additionally, if technology support is used, the facilitator must be trained in the use of the technology. Compared with individual interviews, the moderator has less control over the flow of the discussion so it is possible that the group can divert from the topic, or be distracted with group dynamics issues such as power struggles or unequal participation.

Because of the deeper level of discussion and analysis performed by focus groups, only a limited number of questions or evaluations can be covered. Regardless of the number of questions, it is likely that the meeting will generate a large amount of information. Some information will be specific to the topic, some information will be tangential to the topic, and some will not useful to the discussion. Summarising and analysing the results can therefore be difficult.

Research into Technology supported Focus Groups

The initial research into technology support for focus groups concentrated mainly on idea generation tasks. Clapper and Massey (1996) noted the similarity between some focus group interviews and ‘brainstorming groups’ and Parent, Gallupe, Salisbury and Handelman (2000) stated that focus groups and brainstorming groups are both “ultimately concerned with generating ideas and encouraging creative expression” (p. 44).

Focus groups are not just constrained to brainstorming however, and another type of focus group described by Tse (1999) is one that is used to “evaluate concepts, potential advertising, packaging, and other elements of a product or service” (p. 407). Whether the task is idea generation or evaluation, it is argued that technology support can be used to improve focus group performance.

Interestingly, there has been less empirical research on technology support for focus groups than other types of group work. Easton, Easton and Belch (2003) note that ‘electronic’ focus group research was “uncharacteristic of the GSS research literature” as the tasks undertaken by these groups did not generally result in a solution, a decision or a “consensus threshold measure” (p. 717). In marketing journals and publications, however, there has been an on-going debate on the usefulness and effectiveness of technology support, and in particular ‘online’ focus groups (Greenbaum 1997; D'Onofrio 1999; Ozer 1999; Comley 2000; Taylor 2000). This debate is characterised by two main views: Those focus group practitioners who believe that technology has no part, or only a limited part, in supporting focus groups, and those practitioners that believe that technology will revolutionise focus groups.

The discussions typically centre on whether technology support detracts from the social interaction of the group and limits or eliminates group synergy. Those that believe technology can enhance or not detract from group interaction argue that there are additional benefits from using technology that cannot be ignored. The debate is particularly polarised when reviewing the utility of internet-based technology support that supports asynchronous communication between group members.

Benefits of technology support

One benefit of technology support is that it can be used to remove the traditional requirement for homogenous groups (Krueger 1994). The main reason cited for using homogenous focus groups is that the ‘negative dynamics’ created in heterogeneous groups can be minimised as can the impact of these dynamics on group effectiveness. Technology can be used to minimise or eliminate these ‘negative dynamics’ allowing the group to benefit from the extra stimulation of different ideas and making it possible to reduce the number of focus groups needed to gain a representative view of the area under investigation (Clapper and Massey 1996).

Another benefit of using technology support is that most technology support has the ability to allow participants to remain anonymous. The anonymity feature in many GSS, including the one used with the ADFA focus groups, reduced inhibition among group members (DeSanctis and Gallupe 1987; Jessup, Connolly et al. 1990). Research has shown that anonymity can make group members more critical and probing (Jessup, Connolly et al. 1990; Valacich, Dennis et al. 1992) which can be beneficial for certain types of focus groups. There is also the possibility when conducting a focus group in the different time/different place condition, meeting anonymity can remove any gender, race or status identification from group members. Anonymity can also reduce the potential for one or more group members to dominate proceedings by using gender, race or social status, and can reduce the likelihood of participants feeling unable to disclose their ideas, feelings or opinions (Sweeney, Soutar et al. 1997). Summarising the potential of anonymity as a moderator of ‘negative dynamics’, Soutar et al. (1996) note it is especially beneficial if group members have not “invested time in building open relationships” (p. 40).

Changing the level and type of interactions between group members and between the group and the focus group facilitator is also possible after technology support is introduced. In a meeting room there is often conformance pressure and group members are apprehensive about evaluating the ideas or opinions of others in an open forum. Using a GSS with voting support and anonymity features in a same-time/same-place setting can hide individual evaluations and present only the group results. Comments can also be made anonymously which reduces the pressure to conform or the apprehension associated with evaluating another participants work. In the asynchronous focus group, time constraints can also be relaxed. This may benefit participants who are apprehensive about their lack of technological skill or are uncomfortable with communicating in public in written form.

In an early theoretical paper examining some of these issues and the general question using technology support with focus groups, Clapper and Massey (1996) argued that technology support has a number of benefits. One benefit is that technology support can reduce the financial and time costs of conducting focus groups (see also Cowley 1999). Clapper and Massey (1996) summarise these costs as salaries for the moderator, potential payment of participants in lieu of their normal salaries, rental of meeting rooms or research facilities, and the costs of tape production and transcribing. They do not, however, comment on the costs of providing technology support or whether their proposition about financial savings takes technology support costs into account.

A second benefit is that it may be easier to get participants for focus groups. Asynchronous technologies can eliminate the need for participants to be released from their workplace and dispersed group members can undertake the tasks whenever and wherever they choose within the framework set up by the facilitator. Additionally, if time and location are flexible, facilitators have the potential to select participants from a much wider pool. This could have major advantages when examining, for example, policies in widely dispersed organisations or when cross-cultural groups would be most appropriate (Tse 1999).

Early experiments and studies

Like Clapper and Massey (1996), Soutar, Whitely and Callan (1996) also saw the potential for using a GSS to support focus groups. They conducted an exploratory study to examine how a GSS could be used in a marketing context, and what types of information it could provide. Focus groups used either technology supported Nominal Group Technique (NGT) (Van de Ven and Delbrecq 1974) or a traditional NGT process to evaluate student views about student and teacher interactions in an MBA program. Participants in the technology supported groups had phases of working on their individual workstation (brainstorming, rating ideas, commenting on ideas) and a combined phase working on the facilitator's workstation (rating and organising ideas).

Some of the benefits of using technology support with focus groups using NGT that (Soutar, Whitely et al. 1996) identified are:

- Time spent waiting for others to write their ideas can be eliminated.
- Time spent on prioritising and evaluating ideas can be reduced.
- The number of ideas able to be generated in a set time can be increased.
- The potential for time disruptions leading to loss of spontaneity and rhythm may be reduced or eliminated.

The main benefits seen by Soutar et al. (1996) in using technology support are that parallel and anonymous processing reduces or eliminates time spent waiting for others, increases the volume of work that can be covered in a set time, lowers evaluation apprehension, and makes participation equality easier to achieve. A GSS can also provide hardcopy reports at any stage in the meeting, and frees the facilitator from note taking and process structure tasks.

The advantages listed above and the benefits identified by Soutar et al. (1996), however, are not limited to focus groups or using NGT. These advantages and benefits were identified earlier by Nunamaker et al. (1991) as general process gains from using a GSS.

Soutar et al. (1996) identified the main disadvantages of using the GSS in terms of access and participant apprehension. A GSS requires hardware and software (and possibly a specialised meeting room), and normally a trained facilitator and/or chauffeur is necessary. Introducing a GSS could also disturb the dynamics of the group and group members may be apprehensive about the technology. The researchers did not assess the perceptions of the participants toward the use of the technology support, or evaluate the 'efficiency' of the use of NGT and technology support in these focus groups. The research focus was on assessing the benefits and limitations of technology support.

Soutar et al. (1996) did not look explicitly at fit, however the intent of the research seems to be to assess the general concept that compared to traditional focus groups, if there is a fit between technology support and task then technology supported focus groups could have improved outcomes. While there is not enough detail in the reporting to conclusively determine a perspective of fit, the fact that this exploratory research is ‘criterion-free and minimally precise’ then it could be categorised as being being undertaken from a *gestalt* perspective.

Developing the work of Soutar et al. (1996), Sweeney, Soutar, Hausknecht, Dallin and Johnson (1997) conducted an experiment comparing traditional focus groups and technology supported focus groups in a same time-same place setting. The researchers compared how the technology support was received by the group participants, by the moderators and by the researchers themselves and the number of ideas generated in each condition. The task was to examine participant understanding of the concept of cognitive dissonance with the aim of developing a scale of items to “describe and measure consumers” cognitive dissonance’ (p. 401).

Using a pre and post-group questionnaire to assess group participant’s reactions, two groups were conducted using a traditional focus group approach and two groups were conducted using technology support (GSS). A total of 34 participants were recruited from the local community, with nine participants in each of the traditional groups and eight participants in each of the technology supported groups.

It is not reported which GSS was used but the main features were that it was a same-time, same-place system where each participant had a workstation and the meeting was controlled by a facilitator who had their own workstation. There was also a public screen for the displaying of ideas, and a printer in the room.

The results from the experiment showed that in the pre-meeting responses, participants in the GSS sessions showed more interest in the group and were more optimistic than those in the traditional groups. Members of the GSS groups also showed an increased level of concern about whether they would know what to say.

One of the benefits of technology support identified by Sweeney et al. (1997) was the ability of the group to capitalise on parallel processing, or the ‘parallel interviewing process’ as they called it. Specifically, parallel processing led to an increased number of ideas able to be generated in a shorter time and an increased participation equality. These features, and the anonymity feature of a GSS, were seen as offering major gains over traditional focus group methods.

Interestingly, the post-session responses showed that the members of the technology supported groups were more ‘confident’ than those members in the traditional groups, but whether this is a measure of confidence in the process, confidence in the result or some other construct is not stated. Participants in the technology supported focus groups also felt that the meeting had gone better and that they had had the opportunity to contribute all they wanted to contribute.

When the researchers measured the efficiency of the groups, the results showed that both traditional and technology supported groups covered the same concepts and ideas, but the technology supported groups produced on average a third more ideas than the traditional groups. Although producing more ideas, the researchers also assessed that technology supported groups had more conservative and less colourful ideas than the traditional groups. Their explanation of this finding was based on previous work by Horowitz and Newman (1964) who suggested that people believe writing is a more 'serious commitment' than speaking. A more serious approach, it is argued, makes participants more conservative in their outlook and more likely to present more mainstream (or less colourful) ideas.

Those in the technology supported groups also reported that group member interaction was significantly improved by using a GSS, and they were more enthusiastic about the possibility of attending another group using a GSS to support the group process. When the facilitators of the technology supported group were interviewed they stated that from their perspective a greater quantity of information was obtained during the meeting but there appeared to be a reduction in "free flowing conversation and 'in-depth' understanding" (p. 406). Part of this feeling was attributable to the fact that the technology supported groups were tightly scripted and participants could only progress to the next stage after completing the previous one. The researchers also identified that a GSS could potentially improve group effectiveness on a brainstorming activity by providing focus groups with tools for evaluation, and idea structuring through lists and levels within lists. The impression of an improvement in output or effectiveness, or a heightened emphasis on the task at the expense of social interaction and detailed analysis, has also been noted by others (e.g. Keleman, Lewis et al. 1983).

The perspective of fit that underpins this research is not explicit. While the underlying purpose of the research was to generate scales to measure consumers' cognitive dissonance (p. 401), and the results support the use of technology support for this type of task, no conclusion can be made about the perspective of it that the researchers had in mind when structuring this research.

In summary, the findings of Sweeney et al. (1997) indicate that technology support may improve aspects of the conduct and outcome of focus groups. Although the sample size is small, this research showed that augmenting traditional focus groups with technology support can lead to increase in the group members' perceptions of participation equality, confidence, level of contribution, interaction between participants, and an increased likelihood of using the GSS again in the same setting. Technology support can also increase the quantity of ideas generated, although it could also produce more conservative responses. Like the work of Clapper and Massey (1996), this research points to the potential benefits, in terms of cost and time, of using technology support to support focus group processes. Sweeney et al. (1997) also note that another 'major avenue' is to use technology support to conduct different-place/same-time focus groups.

Lewis and VanSchoorl (1998), after conducting nine focus groups aimed at identifying the effectiveness of an International Marketing Programme (IMP), made a number of observations on the usefulness of technology support (GSS). Overall, technology support was seen by participants and users of the group output as an effective method to gather ideas, attitudes and evaluations. Because of the meeting structure, the method was also seen as easy to use and objective. The research also showed the importance of clearly outlining the level and type of interaction that participants can expect during the meeting.

The focus group was deliberately structured to collect both qualitative and quantitative data about the IMP and Lewis and VanSchoorl showed how both types of data can be combined to analyse the effectiveness of the IMP. By using technology support in the same-time/same-place condition both written and verbal interactions can be captured. Quantitative data was obtained by using the evaluation tools available in the particular GSS (MeetingWorks ™) and the results were presented in terms of measures of variance. The qualitative data was collected from comments put into the GSS.

The aim of this research was to examine the advantages and disadvantages of technology support, and lessons learnt for future GSS projects. There was no explicit or inferred perspective of fit.

Overall, the participants reported they thought the technology support was easy to use, conveyed their opinions, was efficient and that the outcomes of the meeting met their expectations. The facilitator and staff thought that the use of technology was a more effective method of gathering and presenting data than through manual methods.

A report by Taylor (2000) made similar comparisons between two modes of communication but focused on the relative effectiveness of telephone surveys (same-time/different-place) and asynchronous on-line surveys (different-time/different-place). The main differences that Taylor identified were that in asynchronous surveys:

- The sample is often not based on probabilistic sampling but on ‘volunteer’ sampling.
- The participants can view images and other non-written information if the survey is Internet-based.
- Written responses were often ‘richer and longer’ than spoken ones.
- The group participants may be more effective when addressing sensitive issues.
- Fewer participants in asynchronous meetings pick the extremes on scales when completing on-line surveys and the number of ‘unsure’ or ‘uncertain’ responses can be greater.
- There is a potential for the raw data to substantially under-represent some groups because of the participants' likelihood to have on-line access and their propensity to participate in the survey.

Taking those differences into account, Taylor concluded that over a range of topics, there were many similarities between on-line and telephone survey results. Although Taylor examined the effect of technology support on conducting surveys, it is likely that many of these characteristics are also found in asynchronous focus groups although judicious research design should eliminate sampling and access problems, and follow-up questions should reduce the number of ‘uncertain’ responses if this type of evaluation is part of the focus group work.

There was no explicit or implicit perspective of fit that can be identified from Taylor’s work. The key aim of this research was to improve understanding of how to use the internet to conduct qualitative and quantitative research.

Another study that empirically measured the outcomes of introducing technology support into the focus groups process was that of Parent, Gallupe, Salisbury and Handelman (2000). The researchers reported two experiments that examined the difference between groups of university students involved in a knowledge creation activity using either technology support (GroupSystems ™) or no technology support.

Parent et al. (2000) believe that "when the group's effort can be best enhanced by improvements to mechanics, the strengths of GSS come to the fore. This is consistent with the concept of task-technology fit" (p. 49). The perspective of fit that Parent et al. (2000) align their research with is the profile deviation perspective described by Zigurs and Buckland (1998).

The first experiment looked at knowledge creation in terms of the number of 'enriched, unique ideas generated' by ten groups of four undergraduate students, where each idea generated was evaluated for uniqueness and relevance. The result showed that the technology supported focus groups generated significantly more unique ideas than the traditional groups.

The second experiment built on the first experiment using more than one task , a larger number of groups and more dependent variables. Forty groups of four or five undergraduate students completed a knowledge creation (idea or comment generation about two products) and a knowledge consensus task (agreeing on the relative price of the product). The variables measured in this experiment were the number and usefulness of the unique ideas produced by each group, satisfaction with the knowledge generation process, the degree of difficulty in reaching consensus and the overall satisfaction with the consensus process.

In the knowledge generation task, the results supported the first experiment, with the technology supported groups producing a significantly greater number of ideas. Analysis of the quality of the ideas and comments also showed that technology supported groups produced higher quality comments for both knowledge creation tasks. Technology supported groups, while producing higher quality outputs, were significantly less satisfied with their experiences in idea and comment generation with their performance than the traditional groups.

On the 'consensus-reaching' task the participants in the technology supported groups were able to reach consensus more easily than those in the traditional groups and strongly advocated the use of technology support over traditional approaches. Satisfaction was not significantly different between technology supported and traditional groups. The results of the Parent et al. (2000) study suggest that technology support, when appropriately employed, can improve the performance of focus groups.

Walston and Lissitz (2000) examined the effectiveness of applying technology support to student focus groups addressing the sensitive question of academic dishonesty. This study also addressed practical questions such as whether computer generated transcripts could provide interpretable and useful information. The study involved five groups across two conditions – three technology supported same time and same place groups and two traditional focus groups. The group sizes were eight, nine and twenty students in the three technology supported groups and seven and eight in the traditional groups.

Each group was asked the same questions, and at the conclusion of the meeting they were given two questionnaires. The first was to assess their reaction to the focus group sessions, including questions about the technology support. The second questionnaire required students to estimate the number of academically dishonest acts they had committed while in college. The computer generated transcripts were also assessed for their interpretability and whether the information was usable.

The analysis of responses, indicated that participants thought that using technology support did not affect the honesty of their comments, but those in the traditional FTF groups were significantly more embarrassed to reveal some of their experiences. The statistical analysis also showed that those in the technology supported groups did not feel as encouraged to reveal their experiences as those that met FTF. The participants in the technology supported groups reported that they were significantly less concerned about what the facilitator thought about them than those in the FTF groups.

The assessment of the transcripts showed they were easy to follow, and that summaries and conclusions about the focus group topics could be derived from them. Because there were only five groups in the study, no group-level quantitative analysis could be conducted. The researchers, based on observations during the focus groups, concluded the conclusions made by the participants were fairly similar between the two conditions.

From the moderator's observations, there were discernable differences between the FTF and technology supported groups in participation. Those in the technology supported groups had more equal participation, and those in the technology supported groups had less inhibition and were more likely to disagree with other group members than those in the traditional FTF groups.

Walston and Lissitz (2000) did not conduct their research with any explicit view, or any discussion, on the perspective of fit and it is not possible to identify any implicit perspective from the discussion on the experiment or the discussion on the results.

Studies and research after 2000

In 2001, Franklin and Lowry (2001) reported the results of four technology supported focus group sessions looking at university faculty attitudes toward technology use in the classroom. Twenty eight university faculty were divided into four focus groups with each focus group lasting approximately one hour. The participants were allocated to groups based on their academic status and faculty affiliation, and the objective of the study was to examine:

- The impact of technology support on reinforcing the objectivity of the facilitator.
- How the facilitator can guide the participants on a sensitive research topic.
- How participant discussion can be managed.

The technology support (GroupSystems ™) was expected to support discussion of the topic while "minimising the influence of the rapporteur on the data collected" (p. 177), and providing "a cloak of anonymity that encouraged faculty members to share their true opinions and attitudes" (p. 178). Using technology support was also expected to reduce domination by faculty members over the student researchers, and because the time allocated for the tasks in the focus group could be preset, time overruns due to dominance by one of more facility could be avoided.

The GroupSystems tools used in the focus groups were Topic Commentator and Categorizer. The meeting process involved participants generating their comments without seeing other participant inputs, and once all the comments were collected they were displayed publicly. Participants were then given the opportunity to comment on the ideas via the technology support. Franklin and Lowry saw the value of this meeting process as enabling “electronic conversations conducted between two or more participants, without disturbing the contribution of others” (p. 177).

The research approach used by Franklin and Lowry was an interpretivist, naturalistic approach. After each meeting, the researchers performed a content analysis of the data by ‘bracketing’ the output into attitude themes, and then converting those themes and patterns into a theoretical framework on attitudes to technology use.

After analysing the observer comments and the results of the focus groups, Franklin and Lowry reported that using technology support had:

- Improved the objectivity of each meeting.
- Reduced the influence of the sensitive topic of the use of instructional technology in the classroom on participation.
- Enhanced the management of participation discussion.

Additional reported benefits were also identified:

- Data accuracy was enhanced as all communication was conducted by typing into GroupSystems.
- By reducing the influence of the facilitator, more facilitators could be used without negatively influencing the outcomes.
- The ability to print the results immediately after the meeting meant no transcribers were required and there was no transcriber bias.
- Because all communication was through the technology support, there was no requirement for video or audio recording of the focus groups.

While concluding that there were benefits to using technology support for focus group meetings, Franklin and Lowry believe that there are also a number of ‘challenges’. The ‘primary challenge’ was the reduced ability of the facilitator to guide the discussion and request elaboration on any given topic. While improving the objectivity of the focus group, the researchers believe that lack of interaction did not allow the facilitator to keep the group focused on the topic.

A second challenge arose when trying to code the output from the groups. The comments were much more concise than traditional transcripts, were often incomplete and had a ‘lack of depth’. This made the bracketing of the topics difficult and “required more interpretative skills by the researcher in completing valid coding” (p. 179).

Franklin and Lowry also noted that the ability of the participants to use the technology support also affected the results. Those participants that were “better and faster typists” had the potential to dominate the discussion because of their “expertise with, and speed on, a computer keyboard” (p. 180). Finally, if the participants knew each other and the focus group was small, the anonymity was lost as the comments identified the participant.

This research was qualitative in nature, and the perspective of fit was not made explicit. From the reported results, it was not possible to discern the views of Franklin and Lowry about what perspective of fit underpinned this research.

Easton, Easton and Belch (2003) applied technology support (GroupSystems ™) to focus groups undertaking a market research task. Using 120 undergraduate students divided into six groups of eight students and six groups of 12 students, the groups were tasked with watching advertisements and providing evaluative feedback on the product. The focus groups were completed in a meeting room and all the groups using technology support were same time and same place focus groups.

The aim of this research was to investigate how technology supported focus groups would perform in terms of idea generation (number of unique ideas and number of on-task ideas) and participation (involvement of group members in the discussion) compared with traditional focus groups. A second set of hypotheses tested if there were any differences between large and small technology supported focus groups. The experimental design was an empirical assessment using a two-by-two factorial design with group size and communication medium (no technology support and technology support) as the factors.

The results showed that technology supported focus groups produced significantly more unique ideas and on-task ideas than traditional focus groups. Participants in the technology supported focus groups were also significantly more likely to participate in the discussion and were more satisfied in the process than traditional focus groups.

The research failed to find any significant difference in reported satisfaction in the outcome of the focus group between those with technology support and traditional focus groups.

Comparing large and small technology supported focus groups, the results showed no statistically significant support for the hypotheses that larger groups would generate more unique ideas, or that large groups would generate a comparable number of on-task ideas as small groups. The small groups generated more unique ideas and more on-task ideas than the large groups. Testing differences in satisfaction, and participation levels showed that there was no difference in satisfaction with the process, the outcomes or the participation between large and small groups.

Easton et al. (2003) note that using technology support provides “additional value added to the process and/or to the outcomes from the tools relative to traditional market research technique” (p. 717). This would suggest a matching perspective, although later they state that to meet the objective of the study they studied “the outcomes of focus groups supported by Group support system (GSS) technology and analysed the results for gains/losses relative to traditional focus groups” (p. 717). The later statement would indicate that they based their research on a profile deviation perspective. Assessing the research as a whole, however, shows that the profile deviation perspective is not supported by the details. There is no comparison to an ideal profile or an assessment of the degree of adherence to an externally specified profile or the implications of adhering to that profile. This research, like many of the other studies discussed in this chapter, is not explicit about the perspective of fit.

Newby, Soutar and Watson (2003) continued the earlier work of Soutar and colleagues on the utility of technology support for focus groups. The research involved two technology supported focus groups and two traditional focus groups addressing factors that motivate a person to start a small business and continue to operate that business. In total there were 16 participants in the two traditional meetings and 13 participants in the technology supported groups, and all groups met for their session in a meeting room in the same time and same place condition. The researchers did not report the GSS used in the study.

The qualitative results of this study were consistent with the earlier reported findings of Soutar et al. (1996) and Sweeney et al. (1997) that technology supported focus groups produced a greater 'breadth' of information and more unique ideas than traditional focus groups. One observation during the idea generation phase was that there was a higher degree of 'yea saying' in the traditional groups. The observations in the earlier experiments that technology supported groups generate more usable information because the participants could not get sidetracked (the agenda was fixed in the GSS) was also supported in this study, and the effect of dominant members of the technology supported groups were limited because of the anonymity feature and the inability of the dominant members to control the agenda.

Newby, Soutar and Watson (2003) conclude that while there are clear advantages to using technology support, these would be most likely to have a positive impact when groups are generating ideas or getting 'a breadth of ideas'. They noted one of the disadvantages of using technology support is the tendency to reduce the free flow of discussion as participants were inputting the ideas without any prior discussion taking place. They postulate that where the aim of the focus group is idea generation or getting a wide breadth of ideas, using technology support is likely to produce better outcomes than traditional groups, but if depth of understanding is required then a traditional approach is likely to produce better outcomes. They also state that a combination of approaches might be useful in some situations.

Like the earlier work of Soutar et al. (1996), Newby, Soutar and Watson (2003) did not look explicitly at fit and in this research there was nothing that might indicate the perspective of fit.

The most recently reported application of technology support for focus groups was a study aimed at collecting user opinions about the usability of a university website. Kontio, Lehtola and Bragge (2004) used technology support (GroupSystems™) in the same-time/same place condition with one focus group of 9 representatives of the faculty and staff. Oral communication was also allowed during this focus group. The compete usability study had four phases: focus group, web survey questionnaire, usability tests and heuristic evaluations.

Over a two hour period the participants followed an agenda with an idea generation task, an evaluation task, an oral discussion and a post-group questionnaire. The qualitative analysis of the focus groups found that the comments received in the technology support phase were more frank than the comments in later traditional focus groups addressing the same questions. The technology supported focus groups also identified the most severe problems with the web site. The focus group also allowed the researchers to structure their agenda before the meeting, collect more detailed information than traditional focus groups, and have the information organised and produced in report form at the conclusion of the meeting.

A review of estimated effort across the technology supported and traditional focus groups found that the effort required to prepare and conduct the focus groups was 27 hours for the technology supported focus group and for the two traditional focus groups is was 33 and 83 hours respectively. This finding should be treated as indicative only however, as the number of participants and type of tasks differed across the three studies.

One of the interesting findings of this study was that little verbal communication took place, even though it was available to the participants. Kontio et al. reported that because of the lack of verbal communication some participants thought that “the session could have been conducted online as well (i.e., not necessarily being at the same place nor at the same time”.

Kontio, Lehtola and Bragge (2004) do not explicitly discuss the perspective that they have based the technology support elements of this research upon. They do, however, describe the ability of technology support to ‘alleviate’ process losses and provide some process gains and this suggests that they have approached their research from a profile deviation perspective.

The consolidation of research to date on technology support for focus groups is shown in Table 16.

Research	***Benefits***	***Limitations***
Clapper and Massey (1996)	• Reduced financial and time costs. • More access to group members. • Group members can remain in their workplace. • Dispersed group members can undertake tasks any-time/any-place.	
Soutar et al (1996)	• Parallel processing. • Reduced time spent prioritising and evaluating ideas. • More ideas in a set time. • Reduced loss of spontaneity and rhythm due to time disruptions. • Lower evaluation apprehension. • More equal participation. • Frees the facilitator from note taking. • Provides process structure. • Provision of hardcopy reports at any stage.	• Access to GSS constrains participation.
Sweeney et al. (1997)	• Increase in participation equality. • Increase in confidence. • Increase in level of contribution. • Increase in interaction between participants. • Increase in number of ideas. • Potential reduction of time and cost. • Ability to use in different-	• More conservative and less colourful ideas. • Reduction in “free flowing conversation and ‘in-depth’ understanding”. • Suppression of a range of emotional responses.

Research	***Benefits***	***Limitations***
	place/same-time setting.	
Lewis (1998)	• Effective method to gather ideas, attitudes and evaluations. • Easy to use and objective. • Efficient. • More effective method of gathering and presenting data.	
Taylor (2000)	• Richer and longer responses. • More effective for addressing sensitive issues.	• Lack of access can lead to under-representation by some groups. • The number of ‘unsure’ or ‘uncertain’ responses can be greater, and extremes less.
Parent et al (2000)	• Significantly more unique ideas are generated in the knowledge generation task. • Higher quality ideas. • Higher quality comments. • Can reach consensus more easily.	• Less satisfied with their experiences in idea and comment generation, and performance. • Satisfaction was not significantly different between technology supported and traditional groups.
Walston and Lissitz (2000)	• Mode did not affect the honesty of comments. • Less embarrassed to reveal experiences. • Less concerned about what the moderator thought. • More equal participation • Less inhibition. • More likely to disagree with other group members.	

Research	***Benefits***	***Limitations***
Franklin and Lowry (2001)	• Improved meeting objectivity. • Reduced influence of topic sensitivity. • Enhanced participation discussion management. • Enhanced data accuracy. • Reducing facilitator influence allows more facilitators without negatively influencing the outcomes. • No transcriber, video or audio recording required. • Ability to print the results immediately after the meeting.	• Reduced ability of the facilitator to guide the discussion and request elaboration on any given topic. • Difficult to code output due to conciseness of comments. • Comments often incomplete and had a 'lack of depth'. • Topics required more interpretative skills by the researcher in coding. • Participants ability to use technology affected results. • Anonymity was lost in small focus groups if participants knew each other.
Easton, Easton and Belch (2003)	• Significantly more unique ideas and on-task ideas. • More likely to participate in the discussion. • More satisfied in the process • Smaller groups generated more unique ideas and more on-task ideas than the larger groups. • No difference in satisfaction with process, outcomes or participation between large and small groups.	• Larger groups did not generate more unique ideas. • Larger groups did not generate a comparable number of on-task ideas as the small groups.
Newby, Soutar and Watson (2003)	• Greater 'breadth' of information. • More unique ideas. • More usable information. • Reduce ability to dominate. • Lower degree of 'yea saying'.	• Tendency to reduce the free flow of discussion. • Little prior discussion before ideas are entered.

Research	*Benefits*	*Limitations*
Kontio, Lehtola and Bragge (2004)	• More frank comments. • Greater meeting structure. • More detailed information collected. • Better information organisation. • Easier and timely report. production • Less effort to prepare and conduct focus groups	• Little verbal communication took place, even though it was available to the participants.

Table 16 - Summary of prior research

Summary

Focus groups have become an important and increasingly used method for data collection in a number of research areas. The strengths of focus groups as a data collection method lie in their structure and intent. The intent of focus groups is to explore issues and topics to try to reveal *what* participants think about a topic or issue and *why* they think that way. In arriving at conclusions about these two questions a group facilitator or researcher can use focus groups in isolation or as part of a wider program employing more than one research method. Additionally, both qualitative and quantitative information can be obtained during the meeting.

A review of the focus group literature examining the potential and/or actual use of technology support suggests there are a number of aspects of focus groups that can be improved by the application of technology. Technology supported groups can use the anonymity feature to encourage participants to be more critical and probing in their analysis and interactions with each other. Technology supported groups may also generate more ideas and better quality ideas than groups without technology support, and may lead to participants feeling more satisfied with the meeting process.

It has also been reported that technology supported groups reach consensus more readily, and that less focus groups are needed because the anonymity features means that heterogeneous groups can be used. This could lead to reductions in the time and cost of conducting focus groups and improvements in the range quantity, and quality of ideas.

Technology support can also improve the process of conducting focus groups as the agenda is structured before the meeting. There is no requirement to transcribe records after the meeting as the discussion is captured in the technology support used in the focus group, and the record of the discussion can be produced immediately after the meeting. Having a number of different tools, such as voting and ranking tools in the technology support can also assist the group in its discussions.

A feature of the research on technology support for focus groups is that the perspective of fit is not stated in each experiment, although there are promising signs of the ability of technology supported focus groups to be more effective than traditional focus groups in some circumstances. There is only limited empirical research comparing traditional and technology supported focus groups and the research to date has only looked at one or two different meeting conditions (normally same-time/same-place and/or different-time/different-place). This thesis is the first attempt to examine the potential of technology support over 4 different technology-supported configurations in a field study.

As the body of knowledge is still too limited to draw definitive conclusions, there is an opportunity to complete a comprehensive investigation into the effectiveness of technology support for focus groups, and also to state and examine the perspective of fit that is the basis of the investigation.

The next chapter takes the general model for using SSM for hypothesis testing developed in Chapter Three, and applies it to the area of interest in this thesis – technology support for ADFA focus groups undertaking an evaluation of SST.

Chapter 7 – Using SSM to structure the ADFA focus group field experiment

When I die, I want to come back with real power. I want to come back as a member of a focus group. (Roger Ailes, Former Reagan Media Advisor, 1996, from Parent, Gallupe et al. 2000)

Introduction

In this chapter the general SSM model for hypothesis testing is operationalised. The first section of this chapter develops the hypothesis, Root Definition and Conceptual Model. The operationalised SSM RD/CM combination guided the field experiment that compared the effectiveness of 20 focus groups completing an evaluation of SST using one of four available communication modes.

Activity One - Become Familiar with Research Area and Decide on Hypothesis

The first stage of the enhanced SSM model of hypothesis testing developed in Chapter Three is to become familiar with the research area and to decide on a hypothesis developed from reviewing the relevant research literature.

Stream of cultural analysis

Cultural Analysis in this study followed the three dimensions of analysing social structures and roles, cultural and political dimensions. This analysis, while commenced at the early stages of SSM, was continued throughout the research. As Checkland and Scholes (1990) advise, it is not the case that the cultural analysis can be done "once and for all at the start of the study" (p. 186).

Analysis of social structures and roles

Examining the social structures and roles is the first stage in the stream of cultural enquiry. In this study there were two clients, the TDO and the researcher who, between them caused the study to take place. The Training and Development Officer (TDO) was looking for an improvement in his understanding of how cadets viewed SST and saw that focus groups in a non-military environment might provide a vehicle to gather this information. The researcher was interested in assessing the effectiveness of technology support for group work, and whether SSM could be used as a vehicle for that analysis. Having two clients worked well in this study as each applied their different resources and skills to the problem. Using a participative approach the researcher and the TDO were what Checkland calls the 'would-be improvers of the problem situation' (e.g. Checkland and Scholes 1990, p. 186) and could jointly develop the focus group questions.

The primary problem owner in this research was the TDO. The TDO role at ADFA included the development of training that led into SST and built on it. He was also responsible for coordinating SST activities with the Army, Air Force, and Navy training organisations and evaluation of SST from ADFA's perspective. The examination of the effectiveness of technology support and SSM for hypothesis testing was only the concern of the researcher, so from that perspective the researcher was also a problem owner.

The problem solver was the researcher who wanted to undertake a field experiment rather than a laboratory experiment and saw that the TDO's problem of SST evaluation would provide an appropriate problem situation. The problem-solver being the same as the problem owner, or one of the problem owners, provides a coherence to the study (e.g. Checkland and Scholes 1990, p. 186).

The cultural dimension

The roles of the TDO and the researcher are two of three main positions in the study. Both were senior military officers, with the TDO being part of the military staff at ADFA and the researcher was on the academic staff as a Visiting Military Fellow. The cadets thought that because of the rank and status of the problem owners, participation could influence the future direction of SST or could provide valuable feedback on the limitations of SST as the cadets perceived them.

The role of the cadets, as participants in the SST evaluation and this research, also played a key role. Assessing and reviewing the motivation of the cadets identified three distinct cultures in this study and most cadets fell primarily into one of the three cultures. First, and by far the largest group, were those cadets that saw this study as an opportunity to speak freely about their experiences on SST and to evaluate the program. I have labelled these cadets as 'opportunists'. As one of the cadets declared: "*You don't have to worry about what others may say about your opinions. For example, you don't have crusty old Sergeants telling you off for having an opinion!*"

As SST is a key component of their training, and cadets value military training at least as importantly as their academic studies, most cadets have an opinion on the usefulness of SST in their preparation to enter the ADF. The 'opportunists' among the 80 cadets that completed the evaluation saw that the outcomes of the focus groups could improve SST for those cadets yet to complete the training. Those in the early years of their training believed that the changes they identified would directly benefit them in the SST they had yet to complete. Those in the final year of training tended to be more critical of SST and the main reason given was that they were about to go to their single service training institutions and they felt that SST had failed to give them adequate training in one or more areas.

For the opportunists, the rank and position of the researcher was seen as an advantage to getting changes implemented. The views of the opportunists compared starkly with the 'sceptics'. While a minority of participants, the sceptical cadets participated as enthusiastically as the opportunists but were less certain about the results of the evaluation having a short term positive effect on SST. One of the reasons was that because of the rank and position of the researcher, some cadets viewed the study with suspicion.

Even though the researcher made it clear that the two motivations for completing the evaluation were to provide detailed information back to the Services on how cadets perceived SST, and to assess the effectiveness of technology support for focus groups, the sceptics were unconvinced. Because the normal relationship between cadets and officers is one of subordinate and superior, it was difficult for some cadets to be convinced that more cooperative and collaborative interactions were possible.

The second norm discussed by the sceptical cadets was that, even though they were volunteers, they believed that the study was an attempt by the ADFA military staff to appear to be doing the 'right thing' while not planning to change any part of the program. The TDO was described as 'going through the motions' and a number of the senior cadets had previously completed questionnaires on SST in their earlier years and as they saw it, nothing had changed as a result of their feedback. The researcher was also seen as part of the military system and, because of this, the cadets in this group saw that the outcomes would be diluted, sanitised or made acceptable to the military hierarchy. Their participation was based on a view of 'let's see what will happen, but don't expect too much'. Interestingly, during the course of the research and evaluation, some of the sceptics became more optimistic about the likely impact of the evaluation on the SST program and moved more toward the opportunist viewpoint.

A third group, not necessarily discrete from the opportunist and/or skeptical views, could be described as the 'technologists'. These cadets were primarily interested in participating because the groups would be using technology support and this was the interesting part of the meeting. The topic was only an access mechanism to using the technology. The technologists tended to make more comments on the questionnaire and during the interviews on whether the technology support operated as they expected. The comments included: *"I couldn't access the software from my room, so I was not satisfied with the process we went through"* and other insights such as *"You can play games while you wait for others to complete the tasks and/or the time to complete the task to end"*.

The relationships between the cadets, the TDO and the researcher also require elaboration. Neither the TDO nor the researcher had direct supervisory or leadership roles over the cadets. The TDO, as a member of the military staff at ADFA, did have a general responsibility to be a role model to the cadets and had a direct responsibility for defining and in some cases delivering military training programs. Most cadets were aware of the TDO and his role but would not have direct contact with him during their time at ADFA.

The researcher also had a responsibility to provide a positive role model for the cadets and for delivering academic courses in Information Systems. From that perspective, all the cadets that undertook the SST evaluations had contact with the researcher prior to the study. At the outset, all the cadets were briefed on why the TDO wanted to gather information on SST and that technology support would be used in the focus groups as the researcher wanted to investigate the utility of this type of support on focus groups. The cadets were aware that the TDO and the researcher were working together to develop a coherent SST evaluation program that addressed two separate motivations.

The relationships identified in this analysis were the social system in which the evaluation took place. During the three months of focus groups this social system changed in a number of ways. Firstly, one block of SST occurred toward the end of the period so some groups had more recent recollections of SST than others. This could have affected the norms, values or beliefs ascribed to by the groups, although there was no evidence from the interviews that this was the case. The second change was that the senior cadets were nearing the completion of their cadet training and this had an interesting effect on some cadets. As they came closer to graduation some of the cadets began to talk more freely about their experiences on SST and while the number or quality of ideas or evaluation scores did not materially differ across groups, the groups of senior cadets had more strident views and more critical comments than the more junior cadets.

The political dimension

Analysis of the political dimension involved examining the different power relationships that may have existed in the SST evaluation situation, and how those relationships might have been obtained, used, protected, preserved, or relinquished. Power relationships that were examined were the effects of formal (role-based) relationships, intellectual authority, personal charisma, reputation, and the 'credibility' of the officers at ADFA and the cadets in different years of study at ADFA.

The first phase of the political analysis commenced before the cadets were assigned to groups. The TDO and Deputy Commandant of ADFA needed to be convinced that by lending their authority to the evaluation they would achieve their desired outcome – a thorough analysis of cadet's perceptions of SST that would allow ADFA to provide meaningful feedback to the Service training organisations. The relationship that developed between the TDO and the researcher was based on the understanding that both would be able to achieve their individual goals. There was no formal role-based relationship between the two individuals, but both recognised the credibility of the other, based on them both being senior Air Force officers and having some similar experiences with military training organisations in the past.

In this research, the political dimension manifested itself primarily through the power relationships between the researcher and the TDO and the cadets. Traditionally, the main instruments of power in military organisations are military rank and organisational position. The researcher, while being a military officer, was one of the academic staff and had no direct command relationship with the participants and was not part of the military training organisation. Because the researcher had no direct influence over the participants, most saw the study as a chance to express their feelings without fear of any (possibly perceived) repercussions from the military hierarchy. As the cadets were also completing undergraduate studies, and some were students of the researcher, it could be argued that the researcher had a power relationship over the cadets established through intellectual authority.

A second political influence that became apparent during the training phase of the evaluation and in early discussions with the cadets was that a small number of cadets thought that by participating in the evaluation it would provide them with a chance to increase their influence over the composition of the SST syllabus. This perception was based on the recognition that the researcher did have some standing at ADFA in terms of military rank and because the study had been approved by the Deputy Commandant. While the perception that the cadets could exercise influence by participating in the SST evaluation was never articulated by either the TDO or researcher, it persisted throughout the evaluation. In fact, as the results of each group were reported back to them, and some overall summary data became available, their perception of their ability to influence the future direction of SST grew.

The general effect of the disposition of power between the researcher and the participants, and the impression that the researcher's results could influence the composition of SST meant that the participants provided a detailed and critical analysis of SST that would not normally be seen in a training review. Participation was enthusiastic, and the cadets were committed and keenly followed the progress of the review.

The result of the initial cultural analysis, and the continual review during the course of the focus groups, provided the researcher with an awareness of some key factors. It was important not to change the power relationship between the researcher and the cadets as it may have led to a situation where the cadets began telling the researcher what they thought he would want to hear. It was also important to foster the 'opportunists' and to try to reduce or neutralize the negative effects of the 'sceptics'. A detailed and complete SST evaluation depended on the cadets being able to freely express their ideas and believe that what they said or reported would be used to change SST for the better. The cultural indicators gathered in this part of the research allowed the researcher to develop a number of 'cultural measures of performance' that could be used to determine any cultural changes.

Another important contribution of the cultural analysis was that it put some of the results and the comments of the cadets into context. Understanding the motivations of the cadets and their impressions of social roles, norms and the political situation assisted in the data collection, and in the analysis and reporting of the results.

Becoming familiar with the research literature

Becoming familiar with the effects of technology support on group work, and on focus groups in particular, was achieved through the literature review that was presented in Chapters Four, Five and Six. Having completed the literature review, the general research question to be addressed in this thesis was formulated. As stated in Chapter One the general research question addressed in this thesis is:

> *What is the effect of different combinations of technology support on group performance, where group performance is measured in terms of impact on task-related activities and on the group social system?*

The current body of research into the effects of technology support on group performance and group work was reviewed from both a focus on technology aspects and the social aspects of group work. Additionally, the literature was analysed in terms of the perspective of fit. The different views of fit, when applied to the literature, showed that while models developed to analyse the impacts of technology support typically identify clusters of attributes that exhibit some internal coherence they are tested using a much more restrictive approach. Alternatively, “exploratory perspectives that are less precise in specifying the functional form of fit may be more appropriate, but as the research stream matures, using confirmatory perspectives would be more appropriate” (Venkatraman 1989, p.439). Examining for the first time the impact of four different modes of technology support on focus groups undertaking a program evaluation makes an ‘exploratory perspective’ an appropriate approach for this field experiment.

Decide on the hypothesis

Having decided on using an exploratory approach and become familiar with the research area by looking at prior research and at the research area from a cultural perspective, the decision on the hypothesis can be made. Based on this work, the overall hypothesis examined was:

> *There will be a significant difference in perceived overall focus group effectiveness between groups in the four conditions.*

From this general hypothesis, specific hypotheses are developed that focus on the overall effectiveness of each mode, and the impacts of technology support on task effectiveness, participant satisfaction and group relations. The development of these specific hypotheses is presented in the later sections of this chapter.

Stream of logic-based analysis

This section presents the stream of logical analysis development and associated work in preparing and conducting the field experiment. In summary, the logical analysis follows the steps of:

- Formulating a RD and CM to an appropriate level of resolution.
- Expressing measures of performance.
- Conducting the focus groups.
- Analysing the quantitative data collected during and after the focus groups.
- Presenting the integrated results of the stream of logical analysis and stream of cultural analysis.

The first two steps of the logic-based analysis are described in this chapter, and the later steps are addressed in Chapter Eight.

Model development and research method

The first step in the logical analysis is to formulate a RD and CM to the appropriate level of resolution. The RD developed to address the themes identified through the review of the research literature was:

> *A researcher developed and cadet operated system that uses SSM as a systemic framework and a technology supported SSM evaluation to increase the current level of knowledge on the effects of different modes of technology support on focus groups.*

The CATWOE analysis of the RD is shown in the table:

C	Customer(s)	GSS/Academic community, Researcher, ADFA Military Training Wing
A	Actor(s)	Researcher; ADFA cadets
T	Transformation	Current level of knowledge on effects of different modes of technology support on groups → increased level of knowledge on performance effects of different modes of technology support on group work
W	Weltanschauung (worldview)	It is possible to use soft hypothesis testing, to capture the range of elements needed to yield a rich evaluation of the effects of technology support on the performance of ADFA focus groups
O	Owner(s)	Researcher
E	Environment	ADFA Culture (E1)

Table 17 - CATWOE of high level root definition

Taking the RD, and developing the Conceptual Model led to the following model:

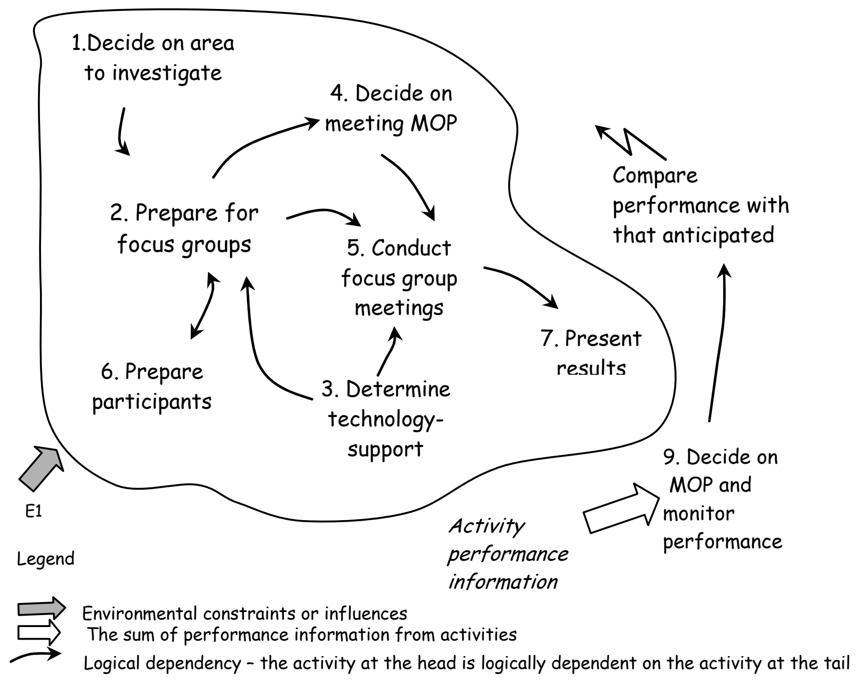


Figure 38 - High level SSM model for conducting the focus group experiment

This CM provided the basis for the research, but at this level of resolution it was not possible to develop a robust research program. Further decomposition of the model was undertaken, but only to the level where meaningful contribution to the research setup, conduct or development of measures of performance could be achieved. This model is shown in Figure 39.

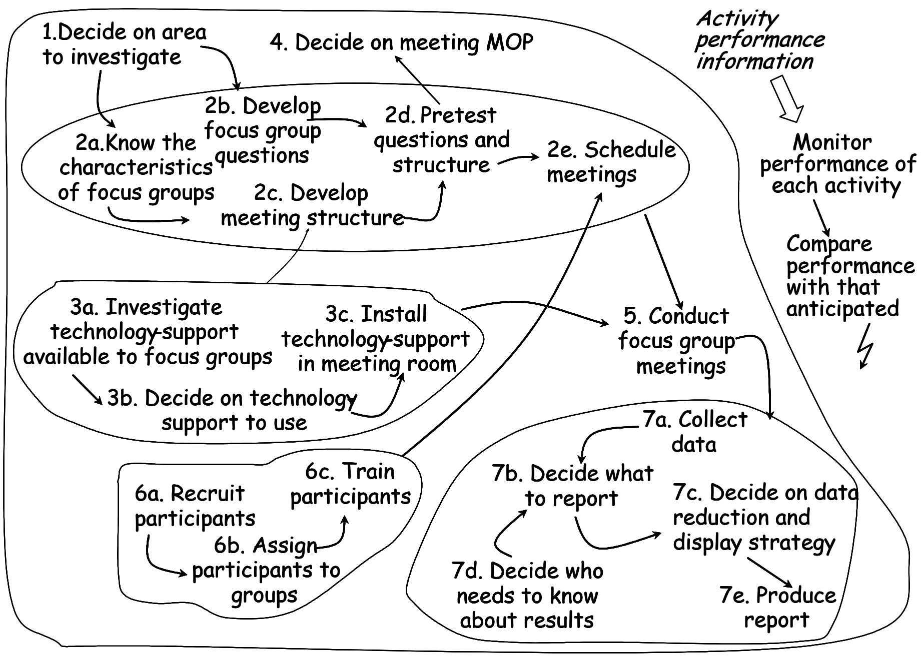


Figure 39 - Detailed SSM model for conducting the focus groups

For the lower level models, both a RD and CATWOE analysis was completed by the researcher. These two elements of the SSM analysis are not presented in this thesis as their removal from this chapter was assessed as not detracting from the reporting of the field experiment, and by removing them it improved the clarity of presenting the results.

Using the EDI framework proposed by Ledington and Ledington (1999), the researcher saw the SSM CM developed to address the hypotheses and the guide the research as important. The model was also seen as an important tool by the TDO, who was seeking to have a structured and defensible evaluation approach. The cadets had no interest in the model as their focus was on SST training itself.

The activities in the CM developed to logically support the hypothesis are seen by the researcher as desirable; that is the activities in the model should be seen in the real world of the field experiment. In analysing the SSM framework and methodology, as applied in this research, an assessment will be made about whether the real world activities matched the model or whether there were suggested changes in the situation that required modification to match the model. For the researcher, this feature of the EDI framework had two purposes. Firstly, it focused the evaluation of the model on reviewing the real world activities based on the 'desirable' CM, and secondly it allowed the researcher to communicate to the TDO and the cadets if the field experiment had gone ‘according to plan’.

In developing the model logically from the hypothesis, the researcher also had an expectation that there would be a close alignment with the conduct of the field experiment. Additionally, there was an expectation that the model would have meaning to those in the field experiment, should they be interested in assessing the comparison between the model and real world.

Overall, the use of the EDI framework clarified in the researcher’s mind the specific characteristics of the CM developed for this field experiment, and how that model could be used in the conduct and later assessment of the experiment.

Activity Two -Prepare for Focus Groups

- The model developed to guide the preparation of the focus groups is shown in Figure 40. Activity Two involved developing the activities required for preparing for the focus groups. The research literature on focus groups was researched (Activity 2a) and the specific literature on technology support for focus groups was analysed. From this analysis, and the collaboration between the researcher and the TDO, a set of questions on SST and a meeting structure was developed (Activity 2b and 2c).

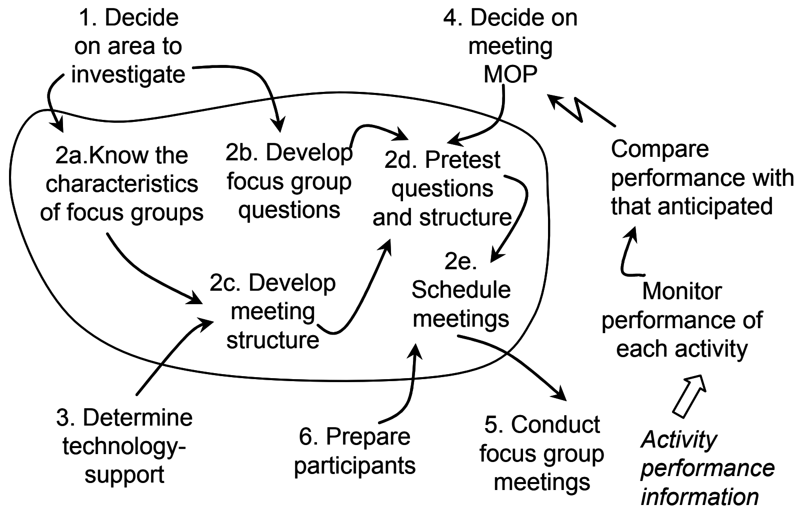


Figure 40 – Activity 2- Prepare for ADFA focus groups

In summary, the focus group questions asked are:

- What do you think is the aim (or aims) of Single Service Training?

- What do you think are the strengths and weaknesses of the SST program?
- What improvements do you think could be made to SST?

Evaluate SST in terms of how relevant and important you believe the topics are for preparing you for post-ADFA officer training and your future career in the ADF.

Developing the meeting structure

The activity of developing the meeting structure (Activity 2c.) followed from an understanding of both the task (SST program evaluation using focus groups) and the technology support. How the general research question is to be addressed is covered in this activity. The RD/CM combination is shown below:

> *A researcher developed system that uses SSM as a systemic framework to develop a meeting structure that supports examination of the effects of different modes of technology support on the effectiveness of focus groups.*

C	Customer(s)	Researcher
A	Actor(s)	Researcher
T	Transformation	Undeveloped meeting structure → meeting structure developed that supports examination of the effects of different modes of technology support on focus groups
W	Weltanschauung (worldview)	A meeting structure can be developed using SSM to support development of a set of hypotheses to examine the effects of different modes of technology support on the effectiveness of focus groups
O	Owner(s)	Researcher
E	Environment	Current knowledge on technology supported focus groups (E1); Understanding of perspectives of task-technology fit (E2)

Table 18 - CATWOE analysis

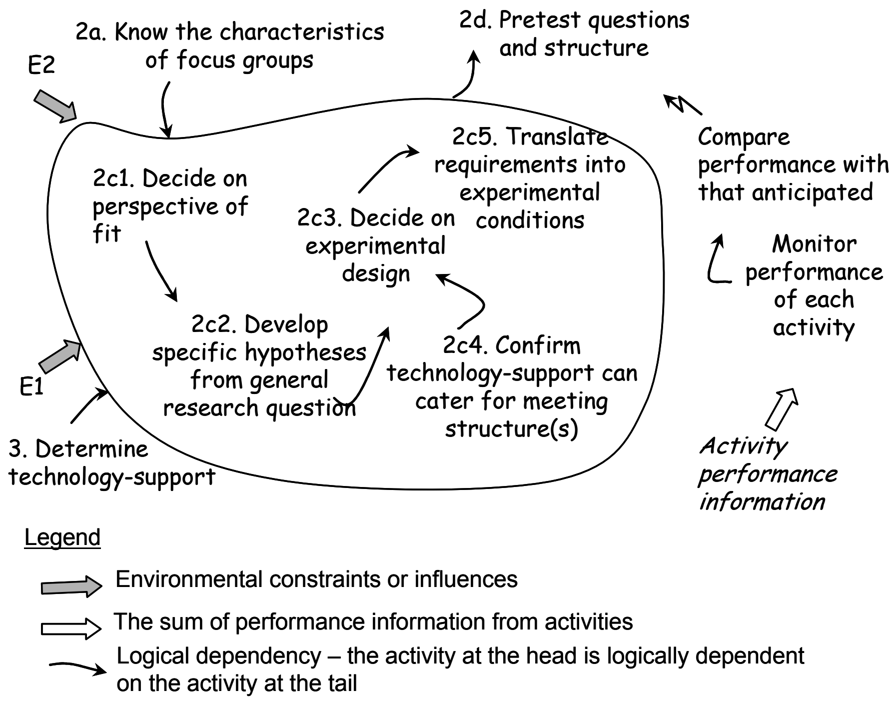


Figure 41 - Developing the meeting structure

Decide on perspective of fit

The literature review (see Chapters Four, Five, and Six), showed that models developed to examine TTF typically identify many potential variables and are essentially criterion-free. However to empirically test those models researchers move to a more restrictive perspective where they define a small set of variables against a specific outcome criteria. The results of the criteria-specific experiment based on this small set of variables are then generalized to either support or invalidate the more general hypothesis and TTF theory.

Rather than take the criterion-specific approach, the overall perspective of fit adopted in this research is that of gestalt. Hypotheses are developed to address the differences between groups in the following areas:

- Overall effectiveness.
- Task effectiveness.
- Participant satisfaction
- Group relations.

While this level of hypothesis, combined with the qualitative analysis of these factors, would be sufficient for examination of the effect of technology support from a gestalt perspective, as has been noted in Chapter Five, most of the research has been conducted from a profile deviation perspective.

To enable the results from this research to be added to the prior TTF research results, a set of subordinate hypotheses were also developed based on a profile deviation perspective.

Having the two levels of hypotheses allows for two levels of analysis of the descriptive validity and the predictive validity of the different perspectives of fit. The two levels are:

- Using the quantitative analysis results to test empirically whether a profile deviation perspective is comprehensive enough to assess the impact of technology support on task and social aspects of focus group work, and to add to the body of knowledge based on the profile deviation perspective.
- Combining the quantitative results from the main and subordinate hypotheses and the qualitative data associated with these hypotheses to look at the research question from a gestalt perspective to assess if this perspective provides a better basis for assessing the effect of technology support and other factors on group performance.

Develop specific hypotheses from the general research question

Consideration of the objective of the research and perspective of fit leads to the following general research question detailed in Chapter One:

> *What is the effect of different combinations of technology support on focus group performance, where focus group performance is measured in terms of impact on task-related activities and on the group social system?*

The hypotheses developed to assess the effects of technology support across the four modes addressed the overall perceptions of each group, task effectiveness, participant satisfaction and group relations.

The first set of hypotheses examine whether there are any significant differences in the focus group perceptions of their overall effectiveness, and their satisfaction with the focus group process and focus group results. Using a profile deviation perspective, the following hypotheses were developed:

- **Task Effectiveness**. The hypothesis proposes that based on the fit between task and technology there will be significant differences in task effectiveness between focus groups using different communication modes.
- **Efficiency**. An asynchronous medium is the best fit for idea generation and will lead to more efficient groups. When completing evaluation tasks, groups using a synchronous medium will be more efficient.
- **Participant Satisfaction.** TTF, from a profile deviation perspective, predicts that focus groups performing idea generation tasks asynchronously will be the most satisfied, and focus groups completing the evaluation phase synchronously will be more satisfied than those groups completing the evaluation asynchronously.
- **Group Relations.** These hypotheses are based on the premise that a better fit between the task and the technology will lead to groups reporting better group cohesion and more equal group member participation.

The details of the hypotheses are given in the reporting section.

Decide on experimental design

Developing the meeting and experimental structure, a 4 x 2 factorial design was employed. The focus groups were randomly assigned to one of four communication modes, and all focus groups performed the same tasks. The groups also performed the tasks in the same sequence (idea generation followed by evaluation of SST topics) so there was no necessity to test for differences in results due to groups using different sequences.

The SST evaluation completed by the focus groups can be described in terms of its component tasks. The advantage of identifying the component tasks is that most GSS research assesses the impact of the technology support on specific tasks and by structuring this research in a similar way comparisons can be made with the findings of other studies comparing communication modes.

In the first phase of the focus group, participants were asked their opinions on the aim of SST, the strengths and weaknesses of the SST program and possible improvements. In McGrath's Group Task Circumplex (McGrath 1984) these activities would be described as a ‘generation’ activity, and specifically a 'creativity task. In my research I have used the more specific term of 'idea generation' to describe this task.

The second activity for the focus group was to evaluate the SST program for relevance and importance to the cadets, and whether the cadets perceived the program met the original intentions of SST described in the Terms of Reference. Because there is no correct answer but there is an agreed group response, this type of task is categorised as 'preference' (McGrath 1984). Preference task types have a degree of conflict between group members and require the group members to choose between options. In my research I have used the term 'program evaluation' to describe preference tasks.

Four modes of communication

The four modes of communication used in the experiment were:

- **Synchronous.** Communication using MeetingWorks ™ in a meeting room for both the idea generation and the program evaluation tasks. I have designated this communication mode as Synchronous (S) or face-to-face (FtF).
- **Mixed Mode 1.** Communication using MeetingWorks ™ in a meeting room for the idea generation tasks and Meeting Works in a dispersed setting via the Internet for the program evaluation tasks. I have designated this communication mode as Mixed Mode 1 (MM1).
- **Mixed Mode 2.** Communication using Meeting Works™ in a dispersed setting via the Internet for the idea generation tasks and MeetingWorks ™ in a meeting room for the program evaluation tasks. I have designated this communication mode as Mixed Mode 2 (MM2).
- **Asynchronous.** Communication using MeetingWorks ™ in a dispersed setting via the Internet for both the idea generation and the program evaluation tasks. I have designated this communication mode as Asynchronous (A).

Pre-test questions and structure

Pre-testing the meeting structure involved a number of post-graduate classes at ADFA. Three groups of post-graduates were given a task involving idea generation and evaluation to assess the flow of the meeting and the use of the technology support. The groups of three to eight students met in the meeting room in a synchronous mode, and were asked to generate ideas about their favourite holiday destinations. The ideas were consolidated and evaluated against the criteria of location, price, and availability. Reports were generated at the completion of the meeting. The groups were then given a questionnaire that included questions about the structure of the meeting.

The participants agreed that the structure of the meeting was appropriate for these types of tasks and that the structure allowed them to develop and express their ideas on the topic. Having established that the focus group structure was appropriate, the questions on SST evaluation were pre-tested on one group of cadets that did not participate in the field experiment. The observation of the researcher was that the questions proposed by the TDO could be explored using technology support and the structure proposed. The final meeting structure is shown at Figure 42.

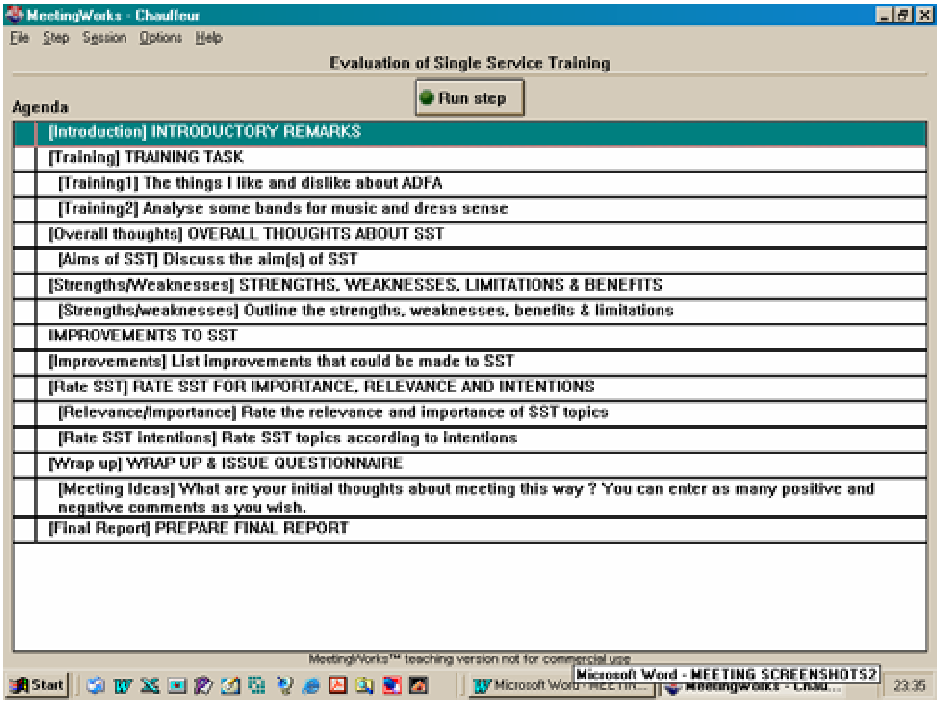


Figure 42 - Focus Group Structure (Agenda)

Schedule focus groups

The 20 focus groups in the field experiment were scheduled over a three month period. They were put into four different modes, and Table 19 is a summary of the allocation of focus groups to each communication mode. The Group Identification Code was allocated by the researcher; the letter prefix denotes Army (A), Navy (N) or Air Force (R), and the numbers and any suffix are purely for unique group identification.

Group Identification Codes	*Mode of Technology support*	*Mode Identification*
A1A, A2A, N1A, N3, R2A	Meeting Room for all tasks	Synchronous (S)
A31, A53,N63, R36, R38	Meeting Room for SST idea generation task; Internet for SST evaluation	Mixed Mode 1 (MM1)
A32, A52, A54, R37, R39	Internet for SST idea generation task; Meeting Room for SST evaluation	Mixed Mode 2 (MM2)
A51, N62, R3,R34, R35	Internet for all tasks	Asynchronous (A)

Table 19 - Allocation of groups to communication mode

Activity Three -Determine technology support to be used

Activity Three involves the researcher investigating the technology support that is available to support focus groups across different communication modes, deciding which technology support would be appropriate to use and installing the technology support in the meeting room and on the ADFA network.

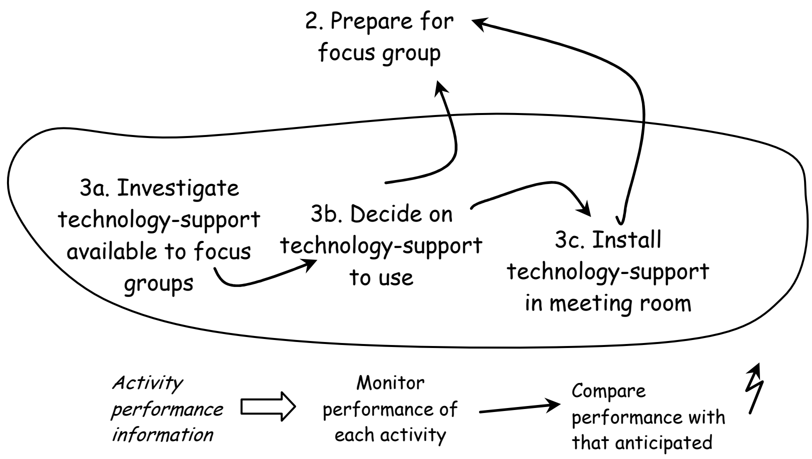


Figure 43 – Activity 3 - Determine technology support to be used

Technology support – MeetingWorks ™

There were a number of commercially available GSS that could have been used for this research. ADFA did not have a GSS that could be used over the internet, so one had to be procured.

The MeetingWorks ™ GSS was selected to be used in this experiment, and both the meeting room version and the Internet edition were employed. In essence, the Internet version is an addition to the meeting room version and the software tools used in the experiment are the same for both versions so all focus groups used the same tools. Additionally, the look-and-feel of the tools is the same in the meeting room and Internet-based versions of the software. This not only simplified training but also eliminated the potential for the results to be affected by different presentation styles or tool operation.

The agenda was the same for each of the focus groups and the MeetingWorks tools used were:

- *Generate*. For collecting and displaying lists of ideas on SST, its strengths and limitations and opportunities for improvement.
- *Organize.* Used to initially structure the agenda for the focus groups, and also structure the ideas gathered through the *Generate* tools for later presentation in the final report.
- *Evaluate.* Gathered ratings and comments on the cadet's perceptions of the relevance and importance of SST topics. The cadets were also encouraged to enter comments along with their evaluations.
- *File Editor.* Used to structure the group reports. An example of the output from one of the meetings is at Annex G.

Further technical detail on the MeetingWorks™ software and screenshots of the use with the focus groups is at Annex C.

Install technology support in meeting room

The MeetingWorks software was installed on a server in the meeting room to support both the synchronous and internet tasks. Additionally the client software was installed on the laptops in the meeting room. Figure 44 and Figure 45 illustrate the meeting room setup for the focus groups.

Figure 44 - Meeting Room shown from rear

Figure 45 - Meeting room from front

Activity Four - Decide on meeting MOP

Qualitative data categories and descriptions

Measures of performance for the focus groups were developed using established, validated questions from previous research wherever possible. The guidance provided by Graeml et al. (2004) about mapping effectiveness, efficiency and efficacy measures to the root definition, and the suggestion by Mobach et al. (2000) to use both reality judgements and value judgements in monitoring the activities were both used in evaluating and selecting the measures of performance.

The qualitative data collected from the questionnaire, through the interviews, and from the researcher's field notes were aligned with the quantitative data collection strategy using the three categories described below:

- **Task Effectiveness**. This category includes any data which relates to a group member's impression about how effective the group has been in completing the tasks set for them. Task Effectiveness was further divided into the effectiveness of the group in idea generation, evaluation of SST topics, their confidence with the process, and their perceptions of efficiency.
- **Participant satisfaction.** This category includes any comments that seem to indicate a person's satisfaction (or lack of) with the technology supported focus group. Participant satisfaction was further divided into satisfaction with the process used, and satisfaction with the outcomes of the focus group.
- **Group Relations.** This category covers any data where comments were made about how group members related or how the technology support may have assisted or hindered group operation. The sub-categories of Group Relations were the participant's perceptions of the group's cohesiveness, the equality of participation amongst group members, and whether they actually felt part of the group.

Any comments that, in the context in which they were said, did not fall into these three categories were included in a general category.

Quantitative data dependent variables

The dependent variables used to gather quantitative data were grouped into the same three categories:

- **Task effectiveness**: (number of unique ideas, confidence with the idea generation and evaluation processes, and idea and evaluation efficiency). Duplicate ideas and redundant ideas were removed so that the number of ideas represents the number of unique ideas generated by the group. This treatment is consistent with the majority of ideas generation studies in the field (e.g. Dennis and Valacich 1993; Valacich, Mennecke et al. 1993; Pinsonneault, Barki et al. 1999). Confidence with the processes was assessed after the participants completed each phase using a seven point Likert scale similar to that used by Gallupe and McKeen (1990). As there is no generally accepted calculation for either idea efficiency or evaluation efficiency I used processing time and idea generation time as the basis of my calculations. Idea efficiency is taken to be the total number of unique ideas divided by the total time taken in the idea generation phase. Evaluation efficiency is calculated by dividing the total number of evaluations made by the total time taken to complete the evaluation.

- **Participant satisfaction**: (satisfaction with idea generation and evaluation process, and satisfaction with idea generation and evaluation results). The measures of process satisfaction were adapted from Dennis and Valacich (1993) and Gopal, Bostrom and Chin (1992) and assess the individual's satisfaction with the process of idea generation or evaluation. The scheme for assessing decision satisfaction was developed by Taber and Green (1980) as reported in Huang, Wei, Tan and Raman (1997). All measures use a seven point Likert scale.
- **Group relations**: (perceived group cohesiveness and perceived equality of participation). Cohesiveness was measured using an index of group cohesiveness originally presented by Seashore (1954) and modified by Chidambaram (1996) for use with groups supported by technology. Participation equality was assessed using four questions from Hemphill's Index of Group Dimensions (Miller 1991) which address issues including whether all opinions are considered equal, and do higher ranking members control the group.

The questionnaire was the same for all participants, except that groups that met over the internet were also asked an additional question about the time they spent doing each of the tasks completed using that mode. The complete questionnaire given to each cadet is at Annex D

Activity Five - Conduct Focus Group Meeting

The conduct of the focus groups was as follows:

- All groups were given an introduction to the aim of the focus group, what topics would be covered, what would be expected of each of the participants during the focus group and how the outcomes of the groups would be used by the researcher and by ADFA.
- Each participant completed a Consent Form that confirmed they were volunteers and that they would participate as per the rules of the focus group and the field experiment. (Annex E).
- Each participant was given a user manual tailored for the technology support they would be using. See Annex F for an example.
- All focus groups undertook training using the same idea generation and evaluation questions and in the communication mode that they would be completing the SST evaluation. More detail is provided in the next section (Train Cadets).
- The specific tasks to be completed in the focus group, and the communication mode that they would be undertaking those tasks, were explained to the participants, and the group completed each task in the communication mode allocated to it. An agenda from one of the focus groups is shown at Figure 42.

The timings for the meetings were as follows:

- Those groups that completed both the tasks in the asynchronous mode were given 5 days for the focus group.
- Those groups that completed both the tasks in the synchronous mode were given 2 hours for the focus group.
- Those groups that completed one task in the synchronous mode and one task in the asynchronous mode were given 1 hour for the task in the synchronous mode and 3 days for the task in the asynchronous mode.
- Participants completed a questionnaire during and after the meeting. A copy of the questionnaire is at Annex D.

- A number of post-meeting interviews were conducted to gather participant's perceptions and to clarify issues or points raised in the focus groups about the use of the technology support.

Activity Six - Prepare ADFA Cadets

Activity Six includes those activities concerned with recruiting cadets for the focus groups, and preparing them to complete the SST evaluation using MeetingWorks in a particular communication mode.

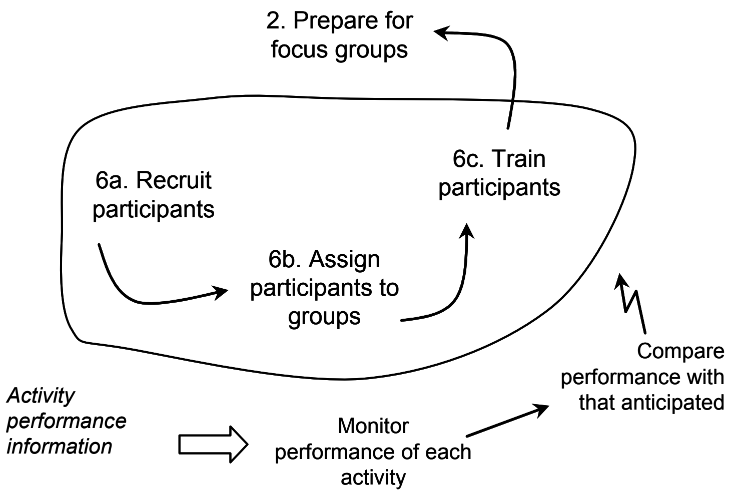


Figure 46 – Activity 6 - Prepare ADFA cadets

Recruiting cadets for the focus groups

Cadets were recruited from all ADFA academic streams and years. The researcher presented the aim of the SST evaluation, the aim of the research and an introduction on how the evaluation was to be done using technology support to a cross-section of classes at ADFA. Cadets were then asked to volunteer. To illustrate a level of commitment from the ADFA management to this research and the evaluation, the focus groups were conducted during the normal working day and cadets were released from their normal military and academic studies to participate.

The average age of the group members was just over 20 years, and the majority of participants were male. This mirrors the normal cadet population at ADFA. The majority of the cadets had used PCs for between 1 and 5 years and were more than comfortable with the technology and using the Internet, although the majority had no experience in using a GSS. They also expressed confidence in their ability to undertake the program evaluation tasks, and the majority of the participants had been part of at least one group that had generated ideas and evaluated options. One of the benefits in using a population such as the ADFA cadets is that they regularly participate in group decision making and evaluation as part of their military

General characteristics and prior group experience		***Technology use and task confidence***	
General		**GSS Experience**	
Total number of participants	82	None	63
Number of participants data used in analysis (completed questionnaires)	73	1-5 groups	9
		5-10 groups	1
		more than 10 groups	0
Average Group Size	3.6		
Average age of participants	20.2	If used GSS before how did they rate their experience (1 = totally disliked)	4.75
Gender		**Prior PC Use**	
Male	57	PC at work	73
Female	16	PC at work<1yrs	4
		PC at work1-5yrs	63
		PC at work>5yrs	6
Service		**Time spent on PC**	
Army	28	<1hr per week	1
Navy	15	1-5hr per week	10
RAAF	30	5-10hr per week	29
		>10hr per week	33
Year of Academy		**Internet access & time spent on-line**	
1st year	6		
2nd year	10	Internet Access	73
3rd year	56		
4th year	1	<1hr per wk on-line	18
		1-5hr per week on-line	46
		5-10hr per week on-line	7
		>10hr per week on-line	2
Degree being undertaken		**Confidence in tasks**	
BA	23	Confidence in idea or option generation (1= no confidence)	5.5
BSc	7		
BTech	11		
BE	32	Confidence in idea or option evaluation using a scale(1= no confidence)	5.1
Prior experience in idea generation and evaluation in groups			
No prior groups	16		
1-5 groups	35		
5-10 groups	14		
> 10 groups	8		

Table 20 - Demographic Data

communication and training programs at ADFA. They are comfortable with quickly forming a group and becoming productive.

Table 20 contains the summarised demographic data of those that participated in the program evaluation. The 7 point scales for Confidence and GSS experience in tasks range from 1 (no confidence or totally disliked) to 7 (total confidence or completely satisfied).

Assigning cadets to groups

Cadets were assigned to groups based on their seniority and Service. For example, a group would consist of all Third Year Navy cadets, or all second year Army cadets. The grouping ensured that all the cadets in the group had completed the same SST syllabus. Within each year/Service combination, the cadets were randomly assigned to groups.

Training on the technology support

All groups completed approximately 20 minutes training in the meeting room. This allowed the cadets to become familiar with the MeetingWorks tools they would be using for the focus groups and access to the researcher if they required it. Those groups that were completing one or both tasks over the internet used the MeetingWorks Internet Edition in the meeting room; those completing tasks in the meeting room were trained using the standard MeetingWorks software.

The two training tasks that each of the groups undertook were:

- The things I like and dislike about ADFA (idea generation).
- Analyse some bands for the quality of their music and their dress sense (evaluation).

Activity Seven - Present Results of the Field Experiment

Having completed the focus groups and collected data from multiple sources, the researcher was required to collate the data, make a decision on what to report and how to report it, and produce the thesis.

The challenge with presenting results combining both qualitative and quantitative results is, as Patton (1990) says, to achieve a presentation where description is balanced by analysis and interpretation. The approach to integrating the data has been to present the qualitative and quantitative data together under the three broad categories of Task Effectiveness, Participant Satisfaction and Group Relations. As this field experiment is based partly on examining SST for hypothesis testing, the quantitative data will form the basis for comparison with empirical studies in TTF, and the combination of the qualitative and quantitative data will provide the total set of information for assessing the effectiveness of technology support for the ADFA focus groups.

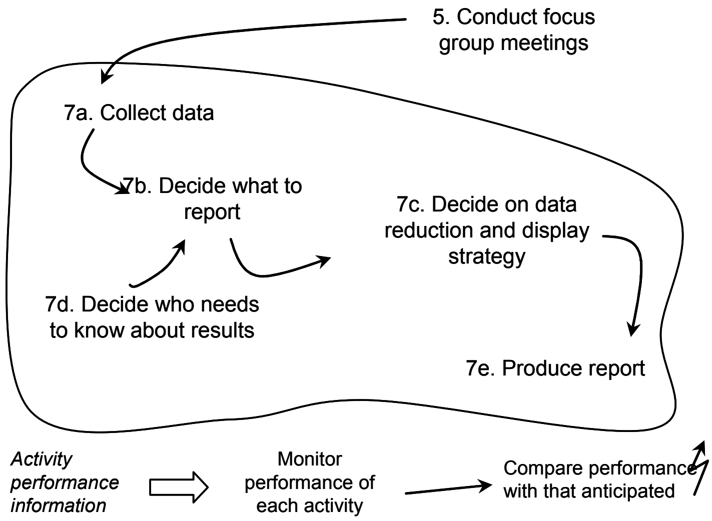


Figure 47 – Activity 7 - Present results of field experiment

Data Collection

Data was generated from this experiment in a number of different forms. These were as follows:

- GSS generated and stored data on the results of the focus group including ideas generated, evaluations and comments.
- GSS event log containing information on group and individual actions such as timings for activities, tools used, and sequence of actions.
- Participant questionnaire data (both quantitative and qualitative).
- Transcribed qualitative data from post-experiment interviews and facilitator observations.

Qualitative data

Qualitative data was collected through interviews, open-ended questions on the questionnaire and the researcher's field notes. Once the qualitative data had been collected, the data relating to the technology support was identified and, if necessary, translated and simplified. The technique chosen to classify the information was to use a mind map and the Mindjet Mind Manager software.

The data was then classified and clustered according to the three categories of Task Effectiveness, Participant Satisfaction and Group Relations. To align with the quantitative variables, the three categories were further divided into sub-categories and whether the comments related to group work conducted in the meeting room or over the Internet:

- Task Effectiveness
    - Effectiveness of Idea Generation and evaluation of SST topics
    - Confidence with the idea generation and/or evaluation process
    - Efficiency of the idea generation and/or evaluation process
    - Other aspects of Task Effectiveness
- Participant Satisfaction
    - Satisfaction with the idea generation and/or evaluation process
    - Satisfaction with the results of the meeting
    - Other elements of satisfaction
- Group Relations
    - Cohesiveness of the group
    - Equality of participation
    - Feelings of being 'part of the group'

The benefit of using a mind map is that information from a number of sources could be arranged in a logical order, based around the idea of technology support for focus groups. Comments from the cadets, both written and oral, and comments from the researcher could be categorized and simplified by creating branches for each of the three categories of group effectiveness and then sub-branches for the main ideas or variables that made up each of the categories. The high-level map created for focusing and simplifying the qualitative data is at Figure 48, and more detail on mind maps can be found in Buzan (1991).

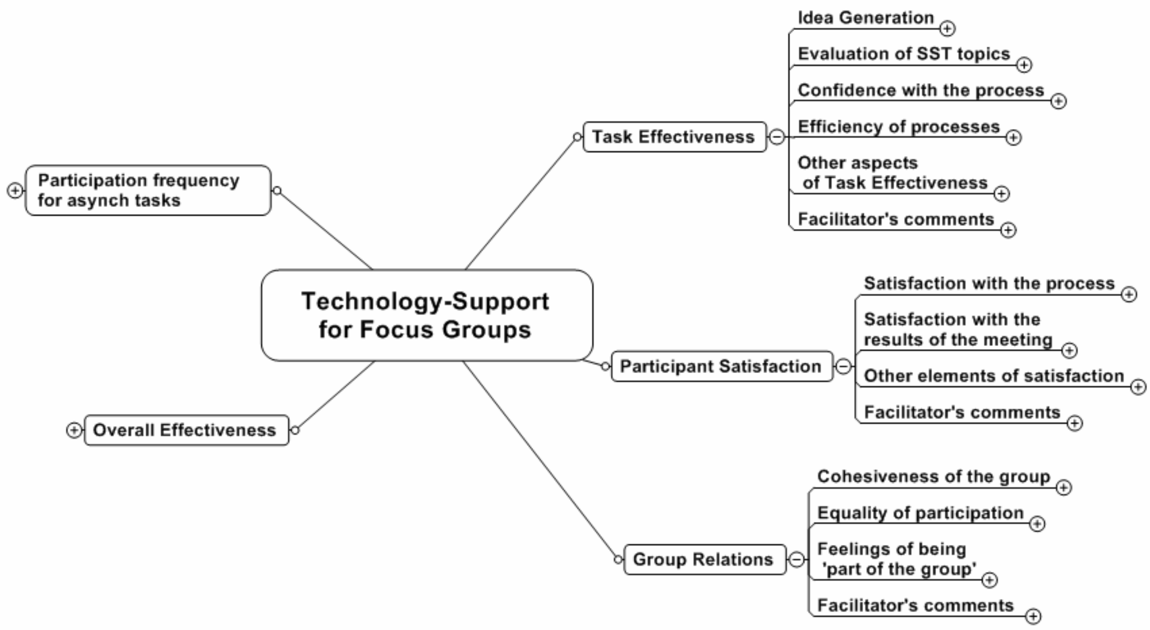


Figure 48 - High Level Categories for qualitative data

Quantitative data

Data level

Data was collected at both the individual participant and the group level, and the individual-level data was transformed into group-level data for the analysis. Other studies have analysed the data at the individual level but it is preferable for the experimental unit and the unit of measure to be the same. Translating individual participant data into group-level data has the added advantage that when both the experimental unit and the unit of measurement are group-level units, a standard MANOVA or ANOVA can be used to test for variances (Walczuch and Watson 1999).

Data summary techniques

Where individual-level data was collected, these values were translated to group-level values by summing the individual values and then averaging them across all group members. As focus groups do not have an elected group leader, all group members were assumed to be of equal standing and their responses were afforded equal weight.

A number of variable values required some treatment before they could be used and the treatments were as follows:

- **Number of ideas**. Duplicate ideas and redundant ideas were removed so that the number of ideas represents the number of unique ideas generated by the group. This treatment is consistent with the majority of ideas generation studies in the field (e.g. Dennis and Valacich 1993; Valacich, Mennecke et al. 1993; Pinsonneault, Barki et al. 1999)
- **Time taken.** Those activities that took place in the synchronous communication mode had the time taken by the group recorded automatically in the event log of the meeting room version MeetingWorks ™ software. The same facility did not exist in the Internet version of the software so participants were asked to record the time they took on the task(s) and the group-level time was the average of the reported times for the task.
- **Idea efficiency and Evaluation efficiency**. As argued in previous chapters, effectiveness and efficiency while related are not synonymous. As there is no generally accepted calculation for either idea efficiency or evaluation efficiency I used evaluation time and idea generation time as the basis of my calculations. Idea efficiency is taken to be the total number of unique ideas divided by the total time taken in the idea generation phase. Evaluation efficiency is calculated by dividing the total number of evaluations made by the total time taken to complete the evaluation.
- **Missing data.** Although there were 82 questionnaires issued during the 20 focus groups, and all groups had at least four members, only 73 questionnaires were returned. After 2 attempts at hastening the return of these questionnaires, the analysis was completed without them. This meant that the analysis had to be done on some groups of 3 responses rather than the 4 that had been planned in the experimental design.

Statistical method

The Analysis of Variance (ANOVA) procedures in S-Plus 4.0 (*aov* and *manova*) were used to analyse the effects of the communication mode on the dependent variables. One of the benefits in using ANOVA tests to analyse the results is that other studies comparing communication modes also used this statistical technique and therefore direct comparisons of results can made between studies. Some of the previous studies in this area also used the t-test regime to examine statistical differences between groups. Using similar techniques, whether these are ANOVA or t-tests, to other studies also allows for the 'validation' of some of the laboratory studies which meets one of the recommendations of Zigurs (1993) about measurement selection.

The purpose of analysis of variance is to test differences in means for statistical significance. Basically, the total variance between the groups is partitioned into the variance that is due to true random error and the variance that is due to differences between means known as the within- group and the between-group variances respectively (Chambers and Hastie 1992). The between-group variances are then tested for statistical significance, and if a significant difference is found we can reject the null hypothesis of no differences between means and accept the alternative hypothesis that the means are different from each other (Hair, Anderson et al. 1995).

The selection of statistical tests was straightforward. Taking each of the three dependent variables (Task Effectiveness, Participant Satisfaction and Group Relations) separately, a MANOVA test was conducted to establish if there were statistically significant differences (or marginal differences with a probability of less than or equal to 0.1) between the communication modes. Having established this, a series of ANOVA tests or t-tests examined the individual measures and their contribution to the dependent variable and whether there was a statistically significant difference between groups.

An alternative approach to the analysis would have been to sum the measures for each of the three dependent variables and perform an ANOVA on each of the summed dependent variables. While this approach can provide a more powerful analytical approach than a MANOVA, the measures that make up the dependent variables are a multi-dimensional rather than uni-dimensional view of group effectiveness. For example, group cohesiveness and equality of participation are two different perspectives on group relations. In this experimental design, summing was inappropriate.

In reporting the *p*-value, I have set the level of significance at less than or equal to 0.1. Setting the level of significance at less than or equal to 0.1 is appropriate for research that is primarily exploratory because while not statistically significant, results at the 0.1 level could indicate areas of potential interest and significance that could be later explored using a gestalt perspective of fit. Reporting and examining p-values of 0.1 and less is also consistent with other GSS studies that were exploratory in nature (see Ocker, Fjermestad et al. 1997; Fjermestad 1998) and arguments for this stance rather than a strict reliance on statistical significance tests can be found in Pervan (1992).

In summary the results are separated into 3 classes:

- If α is a statistically significant finding, the results are annotated as '***' if $\alpha< 0.001$, '**' if $\alpha< 0.01$, and '*' if $\alpha< 0.05$.
- If α is between 0.1 and 0.05 then the finding is worth further examination. I have adopted the terminology of 'marginally significant' used by Ocker et al (1997), and the notation '^{m}'.
- If $\alpha > 0.1$ the finding is not statistically significant.

Summary

This Chapter takes the general SSM hypothesis model developed in Chapter Three and details how SSM can be used to structure hypothesis testing for the ADFA focus group field experiment. The two streams of analysis, cultural and logical, are examined concurrently and the general research question is framed as a Root Definition. A Conceptual Model is developed from the RD and is, by its derivation, logically defensible. The CM provides the basis for a systemic development of the field experiment, including the decision on experimental design and measures of performance. Having developed the field experiment, the next chapter reports the results of the ADFA focus group field experiment.

CHAPTER 8 – ASSESSING THE EFFECTIVENESS OF TECHNOLOGY SUPPORT FOR ADFA FOCUS GROUPS

Introduction

This chapter uses the SSM framework developed in the previous chapter for testing the hypothesis that different combinations of technology support will have different effects on group performance. The field experiment compared the effectiveness of 20 focus groups completing an evaluation of SST using one of four communication modes. Analysis of the data collected from the focus groups is clustered into three themes: the effects of communication mode on group satisfaction, the effectiveness of the group in completing the task, and the effect of different modes of communication on group relations. Comparisons between groups are also made.

Overall Focus Group Effectiveness

The first set of hypotheses examined whether there were any significant differences in overall effectiveness, satisfaction with the focus group process or focus group results between groups in one of four communication modes.

When assessing TTF in terms of task effectiveness and the efficiency with which the group undertakes the task, using a medium that is 'too rich' will not affect a group's effectiveness but will make them less efficient. A medium that is 'too lean' however will make a group less effective.

The predictive validity of the profile deviation perspective of fit suggests that the MM2 condition is theoretically the best overall fit between task and technology, the single mode conditions (S and A) both have a mismatch between the task and the technology on one task-technology combination, and the MM1 condition has no match between tasks and technology.

The ranking of communication modes, based on a profile deviation perspective is shown in Table 21. The MM2 and S groups will both have the necessary fit between task and technology to be effective, however the idea generation task does not require the richness available in the meeting room so the MM2 group has the more theoretically ideal profile. The A and MM1 groups have a task and technology combination which would support the idea generation task, but where the technology is too lean to support the evaluation task effectively. Translated into tabular form, the ranking from 1 (most satisfied or effective) to 4 (least satisfied or effective) is shown in Table 21, and the

symbols are:

- A tick indicates a match between the technology and the task.
- A minus sign indicates that theoretically the medium is too lean for the task.
- A plus sign indicates that theoretically the medium is too rich for the task.

Activity/Condition	*MM2*	*S*	*A*	*MM1*
Idea Generation	✓	+	✓	+
Evaluation	✓	✓	—	—
Rank	1	=1	=2	2

Table 21 –Group ranking - overall satisfaction or effectiveness

Specifically the TTF hypotheses based on a profile deviation perspective are as follows:

H1: There will be a significant difference in perceived overall focus group effectiveness between groups in the four conditions.

H1a: There will be no significant difference between groups in the MM2 or S condition on any measure of overall effectiveness.

H1b: Groups in the MM2 condition will be no more satisfied with the overall focus group process than groups in the S condition.

H1c: Groups in the MM2 condition will be more satisfied with the overall focus group process than groups in the MM1.

H1d: Groups in the MM2 condition will be more satisfied with the focus group results than groups in the A condition.

H1e: Groups in the MM2 condition will be more satisfied with the focus group results than groups in the MM1 condition.

H1f: Groups in the MM2 condition will report they are more effective than groups in the A condition.

H1g: Groups in the MM2 condition will report they are more effective than groups in the MM1 condition.

Table 22 contains the mean and standard deviation for each communication mode for the three questions on overall effectiveness. The range is from 1 (lowest) to 7 (highest). As predicted, the S and MM2 groups were, on average, more satisfied with the process and the results of the focus group. The S and MM2 groups also rated their perceived effectiveness higher than the MM1 or A group.

Between the four communication modes, those groups in the S condition felt that their overall effectiveness was higher than those in the MM2 condition, and those in the MM1 condition rated their overall effectiveness higher than those in the A condition.

	Satisfaction with process		***Satisfaction with results***		***Effectiveness***		***Overall effectiveness***	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Synch	6.47	0.32	6.32	0.32	5.27	0.53	6.02	0.65
MM2	6.23	0.14	6.17	0.16	5.22	0.41	5.87	0.57
MM1	5.43	0.71	5.20	0.54	4.85	0.43	5.16	0.29
Asynch	5.30	0.33	5.27	0.47	4.40	1.08	4.99	0.51

Table 22 - Overall measures of effectiveness

Results of Overall Effectiveness Hypotheses

H1 proposes that there will be a significant difference in overall effectiveness between groups and the statistical analysis provided marginal support for this hypothesis. A MANOVA conducted on the data established that the small differences in the three measures of overall effectiveness between the four groups were marginally statistically significant (F=1.99, p= 0.061). As this is an exploratory study, further analysis was conducted by performing an ANOVA for each of the three 'overall' measures and the results are presented in Table 23.

Variable	***F(df=3,16)***	***p-value***
Overall Effectiveness	1.99	0.061^{m}
Satisfaction with the process	8.249	0.001***
Satisfaction with the focus group results	9.608	0.0007***
Perceived focus group effectiveness	1.688	0.209

Table 23 - Results of ANOVA for Hypothesis 1

The results show significant differences between groups in the responses to two of the three hypotheses. Groups significantly differed in their satisfaction with the focus group process and their satisfaction with the results of the focus group.

Interestingly, the groups had no statistically difference to the question ' Using an Electronic Meeting System made the group more effective'. During the interviews with cadets, it became evident that the cadets have an expectation that technology support will be available for most of their tasks, be it Instant Messaging, Net Meeting, or other technologies that support individual and group work . While only 16% of the cadets had used a GSS before, and none had used an Internet version of a GSS, they perceived that it was 'just another application that can be used to help us with our work'. As one cadet noted:

> *What is the big deal about? I use ICQ every day and I think you could easily have a meeting using it. This system has some great tools in it, was easy to use and was simple but computers are a way of life and it is really just another step in that direction.*

The next phase of the analysis involved examining satisfaction with the process, the results and group effectiveness individually. An ANOVA was performed on each of the conditions to ascertain if the rankings illustrated in Table 21 are supported by the results.

Satisfaction with the Focus Group Process

The results in Table 24 show no significant difference in satisfaction with the focus group process between groups that met in the MM2 and S conditions or between groups that met in the MM1 and A condition. Those groups in the MM2 condition were, however, marginally more satisfied with the process than those in the MM1 condition and were significantly more satisfied than those groups in the A condition. These results support hypothesis H1b, and marginally support hypothesis H1c. Taking the mean values reported in Table 22 and the ANOVA results in Table 24, the results support the predictive ability of TTF in assessing the overall satisfaction with the process.

Variable	*F(df=1,8)*	*p-value*
Satisfaction with the process (MM2, S)	3.399	0.102
Satisfaction with the process (MM1, A)	0.144	0.714
Satisfaction with the process (MM2,MM1)	4.543	0.066^{m}
Satisfaction with the process (MM2, A)	22.001	0.001***

Table 24 - ANOVA for satisfaction with focus group process

Focus Group Results

A similar pattern emerged after analysing the group's perceptions on the results of the focus group (Table 25). As predicted by the TTF profile deviation perspective, groups in the MM2 condition were significantly more satisfied with their group's results than groups in either the MM1 or A condition. There was also no significant difference between groups in the MM2 and S conditions or MM1 and A conditions. These results support hypothesis H1d and hypothesis H1e.

Variable	*F(df=1,8)*	*p-value*
Satisfaction with the focus group results (MM2,A)	12.348	0.008 **
Satisfaction with the focus group results (MM2,MM1)	11.306	0.009 **
Satisfaction with the focus group results (MM2,S)	1.905	0.205
Satisfaction with the focus group results (MM1, A)	0.042	0.842

Table 25 - ANOVA for satisfaction with focus group results

Interviews suggested that most of the cadets, regardless of communication mode, were satisfied with the results of the focus group and their scores of 5.5 to 6.32 supported this finding. The most common comment was that the technology support made obtaining results simpler and more straight-forward than meetings without technology support. As one cadet stated "*I found this quick and easy and we had the results straight away*".

The comments from the groups in the meeting room also suggested that they found it easier to achieve the SST evaluation results than groups in other modes. Specifically, those groups that completed the SST evaluation task over the Internet provided many comments during the feedback discussion on how they would have liked to have discussed evaluations and comments, even though there was a feedback mechanism in place. They were not satisfied with the daily postings on the intranet as feedback, preferring a more immediate and interactive method of communication. In summary, the comments from the cadets support the descriptive validity of the TTF profile deviation perspective.

Perceived focus group effectiveness

Focus groups were also asked to rate their perceptions of whether the use of the technology support made them more effective. The results (Table 26) for hypothesis H1a support the predictive validity of TTF, but do not support the predictive validity or communication ranking tested by hypotheses H1f and H1g.

Variable	***F(df=1,8)***	***p-value***
Perceived focus group effectiveness (MM2,S)	0.085	0.778
Perceived focus group effectiveness (MM2, A)	2.236	0.173
Perceived focus group effectiveness (MM2, MM1)	1.387	0.273
Perceived focus group effectiveness (MM1,A)	0.754	0.410

Table 26 - ANOVA for perceived group effectiveness

The lack of a significant finding to this question could have been the result of lack of exposure to focus group processes. Approximately 70% of the cadets had participated in less than 5 focus groups prior to this one and none had participated in technology supported focus groups. Even though they reported they were confident in completing the tasks in the evaluation, the cadets had little background from which to make a comparative judgment on the effectiveness of technology supported focus groups compared with traditional focus groups, or comparisons between different modes of technology support for focus groups.

While some of interviews and comments of cadets supported both the predictive and descriptive validity of the profile deviation perspective, it was also evident that most of the cadets thought that the process, and in particular the structure that the technology support enforced, lead to more effective groups regardless of communication mode. One cadet described it in the following way:

> *The GSS is very organised. The Squadron Leader set up the agenda before the meeting, so I don't know how long that took but it made the meeting go very smoothly. I mean, the way we worked through each of the questions in order and got the results straight away and also a summary at the end is a lot different to other groups we've done. In those groups, you might have had an agenda but you didn't always follow it and that can get confusing.*

A second observation is that those groups in the A condition did not complete their tasks consistently over time, unlike the groups in the MM1 and MM2 conditions that had their first tasks in the meeting room. The groups in the A condition tended to wait until the end of the allotted time before commencing and completing the task. This observation is examined in greater detail later in this section.

In hindsight, a better approach to assessing participants' views on overall effectiveness may have been to ask them to rate how effective they perceived their group had been at achieving the aims of the focus group rather than associating the overall effectiveness rating with prior focus group experiences.

Task Effectiveness

The second set of comparative measures in the GSS literature are grouped under the heading of 'Task Effectiveness'. Based on the profile deviation perspective, Hypothesis H2 states that there will be significant differences in task effectiveness between focus groups using different communication modes. Specifically, those groups performing idea generation tasks asynchronously will be more effective than those performing idea generation tasks in a synchronous mode. When completing the evaluation phase, those using the GSS in the meeting room (synchronously) will be more effective than those groups that perform the program evaluation via the Internet (asynchronously). The left side of Table 27 summarises the rankings on Task Effectiveness based on a profile deviation perspective. The symbols are the same as those in Table 21 with the addition of a double plus:

- A tick indicates a match between the technology and the task.
- A minus sign indicates that theoretically the medium is too lean for the task and will have a negative effect on effectiveness.
- A plus sign indicates that theoretically the medium is too rich for the task and will have a negative effect on effectiveness.
- A double plus sign indicates that theoretically the medium is too rich for the task and will have a negative effect on efficiency.

The hypotheses derived from these propositions are as follows:

> H2: There will be a significant difference in task effectiveness between focus groups in the four conditions.
>
> H2a: Groups generating ideas asynchronously will generate significantly more ideas than those groups generating ideas synchronously.
>
> H2b: There will be no significant difference in the number of ideas generated by groups in the MM2 or A condition.
>
> H2c: Groups generating ideas asynchronously will report significantly more confidence with the idea generation process than those groups generating synchronously.

H2d: Groups in the MM2 condition will report no significant difference in confidence with the idea generation process than those groups in the A condition.

H2e: Groups evaluating the SST program synchronously will report significantly higher confidence in the evaluation process than groups evaluating the program asynchronously.

H2f: There will be no significant difference in the level of confidence in the evaluation process between groups in the MM2 condition and those in the S condition.

Activity	*Task Effectiveness*				*Task Efficiency*			
	MM2	S	A	MM1	MM2	S	A	MM1
Idea Generation	✓	+	✓	+	✓	++	✓	++
Evaluation	✓	✓	-	-	✓	✓	N/A	N/A
Rank	1	=1	2	3				

Table 27 – Group ranking - task effectiveness and efficiency

An additional group of hypotheses were developed on the premise that if a communication medium is too rich then groups may not be as efficient as those groups where the technology support and the task match, although they can still effectively complete the task. The profile deviation perspective of TTF does not address the difference between efficiency and effectiveness, although in this research it is seen as important to examine potential differences. The rankings for task efficiency are presented in the right-hand column of Table 27.

It is predicted that for idea generation tasks using a synchronous medium will be less efficient than using an asynchronous medium because the synchronous medium is too rich and the additional information will 'distract' focus group members or will require additional processing requirements for them to complete their task. In contrast, when completing evaluation tasks the synchronous medium is seen as a better fit in terms of efficiency because the asynchronous medium is too lean for the task and will require participants to perform additional individual and group processes to complete the evaluation. The 'N/A' in the Evaluation row in Table 27 indicate that there is nothing in the TTF literature to suggest a reduction in effectiveness will lead to either a reduction or an increase in task efficiency. It is possible for a communication medium to be ineffective in terms of TTF theory but it can still be used in an efficient manner. Because a complete comparison between conditions could not be drawn by using the profile deviation perspective, there are no communication mode rankings for the task efficiency hypotheses.

The hypotheses concerning task efficiency are as follows:

H3a: The efficiency of idea generation in groups conducted in the MM2 condition will not significantly differ from the efficiency of idea generation in groups conducted in the A condition.

H3b: Those groups undertaking idea generation in the asynchronous conditions (MM2 and A) will be significantly more efficient than those groups in the synchronous (MM1 and S) condition.

H3c: Program evaluation efficiency will not significantly differ between groups conducted in the MM2 or S conditions.

H3d: Groups generating ideas in the asynchronous (A or MM2) condition will report significantly more confidence with the idea generation process than those groups generating ideas in the synchronous (S or MM1) condition.

A MANOVA established a small but statistically significant difference between groups ($F=2.66$, $p=0.006$**), so based on this finding a more detailed examination of the elements of both task effectiveness and task efficiency was conducted. This finding provides marginal support for the profile deviation perspective of TTF.

	Number of Ideas Generated		*Confidence with idea generation process*		*Idea efficiency*		*Efficiency of evaluation*		*Confidence with evaluation process*	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Synch	33.80	9.20	5.68	0.37	2.30	0.52	5.02	0.51	3.34	1.89
MM1	45.20	16.18	5.40	0.57	2.64	0.91	5.07	0.65	5.07	3.80
MM2	26.80	17.48	5.50	0.29	0.94	0.58	5.40	0.47	3.76	2.24
Asynch	31.80	10.96	5.13	0.96	0.94	0.46	4.98	0.58	3.82	1.38

Table 28 - Measures of task effectiveness and efficiency

Table 28 summarises the mean and standard deviation for the task effectiveness and efficiency measures. The number of ideas generated is the average of the total unique ideas generated by the five groups in each condition, the confidence measures range from 1 (least confident) to 7 (most confident), and the higher the efficiency score the more efficient the group was at the task.

The results in Table 28 indicate that groups in the MM1 condition generated many more ideas than groups in any other condition. Comparing the groups that met synchronously (S and MM1 conditions) with those groups that generated ideas asynchronously (A and MM2 conditions), the mean and standard deviation of synchronous mode groups is 39.5 (13.79) ideas and the asynchronous groups is 29.3 (14.01) ideas. A t-test shows that synchronous groups produced marginally significantly more ideas (p=0.057^{m}) than asynchronous groups. Based on these findings, Hypothesis 2a is not supported and the predictive validity of TTF from a profile deviation perspective is not supported.

The t-tests conducted to examine the task effectiveness hypothesis is at Table 29. With no statistical difference between groups generating ideas and evaluations either synchronously or asynchronously, Hypotheses H2c and H2e are not supported.

Completing t-tests for differences between the MM2 and A and MM2 and S conditions showed no significant differences between groups in these conditions in the number of ideas generated (p=0.36), or confidence with the idea generation process (p=0.23). There was also no significant difference between the level of confidence in the evaluation process between those groups in the MM2 condition and those in the S condition (p=0.12). Hypotheses H2b, H2d, and H2f are supported, as is the predictive validity of TTF in these areas.

A number of themes merged during the interviews that provided possible reasons for the marginal statistical support for the profile deviation perspective. Many cadets commented on the lack of discussion that took place in the groups as they were restricted to commenting through the GSS. The consensus was that *"the level of discussion over the issues is lacking, even though the ideas are brought out"*. Some groups did try to establish dialogue over the ideas they were producing, and it often led to a conversational sequence such as the one reproduced below about things cadets disliked about ADFA:

> *On the bus, off the bus system*
>
> *Hypocrisy*
>
> *Correction – waking up*

The fact that there is never a weekend you can have to yourself

I hate the present roll call system

I agree

And the way we are told that we are in an adult learning environment and yet we are treated as underlings

While only about a quarter of the groups exhibited this type of conversation-building via the GSS, it did occur in both the synchronous and asynchronous groups. It was more prevalent in the synchronous groups, and only occurred in the idea generation phase.

Another comment by the cadets was that while it may be more efficient using technology support to collect ideas, they believed that they were of variable quality and that the variability may not have not occurred if the comments could have been attributed to the author:

Some of the ideas are probably trivial, and have nothing to do with the real problems of the topic. Because you were anonymous, some people took advantage of the opportunity to make stupid comments

This observation was consistent with the researcher's findings when analysing the number of unique ideas produced by a group. There were large numbers of duplicate and spurious comments produced by most groups. Additionally, an observed pattern emerged in the synchronous idea generation in the meeting room, where the ideas on SST generated by the group tended to flow from the preceding ideas. For example, in one second year cadet group the first idea generated fixated the group and this led to another 11 ideas that either were variations or reiterations on the first idea. Analysis of the asynchronous groups showed a similar pattern where a group's ideas tended to converge based on the first idea published, rather than diverge or produce a range of unique ideas.

There were also comments from the cadets on the utility of the public screen. Overall they thought that the public screen or daily postings on the internet were beneficial and contributed to group effectiveness. As a example of this feeling, one cadet noted:

Because I can touch type, I could enter many ideas in a short time. The guy beside me struggled a bit. The real plus was that we could all enter our ideas at once and they came up on the screen for everyone to see. If the idea was already there you didn't need to type it in, and this saved time. Some of the ideas made me think 'oh yer' and a similar idea or one on that theme came to me and I could type it in.

Those cadets in the asynchronous groups that were interviewed had more mixed opinions on the usefulness of the public area. The main reason for the difference between the synchronous groups and the asynchronous groups was that the feedback in the later groups was daily and not immediate. For idea generation tasks, the asynchronous groups could not co-ordinate when it was best to enter their ideas, so those cadets that completed the task before the first daily posting missed out on seeing the ideas or comments that other cadets had generated. Unless the process of completing the task is made more like a synchronous task, with an agreed start time and immediate feedback, then this co-ordination problem is likely to be a feature of asynchronous focus groups.

Further analysis on task efficiency measures and the t-test results are in Table 29. The results show that there was a marginally statistically significant difference between groups in number of ideas they generated and also that synchronous groups were more efficient at generating their ideas. However, there was no significant difference on the other measures. Because the results did not follow the prediction of the profile deviation perspective and groups in the synchronous condition produced significantly more unique ideas and were much more efficient at producing those ideas than those groups that met in the asynchronous condition, Hypotheses H3b and H3d were not supported.

T-tests were then completed to test support for hypotheses H3a and H3c. The efficiency of idea generation in MM2 groups did not significantly differ from the efficiency of idea generation in groups conducted in the A condition (p=0.499) and program evaluation efficiency did not significantly differ between groups conducted in the MM2 or S conditions (p=0.323). These results support hypotheses H3a and H3c, and the profile deviation perspective.

Variable	*Synch Groups Mean (SD)*	*Asynch Groups Mean (SD)*	*p-value*
No of ideas generated	39.5 (13.79)	29.3 (14.01)	0.057[m]
Confidence with idea generation process	5.54 (0.78)	5.32 (0.70)	0.255
Confidence with evaluation process	5.04 (0.55)	5.23 (0.56)	0.171
Idea Efficiency	2.47 (0.72)	0.94 (0.49)	0.000***
Efficiency of evaluation	4.21 (2.97)	4.42 (3.02)	0.442

Table 29 - T -test results for Hypothesis 2 and Hypotheses 3b and 3d

While there was no statistical significance in reported evaluation efficiency, this was an area that many cadets commented upon. The majority of cadets thought that using the GSS for this task was very efficient. Common themes were "*I'm sure it makes the collection and usability of information easier*" and "*Meetings can be better organised electronically and this generates avenues for better time management*". As they had the most topics to consider and rate, third year cadets had the most comments on the time required to complete the evaluation. A third year navy cadet noted:

> *It took a long time to enter the scores for each topic with a score, so I tended to put comments only against those I felt I really wanted to say something. Once the scores were loaded into the systems though, it took no time at all to do the summary and get feedback on the group's scores. There were some differences in scores and comments that I found interesting.*

Reviewing the number of comments against the evaluation topics, and asking other cadets on their feelings about the length of the evaluation, it became evident that only putting comments against those topics that they had strong opinions or feelings about was a common occurrence. This practise could have impacts on experimental results if the number of comments generated was being used as a measure of group effectiveness or performance.

Cadets also commented on the utility of the technology support in structuring the focus group: "*One advantage when using this system was that it formalised the meeting procedures and all the input is saved so nothing is missed*." The fact that the agenda was set and the process for idea generation and evaluation had to be followed was seen as a positive aspect of technology support.

This process is not as affected by personalities. There was a lot of evaluations to do, and using MeetingWorks made me feel that it was more thorough an analysis than if we had done it without the system. The software did not allow you to skip elements of the evaluation.

Perhaps the most common comment by cadets was the restriction imposed on speaking to other group members. There were two aspects of the elimination of verbal conversation that were most noted. Firstly, the lack of verbal communication, coupled with the anonymity feature, led to more effective group work because completing the tasks required less co-ordination and no one person could dominate the focus group:

Putting my comments and scores in once, and then having the system collate the data from all the team and present it in graphs and tables was much more efficient than trying to get agreement amongst the team. I prefer this to the normal way

The computer in the meeting room was a great idea to make sure we could all put our ideas in, without anyone taking over. I believe that the results were much more even then if one or more of the group had been dominating the conversation, and I'm really confident that we've come up with a number of ideas and comments that will be useful to the TDO in making improvements.

Second, some cadets believed that restricting verbal conversation led to a less effective focus group because speaking to other cadets is beneficial in explaining or expanding on ideas or evaluations. The following two quotes are typical:

I found that to a certain extent, conversation that helps in formulating ideas is lost. If we would have had looked at the aims, advantages etc in the meeting room and were allowed to type and talk I think it would have resulted in much better ideas. As it was we did this task over the internet and the evaluation task in the meeting room. It might have been better the other way around.

It would have been much more efficient if I could have talked with the others about why they had voted like they did. I only got to see the scores after the others had submitted them, and not many scores had additional comments so it made it even harder. Although we got a result, it was a mathematical score, not a consensus.

The themes that emerged from the interviews and the comments had a close alignment with the roles identified in the cultural analysis. The *technologists* tended to be less critical of the lack of verbal communication among focus group participants, and were more positive about the usefulness of the public screen and the structuring support afforded by the technology support. The *technologists* also tended to provide more positive comments about technology support making focus groups more efficient. Overall, cadets described as *technologists* were less concerned with the outcome of the task and more concerned with the process and technology.

The *opportunists* tended to concentrate their comments on the actual output of the tasks. Discussion about the variable quality of the ideas generated was common amongst cadets in this role. The technology support was not necessarily seen as hindering a consistent quality; rather the technology support was seen as not able to filter those ideas that the cadets thought were of low quality. Even when discussing the technology the *opportunists* were focused on the ability of the technology to support an outcome, and not the technology itself.

In summary, for measuring task effectiveness there is little significant statistical evidence on the predictive validity of TTF from a profile deviation perspective. There was no support for any hypothesis that predicted significant differences between communication modes in idea generation, idea or evaluation efficiency, or confidence in the idea generation or evaluation process. In terms of descriptive validity the majority of comments made by cadets on the technology support they used and their perceptions of benefits and limitations, concerned aspects of the focus groups directly addressed in the profile deviation perspective.

Participant Satisfaction

The second set of task effectiveness variables measured the satisfaction of the participants with the processes used in the SST evaluation and satisfaction with the results the group achieved. Following on from earlier work, a multi-dimensional construct of measuring satisfaction with the focus group process and with the results of the focus group was used (Shaw 1998).

The profile deviation perspective of TTF asserts that the better the fit between the task and the technology support the more satisfied the group members will be in the process used, and in results of the group work. The analysis was planned to assess a single satisfaction measure and to also separately analyse the participant satisfaction with the process and with the results. In the interviews and questionnaire feedback, the participants did differentiate between process and results, and this separation is reflected in the comments presented later in this section.

Like the rankings for task effectiveness, the profile deviation perspective predicts that those groups performing idea generation tasks asynchronously will have a better match between task and technology support and therefore they will report higher levels of satisfaction than those groups performing idea generation tasks synchronously. When completing the evaluation phase, those using the GSS in the meeting room (synchronously) will have a better match between task and technology, and they should be more satisfied than those groups that perform the program evaluation via the Internet (asynchronously). The rankings are summarised in Table 30.

Activity/Condition	*MM2*	*S*	*A*	*MM1*
Idea Generation	✓	+	✓	+
Evaluation	✓	✓	—	—
Rank	1	=1	=2	2

Table 30 – Group ranking - participant satisfaction

The hypotheses drawn from this analysis are as follows:

> H4a – Groups who generate ideas asynchronously (MM2 and A conditions) will report significantly higher levels of satisfaction with the process than those groups that meet synchronously (S and MM1 conditions).
>
> H4b – Groups who generate ideas asynchronously (MM2 and A conditions) will report significantly higher levels of satisfaction with the results than those groups that meet synchronously (S and MM1 conditions).
>
> H5a – Groups who evaluate the SST program synchronously (S and MM2) will report significantly higher levels of satisfaction with the process than those groups that meet asynchronously (MM1 and A conditions).

H5b – Groups who evaluate the SST program synchronously (S and MM2) will report significantly higher levels of satisfaction with the results than those groups that meet asynchronously (MM1 and A conditions).

A MANOVA analysis on the data from the 4 conditions showed that if participant satisfaction was taken as a single undifferentiated measure there was no significant difference between the conditions (F=1.31, p= 0.245). Because of the conclusions drawn from earlier work on the participant satisfaction construct, further analysis was conducted by performing an ANOVA for each of the task types and investigating if there were statistically significant differences between groups in their satisfaction with the focus group process and/or the focus group results. The ANOVA results are presented in Table 31.

	Satisfaction with Idea Generation Process		*Satisfaction with Idea Generation Results*		*Satisfaction with Evaluation Process*		*Satisfaction with Evaluation Results*	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Synch	5.25	0.25	5.47	0.44	5.45	0.34	5.29	0.11
MM1	5.20	0.48	4.98	0.57	5.24	0.31	4.93	0.18
MM2	5.45	0.31	5.22	0.40	5.87	0.31	5.27	0.29
Asynch	4.88	1.13	5.02	0.32	4.80	0.43	4.86	0.40

Table 31 - Measures of participant satisfaction

Analysing the means in Table 31, those groups that completed both the idea generation task and program evaluation in the meeting room (S condition) recorded the highest satisfaction with the results of the focus group and those groups also reported the second highest satisfaction rating for the focus group processes. Those groups in the MM2 condition were the most satisfied with the idea generation and evaluation processes but were not as satisfied with the results as the groups in the S condition. Those groups that met entirely over the Internet (A condition) were the least satisfied with the idea generation and evaluation processes and also least satisfied with the program evaluation results. They were, however, more satisfied with the results of the idea generation than those groups in the MM1 condition. These results support the predictive validity of TTF from the profile deviation perspective.

To test the statistical differences between groups that performed a task in the meeting room and those that performed a task over the Internet, ANOVAs were conducted between the two sets of groups. The results in Table 32 show that there were no statistical differences in satisfaction with the idea generation process and results between groups completing this task in the meeting room or over the Internet. Based on these findings hypotheses H4a and H4b are not supported. In the evaluation task, groups that completed the task in the meeting room were marginally more satisfied with the process of evaluation, and were significantly more satisfied with the results of the evaluation than those groups that completed this task over the Internet. These findings provide support for hypothesis H5b and marginal support for hypothesis H5a.

Variable	*F(df=1,18)*	*p-value*
Satisfaction with idea generation process	0.333	0.571
Satisfaction with idea generation results	0.060	0.809
Satisfaction with evaluation process	3.212	0.089^{m}
Satisfaction with evaluation results	11.484	0.003**

Table 32 – Comparison of participant satisfaction

The ANOVA results only partly support the predictive validity of the profile deviation perspective of TTF. Unlike the assessment using the group means in Table 31, the ANOVA results in Table 32 show that the only prediction statistically supported is that groups completing the evaluation task in the meeting room would be more satisfied than those completing the task over the Internet. Additionally, those groups generating ideas in the meeting room were marginally statistically more satisfied. There was no statistical support for any prediction about either the process or the results of the idea generation task.

While the statistical results were mixed, participant satisfaction was the most discussed topic during the interviews and drew the most comments on the questionnaire. A number of the themes identified by the cadets when discussing task effectiveness were also covered when discussing participant satisfaction but there were also additional aspects that were directly related to the cadets' satisfaction.

The majority of cadets identified a key benefit of technology support was its ability to reduce the dominance of one or a more cadets in the group. Positive comments were received from group members in both the meeting room and Internet conditions. It must be remembered that in military organizations like ADFA, power and authority is institutionalized by a hierarchy of cadets and military staffs. Overall, the cadets that were interviewed felt that the use of the technology support provided a mechanism to reduce or eliminate dominance, gave the groups more focus and added process support for the group.

> *At ADFA you have to be careful as there are standards and expectations. This system means you can be honest. It is also quick and gives us a say in what we are doing with SST and are trying to do to improve SST.*
>
> *It focuses people on the topic and obno {obnoxious} people don't dominate. You don't get shot down using this system to enter ideas.*
>
> *It's a very good idea if the rules stick that no one talks except through electronic means. This will allow more ideas to be put forward, and less intimidation and group think to occur.*

The comments on dominance were closely related to the anonymity feature of the technology support. Those cadets that were interviewed were evenly divided about the usefulness of the anonymity feature. Some cadets thought that being anonymous might have led to more radical or lower quality ideas or comments: "*Anonymity can sometimes make suggestions more left or right than they normally would be*"; and "*As it is anonymous, it is easy for people to mouth off about topics discussed without having to back up their statements*". Other cadets thought that anonymity encouraged more open and honest responses.

> *An advantage of this system is that it is anonymous which means that you are more likely to get honest and accurate responses to the question you are asking.*

Comments on the process employed in the focus groups were generally positive. The majority of cadets interviewed were satisfied with the idea generation and evaluation processes, and could see the benefits in using technology support for this type of program evaluation. In the idea generation tasks, the cadets were more satisfied using the technology support than completing the tasks using traditional methods. For example, a number of cadets made statements similar to "*This is an excellent way to brainstorm in a group. It removes the sometimes messiness associated with using pen and paper*".

As 86% of cadets had never used a GSS before, there were a series of comments from both meeting room and Internet participants that supported the general notion that technology support makes a group more effective. A cadet in a MM1 condition group observed:

> *The data processing features of MeetingWorks allows for easier interpretation of the information. It was excellent the way that we could input the data straight into the system and it would organise it and produce instant output. The graphs were pretty useful in looking at how we rated the relevance of SST topics, and we could also see the comments against the scores so that was a bonus.*

The comments that arose during the discussion on satisfaction also concerned task effectiveness, thus drawing the link between the cadets' comments on task effectiveness and their satisfaction with focus groups. Cadets that thought the task had been effectively completed gave more positive comments on their satisfaction with the meeting. As two cadets from groups in the MM2 condition said:

> *I had not used this system before. I found it was very effective and I believe successful in the way it operates. I can see how it makes groups like ours more effective in the way they do things, and get results more quickly.*

> *An interesting, time efficient way to get through quite a big agenda. If you have to interview this many people in groups and handwrite everything then it would take much longer I think.*

The largest number of comments, and the area that cadets expressed the most dissatisfaction with, was the lack of verbal interaction among group members. While this was imposed by the research design, it frustrated a high number of cadets that met in the meeting room.

> *It may be easier if we couldn't see each other {in the meeting room}. It feels weird typing everything out when you can see each other and would normally just talk about the issues.*

Those in the mixed conditions (MM1 and MM2) did not express as many negative comments as those cadets that met the entire time in the meeting room (S condition). A typical comment was:

I found it very hard to explain my ideas to the others in my group. It would have been much easier to write them down and then explain to the others verbally what I meant. Maybe there is a place for this type of technology but it can't fully replace talking with others.

The main reason given for wanting to combine technology support with verbal communication was cadets thought that the verbal communication was required to explain or expand on the written comments. The type of sentiment that cadets had about the restriction on verbal communication are covered in the following quotes from three different groups that met in the synchronous condition:

Many of the answers given to the question may be ambiguous and might make the meeting results unusable. If we could talk about them, this might not have happened.

We didn't really discuss people's opinions, there was no chance to perhaps correct misconceptions and misunderstandings. This probably affected the results of the meeting.

Additionally, some cadets felt that by verbally discussing the ideas or ratings the group could have developed better outcomes. A cadet in a group meeting in the MM2 condition summarized his thoughts as:

In our group, there was no group discussion and therefore we couldn't build on each others ideas. I found this to be a disadvantage when it came to assessing the relevance of SST topics. It would have been much better if we could have discussed the topics and get an idea of how the others were thinking about how relevant they thought the topic in the SST program was.

Similarly, a cadet in one of the groups in the synchronous condition expressed the following:

I thought that using the computer lost the one to one contact and that the ideas were rushed. You didn't get a proper discussion about things and there were some interesting comments about SST that would have been good to talk more about.

Cadets that completed both tasks in the asynchronous condition were less critical of the lack of verbal communication, and some believed that it actually helped because they were "*able to get your point across without being interrupted*'. Others found similar issues with the lack of verbal communication to those express by the cadets in the synchronous condition: "*I found that it was harder to tell in the {asynchronous} meeting exactly what someone is trying to say and it was made worse by the fact that you could not question another person's contribution"*. As discussed earlier, one mechanism that the participants employed to try to overcome the lack of verbal communication was to structure the written inputs as a conversation.

Regardless of the instructions about no verbal communication, on a number of occasions there were some non technology supported discussions that took place during the task. For the groups that met in the meeting room, there was also discussion that occurred between the tasks, both social and task-related. It was obvious that the participants wanted to talk during the tasks but on the whole they kept to the 'rules' of the meeting until the first chance they had to revert to talking. The conversation was mostly about the questions posed during the meeting so some ideas and some comments were 'lost' as they were not recorded via MeetingWorks. A comment that aptly summed up this aspect was *"I found that it was frustrating that I couldn't interact to discuss issues with others. From looking at the final report from our group, I think that the lack of discussion of ideas and the loss of ability to clarify remarks made the report not representative"*.

While the lack of verbal communication was the major issue for the cadets in the focus groups, there were also a number of comments about the lack of social or visual clues. Primarily, cadets meeting in focus groups over the Internet found the focus group to be impersonal. A number of cadets felt that " *It is very impersonal and I think it was hard to hold a meeting without actually being able to look at them {other group members}"*.

Some cadets in the asynchronous condition also felt that because the participants could compete their work at any time over the allocated meeting period, it was very difficult to co-ordinate their input so they could see other participants responses.

It was an advantage that you can participate at any time during the day, but it was not possible to know when someone contributes until you check the reports.

Even though there were daily postings on the Internet of the group's work to-date and of participant input, this was not timely enough for many of the cadets. The feeling was that the lack of immediate feedback stifled the discussion.

This meeting allows the viewpoints of many people and allows them to express their opinions without being intimidated by group pressures. However, the meeting felt very impersonal and artificial, especially when considering you cannot ask another person the reason for the statements they make during the meeting.

It may not make the group more effective as such, as it doesn't allow a high degree of debate. Any debate that does occur is limited and slow.

The final theme identified in the interviews was that the features of the technology support assisted participants reach an outcome. Cadets in groups that completed one or both task over the Internet were more enthusiastic about the technology than those in the meeting room, and in particular the ease of use, and the different time and different place capabilities of MeetingWorks were mentioned as features that were definite benefits of this use of technology. As one of the cadets that completed the evaluation over the internet stated:

In this case, using MeetingWorks meant that input can be given when it is convenient not when a meeting is called and everyone must be present until the end to ensure that their input is obtained. You can also do it with minimal effort (getting changed, etc...)

A cadet that completed the idea generation over the Internet had a similar sentiment:

I thought the ease and privacy were two big advantages of using this system. As it was on the computer, it made the meeting very easy to conduct in the comfort of your own room. It also created a structure or format to the meeting so there is not so much straying from the topic.

Taking both the quantitative and qualitative assessments, it is clear that when looking at participant satisfaction the profile deviation perspective of TTF does not have either predictive or descriptive validity. While the cadets made generally positive comments on their level of satisfaction with the process and the results of their program evaluation, there were few observed differences in the comments across the different communication modes. From a profile deviation perspective, both statistical and qualitative differences would be predicted across the different communication modes.

Secondly, the key observations by cadets on dominance, anonymity and lack of visual and social clues point to a gestalt perspective rather than a profile deviation one based on just task and technology support. It appears from the interviews that in terms of satisfaction or dissatisfaction, the visual and social clues and the ability of the technology support to reduce dominance were more important determinants than the interaction of task and technology support.

Group Relations

The final set of variables relate to the interpersonal aspects of group work. Participants were asked to consider how cohesive they thought their focus group was, and how equal was the participation of the group members. From a profile deviation perspective, those groups that have a better fit between the task and the technology support will feel they have better group cohesion and more equal group member participation.

The analysis of group cohesiveness and equality of participation is similar to the measurement of overall group results in that the results were obtained at the conclusion of the focus group and not at the end of each phase of the focus group like the Task Effectiveness and Participant Satisfaction measures.

In terms of the fit between task and technology, the MM2 condition theoretically has the best fit and is therefore deemed the most likely to foster the best conditions for group cohesion and equality of participation. Having one mismatch and one match, the single mode conditions (S and A) are less conducive to effective group relations, although TTF does not suggest that a ‘too rich’ medium could have a detrimental effect on group relations. A medium that is too lean, however, would theoretically require group members to expend additional effort to ensure co-ordination between members and to compensate for the perceived lack of communication channel attributes. This would have the effect of making the group appear less cohesive.

The hypotheses developed for the group relations measures are as follows:

H6: There will be a significant difference in perceived group cohesion and equality of participation between groups in the four conditions.

> H6a: There will be no significant difference between groups in the MM2 or S condition in terms of group cohesiveness or equality of participation.
>
> H6b: Groups in the MM2 condition will be more cohesive and report more equality of participation than groups in the MM1or A condition.
>
> H6c: Groups in the S condition will be more cohesive than groups in the MM1or A condition.
>
> H6d: Groups in the S condition will report more equality of participation than groups in the MM1or A condition.

Translated into tabular form, the ranking from 1 (most cohesive and equal) to 4 (least cohesive and equal) is shown in Table 33. In the Table the symbols are:

- A tick in indicates a match between the technology and the task.
- A minus sign indicates that theoretically the medium is too lean for the task.
- A plus sign indicates that theoretically the medium is too rich for the task.

Activity/Condition	*MM2*	*S*	*MM1*	*A*
Idea Generation	✓	+	+	✓
Evaluation	✓	✓	—	—
Rank	1	=1	2	=2

Table 33 – Group ranking - group cohesiveness and equality of participation

The data in Table 34 shows that the means and standard deviations for the four conditions are very similar, although those groups that met in the A condition reported a mean level of group cohesion slightly below those of the other groups. The group means show that the cadets that met in the S, MM1 and MM2 conditions thought they had level of group cohesion slightly above average, whereas those that met in the A condition thought their level of group cohesion was about average.

The mean scores for equality of participation are much higher than those reported for the group cohesion results. Focus groups that met in the S condition reported the highest level of perceived equality between group members, followed by those in the MM2, MM1 and A conditions.

	Level of Group Cohesion		*Equality of Participation*	
	Mean	SD	Mean	SD
Synch	4.04	0.59	6.10	0.43
MM1	4.04	0.49	5.34	0.69
MM2	4.05	0.41	5.91	0.44
Asynch	3.55	0.30	5.23	0.70

Table 34 - Measures of group relations

Based on an analysis of the mean scores reported for group cohesion and equality of participation the profile deviation perspective of TTF provides no descriptive validity for the group relations measures.

A MANOVA conducted to establish if there were any significant differences between the conditions showed that there were no significant differences between the four communication modes in terms of group relations (F=1.351,p=0.263). Separating the two measures and conducting an ANOVA on the conditions showed no statistical significance between the MM2 and S, thus supporting hypothesis H6a.

Variable	F(df=1,8)	p-value
Perceived Group Cohesiveness (MM2,S)	0.584	0.467
Perceived Group Cohesiveness (MM2,MM1)	0.774	0.404
Perceived Group Cohesiveness (MM2,A)	1.344	0.295
Perceived Group Cohesiveness (S,A)	2.724	0.373
Perceived Group Cohesiveness (S,MM1)	0.000	0.995
Perceived Equality of Participation (MM2,S)	1.179	0.309
Perceived Equality of Participation (MM2,MM1)	0.435	0.528
Perceived Equality of Participation (MM2,A)	1.694	0.208
Perceived Equality of Participation (MM1,A)	4.404	0.069^{m}
Perceived Equality of Participation (S,A)	5.652	0.044*

Table 35 - ANOVA results for group relations

The results of the ANOVAs, shown in Table 35, confirm that while there were no statistically significant differences between the pairs of group communication modes for the group cohesion measures, those groups that met in the meeting room (S condition) perceived that they had significantly more equality of participation than those groups that met over the Internet (A condition). The groups that met in the MM2 condition also thought they had marginally significantly more equal participation than those groups in the A condition. These results support hypothesis H6d but not hypotheses H6b and H6c.

Overall, the statistical analysis across the four modes assessing both cohesion and equality of participation confirms that from a profile deviation perspective, TTF has no predictive validity in this study.

Discussions about cadets' perceptions on their relationships with other group members strongly supported the quantitative results. The majority of comments on the cohesiveness of the focus group concentrated on the feeling that group participants did not get the opportunity to become a cohesive group because the technology support restricted that ability. Those cadets in the asynchronous focus groups had the strongest feelings in this area.

> *Because the group didn't really have to meet in one place as a group to generate ideas, I didn't really consider it to be a strong group. That is, we didn't really have the chance to see if the group members got along better because they were working together. It was more like a bunch of individuals doing the same assignment.*

> *It is convenient that people can participate in a "meeting" without all having to be present at the same time or venue. On the downside, while this is not a bad system to meet, I found it is a bit impersonal.*

> *Communication requires actually speaking to a person to get more of what they are thinking. Using the computer to communicate meant that we missed this part.*

Reasons that cadets felt that technology support did not encourage group cohesiveness generally centred on comparison with their past experiences with military group activities. Military training is structured with both individual training and what is known as 'collective training'. In a collective training activity, cadets often work closely in small groups. Because in the technology supported focus groups they were restricted from communicating verbally with each other, it was more difficult for the group to become a cohesive group – "*In one room it's easy to get chatting - it's more natural*".

A second reason linked back to similar comments made when discussing task effectiveness and participant satisfaction. Some cadets thought that anonymity reduced the capacity of groups to establish effective group cohesiveness.

> *I didn't like the anonymous part. Not everyone in the group knew who said what and I think that is not as effective as knowing who said what and then if you didn't understand it you could ask them about it.*

The lack of formal meeting roles was also seen as a reason for lack of group cohesion. The cadets were used to having allocated roles, or being asked to allocate roles amongst themselves. Cadets thought that groups form 'normally' with a leader and cadets taking, or being allocated, specific roles in the focus group.

> *I didn't feel that I was part of a group. I know that there were three other people working with me to get the information finished about how we felt about SST but I did my part and then logged off. A real group doesn't act like that.*

Cadets meeting in the Asynchronous condition made the majority of comments about the negative effect of the lack of verbal communication on the cohesion of the group. It was felt by the majority of the cadets interviewed from these groups that:

> *This system is too impersonal to have a proper meeting. It might have been alright in the meeting room, but for us {meeting over the internet} I couldn't think we were a group. I thought of us as four individuals working on the same problem.*

> *Computer meetings remove people from the personal environment. It makes people feel less responsible for their part in the meeting and for the outcomes of the meeting.*

The comments on equality of participation amongst group members were generally much more positive than those about group cohesion, and were aligned with the high mean scores reported in the statistical analysis. Cadets strongly associated equality of participation with other characteristics of technology supported focus groups, such as the lack of dominance. Common statements such as those reported below were made by cadets across all four conditions

This type of meeting is a very effective method, and it would be very good for Defence groups as rank and pressure had no bearing on the results.

You are able to make your ideas known without interrupting others, and even quiet people can have their views heard. Other meetings I've been in have not been as equal, and if you were quiet then you couldn't get a word in.

Cadets in the MM1 and MM2 conditions were more positive when discussing group relations than those in the A condition. For example, typical comments in the mixed mode conditions were characterized by the following sentiments:

You don't have to worry about what others may say about your opinions. The person who wants the information knows that the people giving it are most likely not holding back as they would in other forums, and so is getting what people really feel. I found that I was typing what immediately came to my mind and generally didn't hold back. (MM1 participant)

The e-meeting system was really good, it enabled people to enter any of their ideas and values without the fear of being 'cut down' for them. (MM2 participant)

For people who are not good in personal meetings, it gives them an opportunity to input their ideas. (MM2 participant)

Looking at whether those in the MM1 condition reported stronger or more frequent positive comments than those meeting in the MM2 condition, there was no difference in comments whether the Internet task was first or second in the sequence. Interestingly, one cadet in a group meeting in the MM1 condition did express her 'luck' at the meeting sequence of synchronous followed by asynchronous:

The first part of our group work, when we were in the same room, I felt I was part of a group. When we did the second part over the Internet I did not get the same feeling. We were lucky that we had met during the first part of the meeting, or I would not have thought I was part of a group at all!

Further exploration of these feelings revealed that if the cadet could do the meeting again, she would have kept the sequence of meeting room first and the Internet second but would have swapped the tasks; that is, idea generation asynchronously and evaluation synchronously. This was not the group's statistical response, but interestingly it aligns with the prediction of the profile deviation perspective.

One observation from the comments about group relations and its relationship to the mode of communication is that mixed mode communication may support better group relation opportunities than fully asynchronous groups. From researcher observations and comments by cadets, there were indications that mixed mode communication was sufficient for group relations to form for focus group tasks.

Combining the group relations quantitative and qualitative assessments, it is clear that those groups that met over the Internet for both tasks felt they had the least equality of participation or group cohesion. Those that met in the meeting room had the most positive responses, and those in the mixed mode conditions reported a generally positive response about their participation equality and group cohesion. Of the two measures, the group cohesion scores were lower than the equality scores and comments about group cohesion were more negative than those about equality of participation. The main reason given for lower scores and negative feelings about group cohesion were that the technology support and the lack of verbal communication detracted from groups becoming cohesive. This was especially evident in those groups that had the ability to communicate verbally but were constrained from doing so.

Looking at the profile deviation perspective of TTF, in this study it did not have either predictive or descriptive validity when examining group relations measures. Qualitative measures such as the ability to verbally communicate, establishment of group roles and the lack of dominance and anonymity provided by the technology support had much more influence over group cohesion and equality of participation than the match of task and technology.

Summary of Qualitative Findings

The comments of the cadets have been synthesized and presented in Table 36. Some of the areas of interest relate primarily to the task or the technology, and some relate the effects of the technology support on the task, the technology and/or the group relations. For example, the anonymity feature is a characteristic of the technology support and has the effect of reducing dominance amongst group members. In this field experiment, the fact that the focus group members were military cadets whose normal hierarchy and group norms were changed because of anonymity was seen as both positive and negative depending on the particular cadet's individual perspective.

There were areas of interest that were primarily social factors. Cadets perceptions on the norms of group work, their individual preferences for working with others, and their attitude toward technology as social factors that also influence their perceptions about TTF and their assessment of group performance.

The main themes identified from the interviews and researcher observations are:

- Perceptions on norms of group work.
- Leadership/group structure expectations.
- Individual preferences.
- Attitude toward the role of technology support in group work.
- Feedback expectations.
- Level of participant coordination expected from the technology support.
- Perceptions on requirements for verbal communications complementing or replacing some technology supported communication.
- Perception on the level of group cohesion required to complete task(s).

Area of Interest	***Observations***
Ease of access	Technology support provides easier access, but can also be a constraint if not all group members have the same access
Ease of use	MeetingWorks was seen as easy to use across all four modes. This observation is peculiar to the technology support provided, so is not generalisable.
Immediate results	Immediate feedback on results is seen as a strength of technology support.
Structuring/agenda	Cadets felt that the structured agenda improved the process, and ensured no steps were missed; Seen as improvement over meetings with no technology support
Ability to complete tasks in own time	Variable rate of effort could affect results. This was evident in asynchronous tasks.

Area of Interest	*Observations*
Lack of verbal communication restricts discussion (level of discussion lacking)	Conflicting comments on the impact of no verbal communication. These concerns were expressed by synchronous groups primarily; groups completing one or more tasks over the internet did not have similar concerns. Some cadets felt that this improved efficiency.
Anonymity leads to variable mix of idea quality	Consistent across groups Some cadets thought this also led to less inhibition in an organisation bound by hierarchy and power relationships
Level and frequency of feedback	Influenced views on task effectiveness and group relations, especially in asynchronous groups
Greater useability of information	Universally positive comment across groups
Selective commenting	The length of the evaluation, in particular for 3rd year cadets, led to commenting only selectively.
Reduced dominance/greater equality of participation	Seen as a strength of technology support across all groups
Lack of personal interaction/social clues	Restricted to asynchronous groups. While this was seen as negative, the cadets did not report that they felt this characteristic reduced the group effectiveness or efficiency.
Increased coordination complexity	Reported by cadets completing tasks asynchronously. When completing tasks over the internet when the tasks in the agenda can be completed in any order increases coordination complexity.
Reduced group cohesion	Factors included anonymity, lack of verbal communication

Table 36 – Summary of quantitative findings

Participation Frequency

The final element of analysis compares groups that completed one or both tasks over the Internet. The three conditions considered in this analysis were the Asynchronous, MM1 and MM2 conditions, and the aim of the analysis was to investigate if there was a pattern to when focus group participants completed their tasks. While this analysis has no basis in TTF, during the focus groups the researcher noticed a trend in the asynchronous groups completion times and thought it was a feature worth investigating.

The trend observed in groups that met over the Internet was that they tended to complete the tasks at the end of the five day period. The data presented at Figure 49 supports this observation, with all the groups completing over 70% of the work required in either day four or five of the focus group (period three or four).

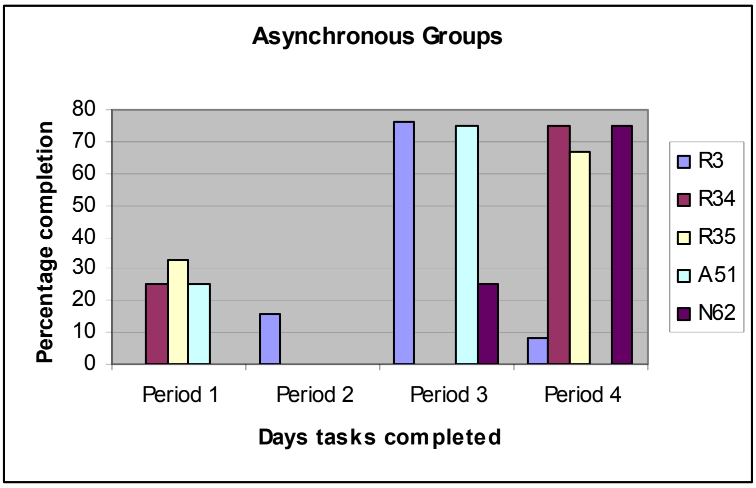


Figure 49 - Participation profile for Asynchronous groups

The work profile of those groups that met over the Internet goes part of the way to explaining some of the group effectiveness results. These groups did not have sufficient time or feedback about the work of others to really become 'cohesive'. The feeling that they were working individually came about either because they were the ones that completed a task early and then did not get timely feedback from anyone else because they hadn't done the task, or they were one of the group members that completed all the tasks later in the meeting and because the feedback was only daily they didn't have enough feedback for them to feel part of the group. Looking at the task, there was no pattern observed that would suggest either of the tasks was 'avoided' or delayed by any of the participants. These groups were also less satisfied and less effective than groups in other modes and one potential reason for these results was delaying participation in the meeting until the last two days.

Those groups in the MM1 condition showed the most consistent work rate over the three days they were given to complete the program evaluation task. Two groups took the full three days, and two groups took two of the three days. Figure 50 presents the profile of participation. When questioned about their work rate, the participants reported that having completed the idea generation task in the meeting room they were motivated to at least commence the evaluation task as soon as possible. The two main reasons given were that participants were motivated because of the topic and the technology support was an additional motivator. The second reason was that, having seen how much work was required to complete the evaluation of SST they believed they should make a start as soon as possible.

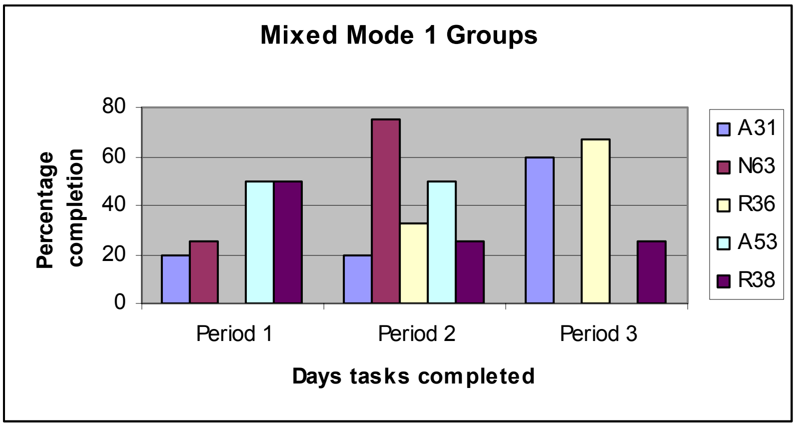


Figure 50 - Participation profile for Mixed Mode 1 groups

Unlike those groups in the Mixed Mode 1 condition, those groups in the Mixed Mode 2 condition showed a more inconsistent work rate over the three days they were given to complete the idea generation task. Three groups completed the task in either the second or third day, one group completed their work over three days but 75% of it in the last two days and one group completed half the work on day one and half on day three. Figure 51 presents the profile of participation. This profile more closely aligned with the asynchronous groups, and when participants were questioned they also cited the lack of feedback and the 'isolation' of group participants as reasons for generally waiting toward the end of the 3 days to complete the task.

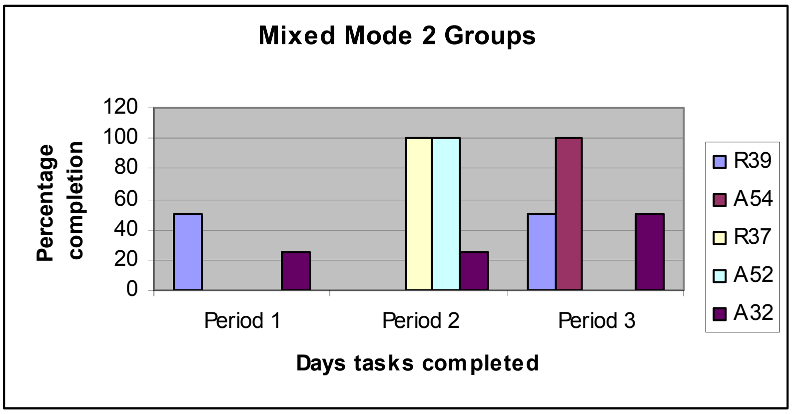


Figure 51 - Participation profile for Mixed Mode 2 groups

The analysis of when participants completed their tasks provides an interesting insight into why and how groups complete tasks in the asynchronous mode. Those that completed all the tasks over the Internet, and those in the Mixed Mode 2 condition generally commenced their tasks later in the allotted time and tended to complete the majority of their task in one sitting. Those in the Mixed Mode 1 condition had a more consistent work rate, and this appears to be because these groups had completed a synchronous phase before they completed their task in the asynchronous mode.

A Gestalt model of technology support for focus groups

Based on the previous analysis, it is clear that there are three clusters of variables, not two, that impacted on the performance on ADFA focus group work. Characteristics of the task and the technology support are important but their fit alone, from a profile deviation perspective, did not have either predictive or descriptive validity. Social variables are as important as task and technology characteristics in determining the cadets' actions during the focus groups and their perceptions of task effectiveness, participation satisfaction and group relations.

This finding confirms the findings of other researchers reported in Chapter Four, which described the effects of technology support and the task as likely to be influenced by both static and dynamic group interactions and processes (including social influences).

The model at Figure 52 illustrates from a gestalt perspective, the three clusters identified in the ADFA field experiment. Figure 52 also breaks social influences into the three key variables that were observed during the field experiment and the interviews with cadets. The variables added to the traditional TTF model are:

- Perceptions of group members of what constitutes the norms of focus group work.
- Individual preferences for communication options and technology support for focus group work.
- Perceptions by group members on the requirements for verbal communications during the focus group.

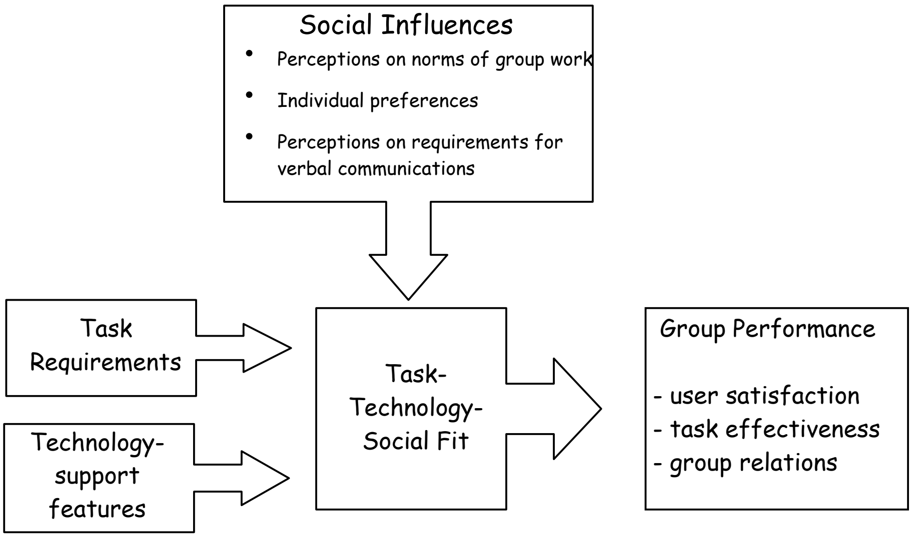


Figure 52 – Three cluster model

This model, developed a detailed analysis of the ADFA focus groups from a gestalt perspective aligns with the model drawn from a high level review of the literature and presented in Chapter One (Figure 4). It is a useful model in that it highlights additional variables that should be considered when structuring focus group research and identifies areas of further research. Identifying the impact and/or influence of these variables in other focus groups or other forms of group work will add to our understanding of the impact of social influence on group performance. Further examination of these variables can also consolidate understanding of the significance of these in situations other than the one covered in this thesis.

Summary

This chapter reported on a field experiment structured and conducted using an enhanced SSM model for hypothesis testing that examined the use of four different combinations of technology support for focus groups evaluating a training program. The specific hypotheses were based on the profile deviation perspective of TTF, and the contention that where there is a match between the technology support provided to the group and the technology requirements of the task then a group will be more effective than if there is a mismatch between task and technology.

Twenty focus groups were conducted, with ADFA cadets evaluating their SST program. The tasks they completed covered both idea generation and evaluation activities, and the groups were divided between four different technology support conditions. Five groups completed all their tasks in a meeting room, five groups completed their tasks over the Internet, and ten groups completed half their tasks over the Internet and half in the meeting room.

The results of the field experiment show that TTF from the profile deviation perspective does not consistently or completely predict the resulting effectiveness of a technology supported focus group. Quantitative assessment showed little statistical support for the profile deviation perspective from the view of overall effectiveness, task effectiveness, participant satisfaction or group relations.

In general, the comments made by the cadets supported the finding that there is only limited support for the profile deviation perspective of TTF when analysed from the task effectiveness or efficiency of groups. Additional variables were also identified by the cadets as contributing to their views about the effectiveness of the mode in which they conducted their particular focus group.

Taken as a whole, the field experiment results show that the profile deviation perspective of TTF is not a robust model and does not provide either descriptive or predictive validity for groups undertaking program evaluation tasks. This finding was consistent across all four communication conditions.

The alternative 'gestalt' perspective provides a much better approach to examining the effectiveness of technology support for group work. Recognising that groups are Human Activity Systems that combine the set of task-related activities with the social system of the group, avoids the oversimplification of the profile deviation perspective. It also provides a much richer analysis of the effectiveness of the four modes of communication examined in this field experiment.

The next chapter concludes the thesis. Learning about the framework, the methodology and the area of application are articulated. Specific learning about the development of the SSM model for hypothesis testing and the use of the model to assess the effectiveness of groups using technology support in different modes are also examined.

CHAPTER 9 – DISCUSSION AND CONCLUSIONS

Introduction

In the previous chapter SSM was used to test the hypothesis that different combinations of technology support will have different effects on group performance. The details of the field experiment that compared the effectiveness of the 20 focus groups completing an evaluation of SST using one of four communication modes, and the quantitative and qualitative results of testing the research questions and hypotheses were presented.

In this chapter, the findings from the ADFA field experiment are related back to the two research threads:

- An investigation of how to apply SSM as a research/hypothesis testing method; and
- An investigation of technology support for focus groups.

When reporting the findings on the utility of SSM for hypothesis testing, the results are summarised in terms of learning about the framework, the methodology and the area of application. The focus is on the key components of SSM as they have been developed and extended in this research. Particular attention is given to discussing the efficacy of SSM for hypothesis testing, and the value of SSM in this context.

Following the review of SSM, the results of examining the effect of technology support on ADFA focus group performance are reviewed. This review highlights that the profile deviation perspective for examining TTF does not provide a rich enough set of variables to fully examine the fit relationship between the task and the technology support and the results of that fit on group performance. Viewing group work as a Human Activity System with both social aspects and task-related activities provides the best chance of a comprehensive examination of the relationship between task-technology fit and group performance.

Throughout the chapter the practical implications of this research are discussed, and at the end of the chapter, recommendations are made for further research in this area.

Overall, this research has shown an alternative approach to assessing the impact of technology support on group performance using SSM as the methodology (M) based on a framework of ideas (F) characterized by systems thinking and viewing groups as

Human Activity Systems rather than information processing structures. The framework of ideas was used in selecting SSM, which was then used to explore an area of application (A) – evaluating a military training program.

Overarching Research Objective

The overarching objectives of this research , drawn from the two research threads, were to explore the following two questions:

- Can Soft Systems Methodology be used as the basis for exploring the relationships between technology support, task and social influence and the effect of these elements on group performance?
- What is the effect of different combinations of technology support on group performance, where group performance is measured in terms of impact on task-related activities and on the group social system?

These questions have been comprehensively addressed in Chapters Six, Seven, and Eight and will be summarized in this chapter. The effect of different combinations of technology support on group performance was addressed through the ADFA field experiment where cadets evaluated their SST program using technology support in one of four different communication modes. The results showed that the profile deviation perspective of examining task-technology fit does not adequately provide either descriptive or predictive validity, and that viewing fit from a gestalt perspective provided a much richer and more comprehensive view of the impact of the communication mode on group performance.

Learning about F,M, and A

This section covers the learning about the framework of ideas, the methodology that builds on the framework and from which the research and research instruments are derived, and the area of interest in which to apply the methodology. The learning follows from the research approach articulated in Chapter Two and summarized in Table 3.

Learning about the Framework

The research approach adopted in this research was a descriptive/interpretive field experiment. The set of principles proposed by Klein and Myers (1999) for conducting and evaluating interpretive field studies in information systems has been used to assess whether this research fits within that framework.

Firstly, Klein and Myers (1999) define interpretive research as:

> *"It does not define dependent and independent variables, but focuses on the complexity of human sense making as the situation emerges; it attempts to understand the phenomena through the meanings that people assign to them".*

This research was based on using SSM and the concept of the Human Activity System to explore the effects of technology support on focus group effectiveness. Both quantitative and qualitative data were gathered, with the quantitative data being obtained from questionnaire responses and examining the MeetingWorks logs and focus group output. The use of the interpretive data gathered through interviews and observations increased the richness of the analysis. So, while variables were defined and tested as part of the study, the use of SSM and the inclusion of the cultural analysis and the data collected from interviews and observations broadened the focus of the study.

Secondly, researchers including Oates and Fitzgerald (2001) and Champion and Stowell (2003) have provided frameworks to assess the validity of field experiments. Oates and Fitzgerald presented a meta-framework based on the '5Ps': Paradigm, Purpose, Participants, Process and Product. The evaluation of this research against the framework (Table 37) proposed by Oates and Fitzgerald supports the validity of the research.

Factor	***Step to operationalise***	***Validity Criteria***	***Evidence in this research***
Paradigm	Decide research paradigm (e.g. interpretivist, positivist, critical).	Explanation of approach.	Chapter Two details the analysis of paradigm options, and the explanation of the approach selected. The use of the Human Activity System as a construct in this research is introduced in Chapter One, used in Chapter Five and underpins the analysis in Chapter Eight and Nine.

Factor	*Step to operationalise*	*Validity Criteria*	*Evidence in this research*
Purpose	• Define research objective. • Define research questions. • Define intellectual framework of ideas.	Explicitly-stated theoretical framework.	The theoretical framework has been detailed in Chapter Two and the development of SSM for hypothesis testing was covered in Chapter Three.
Participants	• Identify & describe the participants (researchers & clients). • Discuss research motivation.	• Extent of participation acknowledged. • Vigilance against delusion.	Chapter Seven includes detail on the cadets that participated in this field experiment, and the stream of cultural analysis. The role of the researcher, and the relationship between the researcher, the cadets and the TDO is also discussed.
Process	• Gain access. • Select and follow a process model. • Generate & analyse data.	• Integration of action and research. • Research cycling. • Paradigm consistency. • Ethical behaviour.	Process issues are discussed in Chapter Seven and in this Chapter.
Product	Identify practical and learning outcomes.	• Judgement of success. • Restrained generalisations.	A successful Transformation (improved knowledge about technology support for focus groups) and learning about the Framework and Methodology is described in Chapter Seven, Chapter Eight and Chapter Nine

Table 37 - 5P analysis of field experiment validity

Champion and Fitzgerald (2003) also provide a framework for assessing the validity ofAction Research field studies.

They argue that:

> *"…the mnemonic PEArL (Participation, Engagement, Authority, relationships, and Learning outcomes) can provide an Action Researcher with a framework with the means to reflect on the authenticity and character of the actual inquiry process. Crucially, the elements of the PEArL mnemonic offer the means for an individual who was not involved in the inquiry process to reflect upon and make a judgment about the authenticity of the inquiry process."*

The detail in Table 37 summarises the evidence on Participation, relationships, and Learning Outcomes. The additional characteristics of Engagement and Authority are reviewed in Table 39.

Factor	***Validity Criteria***	***Evidence in this research***
Engagement	Making evident the methods and tools employed to engage people in the learning process allows reflection on the environment in which the learning took place, the time permitted, the resources made available, and or when meetings were held.	Chapter Three provides detail on the engagement, including the methods and tools employed.
Authority	Reflecting upon who authorized, or supported, which elements of the inquiry, and for what purpose, is essential if concerned individuals are to make a judgment concerning the authenticity of the inquiry.	• The role of the researcher and TDO and the authority for undertaking the study is covered in the cultural analysis in Chapter Seven. • The support of the cadets is articulated in Chapter Seven and their comments on the conduct of the focus groups is described in detail in Chapter Eight.

Table 38 – Engagement and authority validity

Based on the 'intellectual devices' provided by Champion and Stowell (2003) and Oates and Fitzgerald (2001), the research undertaken qualifies as an interpretive field study.

Defining and conceptualising fit

A second viewpoint that underpinned this research and formed part of the research framework was the perspective of fit used when deciding on both the methodology and the research approach.

Perspective	Model
Gestalt	Dennis et. al. (1988); Nunamaker et. al. (1989b; 1993); McGrath and Hollingshead (1994); Fjermestad, Hiltz and Turoff (Fjermestad, Hiltz et al. 1993); Fjermestad and Hiltz (1998a); DeSantis and Poole (1994); Poole and Jackson (1993).
Mediation	Pinsonneault and Kraemer (1989).
Co-variation	Pervan (1994).

Table 39 - Summary of models for studying GSS from the perspective of fit

Using the categorisation developed by Venkatraman (1989), showed that the prevailing view of fit in the literature on technology support for group work was fit from a profile deviation perspective. The models examined in this research that focus on group performance are shown in Table 39, and those specifically addressing task-technology fit are summarized in Table 40.

Perspective	*Technology support Model*
Mediation	• Basic TTF (McGrath and Hollingshead 1994). • TAM with TTF constructs (Dishaw and Strong 1999). • TAM with Social Influence Constructs (Malhotra and Galletta 1999).
Profile deviation	• Cognitive Fit Theory (Vessey 1991a; 1991b). • Task-Technology Fit (Zigurs and Buckland 1998). • Process Loss and Gains model (Steiner 1972; Nunamaker, Dennis et al. 1993). • Fit Appropriation Model (Dennis, Wixom et al. 2001).
Matching	• Social Presence Model (Short, Williams et al. 1976c). • Media Richness Theory (Daft and Lengel 1984; Daft and Lengel 1986; Daft, Lengel et al. 1987). • TTF (Goodhue 1992; Goodhue and Thompson 1995; Goodhue 1998).

Perspective	*Technology support Model*
Co-variation	• Technology Acceptance Model (Davis 1989) – could also be seen as a Mediation perspective. • Technology Acceptance Model with Social Influence Constructs (Malhotra and Galletta 1999).
Gestalt	• Social Influence Model (Fulk, Schmitz et al. 1990). • Channel Expansion Theory (Carlson and Zmud 1994; 1999)– tested as co-variation. • Channel Disposition Theory Swanson (1987) – tested as matching or co-variation.

Table 40 – Fit perspectives in TTF literature

The examination of the perspectives of fit in the literature on GSS is a unique contribution to the body of research as this is the first detailed assessment of the notion of 'fit' that has been conducted. On reflection, examining and explicitly articulating the underlying perspective of fit provides a better understanding of the research results. Further examination of the body of research on technology support is likely to provide more clarity on why there have been mixed results reported on the effects of technology support on group work.

Explicit categorization of the perspectives of fit also provided the basis for the derivation of the SSM RD and conceptual models. In the hypothesis development it was essential that the perspective of fit was made explicit. So that comparisons to prior research on technology support for focus groups could be made, the profile-deviation perspective was used, although it was recognized that this perspective would be too limited and that it was more likely that the gestalt perspective would be more applicable to situations where there is a social environment which will affect participants perceptions of the effectiveness of technology and the usefulness of the technology support in the particular situation.

This research confirmed that the profile deviation perspective is too narrow for investigating the effect of technology support on groups undertaking real tasks and that a gestalt perspective is more appropriate. The strength of the gestalt perspective is that unlike the profile deviation perspective it can be used when multiple variables are involved, and is not anchored to a specific outcome variable. This flexibility was particularly important as examining and comparing four different modes was exploratory research in this area.

Learning about the Methodology

The challenge in this research was to evaluate whether SSM could be used for hypothesis testing so that the field experiment could be completed using the profile deviation perspective, whilst at the same time providing enough flexibility to examine the ADFA focus groups from an interpretive stance and explore whether the gestalt perspective might be a perspective that provided additional and potentially richer insight.

In summary, SSM was used in the following ways in this thesis:

- Chapter Three examined an SSM logic-based model of hypothesis testing that can be used to yield a rich evaluation of the effects of technology support on the performance of groups.
- Chapter Seven developed an SSM-based approach to assessing the effects of technology support on ADFA focus groups and illustrated how the general work in Chapter Three could be operationalised..
- Chapter Eight was the detailed evaluation of the impact of technology support on ADFA focus groups and showed that the 'soft hypothesis testing' approach could yield rich results as it has the intention of examining both the stream of cultural analysis and the stream of logic-based analysis holistically.
- In Chapter Nine, SSM was used in the reflective way to summarise the learning in the three areas of F, M and A.

Reviewing the use of SSM in this thesis, there has been a transition from using SSM as an *intervention* to one of using SSM as an *interaction*. These two different approaches are described by Avison and Wood-Harper (1995) as 'instrumental problem solving' and 'reflection-in-action'. A similar classification is given by Checkland and Scholes (1990), who identify a spectrum of SSM use from Mode 1 (formal stage-by-stage use of the methodology - *intervention*) to Mode 2 (internal mental use of SSM as a thinking mode - *interaction*). The primary difference between each perspective is that in Mode 1 operation, SSM is applied to a problem situation from the outside, whereas in the Mode 2 perspective, SSM is used from the inside.

At the outset of the research, the expectation was that soft hypothesis testing would be applied in a traditional Mode 1 approach characterized by the '*application of* *knowledge as a result of research work, and is generally seen as different from research'*(Avison and Wood-Harper 1995, p. 115). The derivation of the soft hypothesis testing model and the application of the model to the focus group field experiment are typical of activities where SSM is accepted as the methodology and is used to structure an intervention.

The actual investigation of the effect of technology support however, required a transition toward Mode 2. Because a key feature of this research is the interaction of the logic-based and cultural streams of analysis, the use of SSM moved from a Mode 1 approach more toward a Mode 2 use, and the details in Chapter Eight are much more aligned with Mode 2 operation of SSM. Table 41 summarises the learning and application of the different modes of SSM in this thesis.

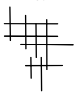
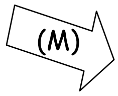
	Mode 1	Mode 2
Framework 	System Ideas – used to develop soft hypothesis testing model.	Two streams of analysis used to assess the impact of technology support on ADFA focus groups.
Methodology 	SSM as a seven stage model, reframed as four mental acts (Figure 17).	Reflection of 'flux of events and ideas' from ADFA focus groups and the effect of this interaction in group performance.
Application 	A part of the real world – ADFA focus groups.	The learning about the performance of ADFA focus groups based on the interaction of ideas and events.

Table 41 - SSM Mode 1 and Mode 2 in this thesis

On reflection, the use of SSM in this way is consistent with Checkland and Scholes' comment that '*the reflective practitioner will always make sure that any serious use of SSM contains elements of both modes*'(Checkland and Scholes 1990, p. 284). The learning from the use of SSM in this thesis is that the SSM practitioner requires a clear understanding of the different modes of SSM use and how, over the time of examining a particular situation, the emphasis changes. I, like other SSM practitioners, initially used SSM in a Mode 1 approach to develop the RD/CM combination, and I do not think that it would have been possible to use SSM in Mode 2 from the outset. The logical derivation of the structure of the research and the development of the hypothesis required SSM to be used in Mode 1 before it could be used in a much more internalised way (Mode 2) once the field experiment was underway. A Mode 2 emphasis was also applied during the reflection on the use of

SSM in this research in this Chapter. The ability of SSM to be used in both modes was a strength of the methodology in this research situation.

SSM is also more than just a process of thinking about the problem situation. At each stage in the process there is a set of techniques that can be applied according to the circumstances of the intervention. SSM use reported by Checkland and others have shown that SSM can be used purely as a process of thinking, or as a set of techniques used on their own, or as a combination of thinking process and techniques. In this research a combination was used, and the techniques that were found to be particularly useful to structure the hypotheses and the field experiment were the combination of the RD and the CM. I chose not to produce the Rich Picture in structuring the problem situation, as it did not lend itself to the specific process of becoming familiar with the research area and deciding on the hypothesis (Figure 18, activity 1a and 1b). A more traditional literature review approach was used in lieu, and this strengthened the initial stages of identifying an area to investigate.

Another benefit of using SSM is that it is built on the concept of the Human Activity System and separates the real world from systems thinking about the real world. This 'coherent intellectual framework' (Checkland and Scholes 1990, p. 24) needs to have a declared perspective or worldview and the models developed in this research had different but related worldviews. These viewpoints guided the development of RD/CM combinations and ultimately the set of hypotheses. The systems thinking applied in this research did provide a sound theoretical basis for examining the effect of technology support on ADFA focus groups.

SSM, as used in this research also helped overcome some of the challenges of integrating qualitative and quantitative data and to make explicit how qualitative and quantitative data was collected and integrated. SSM provided the framework for that integration, particularly in the mental acts of *perceive, compare* and *decide* (see Chapter Three). The development of the hypotheses and research approach in Chapter Seven make explicit how the field data was collected and used to empirically evaluate the hypotheses and illustrates how using SSM and soft hypothesis testing has contributed to the body of knowledge about the ways that the interaction and interpretation of qualitative and quantitative information can be structured.

While developing the enhanced model for hypothesis testing (Figure 18) it became evident that the techniques described in the SSM literature (e.g.Checkland 1981;

Wilson 1984; Checkland and Scholes 1990; Checkland and Holwell 1998; Wilson 2003) for comparing conceptual models to the real world would not provide the structure needed to assess the results of the hypothesis testing or to combine the qualitative and quantitative data. A technique described by Miles and Huberman (1994) was included in the enhanced model to structure and present the data from the field experiment and it was found to be both effective and efficient.

The final benefit in using SSM was that it was particularly useful way of structuring, collecting and interpreting data simultaneously for two different stages of research - theory testing and theory extension (Galliers 1992a). Developing and testing the hypotheses from on a profile deviation perspective was the focus of the theory testing aspect of this thesis. The qualitative data gathered through the SSM cultural analysis, interviews, questionnaires and the researcher's observations provided additional clarity of the qualitative results and also provided the basis for theory extension, with the outcomes showing that predictive and descriptive validity could be improved by including social elements in the analysis. This could be described as task-technology-social fit, and is better viewed from the gestalt perspective than the profile-deviation perspective.

Using the Expectation/Desirability/ Importance (EDI) matrix developed by Ledington and Ledington (1999) was useful in both the development of the models and in assessing their utility in this research. Assessment of the CM using the EDI matrix is covered in Chapter Three, but in summary:

- The models were expected to have high value in structuring the hypothesis and in identifying areas in the field experiment that would require attention. The CM, in Ledington and Ledington's structure, was important.
- As the CM was a theoretical development, the activities were assembled as *desirable* activities. In this research, the assessment of model *desirability* did not add value to the analysis using the EDI matrix but because the CM explicitly included only desirable activities.
- The third dimension (*expectation*) was made explicit from the viewpoint of the research question, and SSM was expected to have utility in developing hypotheses and assessing the effect of technology support. The high level of expectation was met in this research situation.

In summary, the utility of Ledington and Ledington's framework was confirmed, although the *desirability* measure did not lead to greater understanding in CM development in this research situation.

Finally, the methodology selection led to the selection of research instruments. In this thesis, questions from previously published research instruments were used to collect quantitative data so that issues of instrument validity were addressed by others. This approach also allowed for comparisons with prior research.

Learning about the Area of Application

The main learning outcome of this research is, as the thesis title states, an investigation into the effectiveness of different group communication modes. Examining the learning about the Area of Application (ADFA focus groups) involves linking the results reported in Chapter Eight to the second formal research question:

> *What is the effect of different combinations of technology support on focus group performance, where focus group performance is measured in terms of impact on task-related activities and on the group social system?*

Summarising the results of this question from a profile deviation perspective adds to the body of knowledge of research from this perspective, including a discussion of the strength of its predictive and descriptive validity.

Summary of prior research

Prior research into the effect of technology support on focus groups has concentrated on comparing technology supported groups with traditional face-to-face focus groups. There have been a limited number of empirical studies and also some interpretive studies. This thesis is the first comprehensive examination of the impact of technology support for focus groups using a integrative data collection and analysis strategy. The result is a deep understanding of the factors that affected the ADFA focus groups.

Table 16 summarised what prior research has reported as the benefits and limitations of technology support. As the SST evaluation was a field experiment, not all the findings summarised in Table 17 could be tested. Those areas that could be examined were:

- The effect of access across the four communication modes.

- Parallel processing.
- Time spent generating ideas, prioritising and evaluating SST topics.
- Participation equality.
- Participant satisfaction with the process, and the outcome.
- The effect of technology support on group relations.
- Confidence in the process.
- Depth of analysis.
- Total numbers of unique ideas generated in each of the four conditions.
- Participant reaction to lack of verbal communication.

In defining group performance or effectiveness, taking prior research into the effects on focus groups and group work in general, the outcomes under consideration were separated into four elements:

- The effectiveness of the group in completing the tasks assigned to them (*Task Effectiveness*).
- The level of satisfaction that the group has after completing the task (*Participant Satisfaction)*.
- The degree to which the group felt they were a unit rather than a collection of individuals, and their attitudes towards other group members (*Group Relations*).
- The group's rating of their overall satisfaction with the group process and results (*Overall*).
- Each of these categories is further separated into the following variables:

Element	***Variable***
Task Effectiveness	Number of ideas generated.
	Confidence with the idea generation process.
	Confidence with the evaluation process.
	Idea Efficiency.
	Efficiency of evaluation.
User Satisfaction	Satisfaction with the idea generation process.

Element	*Variable*
	Satisfaction with the evaluation process.
	Satisfaction with the idea generation results.
	Satisfaction with the evaluation results.
Group Relations	Group cohesiveness.
	Equality of participation.
Overall	Satisfaction with the focus group process.
	Satisfaction with the focus group results.
	Perceived focus group effectiveness.

Table 42 - Summary of learning about group effectiveness

The data gathered from the focus groups was aimed at providing input to a later military evaluation of SST, but the focus group outputs on the SST program is outside the scope of this thesis. The learning about ADFA focus groups in this thesis is:

- The impact of particular task and technology combinations on the effectiveness of the focus groups. Prior studies have shown that technology support can provide some advantages to focus groups but these studies have been restricted to single modes of technology; either synchronous or asynchronous.
- The impact of factors other than task and technology on the effectiveness of the focus groups.

Summary of findings on the Area of Application (ADFA focus groups)

The results of the field experiment show that TTF from the profile deviation perspective does not consistently or completely predict the effectiveness of a technology supported focus group. The full results from all the hypotheses tested in this research are summarised in Table 43.

Overall effectiveness was assessed as a combination of satisfaction with the process, satisfaction with the results and the effectiveness of the focus group, and the analysis shows the inconsistent results that using a profile deviation perspective can produce. In this section of the assessment, participants were not asked to compare their experiences with traditional focus groups. It was an evaluation of TTF *in this situation*.

Combining the statistical analysis with the qualitative data showed the most common general sentiment expressed by the cadets about the use of technology support for focus groups is that they expected technology support would be readily available for tasks such as those completed in the focus groups, and that there was nothing particularly novel in this application of technology. This underlying assumption affected the scoring for this part of the quantitative analysis. The results provide a different insight than those studies that compared traditional focus groups with technology supported focus groups. All the 20 groups expected technology support would be available so were assessing the utility of that technology support in the focus group not comparing it against traditional focus groups.

Hypotheses	***Finding***
Overall	
H1a: There will be no significant difference between groups in the MM2 or S condition on any measure of overall effectiveness.	Supported
H1b: Groups in the MM2 condition will be more satisfied with the overall focus group process than groups in the A condition.	Supported
H1c: Groups in the MM2 condition will be more satisfied with the overall focus group process than groups in the MM1 condition.	Marginal support
H1d: Groups in the MM2 condition will be more satisfied with the focus group results than groups in the A condition	Supported
H1e: Groups in the MM2 condition will be more satisfied with the focus group results than groups in the MM1 condition.	Supported
H1f: Groups in the MM2 condition will be report they are more effective than groups in either the A condition.	Not supported
H1g: Groups in the MM2 condition will be report they are more effective than groups in the MM1 condition.	Not supported
Task Effectiveness and Efficiency	
H2a: Groups generating ideas asynchronously will generate significantly more ideas than those groups generating ideas synchronously.	Not supported
H2b: There will be no significant difference in the number of ideas generated by groups in the MM2 or A condition.	Supported
H2c: Groups generating ideas asynchronously will report significantly more confidence with the idea generation process than those groups generating ideas synchronously.	Not supported

Hypotheses	*Finding*
H2d: Groups in the MM2 condition will report no significant difference in confidence with the idea generation process than those groups in the A condition.	Supported
H2e: Groups evaluating the SST program synchronously will report significantly higher confidence in the evaluation process than groups evaluating the program asynchronously.	Not supported
H2f: There will be no significant difference in the level of confidence in the evaluation process between groups in the MM2 condition and those in the S condition.	Supported
H3a: The efficiency of idea generation in groups conducted in the MM2 condition will not significantly differ from the efficiency of idea generation in groups conducted in the A condition.	Supported
H3b: Those groups undertaking idea generation asynchronously (MM2 and A conditions) will be significantly more efficient than those groups generating ideas synchronously (MM1 and S conditions).	Not Supported
H3c: Program evaluation efficiency will not significantly differ between groups conducted in the MM2 or S conditions.	Supported
H3d: Groups generating ideas in the asynchronously (A or MM2 condition) will report significantly more confidence with the idea generation process than those groups generating ideas synchronously (S or MM1 condition).	Not Supported
Participant Satisfaction	
H4a – Groups who generate ideas asynchronously (MM2 and A conditions) will report significantly higher levels of satisfaction with the process than those groups that meet synchronously (S and MM1 conditions).	Not Supported
H4b – Groups who generate ideas asynchronously (MM2 and A conditions) will report significantly higher levels of satisfaction with the results than those groups that meet synchronously (S and MM1 conditions).	Not Supported
H5a – Groups who evaluate the SST program synchronously (S and MM2 conditions) will report significantly higher levels of satisfaction with the process than those groups that evaluate the program asynchronously (MM1 and A conditions).	Marginally Supported

Hypotheses	*Finding*
H5b – Groups who evaluate the SST program synchronously (S and MM2 conditions) will report significantly higher levels of satisfaction with the results than those groups that evaluate the program asynchronously (MM1 and A conditions).	Supported
Group Relations	
H6a: There will be no significant difference between groups in the MM2 or S conditions in terms of group cohesiveness or equality of participation.	Supported
H6b: Groups in the MM2 condition will be more cohesive and report more equality of participation than groups in the MM1or A condition.	Not Supported
H6c: Groups in the S condition will be more cohesive than groups in the MM1or A condition.	Not Supported
H6d: Groups in the S condition will report more equality of participation than groups in the MM1or A condition.	Supported

Table 43 - Summary of findings from hypothesis testing

Task effectiveness and efficiency

The findings from examining task effectiveness did not support the profile deviation perspective of TTF. In direct contradiction to the profile deviation perspective of TTF, groups generating ideas in the meeting room produced more ideas (marginal statistical significance) than those that generated ideas over the Internet, with the greater number of ideas generated by groups who met in the meeting room. Also in direct contradiction to the profile deviation perspective, groups completing the idea generation task in the meeting room were more efficient at generating their ideas.

In general, the comments made by the cadets support the finding that there is only limited support for the profile deviation perspective of TTF when analysed from the task effectiveness or efficiency of groups.

One positive observation was that the process structure and the meeting structure that the technology support enforced was perceived by the cadets as improving task effectiveness. As they reported, the structure ensured participants 'stayed on task' and that the technology support restricted or eliminated the potential of cadets to exert any influence over the direction of the meeting. Analysis of the cadets input supported this observation. This finding supports the argument about the positive effects of technology support for focus groups.

The most common statement made by cadets was that the lack of verbal discussion reduced task effectiveness. These comments were consistent regardless of task or condition. During the meetings the technology support and agenda structure allowed for discussion via the technology support but it was only used for some limited interaction. There was no use of the technology support for detailed or prolonged discussions of SST topics or issues.

The anonymity feature was also mentioned by cadets in the interviews. While some cadets felt that task effectiveness improved because they were not identified, others felt that anonymity contributed to some cadets not participating seriously in the evaluation. Perceptions that trivial comments were made by some cadets was supported by an analysis of unique ideas, and this had an impact on the quality of the evaluation and the efficiency of the group as the number of unique ideas was diminished.

Most cadets stated that feedback was very important to the group task effectiveness. The feedback mechanisms in this research were the public screen for groups that completed a task in the meeting room, and daily feedback postings for those completing tasks over Internet. The daily postings, while providing feedback, were too infrequent for some cadets. There were also comments that it was more difficult to co-ordinate responses between group members. There was a tendency to wait for feedback from other cadets in the group before evaluations or ideas were entered into the system.

Like task effectiveness, the comments about the efficiency of the group in generating unique ideas or evaluating SST topics showed that most cadets thought technology supported focus groups were efficient because the technology support enforced an organised sequence for the program evaluation. Technology support also made the collection and usability of the information easier as the structured input and tools for collating, evaluation and ability to present the information immediately after the meeting was a real benefit to the group.

Group relations

The two measures of group relations were ratings on how participants felt about the cohesion of their group and how they rated the equality of participation amongst group members. Cadets, regardless of the condition that they met in, felt that the lack of verbal interaction made it more difficult to perceive themselves as a group. Groups meeting exclusively over the Internet (the A condition) had the strongest feelings in this area, and these groups also found it more difficult to assess the equality of participation among group members.

Groups that had one or both tasks in the meeting room had more consistently positive comments about group cohesion and equality of participation, although these groups also reported feeling that the lack of verbal communication limited group relations.

The anonymity feature was seen by some cadets as something that inhibited group relations as some cadets felt that anonymity did not allow for free flowing communication between participants. The lack of formal roles also made some cadets uncomfortable and led them to believe that the groups were less cohesive.

Cadets comments on equality of participation were much more positive than those comments about group cohesion. The lack of dominance within and across groups, partly supported by the anonymity feature of the technology support, was seen as a major benefit of the technology support in this situation. Not being bound by rank, seniority or year group at ADFA meant the cadets could be uninhibited in their evaluation of the SST program.

Mode of communication appeared to influence cadets perceptions of group relations. Those groups that evaluated SST over the Internet (the A condition) had less positive comments and lower statistical scores than the other modes. Those groups in the S condition reported the highest mean scores for group relations but their comments were no more positive than those groups in the MM conditions. It appears that before participants believe that groups relations are adequate, the groups need at least some time in the meeting room after the training has been completed.

Participation frequency

Finally, an analysis was completed of group activity over time. The trend for groups meeting in the asynchronous condition was to wait until the last two days of their allotted time to complete their tasks. This affected these groups' perceptions of group relations, and possibly reduced their effectiveness and participant satisfaction.

Of the groups in the mixed mode conditions, those evaluating in the MM1 condition showed the most consistent work rate over the allocated time. The main reasons for this pattern of work was that completing the first phase in the meeting room motivated the cadets about the evaluation and they could also see the benefits that the technology support brought to this type of group work. Cadets also gained an insight into the length of time it would take to complete the second phase of the evaluation. These insights led the MM1 condition groups to commence their Internet phase as soon as possible. As these groups generated the most unique ideas perhaps this also affected their perceptions of how long the evaluation task would take.

The groups that completed the first phase over the Internet had a profile more like those groups that met in the asynchronous condition. Most group activity occurred in day two and three of the allotted time. Lack of immediate feedback after entering their ideas and lack of group cohesion were two reasons given for waiting toward the end of the allotted time.

Conclusion

Taken as a whole, the results from this field experiment show that the profile deviation perspective of TTF is not a robust model and does not provide either descriptive or predictive validity for groups undertaking program evaluation tasks. This finding was consistent across all four communication conditions.

The alternative 'gestalt' perspective provides a much better approach to examining the effectiveness of technology support for group work. Recognising that groups can be viewed as Human Activity Systems that combine the set of task-related activities with the social system of the group, avoids the oversimplification of the profile deviation perspective. It also provides a much richer analysis of the effectiveness of the four modes of communication examined in this field experiment.

Limitations

While there are a number of learning opportunities in this research, there are also some limitations. Firstly, because the ADFA focus groups meet only once, there was no opportunity to see if groups would use the technology support faithfully, or adapt its use to provide higher levels of effectiveness (e.g. Davenport and Travica 1995).

For this part of the research, longitudinal analysis was not relevant because the analysis was assessing the implications of technology support on the performance on ‘non-repeating’ focus groups.

Other studies have shown improvements in effectiveness over time (see Burke and Chidambaram 1999) and the two case studies provided an opportunity to observe if this occurred in these meetings. Finally, because all the group participants are drawn from a reasonably homogeneous groups (for ADFA, as noted in Stevenson 1995; Warn, Tranter et al. 1997), there is no scope for an examination of some cultural issues such as power distance, gender bias, or cross-cultural aspects of GSS use.

Finally, only idea generation and preference tasks were evaluated. Other tasks undertaken by focus groups, such as addressing questions that require resolution and conflict (negotiation tasks), should also be addressed.

Recommendations for Further Research

There are a number of potential areas for future work. Investigating focus groups tackling tasks other than programme evaluation would provide a basis for further expanding our knowledge of technology support for group work. Examining a range of different tasks would also provide a basis for further development of those variables that might form the key drivers to focus group effectiveness over a range of communication modes.

Further work can also be done in extending and examining soft systems methodology and its utility in hypothesis testing. The initial work done as a major element of this research can be tested in other problem situations to assess the general characteristics and benefits of this approach.

The research could also be continued into examining the strengths and weaknesses and characteristics of the various conceptual perspectives of fit. This research has examined the profile deviation and the gestalt perspectives and comparisons between the two, but more work could be done to further examine the utility of gestalts, in particular. One next step would be to further define the ‘social cluster’ and then apply some appropriate statistical measures to it, as suggested by Venkatraman (1989).

Summary

The contribution to knowledge of this research has been in two areas:

- A contribution to the body of work on the use of Soft Systems Methodology in hypothesis testing.
- A contribution to the body of work on the effects of technology support on group work.

Specifically, the contribution of this thesis is:

- Development of SSM as a tool for hypothesis testing.
- Applying a SSM hypothesis testing model to the domain of technology support for group work.
- Identification of the prevailing fit perspectives of the research on technology support for focus groups and group work in general.
- A comparison of four modes of technology supported group work and an evaluation of the impact of each mode on the performance of the focus groups.
- An extension of the body of knowledge on technology support for focus groups.
- Identification and description of a third element (Social Influence) that has the potential to increase both the predictive and descriptive validity of the TTF construct based on the findings from the ADFA field experiment.

BIBLIOGRAPHY

ADFA (1996). *Australian Defence Force Academy Annual Report 1996*. Canberra, Australian Defence Force Academy.

ADFA (1998). *University College (UNSW) Handbook*. Canberra, Australian Defence Force Academy.

Alavi, M. and P. Carlson (1992). A review of MIS research and disciplinary development *Journal of Management Information Systems*(4): 45-62.

Alavi, M. and P. Keen (1989). Business Teams in an Information Age *The Information Society 6*: 179-195.

Arnott, D. and G. P. Pervan (2005). A critical analysis of decision support systems research *Journal of Information Technology 20*: 67-87.

Atkinson, C. J. (1989). Ethic: A Lost Dimension in Soft Systems Practice *Journal of Applied Systems Analysis 16*.

Avison, D. E. (1993). Research in Information Systems Development and the Discipline of Information Systems. *Proceedings of the 4th Australian Conference on Information Systems*, Queensland: Australia, University of Queensland.

Avison, D. E. and G. Fitzgerald (1995). *Information Systems Development: Methodologies, Techniques and Tools*. Maidenhead, McGraw-Hill.

Avison, D. E. and A. T. Wood-Harper (1995). Experience of using Multiview: Some reflections. *Information Systems Provision: The contribution of soft systems methodology*. F. A. Stowell. London, McGraw-Hill**:** 102-117.

Bales, R. F. (1970). *Personality and Interpersonal Behavior*. N.Y., Holt, Rinehart & Winston.

Baskerville, R. and M. D. Myers (2002). Information Systems as a Reference Discipline *MIS Quarterly 26*(1): 1-14.

Benathy, B. (2001). *Characteristics of a Human Activity System*, International Society for the Systems Sciences. *2001*.

Benbasat, I. and L. H. Lim (1993). The Effects of Group, Task, Context and Technology Variables on the Usefulness of Group Support Systems: A Meta-Analysis of Experimental Studies *Small Group Research 24*(4): 430-462.

Benbasat, I. and R. Weber (1996). Rethinking 'Diversity' in Information Systems Research *Information Systems Research 7*: 389-399.

Bergvall-Kåreborn, B. (2002). Qualifying Function in SSM Modeling—A Case Study *Systemic Practice and Action Research 15*(4): 309-330.

Bergvall-Kåreborn, B., A. Mirijamdotter and A. Basden (2004). Basic Principles of SSM Modeling: An Examination of CATWOE from a Soft Perspective *Systemic Practice and Action Research 17*(2): 55-73.

Bharadwaj, A. S. (1996). Integrating Positivist And Interpretive Approaches To

Information Systems Research: A Lakatosian Model. *Second Americas Conference on Information Systems*, Phoenix, Arizona.

Blackburn, R. and D. Stokes (2000), Breaking down the barriers: Using Focus Groups to research small and medium-sized enterprises *International Small Business Journal 19*(1): 44-67.

Blaikie, N. (1993). *Approaches to Social Enquiry*, London, Blackwell Scientific.

Blaikie, N. (2000). *Designing Social Research*. Cambridge,U.K., Polity Press.

Borg, W. R. and G. M.D. (1989). *Educational Research: An Introduction*. New York, Longman.

Bostrom, R. P., R. Anson and V. K. Clawson (1993). Group Facilitation and Group Support Systems. *Group Support Systems: New Perspectives*. L. M. Jessup and J. S. Valacich. New York, Macmillan Publishing**:** 146-168.

Braithwaite, J., D. Hindle, R. Iedema and J. I. Westbrook (2002). Introducing soft systems methodology plus (SSM+): why we need it and what it can contribute *Australian Health Review 25*(2): 191-198.

Bryman, A. (1992). Quantitative and Qualitative Research: Further Reflections on their Integration. *Social Research Methods: A Reader (2004)*. C. Seale, Routledge.

Burke, K. and L. Chidambaram (1999). How Much Bandwidth is Enough? A Longitudinal Examination of Media Characteristics and Group Outcomes *MIS Quarterly 23*(4): 557-579.

Burke, K., L. Chidambaram and J. Lock (1995). Evolution of relational Factors Over Time: A Study of Distributed and Non-Distributed Meetings. *Proceedings of the Twenty-Eighth Annual Hawaii International Conference on System Sciences*, California, IEEE Society Press.

Bustard, D. W., Z. He and F. G. Wilkie (2000). Linking soft systems and use-case modelling through scenarios *Interacting with Computers 13*(1): 97-110.

Buzan, T. (1991). *The Mind Map Book*. New York, Penguin.

Camacho, L. M. and P. B. Paulus (1995). The role of social anxiousness in group brainstorming *Journal of Personality and Social Psychology 68*: 1071-1080.

Campbell, D. T. and D. W. Fiske (1959). Convergent and discriminant validation by the multitrait-multimethod matrix *Psychological Bulletin 56*: 81-105.

Carlson, J. R. and R. W. Zmud (1994). Channel Expansion Theory: A Dynamic View of Media and Information Richness Perceptions *Academy of Management, Best Papers*: 280-284.

Carlson, J. R. and R. W. Zmud (1999). Channel expansion theory and the experiential nature of media richness perceptions *Academy of Management Journal 42*(2): 153-170.

Cavaye, A. (1996). Case Study Research: a multi-faceted research approach for IS *Information Systems Journal 6*: 227-242.

Chambers, J. M. and T. J. Hastie (1992). *Statistical Models in S*. Pacific Grove, CA 1992, Wadsworth and Brooks.

Champion, D. and F. A. Stowell (2003). Validating Action Research Field Studies: PEArL *Systemic Practice and Action Research 16*(1): 21-36.

Chapanis, A. (1972). Studies in interactive communication: The effects of four communication modes on the behavior of teams during co-operative problem solving *Human Factors 14*: 487-509.

Checkland, P. (1972). Towards a Systems-Based Methodology for Real World Problem-Solving *Journal of Systems Engineering 3*: 87-116.

Checkland, P. (1981). *Systems Thinking, Systems Practice*. Chichester, John Wiley & Sons.

Checkland, P. (1991). From framework through experience to learning: the essential nature of action research. *Information Systems Research; Contemporary Approaches and Emergent Traditions*. H.-E. Nissen, H. K. Klein and R. Hirschheim. North-Holland, Amsterdam, Elsevier Science Publishing.

Checkland, P. (2000). The emergent properties of SSM in use: a symposium by reflective practitioners *Systemic Practice and Action Research 13*(6): 799-822.

Checkland, P. and A. Casar (1986). Vickers' concept of an appreciative system: a systemic account *Journal of Applied Systems Analysis 13*: 3-17.

Checkland, P., P. Forbes and S. Martin (1990). Techniques in Soft Systems Practice Part 3: Monitoring and Control in Conceptual Models and in Evaluation Studies *Journal of Applied Systems Analysis 17*: 29-37.

Checkland, P. and S. Holwell (1993). Information Management and Organisational Processes: An Approach Through Soft Systems Methodology *Journal of Information Systems 3*: 3-16.

Checkland, P. and S. Holwell (1998). *Information, Systems and Information Systems: Making sense of the field*. Chichester, John Wiley & Sons.

Checkland, P. and J. Scholes (1990). *Soft Systems Methodology in Action*. Chichester, Wiley.

Cheeseman, G. and R. A. Hall (1997). *Preparing for Australia's 'Military After Next': The Price Report and a 'New Model' Australian Defence Force Academy*. Canberra, Australian Defence Studies Centre.

Chen, W. and R. Hirschheim (2004). A paradigmatic and methodological examination of information systems research from 1991-2001 *Information Systems Journal 14*: 197-235.

Chidambaram, L. (1996). Relational Development in Computer-Supported Groups *MIS Quarterly*: 143-165.

Chin, W., A. Gopal and W. D. Salisbury (1997). Advancing the theory of Adaptive Structuration: the development of a scale to measure faithfulness of appropriation *Information Systems Research 8*(4): 342-367.

Churchill, J. (1990). Complexity and Strategic Decision Making. *Tackling Strategic problems: The Role of Group Decision Support*. C. Eden and J. Radford. London, Sage**:** 11-17.

Clapper, D. L. and A. P. Massey (1996). Electronic Focus Groups: A framework for exploration *Information and Management 30*(1): 43-50.

Cohen, R. (1987). Analysing the Structure of Argumentative Discourse *Computational Linguistics 13*(1-2): 11-24.

Comley, P. (2000). Moderated E-mail Groups *International Journal of Market Research 42*(1): 111-112.

Cook, T. D. and D. T. Campbell (1979). *Quasi-Experimentation: Design and Analysis Issues for Field Settings*. Boston, MA, Houghton Mifflin.

Cowley, J. C. P. (1999). Strategic qualitative focus group research - define and articulate our skills or we will be replaced by others *Journal of the Market Research Society 42*(1): 17-38.

Crawford, L., K. Costello, J. Pollack and L. Bentley (2003). Managing soft change projects in the public sector *International Journal of Project Management 21*: 443-448.

Cresswell, J. (1994). *Research design: Qualitative and quantitative approaches*. London, Sage.

Crosswhite, J. (1996). *The Rhetoric of Reason: Writing and the Attractions of Argument* Wisconsin, University of Wisconsin Press.

D'Onofrio, M. (1999). *Online groups seem out of focus to some traditional researchers*. Advertising Age's Business Marketing. *84***:** 10.

Daft, R. L. and R. H. Lengel (1984). Information Richness: A New Approach to Manager Information Processing and Organization Design. *Research in Organizational Behavior*. B. Staw and L. Cummings. Greenwich, Conn, JAI Press.

Daft, R. L. and R. H. Lengel (1986). Organizational information requirements, media richness and structural design *Management Science 32*: 554-571.

Daft, R. L., R. H. Lengel and L. K. Trevino (1987). Message equivocality, media selection, and manager performance: Implications for information systems *MIS Quarterly 11*: 354-366.

Daft, R. L. and N. B. Macintosh (1981). A Tentative Exploration into the Amount and Equivocality of Information Processing in Organizational Work Units *Administrative Science Quarterly 26*(2): 207-224.

Davenport, E. and B. Travica (1995). Soft Decision Support Systems: GDSS in Loosely Affiliated and *ad hoc* Groups *International Journal of Information Management 15*(1): 57-65.

Davern, M. J. (1996). When good fit is bad: the dynamics of perceived fit. *Proceedings of the Seventeenth International Conference on Information Systems*, Cleveland, Ohio.

Davis, F. D. (1986). *A Technology Acceptance Model for Empirically Testing New End-user Systems: Theory and Results*. Sloan School of Management. Cambridge, MA, Massachusetts Institute of Technology.

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology *MIS Quarterly 13*: 319-339.

Davis, F. D. (1993). User Acceptance of Information Technology: Systems characteristics, user perceptions and behavioral impacts *International Journal of Man-Machine Studies 38*: 457-487.

Davis, F. D., R. P. Bagozzi and P. R. Warshaw (1989). User Acceptance of Computer Technology: A Comparison of Two Theoretical Models *Management Science 35*(8): 982-1003.

Davison, R. (1997). An instrument for measuring meeting success *Information and Management 32*: 163-176.

Davison, R. (1998). *An Action Research Perspective of Group Support Systems: How to Improve Meetings in Hong Kong*. Dept of Information Systems. Hong Kong, City University of Hong Kong.

Debus, M. (1988). *Methodological Review: a Handbook for excellence in Focus Group Research*. Washington, DC, Porter Novelli.

Dennis, A. R. (1996). Information Exchange and Use in Group Decision Making: You Can Lead a Group to Information, but You Can't Make it Think *MIS Quarterly*(December): 433-455.

Dennis, A. R., J. F. George, L. M. Jessup, J. F. Nunamaker and D. R. Vogel (1988). Information technology to support electronic meetings *MIS Quarterly 12*(4): 591-624.

Dennis, A. R., J. F. Nunamaker and D. R. Vogel (1990). A Comparison of Laboratory and Field Research in the Study of Electronic Meeting Systems *Journal of Management Information Systems 7*: 107-135.

Dennis, A. R. and J. S. Valacich (1993). Computer Brainstorms: More Heads are Better Than One *Journal of Applied Psychology*(4): 531-537.

Dennis, A. R. and J. S. Valacich (1999). Electronic Brainstorming: Illusions and Patterns of Productivity *Information Systems Research 10*.

Dennis, A. R. and B. H. Wixom (2002). Investigating the Moderators of the Group Support Systems use with Meta-Analysis *Journal of Management Information Systems 18*(3): 235-257.

Dennis, A. R., B. H. Wixom and R. J. Vandenberg (2001). Understanding Fit and Appropriation Effects in Group Support Systems Via Meta-Analysis *MIS Quarterly 25*(2): 167-193.

Denzin, N. K. (1978). *The Research Act*. New York, McGraw-Hill.

DeSanctis, G. L. and R. B. Gallupe (1987). A foundation for the study of group decision support systems *Management Science 33*(5): 589-609.

DeSanctis, G. L. and M. S. Poole (1994). Capturing the Complexity in Advanced Technology Use: Adaptive Structuration Theory *Organization Science 5*(2): 121-147.

Dishaw, M. T. and D. M. Strong (1998). Assessing Software Maintenance Tool Utilisation using Task-Technology Fit and Fitness-for-use Models *Journal of Software Maintenance: Research and Practice 10*(3): 151-179.

Dishaw, M. T. and D. M. Strong (1999). Extending the technology acceptance model with task-technology fit constructs *Information and Management 36*: 9-21.

Drazin, R. and A. H. Van de Ven (1985). An Examination of Alternative Forms of Fit in Contingency Theory *Administrative Science Quarterly 30*: 514-539.

Drucker, P. (1988). The Coming of the New Organization *Harvard Business Review*(Jan-Feb).

Easton, G. K., A. C. Easton and M. Belch (2003). An experimental investigation of electronic focus groups *Information and Management 40*: 717-727.

Ellis, C. A., S. J. Gibbs and G. L. Rein (1991). Groupware: some issues and experiences *Communications of the ACM 34*(1): 38-58.

Emery, F. E. (1970). *Systems Thinking*. Harmondsworth, Penguin.

Engelbart, D. C. and W. K. English (1968). A research centre for augmenting human intellect. *Proceedings of the Fall Joint Computer Conference*, San Francisco, CA.

Falconer, D. J. and D. R. Mackay (1999). The Key to the Mixed Method Dilemma. *Proceedings of the Tenth Australasian Conference on Information Systems*, Wellington, NZ, University of Wellington.

Fennessy, G. and F. Burstein (2000). *Using soft systems as a methodology for researching knowledge management problems*. First International Conference on Systems Thinking in Management. Geelong, Australia.

Fergusson, M. and G. J. Shaw (1996). Information Systems Research: A Question of Relevance. *Proceedings of the 7th Australasian Conference on Information Systems*, Hobart, University of Tasmania.

Finholt, T. and L. S. Sproull (1990). Electronic Groups at Work *Organization Science 1*(1): 41-64.

Fitzgerald, G. and D. Howcroft (1998). Towards dissolution of the IS research debate: from polarisation to polarity *Journal of Information Technology 13*: 313-326.

Fjermestad, J. (1998). In GSS Research How Many Groups per Treatment Condition are Enough? *Proceedings of the 4th Americas Conference on Information Systems*.

Fjermestad, J. and S. R. Hiltz (1997). Experimental Studies of Group Decision Support Systems: An Assessment of Variables Studied and Methodology. *Proceedings of the Thirtieth Annual Hawaii International Conference on Systems Sciences*, Hawaii, IEEE Society Press.

Fjermestad, J. and S. R. Hiltz (1998a). An Analysis of the Effects of Mode of Communication on Group Decision Making. *Proceedings of the Thirty First Annual Hawaii International Conference on Systems Sciences*, Hawaii, IEEE Computer Society.

Fjermestad, J. and S. R. Hiltz (1998b). An Assessment of Experimental Studies of Group Decision Support Systems: Methodology and Results *Journal of Management Information Systems 15*(3): 7-149.

Fjermestad, J., S. R. Hiltz and M. Turoff (1993). An Integrated Framework for the Study of Group Decision Support Systems. *Proceedings of the Twenty-Sixth Annual Hawaii International Conference on System Sciences*, Hawaii, IEEE Computer Society Press.

Flick, U. (1998). *An Introduction to Qualitative Research*. Thousand Oaks, Sage.

Franklin, K. and C. Lowry (2001). Computer-mediated focus group sessions: naturalistic enquiry in a networked environment *Qualitative Research 1*(2): 169-174.

Fried, L. (1995). *Managing Information technology in Turbulent Times*. New York, John Wiley & Sons.

Fulk, J., J. Schmitz and D. Ryu (1995). Cognitive Elements in the Social Construction of Communication Technology *Management Communication Quarterly 8*(3): 259-288.

Fulk, J., J. Schmitz and C. Steinfield (1990). A Social Influence Model of Technology Use. *Organizations and Communication Technology*. J. Fulk and C. Steinfield. California, Sage**:** 117-140.

Fulk, J. and C. Steinfield (1990). *Organizations and Communication Technology*. California, Sage.

Fulk, J., C. Steinfield, J. Schmitz and G. Power (1987). A Social Influence Model of Media Use in Organizations *Communication Research 14*(5): 520-552.

Galliers, R. D. (1992a). Choosing Appropriate Information Systems Research Approaches: A Revised Taxonomy. *Information Systems Research: Issues, Methods and Practical Guidelines*. R. D. Galliers. Oxford, Blackwell Scientific**:** 144-162.

Galliers, R. D. (1992b). Soft Systems, scenarios and the planning and development of information systems *Systemist 14*(3): 146-159.

Galliers, R. D., D. J. Klass, M. Levy and E. M. Pattison (1991). Effective strategy formulation using Decision Conferencing and Soft Systems Methodology. *Collaborative Work, Social Communications and Information Systems*, Helsinki, Finland.

Gallupe, R. B. and J. D. McKeen (1990). Enhancing Computer-Mediated Communications: An Experimental Investigation into the Use of a Group Decision Support System for Face-to-Face Versus Remote Meetings *Information and Management 18*: 1-13.

George, J. F. and L. M. Jessup (1997). Groups over time: what are we really studying? *International Journal of Human-Computer Studies 47*: 497-511.

Goodhue, D. L. (1992). User Evaluation of MIS Success: What are we really measuring? *Proceedings of the Twenty-Fifth Hawaii International Conference on Systems Sciences*, Hawaii, IEEE Computer Press.

Goodhue, D. L. (1998). Development and Measurement of Validity of a Task-Technology Fit

Instrument for User Evaluations of Information Systems *Decision Sciences 29*(1): 105-138.

Goodhue, D. L. and R. L. Thompson (1995). Task-Technology Fit and Individual Performance *MIS Quarterly 19*(2): 213-236.

Gopal, A., R. P. Bostrom and W. Chin (1992). Modeling the Process of GSS Use: An Adaptive Structuration Perspective.

Graeml, F. R., K. S. Graeml, A. R. Graeml and R. Ehrdmann (2004). Using Soft Systems Methodology to Analyse Quality of Life and Continuous Urban Development. *Second World Conference on Production and Operations Management*, Cancun, Mexico.

Gray, P. (1987). Group Decision Support Systems *Decision Support Systems 3*(3): 233-242.

Green, S. G. and T. D. Taber (1980). The Effects of Three Social Decision Schemes on Decision Group Processes *Organizational Behavior and Human Performance 25*: 97-106.

Green, W. A. and H. Lazurus (1991). Are today's executives meeting with success? *Journal of management development 10*(1): 14-25.

Greenbaum, T. (1997). *Internet Focus Groups: An Oxymoron*. Marketing News.

Greenbaum, T. (1998). *The Handbook of Focus Group Research*. Thousand Oaks, CA, Sage.

Gregory, F. (1993). SSM to Information Systems: A Wittgensteinian Approach *Journal of Information Systems 3*: 149-168.

Gregory, F. (1995). Soft Systems Models for Knowledge Elicitation and Representation *Journal of the Operational Research Society 46*(5): 562-578.

Gregory, F. and L. Pong (1999). Logical Soft Systems Modelling For Information Source Analysis - The Case of Hong Kong Telecom *Journal of the Operational Research Society 50*(2).

Guba, E. and Y. Lincoln (1994). Competing Paradigms in Qualitative Research. *Handbook of Qualitative Research*. N. K. Denzin and Y. Lincoln. London, Sage.

Guzzo, R. A. (1986). Group Decision Making and Group Effectiveness. *Designing Effective Work Groups*. P. S. Goodman. San Francisco CA, Jossey Bass**:** 34-71.

Hackman, J. R. and C. J. Morris (1975). Group tasks, group interaction process, and group performance effectiveness: a review and proposed integration. *Advances in Experimental Social Psychology*. L. Berkowitz. New York, Academic Press. 8**:** 45-99.

Hackman, J. R. and C. J. Morris (1978). Group Process and Group Effectiveness: A Reappraisal. *Group Processes*. L. Berkowitz. New York, Academic Press.

Hair, J. F., R. E. Anderson, R. L. Tatham and W. C. Black (1995). *Multivariate Data Analysis*. Englewoods Cliffs, Prentice Hall.

Hakim, C. (1997). *Research Design: Strategies and Choices in the Design of Social Research*. New York, Routledge.

Hall, M. W. (1997). *External Validation Results for 1994 Academy Graduates*. Canberra, Australian Defence Force Academy.

Hart, D. (1999). *Ownership, Organizational Politics and Information Systems*, University of New South Wales.

Hayne, S. C. and C. A. P. Smith (1996). Experiences with Electronic and Voice Mail. *Proceedings of the Twenty-Ninth Annual Hawaii International Conference on System Sciences*, Maui, Hawaii, IEEE Computer Society Press.

Hiltz, S. R. and M. Turoff (1978). *The Network Nation: Human Communication via Computer*. Reading, Mass, Addison Wesley.

Hiltz, S. R. and M. Turoff (1992). Virtual Meetings: Computer Conferencing and Distributed Group Support. *Computer Augmented Teamwork: A Guided Tour*. R. P. Bostrom, R. T. Watson and S. T. Kinney. New York, Van Nostrand Reinhold**:** 67-85.

Hirokawa, R. Y. and M. S. Poole (1996). *Communication and Group Decision Making*. California, Sage.

Hirschheim, R. (1992). Information System Epistemology: An Historical Perspective. *Information Systems Research - Issues, Methods and Practical Guidelines*. R. D. Galliers. Henley-On-Thames, Alfred Waller**:** 61-88.

Hirschheim, R., J. Iivari and H. K. Klein (1997). A Comparison of Five Alternative Approaches to Information Systems Development *Australian Journal of Information Systems 5*(1): 3-28.

Hirschheim, R., H. K. Klein and K. Lyytinen (1995). *Information Systems Development and Data Modelling: Conceptual and Philosophical Foundations*. Cambridge, U.K, Cambridge University Press.

Hirschheim, R., M. R. Klein and K. Lyytinen (1994). Control, Sense-making, and Argumentation: Articulating and Exploring the Intellectual Structures of Information Systems. *Proceedings of the 5th Australasian Conference on Information Systems*, Melbourne.

Ho, K. K. J. and D. Sculli (1994). Organizational Theory and Soft Systems Methodologies *Journal of Management Development 13*(7): 47-58.

Hollingshead, A. B., J. E. McGrath and K. M. O'Connor (1993). Group Task Performance and Communication Technology: A Longitudinal Study of Computer-Mediated Versus Face-to-Face Groups *Small Group Research 24*(3): 307-333.

Holloway, I. (1997). *Basic Concepts for Qualitative Research*. London, Blackwell Scientific.

Horowitz, M. and J. Newman (1964). Spoken and written expression *Journal of Abnormal and Social Psychology 68*(6): 640-647.

Huang, W., K. K. Wei, B. C. Y. Tan and K. S. Raman (1997). Why Does a GSS Fail to Enhance Group Consensus and Satisfaction? An Investigation from An Influence Process Perspective. *Proceedings of the Thirtieth Annual Hawaii International Conference on Systems Sciences*, Hawaii, IEEE Society Press.

Huber, G. P. (1984). Issues in the design of group decision support systems *MIS Quarterly 30*: 195-204.

Igbaria, M., T. Guimaraes and G. Davis (1995). Testing the determinants of microcomputer usage via a structural equation model *Journal of Management Information Systems 11*(4): 87-144.

Iivari, J. (1992). The Organisational Fit of Information Systems *Journal of Information Systems 2*(1): 3-29.

Jackson, M. (1991a). The origins and nature of critical systems thinking *Systemic Practice and Action Research 4*(2): 131-149.

Jackson, M. (1991b). *Systems Methodology for the Management Sciences*. New York, Plenum Press.

Jackson, M. (2001). Critical systems thinking and practice *European Journal of Operational Research 128*: 233-244.

Jarvenpaa, S. L. (1988). The importance of laboratory experiments in IS research *Communications of the ACM 31*(12): 1502-1504.

Jayaratna, N. (1994). *Understanding and Evaluating Methodologies - NIMSAD A Systemic Framework*. London, McGraw-Hill.

Jessup, L. M. and T. Connolly (1993). The effects of interaction frequency on the productivity and satisfaction of automated problem-solving groups. *Proceedings of the Twenty-Sixth Annual Hawaii International Conference on Systems Sciences*, California, IEEE Computer Society.

Jessup, L. M., T. Connolly and J. Gallagher (1990). The Effects of Anonymity on GDSS Group Process With an Idea- Generating Task *MIS Quarterly*: -321.

Jessup, L. M. and J. S. Valacich (1993). *Group Support Systems: New Perspectives*. New York, Macmillan Publishing.

Johansen, R. (1988). *Groupware: computer support for business teams*. New York, Free Press.

Johansen, R., D. Sibbert, S. Bensen, A. Martin, R. Mittman and P. Saffo (1991). *Leading Business Teams: How Teams Can Use Technology and Group Process Tools to Enhance Performance*. Reading,MA, Addison Wesley.

Kaplan, B. and D. Duchon (1988). Combining Qualitative and Quantitative Methods in Information Systems Research: A Case Study *MIS Quarterly December*: 571-586.

Keleman, K., L. F. Lewis and J. Garcia (1983). Script Management: A Link between Group Support Systems and Organizational Learning *Small Group Research 24*(4).

Kelle, U. (2001). Sociological Explanations between Micro and Macro and the Integration of Qualitative and Quantitative Methods *Forum: Qualitative Social Research 2*(1).

Kelman, H. C. (1958). Compliance, Identification and Internalization: Three Processes of attitude Change? *Journal of Conflict Resolution 2*: 51-60.

Kerlinger, F. N. (1986). *Foundations of Behavioral Research*. New York, Holt, Rinehart & Winston.

Kiesler, S. and L. S. Sproull (1992). Group Decision Making and Communication Technology *Organizational Behavior and Human Decision Processes 52*: 96-123.

King, R. C. and W. Xia (1997). Media Appropriateness: Effects of Experience on Communication Media Choice *Decision Sciences 28*(4): 877-910.

Klein, H. K. and M. D. Myers (1999). A Set of principles for Conducting and Evaluating Interpretive Field Studies in Information Systems *MIS Quarterly 23*(1): 67-94.

Kock, N. F. (2001a). Behavior Toward E-Communication Tools: A New Theoretical Model Based on Evolution Theory *Informing Science*: 310-317.

Kock, N. F. (2001b). *A New Theoretical Model Based on Evolution Theory*. Temple University. Philadelphia, PA.

Kock, N. F., R. Davison, R. Wazlawick and R. Ocker (2001). E-Collaboration: A Look at Past Research and Future Challenges *Journal of Systems and Information Technology 5*(1): 1-9.

Kontio, J., L. Lehtola and B. J. (2004). Using the Focus Group Method in Software Engineering: Obtaining Practitioner and User Experiences. *International Symposium on Empirical Software Engineering (ISESE)*, Redondo Beach, IEEE Computer Society.

Krueger, R. A. (1994). *Focus Groups: A practical guide for applied research*. Thousand Oaks, CA, Sage.

Krueger, R. A. and M. A. Casey (2000). *Focus Groups: A Practical Guide for Applied Research*, Sage.

Ledington, P. and J. Ledington (1999). Extending the process of comparison in soft systems methodology *Journal of the Operational Research Society 50*: 1149-1157.

Lee, A. S. (1991). Integrating positivist and interpretive approaches to organisational research *Organization Science 2*: 342-365.

Lee, A. S. (1994). Electronic mail as a medium for rich communication: An empirical investigation using hermeneutic interpretation *MIS Quarterly 18*(2): 143-157.

Lee, A. S. and J. Liebenau (1997). Information Systems and Qualitative Research. *International Conference on Information Systems and Qualitative Research*, Philadelphia, Chapman & Hall.

Lefebvre, E., L. A. Lefebvre and L. Prefontaine (1997). Technological learning and Organizational Context: Fit and Performance in SMEs. *Proceedings of the Thirtieth Annual Hawaii International Conference on Systems Sciences*, Hawaii, IEEE Computer Press.

Levin, W. C. (1988). *Sociological ideas: Concepts and Applications*. CA, Wadsworth.

Lewis, L. F. (1994a). *A Brief Introduction to Group Support Systems*. Bellingham,WA, MeetingWorks Associates.

Lewis, L. F. and M. VanSchoorl (1998). Using Group Support Systems for Program Evaluation in a State Agency. *Proceedings of the Thirty-First Annual Hawaii International Conference on Systems Sciences*, Hawaii, IEEE Computer Society Press.

Lewis, P. (1994b). *Information Systems Development*. London, Pittman.

Lincoln, Y. and E. Guba (1985). *Naturalistic Inquiry*. California, Sage.

Lindsay, D. (1997). *External Validation of Common Military Training Completed by 1995 Graduates of the Australian Defence Force Academy*. Canberra, Australian Defence Force Academy.

Majchrzak, A. and D. Davis (1990). The human side of flexible factory automation: research and management practice. *Peoples Reaction to Technology: The Claremont Symposium on Applied Social Psychology*. S. Oskamp and S. Spacapan. Newbury Park,CA, Sage**:** 33-65.

Malhotra, Y. and D. F. Galletta (1999). Extending the Technology Acceptance Model to Account for Social Influence: Theoretical Bases and Empirical Validation. *Proceedings of the Thirty Second Annual Hawaii International Conference on Systems Sciences*, Hawaii, IEEE Computer Press.

Mandviwalla, M. and P. Gray (1998). Is IS Research on GSS Relevant? *Information Resources Management Journal*: 29-37.

Mandviwalla, M. and L. Olfman (1994). What Do Groups Need? A Proposed Set of Generic Groupware Requirements *ACM Transactions on Human-Computer Interaction 1*(3): 245-268.

Markus, M. L. (1994). Electronic mail as the medium of managerial choice *Organization Science 5*(4): 502-527.

Mathieson, K. (1991). Predicting User Intentions: Comparing the Technology Acceptance Model with the Theory of Planned Behavior *Information Systems Research 2*: 173-191.

Mathieson, K. and M. Keil (1998). Beyond the interface: Ease of use and task/technology fit *Information and Management 34*: 221-230.

Maxwell, J. (1998). Designing a qualitative study. *Handbook of Applied Social Research Methods*. L. Bickman and D. Rog. Thousand Oaks,CA, Sage.

McGrath, J. E. (1964). *Social Psychology: A brief introduction*, Holt, Rinehart & Winston.

McGrath, J. E. (1984). *Groups: Interaction and Performance*. New Jersey, Prentice Hall.

McGrath, J. E. (1991). Time, interaction and performance (TIP) *Small Group Research 22*(2): 147-174.

McGrath, J. E. and A. B. Hollingshead (1993). Putting the "Group" Back in Group Support Systems: Some Theoretical Issues About Dynamic Processes in Groups with Technological Enhancements. *Group Support Systems: New Perspectives*. L. M. Jessup and J. S. Valacich. New York, Macmillan Publishing**:** 78-95.

McGrath, J. E. and A. B. Hollingshead (1994). *Groups Interacting with Technology*. California, Sage.

Mennecke, B. E., J. A. Hoffer and B. E. Wynne (1992). Group development and history in GSS research: A New Research Perspective. *Proceedings of the Twenty-Fifth Annual Hawaii Conference on Systems Sciences*, Hawaii, IEEE Computer Press.

Metcalfe, M. and L. Powell (2000). Revisiting Argumentative Research Methodology. *16th International Conference on Information Systems (ACIS)*, Brisbane.

Migliarese, P. and E. Paolucci (1995). Improved communications and collaborations among tasks induced by Groupware *Decision Support Systems 14*: 237-250.

Miles, M. B. and A. M. Huberman (1994). *Qualitative Data Analysis*. Newbury Park, CA, Sage.

Miller, D. (1981). Toward a New Contingency Approach: The Search for Organizational Gestalts *Journal of Management Studies 18*: 1-27.

Miller, D. (1993). The Architecture of Simplicity *Academy of Management Review 18*(1): 116-138.

Miller, D. C. (1991). *Handbook of Research Design and Social Measurement*. Newbury Park, CA, Sage.

Miller, D. C. (1999). Notes on the Study of Configurations *Management International Review*(July): 27.

Mingers, J. (1995). Using Soft Systems Methodology in the Design of Information Systems. *Information Systems Provision: The contribution of Soft Systems Methodology*. F. A. Stowell. London, McGraw-Hill**:** 18-50.

Mingers, J. (2000). An Idea Ahead of Its Time: The History and Development of Soft Systems Methodology *Systemic Practice and Action Research 13*(6): 733-755.

Mingers, J. (2001). Combining IS Research Methods: Towards a Pluralist Methodology *Information Systems Research 12*(3): 240-259.

Mingers, J. (2003). The paucity of multimethod research: a review of the information systems literature *Information Systems Journal 13*(2): 233–249.

Mingers, J. (2004). Paradigm Wars: ceasefire announced who will set up the new administration? *Journal of Information Technology advance online publication*: doi:10.1057/palgrave.jit.2000021.

Mingers, J. and J. Brocklesby (1996). Multimethodology: towards a framework for critical pluralism *Systemist 18*(3): 101-131.

Mobach, M. P. (2000). The Art of Modelling in SSM. *44th Annual meeting of the International Society for Systems Sciences*, Toronto, Canada.

Morgan, D., L. (1997). *Focus Groups as Qualitative Research*. Newbury Park, CA, Sage.

Morton, A., F. Ackermann and V. Belton (2003). Technology-driven and model-driven approaches to group decision support: focus, research philosophy, and key concepts *European Journal of Information Systems 12*: 110-126.

Mullen, B., C. Johnson and E. Salas (1991). Productivity loss in brainstorming groups: A meta-analytic integration *Basic and Applied Social Psychology 12*: 3-23.

Murthy, U. S. and D. Kerr (2000). Task/Technology Fit and the Effectiveness of Group Support Systems: Evidence in the Context of Tasks Requiring Domain Specific Knowledge. *Proceedings of the Thirty Third Hawaii International Conference on System Sciences*, Hawaii, IEEE Computer Press.

Myers, M. D. (1997a). Interpretive Research in Information Systems. *Information Systems: An emerging discipline?* J. Mingers and F. A. Stowell, McGraw-Hill.

Myers, M. D. (1997b). Qualitative Research in Information Systems *MIS Quarterly 21*(2): 241-242.

Newby, R., G. N. Soutar and J. Watson (2003). Comparing traditional focus groups with a Group Support Systems (GSS) approach for use in SME research *International Small Business Journal 21*(4): 421-434.

Newell, A. and H. A. Simon (1972). *Human Problem Solving*. Englewood Cliffs, N.J., Prentice Hall.

Ngwenja, J. and R. Keim (2001). Group Support Systems: The Effects of Mixing Support Systems on Information Pooling, Decision Time and Decision Quality. *Proceedings of the Twenty-Second International Conference on Information Systems*, New Orleans, Louisiana.

Nissen, H.-E., H. K. Klein and R. Hirschheim (1991). *Information Systems Research: Contemporary Approaches & Emergent Traditions*. The Netherlands, Elsevier Science Publishing.

Nour, M. A. and C. C. Yen (1992). Group Decision Support Systems: Towards a conceptual foundation *Information and Management 23*: 55-64.

Nunamaker, J. F. (1997). Future research in group support systems: needs, some questions and possible directions *International Journal of Human-Computer Studies 47*: 357-385.

Nunamaker, J. F., A. R. Dennis, J. S. Valacich, D. R. Vogel and J. F. George (1991). Electronic Meeting Systems to Support Group Work *Communications of the ACM 34*(7): 40-61.

Nunamaker, J. F., A. R. Dennis, J. S. Valacich, D. R. Vogel and J. F. George (1993). Group Support Systems Research: Experience from the Lab and Field. *Group Support Systems: New Perspectives*. L. M. Jessup and J. S. Valacich. New York, Macmillan Publishing**:** 125-145.

Nunamaker, J. F., D. R. Vogel, A. R. Heminger and W. B. Martz (1989a). Experiences at IBM with Group Support Systems: A Field Study *Decision Support Systems 5*(2): 183-196.

Nunamaker, J. F., D. R. Vogel, A. R. Heminger, W. B. Martz and R. Grohowski (1989b). Experiences at IBM with Group Decision Support Systems: A Field Study *Decision Support Systems 5*(2): 183-196.

Oates, B. and B. Fitzgerald (2001). Action Research: Putting Theory into Practice. *IFIP 8.2 Working Group on Information Systems in Organizations, Organizations and Society in Information Systems (OASIS) 2001 Workshop*, New Orleans, Louisiana, USA.

Ocker, R. (2001). The Effects of Face-to-Face and Computer-Mediated Communication: Results on Group Development, Satisfaction and Performance. *Proceedings of the Thirty-Fourth Hawaii International Conference on System Sciences*, Maui, Hawaii, IEEE Computer Press.

Ocker, R. (2002). The mediating effect of group development on satisfaction in a virtual and mixed-mode environment. *Proceedings of the Thirty-Fifth Hawaii International Conference on System Sciences*, Hawaii, IEEE Computer Press.

Ocker, R., J. Fjermestad, S. R. Hiltz and K. Johnson (1998). Effects of Four Modes of Group Communication on the Outcomes of Software Requirements Determination *Journal of Management Information Systems 15*(1): 99-118.

Ocker, R., J. Fjermestad, S. R. Hiltz and M. Turoff (1997). A Comparison of Four Modes of Communication for Determining Requirements: Preliminary Results on Creativity, Quality and Satisfaction. *Proceedings of the Thirtieth Annual Hawaii International Conference on Systems Sciences*, Hawaii, IEEE Computer Society Press.

Orlikowski, W. J. and J. J. Baroudi (1991). Studying Information Technology in Organizations: Research Approaches and Assumptions *Information Systems Research 2*(1): 1-29.

Ozer, M. (1999). The use of Internet-based groupware in new product forecasting *Journal of the Market Research Society 41*(4): 425-438.

Parent, M., R. B. Gallupe, W. D. Salisbury and J. M. Handelman. (1997). *Improving Focus Group Research Through the Use of a Group Support System, Working Paper No. 97-22.* London, ON., Richard Ivey School of Business, The University of Western Ontario.

Parent, M., R. B. Gallupe, W. D. Salisbury and J. M. Handelman. (2000). Knowledge creation in focus groups: can group technologies help? *Information and Management 38*(1): 47-58.

Patching, D. (1990). *Practical Soft Systems Analysis*. London, Pitman.

Patton, M. Q. (1990). *Qualitative Evaluation and Research Method*. Newbury Park, CA, Sage.

Pervan, G. P. (1994). *A Comprehensive Model of GSS Application: Development and Initial Testing*, Curtin University of Technology of Technology.

Pervan, G. P. (1998). A review of research in Group Support Systems: leaders, approaches and directions *Decision Support Systems 23*: 149-159.

Pervan, G. P. and D. J. Atkinson (1995). GDSS Research: An Overview and Historical Analysis *Group Decision and Negotiation 4*: 475-483.

Pervan, G. P. and D. J. Klass (1992). The Use and Misuse of Statistical Methods in Information Systems Research. *Information Systems Research: Issues, Methods and Practical Guidelines*. R. D. Galliers. Oxford, Blackwell Scientific.

Peters, T. (1988). *Thriving on Chaos*. New York, Alfred Knoph.

Pinelle, D. and C. Gutwin (2000). A Review of Groupware Evaluations. *Proceedings of WETICE 2000, Workshops on Enabling Technologies: Infrastructure for Collaborative Enterprises*, Gaithersberg, MD, IEEE Computer Press.

Pinsonneault, A. and R. Barki (1999). The illusion of electronic brainstorming productivity: Theoretical and empirical issues *Information Systems Research 10*(4): 378-382.

Pinsonneault, A., R. Barki, R. B. Gallupe and N. Hoppen (1999). Electronic Brainstorming: The Illusion of Productivity *Information Systems Research 10*(2): 110-125.

Pinsonneault, A. and K. L. Kraemer (1989). The Impact of Technical Support on Groups: An Assessment of the Empirical Research *Decision Support Systems 5*(2): 197-216.

Pollack, J. (2006). Pyramids or Silos: Alternative Representations of the Systems Thinking Paradigms *Systemic Practice and Action Research 19*(4): 383-398.

Pollard, C. E. and S. C. Hayne (1996). The Reality of Meetings and Use of Electronic Meeting Tools. *Proceedings of the Second Americas Information Systems Conference*, Phoenix, Arizona.

Poole, M. S. and G. L. DeSanctis (1989). Use of group decision support systems as an appropriation process. *Proceedings of the Twenty Second Hawaii International Conference on Systems Sciences*, Hawaii, IEEE Computer Press.

Poole, M. S. and G. L. DeSanctis (1990). Understanding the use of group decision support systems: The theory of adaptive structuration. *Organisations and Communication Technology*. J. Fulk and C. Steinfield. California, Sage**:** 11-328.

Poole, M. S. and M. H. Jackson (1993). Communication Theory and Group Support Systems. *Group Support Systems: New Perspectives*. L. M. Jessup and J. S. Valacich. New York, Macmillan Publishing**:** 281-293.

Raman, K. S., B. C. Y. Tan and K. K. Wei (1993). An Empirical Study of Task Type and Communication Medium in GDSS. *Proceedings of the Twenty-Sixth Hawaii International Conference on Systems Science*, Hawaii, IEEE Society Press.

Rice, R. E. (1992). Task analyzability, use of new media, and effectiveness: A multisite exploration of media richness *Organization Science 3*: 475-500.

Rice, R. E., D. Hughes and G. Love (1989). Usage and Outcomes of Electronic Messaging at an R&D Organization: Situational Constraints, Job Level and Media Awareness *Office: Technology and People 5*(2): 141-161.

Romano, N. C. and J. F. Nunamaker (2001). Meeting Analysis: Findings from Research and Practice. *Proceedings of the Thirty-Fourth Hawaii*

International Conference on System Sciences, Maui, Hawaii, IEEE Computer Press.

Rose, J. (1997). Soft Systems Methodology as a Social Science Research Tool *Systems Research and Behavioral Science 14*(4): 249-258.

Scott-Morton, M. (1990). *Corporation of the 1990s*. New York, University Press.

Seashore, S. (1954). *Group Cohesiveness in the Industrial Workgroup*. Ann Arbour, University of Michigan.

Shanks, G., A. Rouse and D. Arnott (1993). A Review of Approaches to Research and Scholarship in Information Systems. *Proceedings of the 4th Australian Conference on Information Systems*, Queensland: Australia, University of Queensland.

Shaw, G. J. (1998). User Satisfaction in Group Support Systems Research: A Meta-Analysis of Experimental Results. *Proceedings of the Thirty-First Annual Hawaii International Conference on Systems Sciences*, Hawaii, IEEE Computer Society Press.

Shaw, G. J. (2002). Technology-Supported Focus Groups: Using Group Support Systems for Evaluating a Military Training Program. *Group Decision and Negotiation Conference*, Perth, Australia.

Shepherd, M. M. and W. B. Martz (2001). Group Processes in Conflict: The Impact of Communication Channels on Consensus Building. *Proceedings of the Thirty-Fourth Hawaii International Conference on System Sciences*, Maui, Hawaii, IEEE Computer Press.

Shin, B. (2003). *Telework Effectiveness: Task, Technology & Communication Fit Perspective*, Idea Group Publishing.

Short, J., E. Williams and B. Christie (1976a). Communication Modes and Task Performance. *The Social Psychology of Telecommunication*. New York, John Wiley & Sons: 77-89.

Short, J., E. Williams and B. Christie (1976b). *The social psychology of telecommunication*. New York, John Wiley & Sons.

Short, J., E. Williams and B. Christie (1976c). Visual Communication and Social Interaction. *The Social Psychology of Telecommunication*. New York, John Wiley & Sons: 43-60.

Soutar, G. N., A. M. Whitely and J. L. Callan (1996). Group Support System: An Alternative to Focus Group *Australian Journal of Marketing Research 4*(1): 35-46.

Steiner, I. D. (1972). *Group process and productivity*. New York, Academic Press.

Stevenson, E. J. (1995). *Educating the Community's 'Cream': An Examination of the Military Training at the Australian Defence Force Academy*. Faculty of Education. Canberra, University of Canberra.

Stewart, D. W. and P. N. Shamdasani (1990). *Focus Groups: Theory and Practice*. Newbury Park, Sage.

Stowell, F. A. (1995). *Information Systems Provision: The Contribution of Soft Systems Methodology*. London, McGraw-Hill.

Stowell, F. A., D. West and M. Stansfield (1997). Action research as a framework for IS research. *Information Systems: An emerging discipline?* J. Mingers and F. A. Stowell. London, McGraw-Hill**:** 159-200.

Straub, D. W. and E. Karahanna (1998). Knowledge Worker Communications and Recipient Availability: Toward a Task Closure Explanation of Media Choice *Organization Science 9*(2): 160-175.

Straus, S. G. and J. E. McGrath (1994). Does Medium Matter ? The Interaction of Task type and Technology on Group Performance and Member Reactions *Journal of Applied Psychology 79*(1): 87-97.

Swanson, E. B. (1987). Information Channel Disposition and Use *Decision Sciences 18*: 131-145.

Sweeney, J. C., G. N. Soutar, D. R. Hausknecht, R. F. Dallin and L. W. Johnson (1997). Collecting information from groups: A comparison of two methods *Journal of the Market Research Society 39*(2): 397-411.

Taylor, H. (2000). Does internet research work ? *International Journal of Market Research 42*(1): 51-63.

Taylor, M. J. and J. L. DaCosta (2000). Soft issues in IS projects: lessons from an SME case study *Systems Research and Behavioral Science 16*(3): 263 - 272.

Taylor, S. and P. Todd (1995). Understanding information technology usage: A test of competing models *Information Systems Research 6*(2): 144-176.

Tindale, C. (1999). *Acts of Arguing: A Rhetorical Model of Argument.*

. Albany, State University of New York.

Trauth, E. M. and L. M. Jessup (2000). Understanding Computer-mediated Discussions: Positivist and Interpretive Analyses of Group Support Systems Use *MIS Quarterly 24*(3).

Trevino, L. K., R. H. Lengel, W. Bodensteiner, E. A. Gerloff and N. K. Muir (1990). The Richness Imperative and Cognitive Style: The Role of Individual Differences in Media Choice Behavior *Management Communication Quarterly 4*(2): 176-197.

Tse, A. C. B. (1999). Conducting electronic focus group discussions among Chinese respondents *Journal of the Market Research Society 41*(4): 407-415.

Turoff, M. (1972). Delphi Conferencing: Computer Based Conferencing with Anonymity *Journal of Technological Forecasting and Social Change 3*(2): 159-204.

Turoff, M. (1973). Human Communications via Data Networks *Computer Decisions 5*(1): 25.

Turoff, M. (1975). The Future of Computer Conferencing *The Futurist 9*(4): 182.

Turoff, M. (1989). The Anatomy of a Computer Application Innovation: Computer Mediated Communications (CMC) *Technological Forecasting and Social Change 36*: 107-122.

Valacich, J. S., A. R. Dennis and J. F. Nunamaker (1992). Group Size and Anonymity Effects on Computer Mediated Idea Generation *Small Group Research 1*(23): 49-73.

Valacich, J. S., B. E. Mennecke, R. M. Wachter and B. C. Wheeler (1993). Computer-Mediated Idea Generation: The Effects of Group Size and Group Heterogeneity. *Proceedings of the Twenty-Sixth Hawaii International Conference on Systems Science*, Hawaii, IEEE Society Press.

Van de Ven, A. H. and A. Delbrecq (1974). The effectiveness of nominal, Delphi and interacting group decision making processes *Academy of Management Journal 17*: 605-621.

Van de Ven, A. H. and R. Drazin (1985). Alternative Forms of Fit in Contingency Theory *Administrative Science Quarterly 30*(4): 514-539.

Van de Ven, A. H. and D. L. Ferry (1980). *Measuring and assessing organizations*. New York, John Wiley & Sons.

van Eemeren, F. H., R. Grootendorst, R. H. Johnson, C. Plantin, C. A. Willard, J. Woods, D. Zarefsky, D. Walton and F. Snoeck Henkemans (1996). *Fundamentals of Argumentation Theory. A Handbook of Historical Backgrounds and Contemporary Developments*. Lawrence Erlbaum, Mahwah, New Jersey.

Vat, K. H. (2004). On the Idea of Soft Systems Methodology for IS Development: A Perspective Based on Purposeful Action *Proceedings of the International Conference on Computing, Communications and Control Technologies (CCCT2004)*, Austin, Texas, USA.

Venable, J. and J. Travis (1999). Using a Group Support System for the distributed application of Soft Systems Methodology. *Proceedings of the 10th Australasian Conference on Information Systems*, Wellington, New Zealand.

Venable, J., J. Travis and M. Sanson (1996). Supporting the Distributed Use of Soft Systems Methodology with a GSS. *Proceedings of the 1996 Workshop on Information Technology and Systems (WITS'96),* Cleveland, Ohio.

Venkatesh, V. and F. D. Davis (1996). A Model of the Antecedents of Perceived Ease of Use : Development and Test *Decision Sciences 27*(3): 451-481.

Venkatraman, N. (1989). The Concept of Fit in Strategy Research: Towards Verbal and Statistical Correspondence *Academy of Management Review 14*(3): 423-444.

Vessey, I. (1991a). Cognitive Fit: A Theory-Based Analysis of the Graphs Versus Tables Literature *Decision Sciences 22*: 219-240.

Vessey, I. (1991b). Cognitive Fit: An Empirical Study of Information Acquisition *Information Systems Research 2*(1): 63-84.

Vickers, G. (1965). *The Art of Judgements - A Study of Policy Making*, Harper & Row.

Walczuch, R. M. and R. T. Watson (1999). Analyzing Group Data: Including the Effect of the Group. *10th EuroGDSS Workshop*, Copenhagen, Denmark.

Walsham, G. (1995a). The Emergence of Interpretivism in IS Research *Information Systems Research 6*(4): 376-394.

Walsham, G. (1995b). Interpretive case studies in IS research: Nature and method *European Journal of Information Systems 4*: 74-81.

Walston, J. T. and R. W. Lissitz (2000). Computer-mediated focus groups *Evaluation Review 24*(5): 457-484.

Warn, J., P. Tranter and G. Fulford (1997). *Graduate Evaluation of Tertiary Education and Military Training at the Australian Defence Force Academy*. Canberra, Australian Defence Force Academy.

West, D. (1995). The Appreciative Inquiry Method: A Systemic Approach to Information Systems Requirements Analysis. *Information Systems Provision: The contribution of Soft Systems Methodology*. F. A. Stowell. London, McGraw-Hill**:** 140-158.

Whitworth, B. (1997). *Generating Group Agreement in Cooperative Computer-mediated Groups: Towards an Integrative Model of Group Interaction*. Dept of Management. Waikato, N.Z, University of Waikato.

Wilson, B. (1984). *Systems: Concepts, Methodologies and Applications*. Chichester, John Wiley & Sons.

Wilson, B. (2003). *Soft Systems Methodology: Conceptual Model Building and its Contribution*. Chichester, John Wiley & Sons.

Wilson, E. V. and J. P. Morrison (2000). A Measure of Task-Technology Fit for Computer-Mediated Communication. *Human Centered Methods in Information Systems: Current Research and Practice*. S. Clark and B. Lehaney. London, U.K., Idea Group Publishing**:** 146-158.

Winder, R. L., S. K. Probert and I. A. Beeson, Eds. (1997). *Philosophical aspects of information systems*. London, Taylor & Francis.

Winter, M. C., D. H. Brown and P. Checkland (1995). A Role for Soft Systems Methodology in Information Systems Development *European Journal of Information Systems 4*: 130-142.

Yin, R. K. (2002). *Case Study Research: Design and Methods*. Newbury Park, Sage.

Zhang, P. and N. Li (2004). An assessment of human-computer interaction research in management information systems: topics and methods *Computers in Human Behaviour 20*: 125-147.

Zigurs, I. (1993). Methodological and Measurement Issues in Group Support Systems Research. *Group Support Systems: New Perspectives*. L. M. Jessup and J. S. Valacich. New York, Macmillan Publishing**:** 112-122.

Zigurs, I. and B. K. Buckland (1998). A Theory of Task/Technology Fit and Group Support Systems Effectiveness *MIS Quarterly September*: 313-334.

Zigurs, I., B. K. Buckland, J. R. Connolly and E. V. Wilson (1999). A Test of Task-Technology Fit Theory for Group Support Systems *The Database for Advances in Information Systems 30*(3): 34-50.

Zmud, R. W. (1988). Specification Structure and Measurement Strategies for the Non-Repeating Group Decision Context. *Organizational Decision Support Systems*. R. M. Lee, A. M. McCosh and P. Migliarese. Amsterdam, Elsevier Science Publishing.

ANNEX A – SOFT SYSTEMS METHODOLOGY

Introduction

Soft Systems Methodology is a methodology normally used to examine situations that are uncertain, unstructured or 'messy' and its basic philosophy has developed to own in order to address such situations. SSM has also been applied to other situations that are perceived to be certain, structured, and hard. SSM proponents argue the methodology can be tailored to suit the generic nature of the situation being inquired into. The most significant influence on SSM has been Peter Checkland, and his collaborators and students at the University of Lancaster.

SSM is promoted as a systemic methodology where the system of interest is a purposeful activity that has the following characteristics:

- It is not a model of the 'real world' but a model of a problem situation in which problem owners or some other actor in the situation has an interest.
- The systems relate to complex wholes (holons) that can be described in terms of their emergent properties rather than its constituent parts.
- The system maintains its existence by having processes of command and control that allow the system to adapt and survive.
- Explicitly identifying a 'world view' is the key to the definition and development of models (systems thinking about the real world).

Terms

Table 44 summarises the key terms and descriptions in SSM (from Checkland, 1981 and Checkland and Scholes, 1990)

Term	*Description*
Real world	The unfolding interactive flux of events and ideas experienced as everyday life
Systems thinking	The world in which conscious reflections on the "real world" using systems ideas takes place.
Problem situation	A real-world situation in which there is a sense of unease, a feeling that things could be better than they are, or some perceived problem requiring attention.

Term	*Description*
Root definition	Concise verbal definitions expressing the nature of purposeful activity systems regarded as relevant to exploring the problem situation. A full root definition would take the form: do X by Y in order to achieve Z. It expresses the core purposes of purposeful activity systems. The root definition is a model that relates directly to a relevant system.
Relevant system	An inquirer's perception of the human activity system that is relevant to a problem situation. Any situation may have as many relevant systems views as perceived by an inquirer. Two kinds of relevant system are possible: primary task, and issue based.
CATWOE	Elements considered in formulating root definitions. The core is expressed in T (transformation of some entity into a changed form of that entity) according to a declared weltanschauung (W). Customers (C) are: victims or beneficiaries of T. Actors (A) are those who carry out the activities. Owners (0) are individuals or a group who could abolish the system. The environment (E) establishes a set of constraint that the system accepts as given.
Conceptual Model	A systemic account of a Human Activity System, built on the basis of that system's Root Definition. CMs contain the minimum necessary activities for the system to be the one named in the RD (Checkland 1981, p. 313)
Weltanschauung	World view that relates to a transformation T by an inquirer

Table 44 - SSM terms

The shape of SSM

The traditional form of SSM (see Checkland and Scholes 1990, pp. 6)was a seven stage process which:

- Separates the real world from systems thinking about the real world.
- Connects the real world to the systems thinking through the identification of 'relevant systems'.
- Creates Root Definitions and Conceptual Models of the relevant system as a way of representing an intervention in problem situation.
- Compares the systems thinking with the real world and through debate identifies culturally feasible, systemically desirable and acceptable changes to improve the problem situation. The comparison can also lead to a

reformulation of the models and investigation of other relevant systems if the comparison does not generate the agenda for improvement that the participants desire.

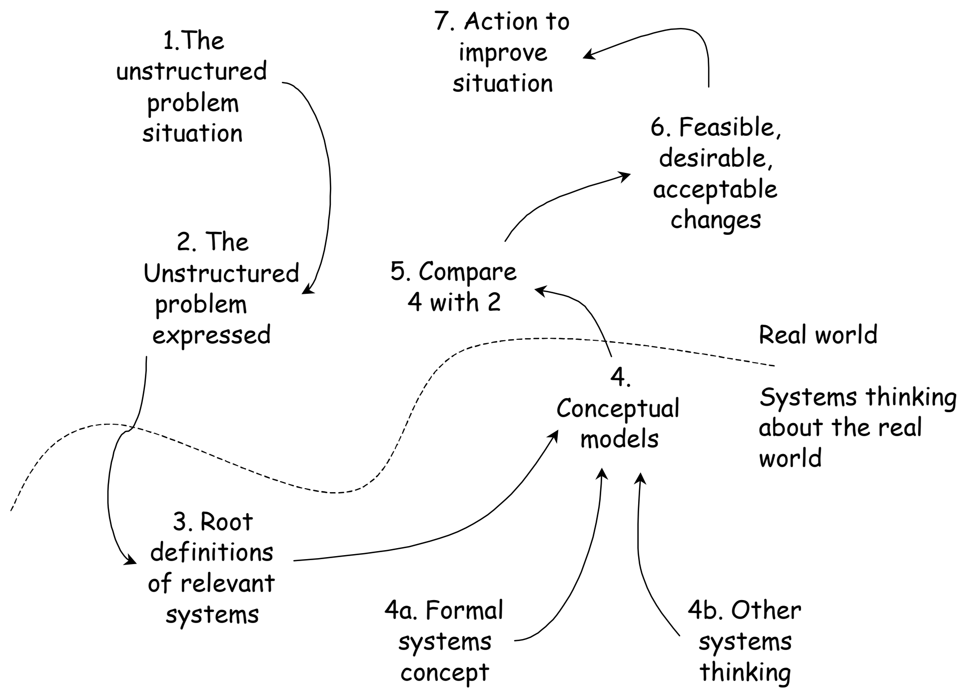


Figure 53 – The traditional shape of SSM

Modern SSM

The 'modern' form of SSM (Checkland and Scholes 1990, p. 309) explicitly recognises there are two interacting streams to any analysis and is illustrated at Figure 11. One stream is the traditional logic-driven approach where models are built and then compared to the real-world so that a debate about desirable and feasible changes can occur. The second stream is an exploration of the problem situation as a culture. The social and political aspects of the problem situation are explored so that this analysis can inform the development and choice of relevant HAS (stages 3 and 4 in Figure 10) and the debate about change (stages 6 and 7). The cultural stream also contains an analysis of the roles in the intervention: the client, the problem solver, and the problem owner. The problem owner is a 'plausible' role from which the situation can be viewed (Checkland and Scholes 1990, p. 288).

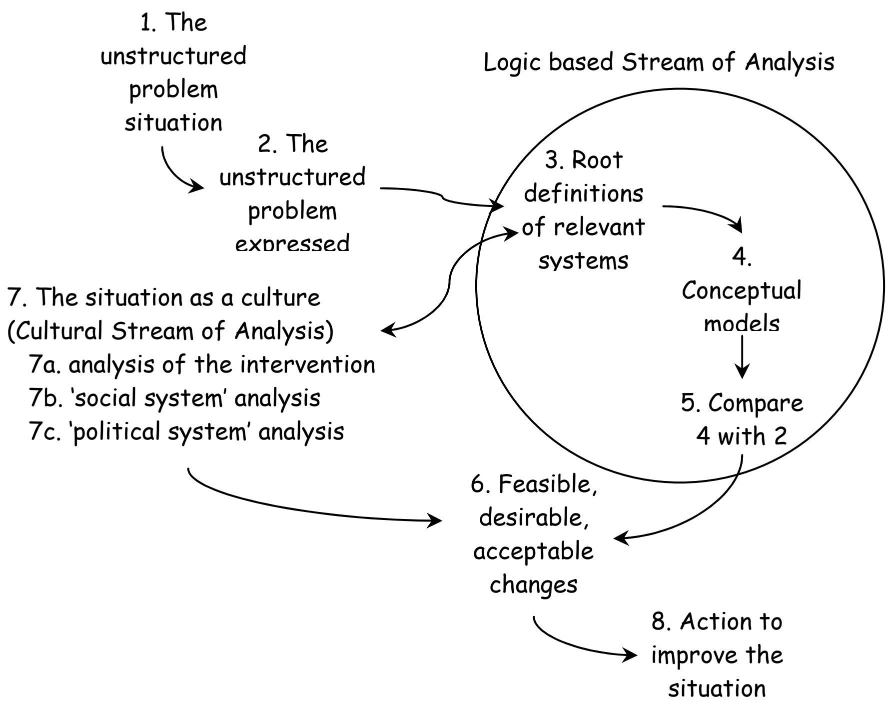


Figure 54 - The 'modern' shape of SSM

Checkland and associates (see, for example Checkland and Scholes 1990, p. 27; Checkland and Holwell 1998) have categorised the cultural stream into three distinct, but linked, analysis:

- Analysis One is an examination of the social structures and roles in the situation. It identifies the client(s), problem owners, and the role of the problem solver. In most SSM studies, Analysis One is presented in the form of a Rich Picture. In this study, Analysis One will be developed in a narrative form.
- Analysis Two examines the cultural dimension; that is, the relationships between the roles identified in Analysis One, behavioural norms and cultural values in the group. Checkland and Casar (1986) argue that a social system is in continual change because of the interaction between the roles, the behavioural norms and the values or beliefs ascribed to by the group.
- Analysis Three is the political dimension of the situation. Politics, as described by Checkland and Scholes (1990, p. 50), is the "process by which differing interests reach accommodation". In Analysis Three, the problem solver looks at the power relationships in the situation, how power is represented and power is obtained and used.

Systems Thinking Propositions

Checkland and Scholes (1990, p. 25) summarise the systems thinking to which SSM adheres. The following systems thinking propositions are adopted:

- Within systems thinking there are two complementary traditions. The `hard' tradition takes the world as being systemic; the `soft' tradition creates the process of inquiry as a system.
- SSM is a systemic process of inquiry that uses systems models. It thus subsumes the hard approach, and the hard approach is seen as a special case of SSM where there is local agreement on some system to be engineered.
- Systems thinking is based on the concept of emergence, which is the idea of an entity (or system) exhibiting properties as a single whole ('emergent properties') which have no meaning in terms of the parts of the whole.
- As the word `system' has a number of meanings in every-day, rather than using it as a general term in SSM, it is suggested that the word 'holon' be used for the constructed wholes. SSM uses a particular kind of holon, the `human activity system’ that is a set of activities connected to make a ‘purposeful whole’.
- The Human Activity System is constructed to meet the requirements of emergence, hierarchy, and contain process of communications and control.
- The process of using systems thinking is to constructed system models (seen as abstract wholes) and compare those models against the ‘real world’ (or a perception of the real world) in order to learn about it. The purpose of this comparison range from engineering some part of the world perceived as a system, to seeking insight or illumination. Checkland and others often cite ‘improving the problem situation’ as the aim of the comparison.
- Real-world situations are characterised by purposeful action, and to meaningfully examine the situation, one relevant holon must be selected. It is often necessary to create several models of human activity systems and to debate and learn their relevance to the ‘real world’.

Constitutive Rules of SSM

Checkland and Scholes (1990, p. 286) provide the following set of rules that constitute SSM:

- SSM is a structured thinking, based on systems ideas and focussed on real world situations.
    - SSM aims to bring about improvements in a situation.
- SSM must be expressed in terms of the explicit epistemology which defines its paradigm.
    - The language of SSM does not have to be used.
    - Whatever is done in SSM must be expressible in terms of its language regardless of scope of study {making the language of SSM 'trivial'}.
- If a claim is made that 'SSM was used' then that implies:
    - There is no automatic assumption that the real world is systemic.
    - If part of the real world is taken to be a system to be engineered, then that is done by conscious choice.
    - Careful distinction is made between unreflected involvement in the everyday world, and conscious systems thinking about the real world.
    - The SSM user is always conscious of moving from one world to another, and will do so many times in using the approach.
- In systems thinking phases holons are constructed.
    - Holons are normally seen as human activity systems that embody: emergent properties, layered structure, process, communications, and control.
- SSM can be used in different ways in different situations.
    - SSM will be interpreted differently by each user.
    - The use of SSM is characterised by conscious thought about how to adapt it to a particular situation.

- SSM as Methodology.
  - Every use of SSM will potentially hold methodological lessons in addition to those about the situation of concern.
  - Methodological lessons may include SSM's framework of ideas, processes, way of use.
  - Potential lessons will always be there, awaiting extraction by conscious reflection on the experience of use.

ANNEX B - THE AUSTRALIAN DEFENCE FORCE ACADEMY AND MILITARY TRAINING

Introduction

This Annex provides more information on the Australian Defence Force Academy and Single Service Training. Firstly, a brief overview of the structure and operation of the Australian Defence Force Academy is given. The two types of military training undertaken by cadets at ADFA are outlined, and details are given about the rationale, conduct and content of this training. Finally, some recent evaluations of military training are summarised, and particular attention is paid to the comments on Single Service Training.

The Defence Academy Environment

The Australian Defence Force Academy was opened in January 1986. The aim of the Defence Academy is to provide military education and training to officer cadets to prepare them for entry into the Australian Defence Force (ADF), and to provide a 'balanced and liberal university education in a military environment' as a foundation to their future careers as Defence Force officers (ADFA 1998, p. 14). The majority of Cadets at the Defence Academy are drawn from the three Services; the Royal Australian Navy (RAN), the Australian Army (ARA), and the Royal Australian Air Force (RAAF). Cadets from a number of other countries including Thailand, New Zealand, and Singapore are also represented. In terms of tertiary institutions, the Defence Academy is unique because it provides 'concurrent tertiary education and vocational education'(Warn, Tranter et al. 1997, p. xiv).

Under an agreement signed in 1981, the military component of the Defence Academy is charged with developing and maintaining a military environment, and providing military education and training (what Warn et al. refer to as vocational education). The University of New South Wales, under the agreement, is charged with the responsibility of providing the 'balanced and liberal university education'(ADFA 1998, p. 14-15). The Rector and the Commandant are seen as holding equal and complementary positions at the Defence Academy. Figure 55 illustrates the main office holders and functions of the two components at the Defence Academy. The areas annotated with an asterisk have primary carriage of military training at the Defence Academy.

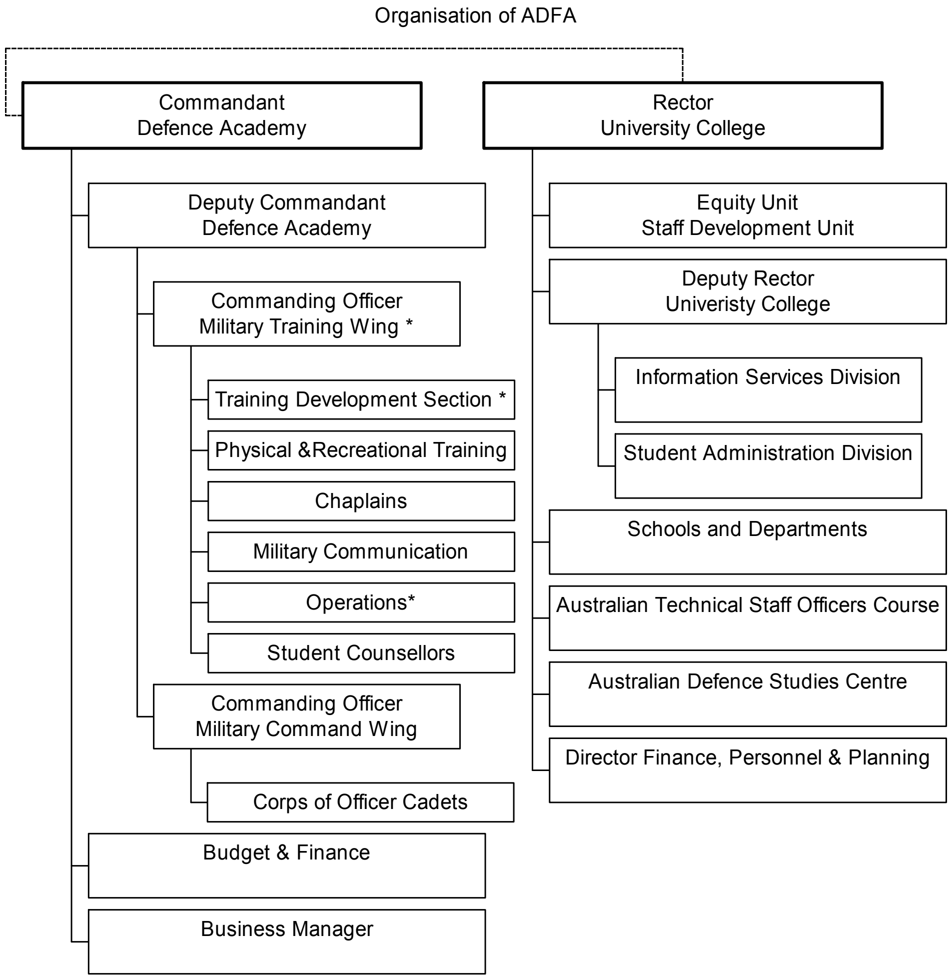


Figure 55 - Outline Defence Academy organisation

Provision of Military Training at the Academy

Under the current organisation, Military Training Wing is responsible for planning, coordinating and implementing of the military training program at the Defence Academy. Military training is conducted throughout the academic year, and in blocks during academic breaks. The two types of military training completed by cadets are Common Military Training (CMT) and Single Service Training (SST).

Cadets at the Defence Academy spend about three months per year completing Military Training. The content and time differs for each year but, as an example, cadets spend about 2 months per year on CMT, and one month per year on SST. In addition, cadets are attached to ships and units so they can experience the responsibilities and roles of a junior officer in their particular Service.

Two types of military training

During the development of the guidelines for the operation of the Defence Academy, The Chiefs of Staff Committee (COSC) provided guidance for military training. The aim of military training, according to the Chiefs, was to prepare cadets for service as officers of the Defence Force. To achieve the aim, they provided the following dimensions of what they believed military training should achieve:

- To develop in cadets the attributes of a military leader.
- To stimulate cadets' motivation towards a career in the Defence Force.
- To develop cadets' basic knowledge in those matters that are fundamental to the profession of arms.
- To foster in cadets a commitment to the ideals of the Service to which they belong.
- To provide cadets with an appreciation of the activities of their respective Services.
- To provide cadets with a general awareness of the other Services and the broader issues of national defence.

(Chiefs of Staff Committee Minutes 1976 No 24 cited in Stevenson 1995, p. 42-43)

To develop the curriculum, a Military Training Committee was formed. This committee did not specify the precise content of military training but did separate training into two distinct groups. The first group was that training that was common to all three Services(CMT), and the second group was the training specific to each Service(SST). Furthermore, the ratio of CMT and SST training was in favour of service-specific training with cadets in their first year having a 1:1 ratio of CMT to SST, in their second year the ration was 1:2.2 and in their final year 1:1.7. This reflected the perceived importance of service-specific training and the emphasis on preparing cadets for their particular Service. Interestingly, Stevenson(1995, p. 44) reported that since the original ratios were given, the CMT component has grown to a level where the ration of common to service-specific training is not 3:1.

As a final point, it should be noted that the original COSC direction was focused on developing attitudes, and knowledge (rather than skills) which were not directly aimed at their first appointment after graduation. The current training curriculum has been criticised (Stevenson 1995; Cheeseman and Hall 1997) for being too focused on the graduates first appointment, and the majority evaluations of military training have also taken this emphasis.

Common Military Training

CMT is conducted throughout the year in alignment with the academic calendar. The syllabus covers areas common to all three Services and the instruction is given primarily by military staff from Military Training and Military Command Wings. The three phases of CMT are as follows:

- Block CMT is conducted in January and February.
- Sessional CMT is conducted from March to October. During this time cadets are programmed for up to six military lessons per week.
- End of Year CMT in November and December.

Table 45 details the CMT subjects covered in the syllabus, and the total number of periods spent on the subject over a three year period.

Subject	*Periods of instruction*
Alcohol & Drug Awareness	7
Character Development	44
Counselling Skills	5
Defence Studies	116
Drill & Ceremonial	174
Field Training	24
Health & Safety	20
Interpersonal Relations	13
Leadership	122
Military Communications	98
Military Etiquette	53
Military Law	24
Military orientation	22
Physical Training	162
Service conditions	5
Stress Management	4
Study Skills	3
Weapons	57
Total	953

Table 45 - Common Military Training

Single Service Training

In addition to CMT, instruction on aspects peculiar to each Service is given at individual Service training establishments. This training is known as Single Service Training (SST), and is the focus of the evaluation and the field experiment.

Single Service Training is conducted by the three Services away from the Defence Academy. For example during Year 1 all Air Force cadets attend RAAF College at Point Cook, and Navy cadets spend time at Naval College HMAS Creswell. Officer cadets can spend up to 16 weeks, depending on their Service, over their three years at the Defence Academy on SST.

The curriculum for SST is determined by each of the three Services, and Military Training Wing ensures that, wherever possible, this training is coordinated and integrated with CMT. As an example of the type of training the cadets undergo, the Table 2 outlines the activities undertaken by cadets during 1996(ADFA 1996, p. 41).

Year /Service	*Year 1*	*Year 2*	*Year 3*
Navy	• New Entry Officer Training. • Specialisation Tertiary Education Programme (aimed at familiarising Midshipman with RAN organisation and career opportunities). • Ship Safety and Survivability training. • Cruise Preparatory Training.	• Sea Familiarisation Cruise. (Midshipman are exposed to basic duties and responsibilities of junior sailors in all departments at sea)	• Combined Defence Academy/RANC New Entry Officer training.

Year /Service	*Year 1*	*Year 2*	*Year 3*
Army	• Basic Military Skills. • Minor Infantry Tactics (section level).	• Field craft. • Weapons familiarisation. • Command a section on exercise (under instruction). • Unit visits.	• Further military skills training. • Command section. • Range practice. • Combined Defence Academy /RMC exercise.
Air Force	• General Service Knowledge. • Air Power studies • Command, Leadership & Management. • Health & PT. • Drill. • Ground Defence exercise. • Visit RAAF Edinburgh.	• Adventure training. • Ground defence exercise. • 'classroom lectures'.	• Combat Survival Course (General Duties Officers). • Work Experience (other Branches). • General Service Knowledge. • Air Power studies.

Table 46 Single Service Training

Difficulties with Provision of Training

One of the main difficulties with providing military training at the Defence Academy is identifying what knowledge, skills and attitudes a junior officer in the Services requires on graduation. Stevenson (1995) believes the underlying problem is that the three Services are different 'markets'. Preparing a program of military training for the different needs of each Service requires a balance between the CMT provided at the Defence Academy, and the SST provided by the Services.

Prior Evaluations of Military Training

Training Development Section conducts yearly formal evaluations of CMT by surveying graduates (Hall 1997; Lindsay 1997). The aim of the evaluation is to identify areas in the curriculum which graduates believe either over-trained or under-trained them for their roles in the Defence Force. Qualitative comments on a range of topics is also gathered and analysed. There is little information about SST gathered from these surveys, and the majority of comments relate to whether drill, weapons training and fieldcraft should be taught with a 'common' emphasis or a 'service-specific' emphasis, and whether these skills should be taught at the Defence Academy or at the Service colleges.

There have also been a number of academic studies that have examined military training at the Defence Academy. Stevenson (1995) undertook a detailed evaluation of military training although there was a heavy emphasis on the CMT component. The research used a survey to assess whether supervisors believed Defence Academy graduates met their expectations in terms of personal, task-related and inter-personal attitudes and qualities; and whether they had been able to satisfactorily perform duties associated with training received as part of the CMT component. The findings identified that CMT and SST were not as interdependent as had been previously thought, particularly in the case of Army and Air Force. He also noted that, in general, the Single Service Colleges have developed their SST in isolation to the CMT conducted at the Defence Academy and that they do not rely on CMT for preparing students for SST. There were no findings or recommendations for curriculum changes to SST.

Warn (1997) also used a survey approach to evaluate both academic and military training at the Defence Academy. Rather than supervisors, they surveyed all past graduates up to 1997. Questions in this evaluation related to military preparation conducted at ADFA covered:

- Attitudes towards SST.
- Informal networks established at the Defence Academy and their impact on later work.
- Inter-service contacts made at the Defence Academy and their impact on later work.

- The influence of ADFA on the development of time management skills.
- The influence of ADFA on the capacity to communicate with Senior officers.

The analysis of 968 responses to the question ‘Single Service Training prepared me well for entry into my Service’ is reproduced in Table 47. The 5 point Likert scale used for the question ranged from 1 (strongly disagree) to 5 (strongly agree). A score of 3 or greater was deemed ‘satisfactory’.

Question	*RAN*	*ARA*	*RAAF*	*All*
Single Service Training prepared me well for entry into my Service	2.55	3.27	2.63	2.84

Table 47 - SST question

Overall, the results indicate that most graduates were less than satisfied with the Single Service Training they received prior to graduation from the Defence Academy. Analysing the data by Service, Army graduates were more satisfied than either Navy or Air Force graduates, with Navy graduates being the least satisfied. One reason mooted for the higher Army scores could be that they spend a further 12 months in training at the Royal Military College prior to posting as a junior officer.

This survey also asked a number of open ended questions dealing with aspects that should be changed in the military training programme. Warn et al.(1997) note that the adequacy of SST was of ‘intense concern’ to Navy and Air Force graduates. Many graduates thought that the aim of SST should be *“to develop enough ‘street credibility’ {to} allow them to make a smooth transition into the workplace’* (p. 60). There was also a feeling that SST should focus on the specific skills that officers required in particular categories. For example, administrative officers wanted activities such as Service correspondence, and pilots wanted more flying training. Finally, there were more comments about the apparent lack of coordination between SST and CMT and the duplication of subjects between the two programmes.

SST evaluation questions

The question set developed for this evaluation focused on a number of themes. The first area of investigation was how the cadets perceived SST in terms of strengths, weaknesses, benefits and limitations. The second focus area aimed to gauge their opinions on whether SST was meeting the original COSC intentions. The topics, grouped under these general headings, are listed below:

- Discuss the aim(s) of SST.
- Outline the strengths, weaknesses, limitations and benefits of SST.
- Suggest improvements to the SST programme
- Rate the relevance and importance of SST subjects.
- Rate the extent to which the subjects meet the initial COSC intentions for SST.

ANNEX C – MEETINGWORKS™ GROUP SUPPORT SYSTEM

The GSS used in the ADFA focus group filed experiment was MeetingWorks Internet Edition™. The GSS is based on developing an agenda which can then be completed by groups either in the meeting room or over the internet. Agendas are reusable and in the ADFA focus groups were used more then 20 times.

MeetingWorks Tools

The tools available to use when developing the agenda are:

- **Generate.** Used to collect ideas or comments, and then displays them. Ideas or comments entered during generate are made anonymously by the participants.
- **Organise.** This tool allows the group to take a raw list of ideas and structure them in a hierarchical way. Organise is the process by which groups can deal with inputs from the *Generate* step.
- **Evaluate**. This tool takes anonymously input from group members, combines the input and summarizes the results. Results are presented graphically, and areas of consensus and disagreement are identified by calculating the degree of variability. Participants can also enter comments with their evaluations, so their rationale can be presented with the results, and can be used by the group in reaching consensus.
- **Multiple Criteria Analysis.** This tool allows the group to weight the importance of factors involved in the decision or vote. The weights can be changed to assess sensitivity of weightings.
- **Cross Impact Analysis.** Compares how one possible solution may positively or negatively affect other aspects of an issue, quickly identifying problems and conflicts.
- **File Editor**. File Editor is used to edit or create files before or during the meeting.

MeetingWorks Technical Characteristics

Meeting room
MeetingWorks is a LAN based system with Chauffeur and Participant stations. The Chauffeur station was used by the researcher to create the meeting agenda and to run

the meeting. For those meetings in the meeting room, the Chauffeur screen was projected at the front of the meeting room so that participants could see the input.

Each participant has access to a laptop where they anonymously entered their inputs to the agenda questions. The participant was collected and displayed at the Chauffeur screen, and the group input could be viewed on the public screen.

Internet Edition

The Internet Edition is an add-on feature to MeetingWorks to extend the functions of the meeting room to different place meetings. The MeetingWorks agenda created for the Field experiment was placed on the web server, and the cadets were registered for their particular meeting.

The tools used with Internet Edition were the same as those used in the meeting room and had the same look-and-feel. The results can be collected and published on the web server for the participants to review, and in the ADFA focus groups it was daily.

Screenshots of MeetingWorks used in ADFA focus group xperiment

The following screens illustrate the steps used in the ADFA focus group experiment.

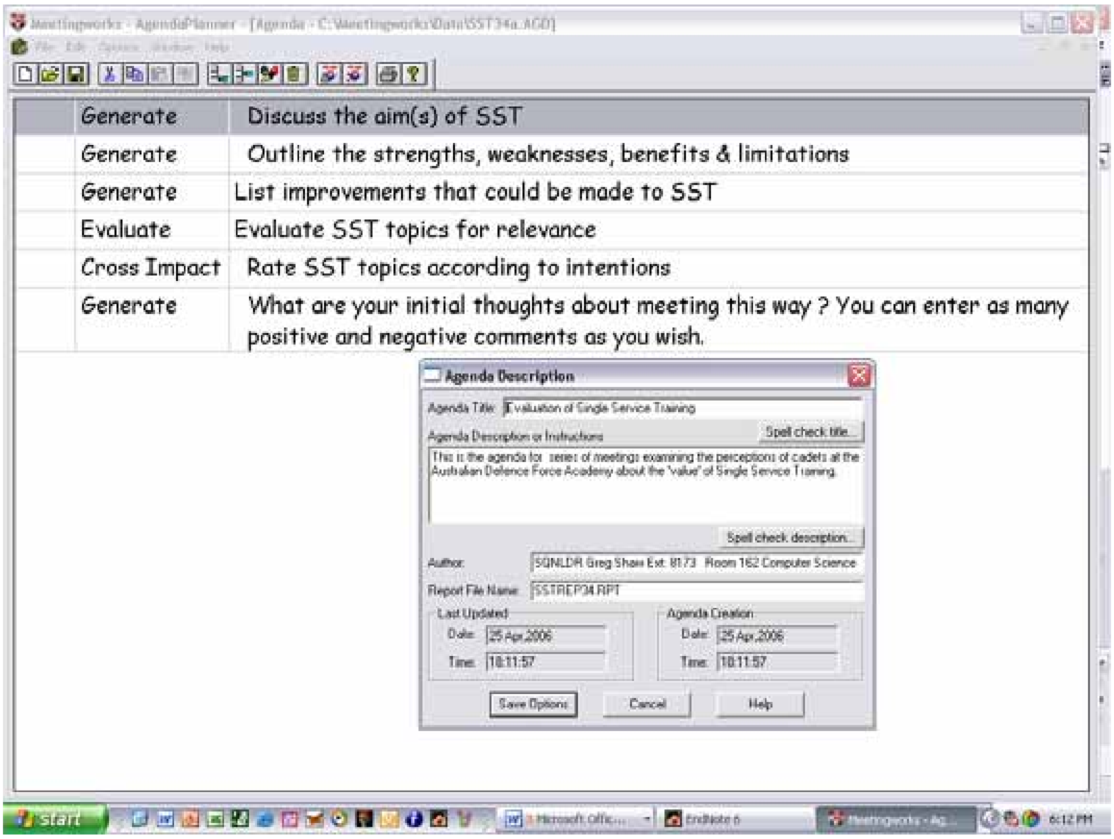


Figure 56 - Agenda planner with description screen

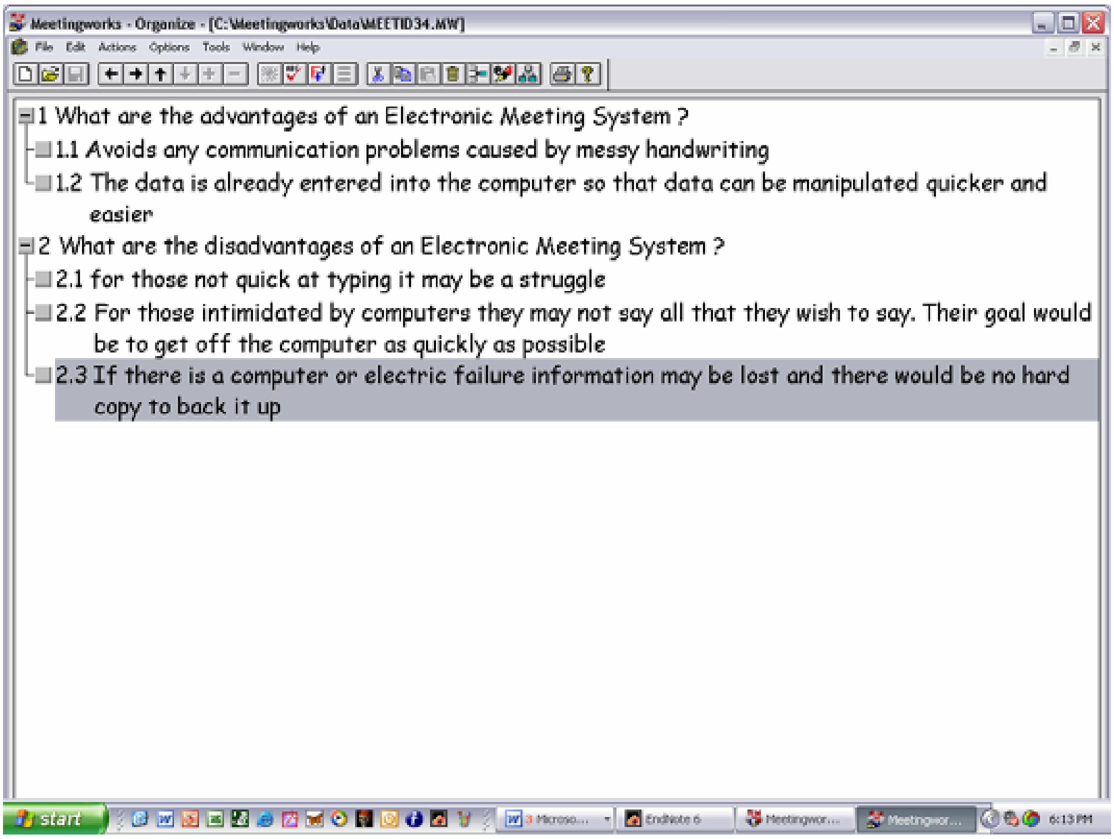


Figure 57 – Organise

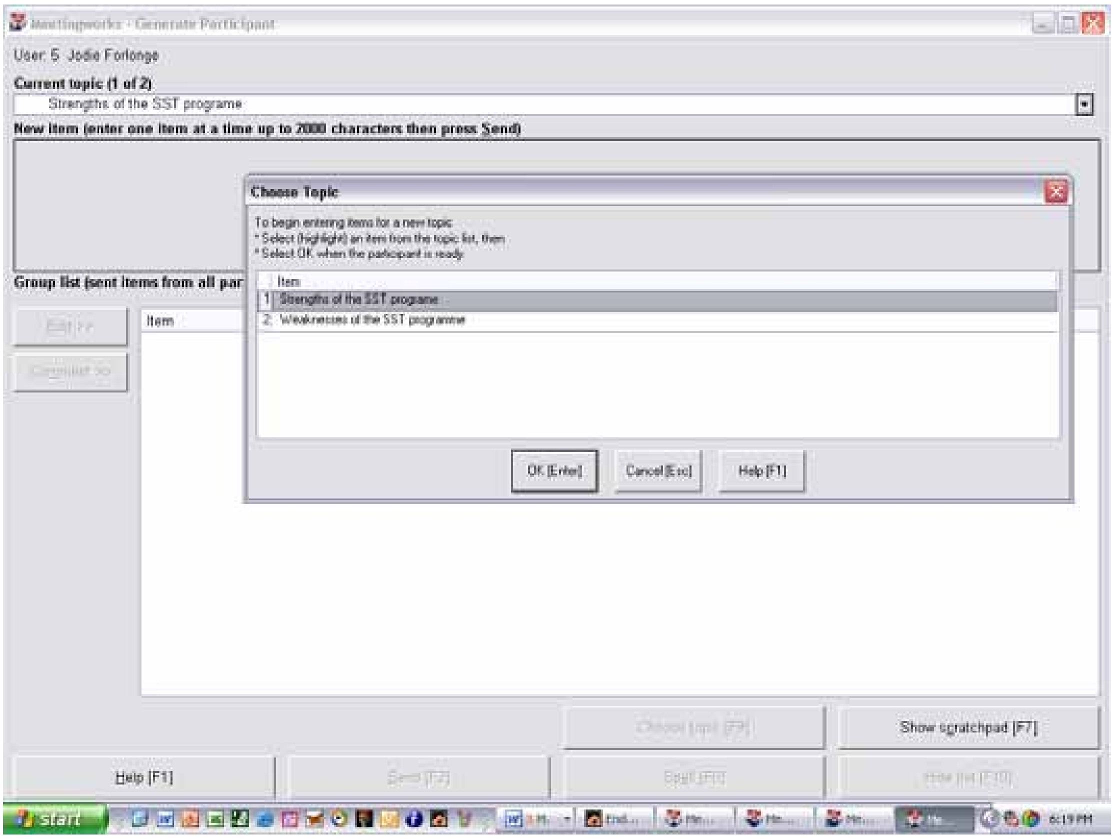


Figure 58 - Generate step with steps to select

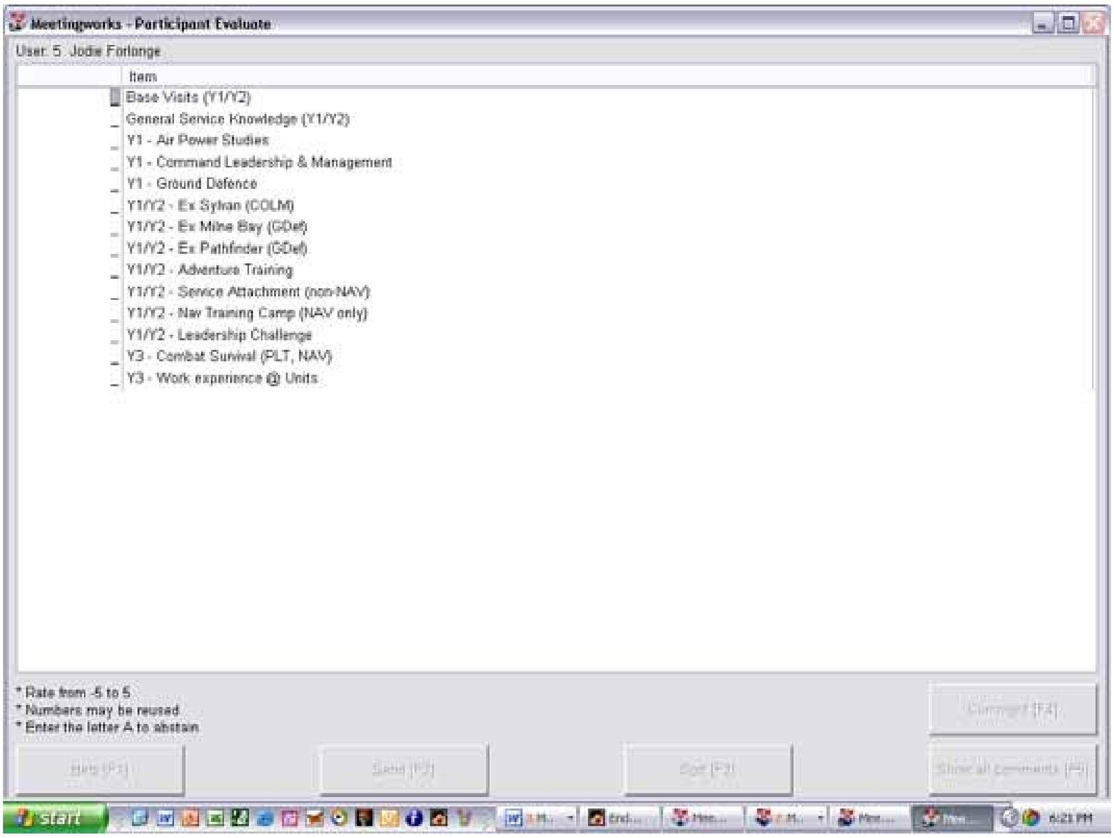


Figure 59 - Evaluate step

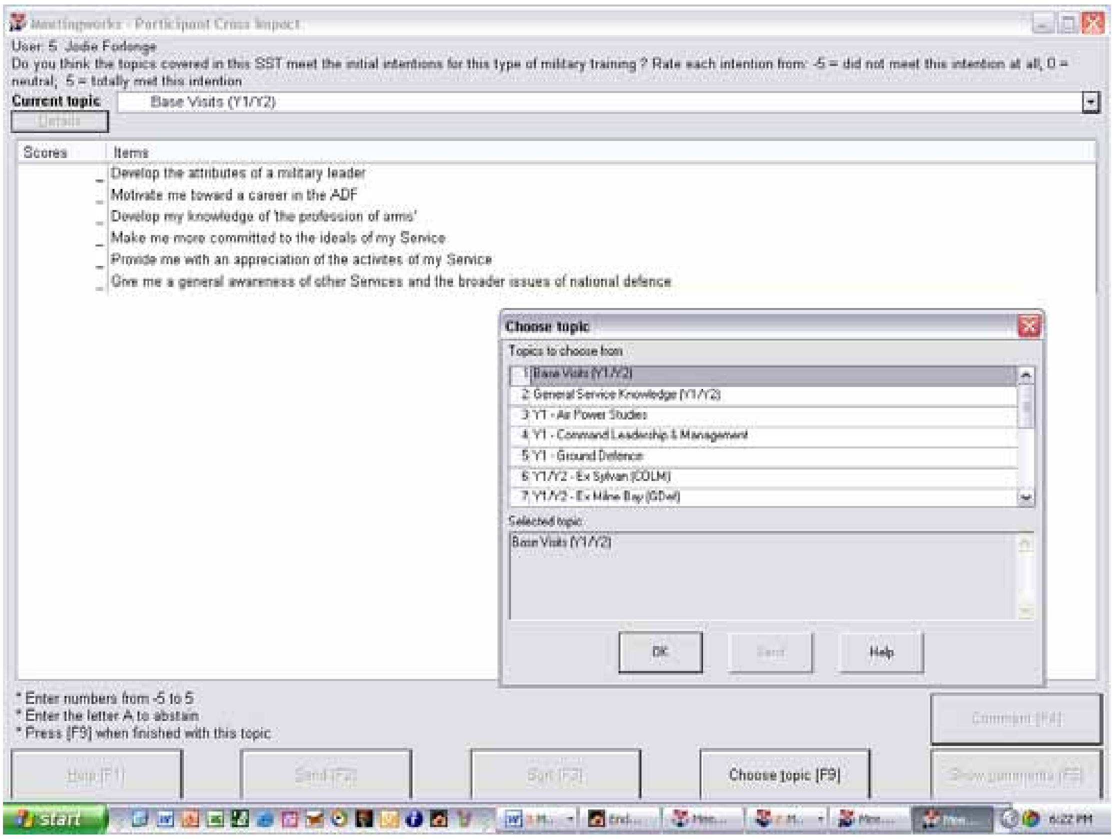


Figure 60 - Cross impact step with selection screen

Annex D - SST Group Instrument

Evaluation Questionnaire

Focus Group Participants

Single Service Training

Purpose of Questionnaire

This questionnaire forms part of a research project being conducted by Greg Shaw at the University of New South Wales.

This research is aimed at analysing the effectiveness of using computers to support group work and by completing this questionnaire you are giving valuable input to this investigation.

This aim of this questionnaire is to gather information about you, and your impressions about the meeting you have just completed. I am specifically interested in your impressions of 2 parts of the meeting: Generating ideas about the SST program, and evaluating the SST program topics for relevance and intention.

This questionnaire should not take more than 10 minutes to complete.

Guarantee of Confidentiality

The data from this questionnaire will be retained by the researcher. The identification number given to you by the group facilitator will link you to a specific group, and will protect your privacy by preventing unauthorised persons determining who completed the survey. Additionally, no individual will be identified in the thesis or any other report. Be assured, all your responses will be strictly confidential and anonymous.

Further Information: Further information can be obtained from:

Greg Shaw Ph: 02 62688173
e-mail: g-shaw@adfa.oz.au

Return of Survey

Please return this questionnaire to your facilitator, or for groups that do not physically meet, use the self addressed envelope to return the survey as soon as possible after the meeting to

Greg Shaw
School of Computer Science
University College, UNSW
Australian Defence Force Academy
CANBERRA, ACT, 2600

Thanks for your participation.

Part A : Biographical Information

1. What is your group identification number or name:

____

2. What is your age: _____ years
3. Are you? Male ❑ Female ❑
4. Service: Army ❑ Navy ❑ Air Force ❑ Other ❑ __________
5. Rank:

1st year	2nd year	3rd year	other
❑	❑	❑	❑

6. Category/Specialisation/Mustering: ________________________________
7. Degree enrolled:

BA	BSc	Btech	BE
❑	❑	❑	❑

Part B: Prior Experience and Skills

1. How many groups have you participated in where the aim was to generate ideas and evaluate options or ideas?

None	1-5 groups	5-10 groups	More than 10 groups
❑	❑	❑	❑

If you have not participated in this type of group before, please skip to **Question 3**

2. Based on your prior experiences, how confident are you of being able to undertake the following tasks:

   a. Generating ideas or options:

Totally unconfident | 1 ⁝ 2 ⁝ 3 ⁝ 4 ⁝ 5 ⁝ 6 ⁝ 7 | Totally confident

b. Evaluating ideas or options using a scale (such as -5 to +5):

Totally unconfident | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Totally confident

3. How many meetings have you participated in using an Electronic Meeting System(e.g. Meeting Ware, Grouputer)?

none	1-5 groups	5-10 groups	More than 10 groups
❑	❑	❑	❑

4. If you have used an Electronic Meeting System before, which system was it and how do you rate your experience with the system:
   System: ________________________

   Rating

   Totally disliked | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Totally liked

5. Do you have access to a personal computer in your Div or your workplace?
   Yes❑ No ❑

*If you do not have access to a computer please go to **Part C** of this questionnaire.*

6. How long have you been using the computer in the workplace?

less than 1 year	1 - 5 years	more than 5 years
❑	❑	❑

7. On average, how much time do you spend on the computer at work each week ?

Less than 1 hour	1-5 hours	5-10 hours	more than 10 hours
❑	❑	❑	❑

8. Do you have access to the Internet Yes❑ No ❑

9. On average, how much time do you accessing the Internet at work each week ?

Less than 1 hour	1-5 hours	5-10 hours	more than 10 hours
❑	❑	❑	❑

Part C: Impressions of the First Stages of the Meeting

In this section, I would like you to concentrate on the first stages of this meeting. Based on your experiences in this meeting, please complete the following questions about how you felt the first two stages went. You can record your response by placing the appropriate number in the box beside the question. The scale for these questions is a number from 1 to 7:

not at all | 1 | 2 | 3 | 4 | 5 | 6 | 7 | totally

Generating ideas

1. How satisfied are you with the process by which you generated ideas? ❑

Not at all | 1 | 2 | 3 | 4 | 5 | 6 | 7 | totally

2. How confident do you feel with the process used to generate ideas? ❑

3. How satisfied are you with the result of this part of the meeting? ❑

4. Does the group's result reflect your inputs? ❑

5. How satisfied are you with the quality of the group's result? ❑

For Internet Based Meetings

How long do you estimate you took to generate:

Aims of SST ___________minutes

Strengths & Weaknesses ___________minutes

Improvements to SST ___________minutes

Evaluating the Programme

The scale for these questions is a number from 1 to 7:

not at all	1	2	3	4	5	6	7	totally

6. How satisfied are you with the process by which you evaluated the programme? ❑

7. How confident do you feel with the process used to evaluate the SST programme ? ❑

8. How satisfied are you with the result of this part of the meeting? ❑

9. To what extent do you feel personally responsible for the correctness of the group's result? ❑

10. Does the group's result reflect your inputs? ❑

11. How confident are you that the group's result is correct? ❑

12. To what extent do you feel committed to the group's result? ❑

13. How satisfied are you with the quality of the group's result? ❑

For Internet Based Meetings
How long do you estimate you took to evaluate:

The importance/relevance of the SST topics ___________minutes

The intentions of the SST ___________minutes

Part D: Group relations

The next seven questions are related to the interaction of group members. For questions 14, 15 and 16, please indicate the response in the box aligned with the appropriate response. The scale for questions 17 to 20 is shown above the questions.

14. Do you feel that you are really apart of this work group ?

Really a part of this group	Included in most ways	Included in some ways, but not in others	Don't really feel I belong too much	Don't feel I belong at all
❑	❑	❑	❑	❑

15. If you had the chance to do the same kind of work in another group how would you feel about moving?

Would want very much to stay where I am	Would rather stay where I am than move	Would make no difference to me	Would rather move than stay where I am	Would want very much to move
❑	❑	❑	❑	❑

16. How does the group compare with other student groups on each of the following points? Use the following scale:

very much better | 1 ¦ 2 ¦ 3 ¦ 4 ¦ 5 ¦ 6 ¦ 7 | very much worse

The way people:

Get along together Work together Help each other

Please complete the following questions about the participation of group members. Use the scale listed below:

strongly disagree	1	2	3	4	5	6	7	strongly agree

17. The opinions of all group members were considered as equal

18. Every member of the group enjoyed the same group privileges

19. The group was controlled by the actions of a few members

20. Certain members had more influence on the group than others

Part E - Overall Impressions

The next three questions are concerned with your overall impression of the meeting. Please complete the following questions by placing the appropriate number in the box. The scale for these questions is:

strongly disagree	1	2	3	4	5	6	7	strongly agree

21. I would use this process again for evaluating a programme such as SST

22. Overall, I am satisfied with the result of the meeting

23. Using an Electronic Meeting System made the group more effective ❏

Part G: General Comments

Please feel free to comment on aspects of the meeting you have participated in, or how this meeting process may be improved for next time. You may use the back of this sheet if you require more room.

Once again , thank you for your participation. If you would like to receive a summary of the results, please print your name, mailing address and or e-mail address below :

ANNEX E – PARTICIPANT CONSENT FORM

Consent Form[1]

I understand that I will be taking part in an evaluation of Single Service Training and an experiment to assess the effectiveness of an Electronic Meeting System in this type of evaluation.

I also understand that:

a. If I am part of a group that meets over the Internet I will <u>not</u> communicate with other members of my group about the meeting except via the Electronic Meeting System.
b. All my comments, votes and evaluations will be anonymous and I will not be identified individually in any report arising from this study.
c. This study requires participation by a group composed of cadets from the same Service and year. If any member cannot attend the session, then a substitute can be used, or another time will need to be arranged for the entire group.
d. A questionnaire about the use of the Electronic Support System will be issued at the conclusion of the meeting.

I am participating in this experiment voluntarily and will do so honestly and to the best of my ability.

Printed Name Signature Date Group Id

[1] This consent form was adapted from a form developed by Dr Brian Whitworth. The original author is acknowledged.

ANNEX F – USER MANUAL

Single Service Training Focus Groups

Meeting Works is designed to operate in the Windows environment (in the meeting room) or via the Internet browser (in the asynchronous mode). These instructions provide you with additional information about the steps you will complete during the meeting. It is also possible to get on-line help at any time by pressing the `F1` key or the `HELP` button.

Any further questions or queries should be directed to Squadron Leader Greg Shaw on ext. 8173 or Room 162.

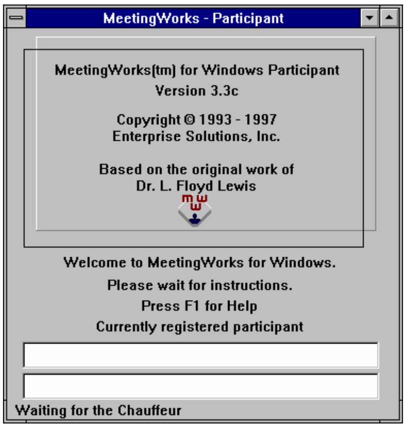
General Windows Techniques

In both the meeting room and Internet environment, it is possible to cut and paste selections of text, delete and insert text and use the 'standard' control functions (such as `CNTRL+C` to copy text and `CNTRL+V` to insert Clipboard selection).

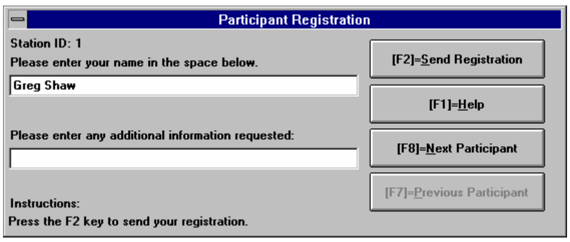
Instructions - Meeting Room

Login to the System

- To participate in the session you need to registered. The welcome screen looks like this:



- You will be asked to enter information about yourself. When the welcome screen changes to the following screen, you need to enter your name. You do not need to enter any additional information.

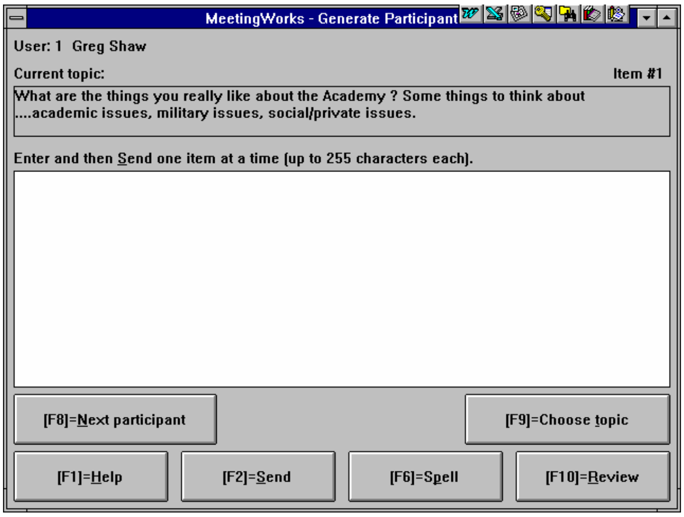


- After entering your name, press `F2` to send the information and then close the window by clicking on the X in the top right hand corner of the window.

Generating Ideas and Options

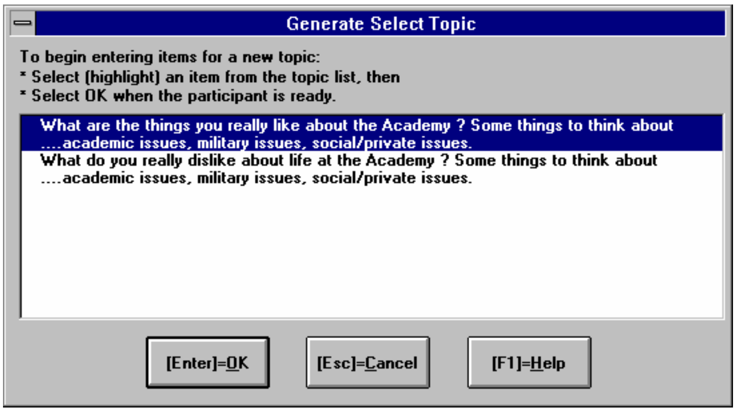
The '*Generate'* tool is used to gather ideas and comments from the group members. When it is time to use *Generate*, a display like the one below will appear. It has the following features:

- Your name and the current topic are shown at the top of the screen
- The middle of the screen (the white box area) is where you can enter up to 256 characters of text
- You can spell check your entry by using the `spell` button or `f6`
- After entering each item, press the `send` button or `f2`
- You can continue to enter items until the time is up



Multiple Topics

If there are multiple topics, the `CHOOSE TOPIC` button will appear in the lower right hand section of the screen. Press the button, or `F9`, select (highlight) the next topic you need to work on, and then click on the `OK` button. The *Generate* screen will return with the new topic in top section



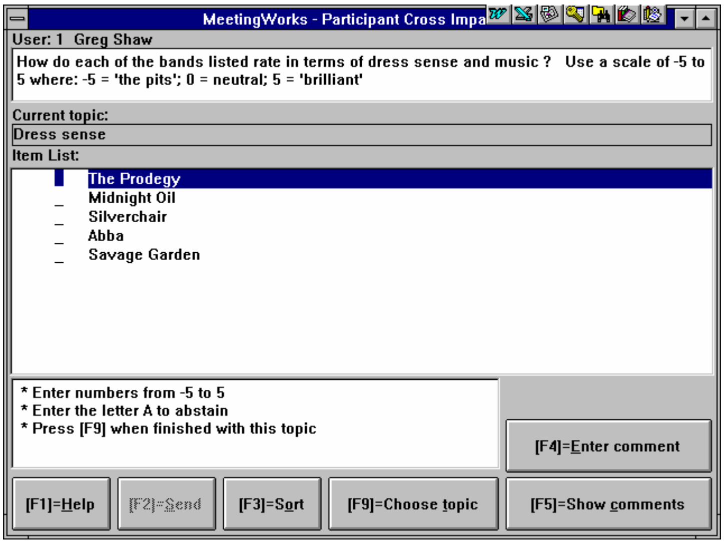
Evaluating Bands and Training

The module you will be using is the *Cross Impact* module. This will allow you to systematically compare 2 lists. When it is time to use *Cross Impact*, a display like the one below will appear. It has the following features:

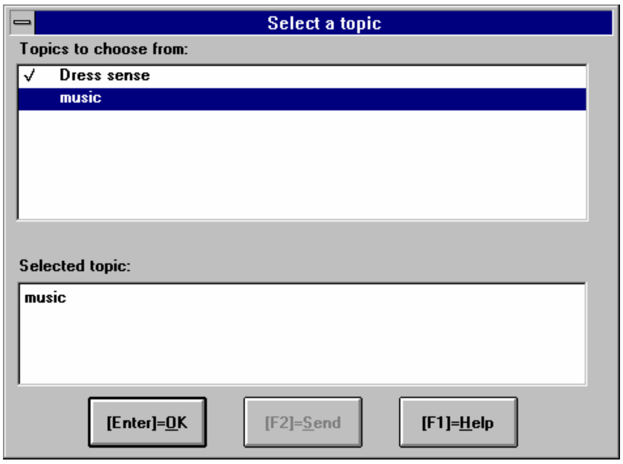
- Your name and the relationship between the lists are shown at the top of the screen. In this example, we are looking at rating the dress sense and music of a number of bands
- The second section shows the current topic (dress sense in this example)
- The middle section (the white box area) lists all the items under consideration (the bands in this example). There is also space to the left of the list items where you can enter a score from -5 to 5 for each band's dress sense
- The lower left hand box provides the rating scale and instructions

You can enter comments about the list item or score by using the `enter comment` button or `f4`

You can sort the scores by using the `SORT` button or `F3`



- After you complete assessing the items, you can bring up the next topic by clicking on the `CHOOSE TOPIC` button or `F9`. Press the button, or `F9`, select (highlight) the next topic and then the OK button. The screen looks like this:

- 

- At the end of all the topics, send the results by clicking the `SEND` button or `F2`.

Note for this Step:

- If you did not participate in a Single Service Activity then Abstain (select `A` rather than a number from -5 to +5) from evaluating that activit

Single Service Training Focus Groups - Mixed Mode

Meeting Works is designed to operate in the Windows environment (in the meeting room) or via the Internet browser (in the asynchronous mode). These instructions provide you with additional information about the steps you will complete during the meeting. It is also possible to get on-line help at any time by pressing the `F1` key or the `HELP` button.

Any further questions or queries should be directed to Squadron Leader Greg Shaw on ext. 8173 or Room 162.

General Windows Techniques

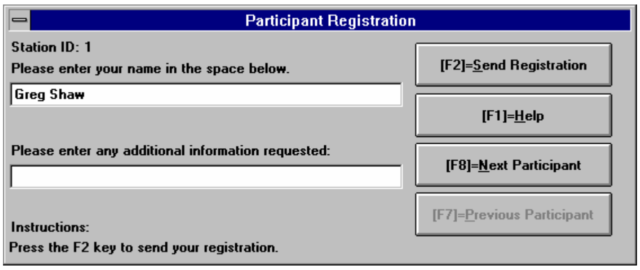
In both the meeting room and Internet environment, it is possible to cut and paste selections of text, delete and insert text and use the 'standard' control functions (such as `CNTRL+C` to copy text and `CNTRL+V` to insert Clipboard selection).

Instructions - Meeting Room

Login to the System

- To participate in the session you need to registered. The welcome screen looks like this:

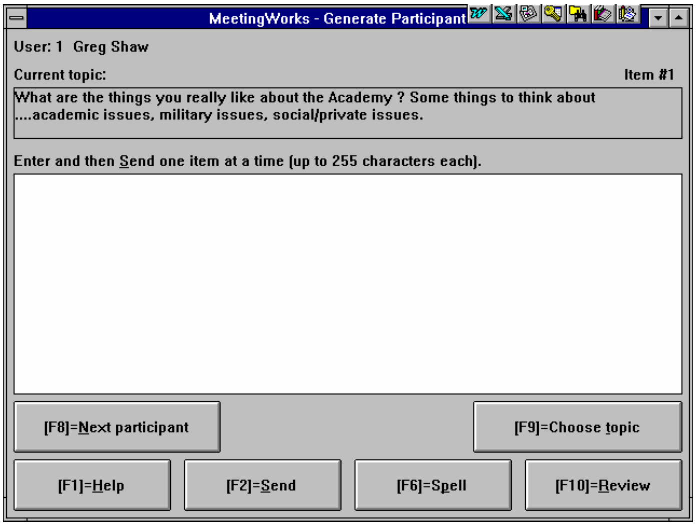
- You will be asked to enter information about yourself. When the welcome screen changes to the following screen, you need to enter your name. You do not need to enter any additional information.



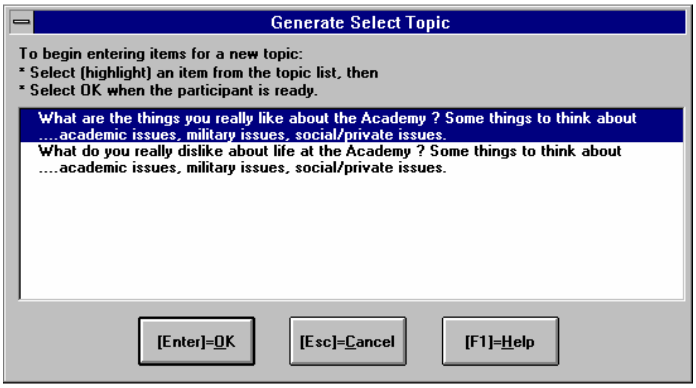
- After entering your name, press `F2` to send the information and then close the window by clicking on the X in the top right hand corner of the window.

Generating Ideas and Options
The '*Generate'* tool is used to gather ideas and comments from the group members. When it is time to use *Generate*, a display like the one below will appear. It has the following features:

- Your name and the current topic are shown at the top of the screen
- The middle of the screen (the white box area) is where you can enter up to 256 characters of text
- You can spell check your entry by using the `spell` button or `f6`
- After entering each item, press the `send` button or `f2`
- You can continue to enter items until the time is up



Multiple Topics
If there are multiple topics, the `CHOOSE TOPIC` button will appear in the lower right hand section of the screen. Press the button, or `F9`, select (highlight) the next topic you need to work on, and then click on the `OK` button. The *Generate* screen will return with the new topic in top section

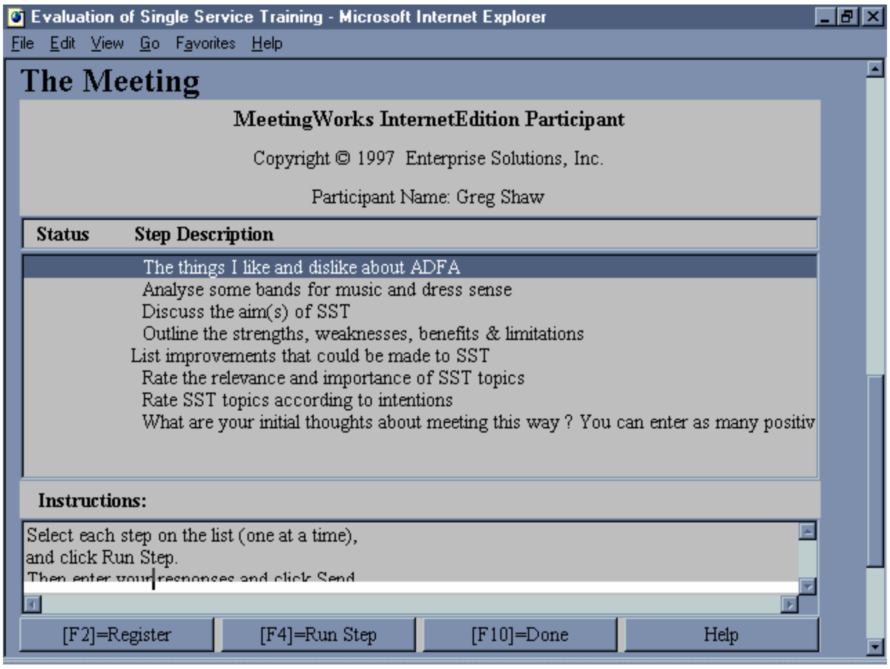


Instructions - Internet

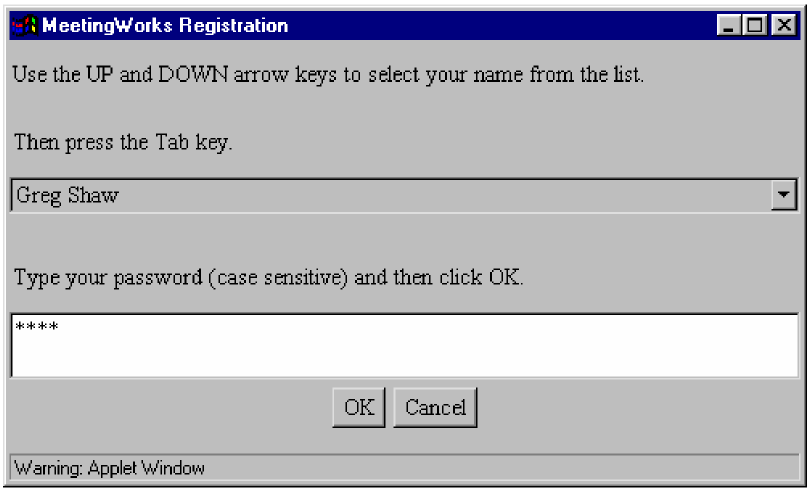
Access the Web page and Login to the System

- The meeting is controlled through a Web page. To access the page that lists all the meetings (including yours), open the Web browser and type the URL http://www.cs.adfa.oz.au/~mww.
- Your group will be listed in the table on this page. Your group is listed under the 'Meeting via the Internet' column. Select your year and it is directly linked to you own meeting home page. It takes a short while for the page to load the first time so please be patient.

- To participate in the session you need to registered. Click on the link labelled



- The Meeting' or scroll down to the agenda. It should look like this:



- 'To login to the meeting, click `Register`. The Registration dialog box displays. Select your name from the list, then press the `TAB` key, type your password as instructed and click `OK`. Remember the password is case sensitive.

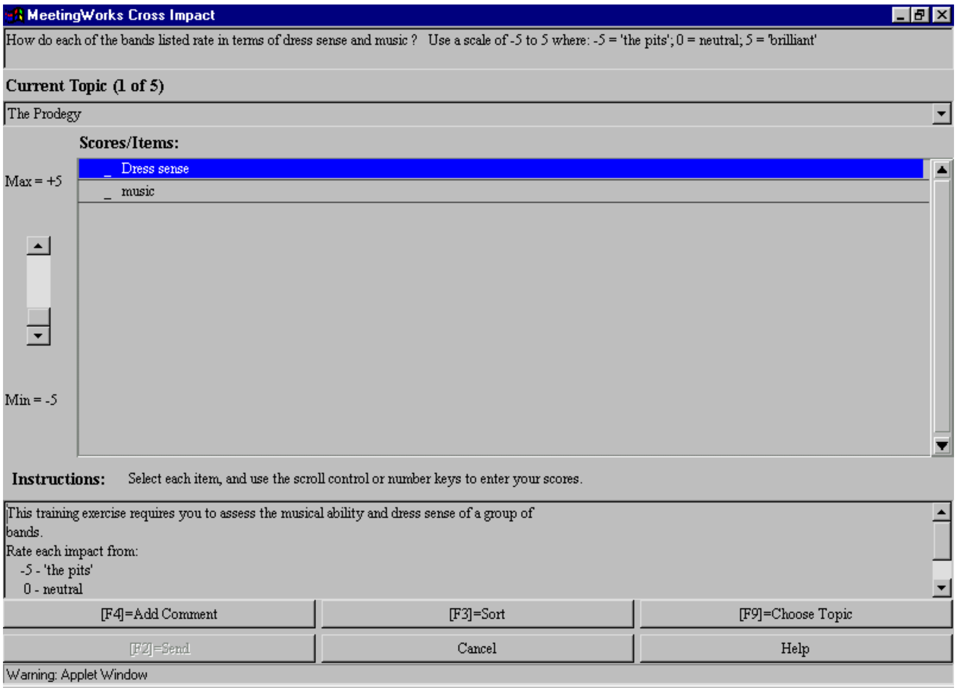
💻 To run each step - highlight the step and click `RUN STEP` or F4

Evaluating Bands and Training

- When you are required to evaluate bands or SST, the module you will be using is the *Cross Impact* module. This allows you to systematically compare 2 lists. When it is time to use *Cross Impact*, a display like the one below will appear. It is best to maximise the screen once it is open. The *Cross Impact* screen has the following features
- The relationship between the lists is shown at the top of the screen. In this example, we are looking at rating the dress sense and music of a number of bands
- The second section shows the current topic (dress sense in this example)
- The middle section lists all the items under consideration (the bands in this example). There is also space to the left of the list items where you can enter a score from -5 to 5 for each band's dress sense or A (abstain from the vote)
- The lower box provides the rating scale and instructions

💻 You can enter comments about the list item or score by using the `enter comment` button or `f4`

💻 You can sort the scores by using the `SORT` button or `F3`



- After you complete assessing the items, you can bring up the next topic by clicking on the `CHOOSE TOPIC` button or `F9`. Press the button, or `F9`, select (highlight) the next topic and then the OK button.

- At the end of all the topics, send the results by clicking the `SEND` button or `F2`.

Re-evaluating the List

- You can go back and revote at any time during the last 2.5 days of the experiment by reopening the step. Click on the step you wish to reopen and then click on `RUN STEP`. A window saying have completed the step will be displayed. Click `OK` and the `RUN STEP` again and you can modify your votes or add or modify your comments.

Note for this Step:

- If you did not participate in a Single Service Activity then Abstain (select `A` rather than a number from -5 to +5) from evaluating that activity.

ANNEX G – EXAMPLE OF FOCUS GROUP REPORT

Evaluation of Single Service Training

Table of Contents

Introduction

This is one of a number of meetings held to evaluate cadets' perceptions of Single Service Training. This report is an unedited version of a final report on this group's work. There will also be a consolidated report with the results from all the meetings.

Session Participants

The participants in this session were:
Amanda Wearmouth
Justine Archer
Adam O'Grady
Sam Dale

The Aims of Single Service Training

Participants were asked to list what they thought was the aim or the aims of SST. They could list as many aims as they wished.

Unedited List of Aims

1. What do you think is the aim (or aims) of Single Service Training ? You can list as many aims as you wish.
   a. Motivation
   b. to gain an appreciation of the RAN
   c. Experience/Exposure
   d. To introduce us to our service
   e. EXpose adfa MIDN to the Navy
   f. To find out about our career
   g. limited training for future job
   h. Learn what it will be like out in the fleet
   i. To cut down on training time we would require once leaving the academy
   j. Get away from the academy
   k. To teach basic skills needed out in the fleet
   l. get a feel for how the navy runs
   m. motivation
   n. to meet personnel from the various branches
   o. Exposure to Naval personnel and our future positions

This list will be edited using the Organize tool and the final copy will be included in the combined report.

Strengths, Weaknesses, Benefits and Limitations

Participants were asked to consider the SST they had just completed in terms of the strengths of the program, the weaknesses, the benefits they thought the program offered them, and the perceived limitations of the program. The participants could submit any number of ideas.

Unedited List of Strengths, Weaknesses, Benefits and Limitations

1. Benefits of SST
   a. Gives a reasonable taste of the Navy - shows that it is different from ADFA
   b. Knowing more about the service we joined
   c. Different environment and subjects specific to our service
   d. Does provide motivation
   e. more motivated to get out in the fleet
   f. Skills gained
   g. see what our job will be
   h. Meet people
   i. Exposure to naval personnel - especially JS
   j. getr tatse for life at see
   k. Separates the commited MIDN from those who aren't quite as commited
   l. More salty than ADFA
2. Limitations of SST
   a. ADFA MIDN untrained, and therefore unable to do anything useful
   b. Rushed
   c. Positions of useful courses are limited, and so a lot of the time is wasted
   d. Time constraints
   e. Not enough time to complete courses such as JNCC (Junior Naval COmmand Course)
   f. limited in what we can do on sst due to previous training
   g. Some bases not equiped or happy to deal with us
   h. Often not organised - more a matter of "We'll send them to Albatross, they can look after them."
   i. Can be demotivational - such as training cruise on HMAS Tobruk
   j. Or demotivational when you dont have anything to do
   k. held when fleet is to "busy" to help ADFA MIDN
   l. Negative perceptions of ADFA MIDN in the fleet

This list will be edited using the Organize tool and the final copy will be included in the combined report.

Improvements to SST

Participants were asked to consider how they thought SST might be improved. The participants could as many suggestions as they wished.

Unedited List of Improvements

1. What improvements do you think could be made to SST? Enter as many improvements as you wish.
    a. More input from cadets and better planning
    b. devote more time to sst
    c. More acceptance of academy cadets from naval establishments
    d. have SST catered to each branch - ie SST for SO, Seaman Officer, AVO, MEO, WEEO
    e. Actually organise specific activities, rather than the general - you'll be spending two weeks there, not sure what you'll be doing.
    f. teach only what is relevant
    g. Allow MIDN to gain qualifications while on SST - like coxswains certificate, helmsmans
    h. devote more money and staff
    i. More time perhaps join both end of year and begining together so we can do something worthwhile - especially for 3rd Yr
    j. ensure the staff are experinced eg know what they are talking about
    k. Have longer SST for 1A so that MIDN can learn more
    l. Send MIDN on courses which will be of benefit to our future careers. Eg, AVMED, Helo Escape Course, Advanced NBCD, etc etc.
    m. More sea time
    n. Better organisation on the whole
    o. Better structure, actually set up a syllabus.
    p. begin courses such SUAC while at ADFA, such as Seaman Officers do SEAAC
    q. Dont teach us stuff we've already been taught
    r. Have an SO3 Navy that is interested in cadets and not promotion
    s. Listen to the suggestions of MIDN.
    t. Give us leave if there is nothing constructive to do.
    u. ask previous MIDN that are now in the fleet what was relevant and what could have been helpful,

This list will be edited using the Organize tool and the final copy will be included in the combined report.

Rating SST Topics for Relevance and Importance

A list of the subjects undertaken in the Jan/Feb SST was rated against two criteria: relevance and importance. The scale of +5 to -5 was used, where:

+5 = very important/very relevant
0 = neutral
-5 = not important/not relevant

Variability is a measure of agreement. A high percentage indicates low agreement.

List Relationship:

How important and relevant do you think the topics you covered during SST were to you as a cadet at ADFA. Rate each aspect on a -5 to 5 scale where: Rate each topic from -5 to +5, where -5 = NOT IMPORTANT AT ALL; 0 = NEUTRAL; and +5 = VERY IMPORTANT

Topic: Importance

Item	Average	Variability
Y3 - SEAAC Phase 1	5.00	0%
Y2 - Service Attachment (May break)	3.75	22%
Y1 - Basic Seamanship, firefighting, NBC ...	4.25	17%
Y1 -Visit Shore Establishments	3.25	17%
Y1 - General Service Knowledge (organisation, uniforms ...)	3.00	32%
Y2 - Training Cruise	3.00	47%
Y1/Y2 - Survival/Adventure Training (May Break)	3.00	24%
Y1 - Survival at Sea	3.00	24%
Y1 - Ship Safety	2.75	9%
Y2 - Leadership Challenge	1.25	26%
Y1 - Introduction to Naval History	1.50	41%
Y3 - HMAS Creswell (OOD training ...)	0.50	50%
Total:	34.25	

Topic: Relevance

Item	Average	Variability
Y3 - SEAAC Phase 1	5.00	0%
Y2 - Service Attachment (May break)	3.25	17%
Y1 - Basic Seamanship, firefighting, NBC ...	2.50	30%
Y1 -Visit Shore Establishments	3.00	0%
Y1 - General Service Knowledge (organisation, uniforms ...)	3.25	22%
Y2 - Training Cruise	3.25	30%
Y1/Y2 - Survival/Adventure Training (May Break)	2.00	14%
Y1 - Survival at Sea	1.75	67%
Y1 - Ship Safety	1.25	61%
Y2 - Leadership Challenge	1.75	41%
Y1 - Introduction to Naval History	1.00	37%
Y3 - HMAS Creswell (OOD training ...)	0.00	40%

Total:	28.00	

Item: Y3 - SEAAC Phase 1

Topic	Average	Variability
Importance	5.00	0%
Relevance	5.00	0%
Total:	10.00	

Item: Y2 - Service Attachment (May break)

Topic	Average	Variability
Importance	3.75	22%
Relevance	3.25	17%
Total:	7.00	

Item: Y1 - Basic Seamanship, firefighting, NBC ...

Topic	Average	Variability
Importance	4.25	17%
Relevance	2.50	30%
Total:	6.75	

Item: Y1 -Visit Shore Establishments

Topic	Average	Variability
Importance	3.25	17%
Relevance	3.00	0%
Total:	6.25	

Item: Y1 - General Service Knowledge (organisation, uniforms ...)

Topic	Average	Variability
Importance	3.00	32%
Relevance	3.25	22%
Total:	6.25	

Item: Y2 - Training Cruise

Topic	Average	Variability
Importance	3.00	47%
Relevance	3.25	30%
Total:	6.25	

Item: Y1/Y2 - Survival/Adventure Training (May Break)

Topic	Average	Variability
Importance	3.00	24%
Relevance	2.00	14%
Total:	5.00	

Item: Y1 - Survival at Sea

Topic	Average	Variability
Importance	3.00	24%
Relevance	1.75	67%

Total:	4.75	

Item: Y1 - Ship Safety

Topic	Average	Variability
Importance	2.75	9%
Relevance	1.25	61%
Total:	4.00	

Item: Y2 - Leadership Challenge

Topic	Average	Variability
Importance	1.25	26%
Relevance	1.75	41%
Total:	3.00	

Item: Y1 - Introduction to Naval History

Topic	Average	Variability
Importance	1.50	41%
Relevance	1.00	37%
Total:	2.50	

Item: Y3 - HMAS Creswell (OOD training ...)

Topic	Average	Variability
Importance	0.50	50%
Relevance	0.00	40%
Total:	0.50	

Participants during the evaluation entered the following comments:

1 Importance

Y3 - SEAAC Phase 1

5.00 Although the course is very good, it should be held in Sydney as the lecturers kept saying - oh if we were in Sydney we could show you this and also items were not shown because they were in Sydney and we could not grasp concepts

Y2 - Service Attachment (May break)

2.00 For me personally, I was sent to sea, as a pilot this isn't very applicable to my future career. It was good however to have a chance (probably the only in my career) to see how sailors/seamen live. Also spent 1 wk at ALBATROSS.Could have done it in a day

4.00 very movtavational

5.00 It was irrelevant sending a female to an all male ship if females normally don't serve there

Y1 - Basic Seamanship, firefighting, NBC ...

3.00 Very neccessay but was very quick and forgot alot over the holidays before going to sea

4.00 Important for everyone.

5.00 needed for sea time

Y1 -Visit Shore Establishments

2.00 Was a very good introduction to what the navy was about

Y1 - General Service Knowledge (organisation, uniforms ...)

5.00 Good as the fleet and adfa differ a lot, good to know how the navy does things

Y2 - Training Cruise

-1.00 Not much to do with Aviation.

4.00 Fantasitic Experince

4.00 Very demotivating when on Tobruk

5.00 good, must be taken for what it is can't be seen as the real navy

Y1/Y2 - Survival/Adventure Training (May Break)

2.00 While the skills learnt are not relevant to the RAN there are wide benefit to leadership capabilities

5.00 Was relevant for the Navy - ie went sailing on Alexander

Y1 - Survival at Sea

2.00 Perhaps could have been put closer to our time at sea

3.00 could have been closer to sea time

Y2 - Leadership Challenge

0.00 Is this classed as SST?

Y1 - Introduction to Naval History

-2.00 Amount of time spent on this was far too much.

2.00 Motivational

3.00 Good to have background in RAN history but not as much time needed

Y3 - HMAS Creswell (OOD training ...)

-2.00 Actually spent 2 wks at ALBATROSS, 1 wk on MV WYUNA, 1 wk boatwork at CRESWELL. Nothing really constructive happened the whole time.

3.00 Had seatime and specific branch training, had time on motor boats, and sail boats which took two weeks, could have been greatly condensed

Abs. 2 weeks at Albatross - They wern't prepared for us and had nothing for us to do 1 week Wyuna - not very motivational to supply will never serve on ship and some activities where therefore pointles Crewell Boatwork could have been done in 2 days

2 Relevance

Y2 - Training Cruise

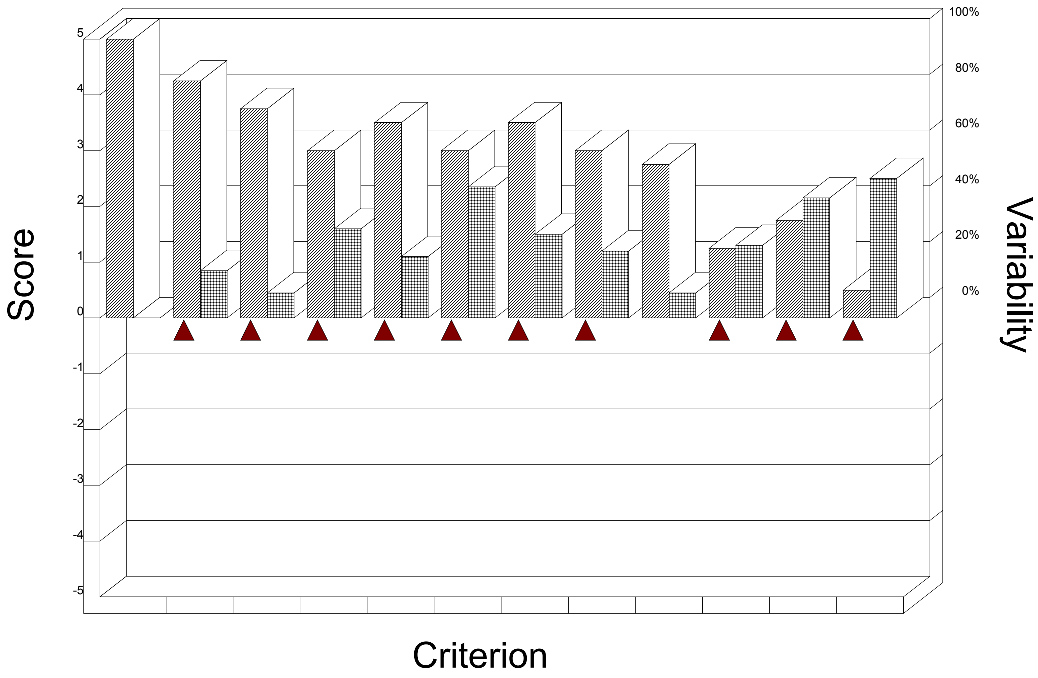
5.00 excellent if given the chance

Y2 - Leadership Challenge

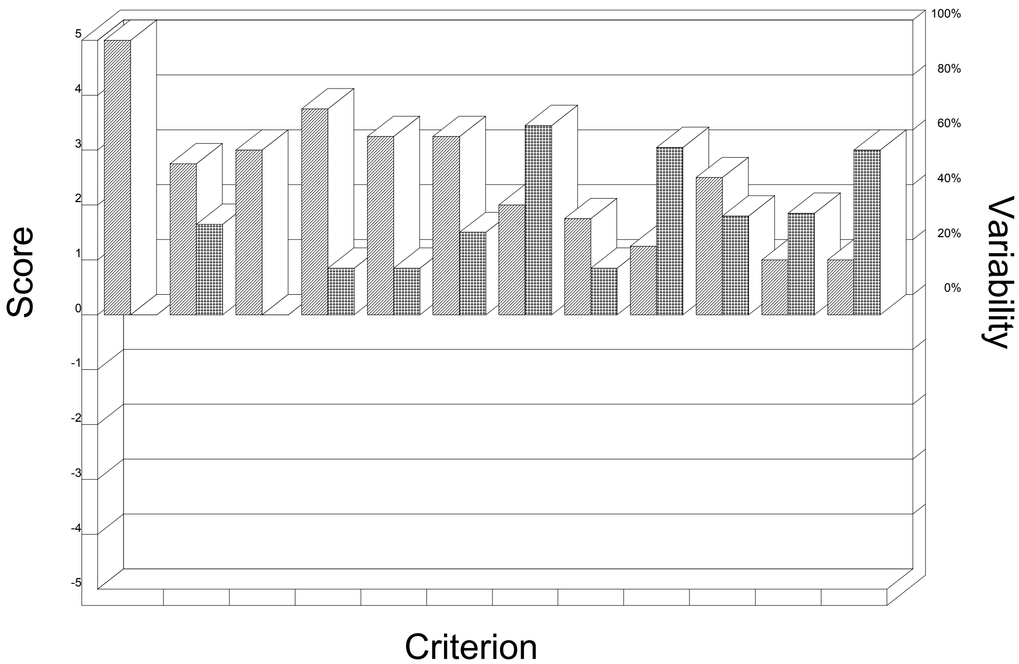
0.00 Is this SST?

Summary charts of each criterion:

Summary Graph: Importance



Summary Graph: Relevance



Rating SST According to Intentions

Initially, SST was seen as having the potential to meet a number of different intentions. Each topic was rated against these intentions. The scale of +5 to -5 was used, where:

+5 = very important
0 = neutral
-5 = not important at all

Variability is a measure of agreement. A high percentage indicates low agreement.

List Relationship:

Do you think the topics covered in this SST meet the initial intentions for this type of military training ? Rate each intention from: -5 = did not meet this intention at all; 0 = neutral; 5 = totally met this intention

Topic: Make me more committed to the ideals of my Service

Item	Average	Variability
Y2 - Service Attachment (May break)	3.75	17%
Y2 - Training Cruise	4.00	0%
Y1 - Introduction to Naval History	3.50	17%
Y3 - SEAAC Phase 1	5.00	0%
Y1 - General Service Knowledge (organisation, uniforms ...)	3.25	26%
Y1 - Basic Seamanship, firefighting, NBC ...	3.00	14%
Y1 -Visit Shore Establishments	2.50	10%
Y3 - HMAS Creswell (OOD training ...)	3.00	20%
Y1 - Survival at Sea	2.50	10%
Y1/Y2 - Survival/Adventure Training (May Break)	0.00	71%
Y1 - Ship Safety	2.25	9%
Y2 - Leadership Challenge	0.00	37%
Total:	32.75	

Topic: Motivate me toward a career in the ADF

Item	Average	Variability
Y2 - Service Attachment (May break)	3.75	17%
Y2 - Training Cruise	3.75	22%
Y1 - Introduction to Naval History	2.25	17%
Y3 - SEAAC Phase 1	3.00	0%
Y1 - General Service Knowledge (organisation, uniforms ...)	1.75	26%
Y1 - Basic Seamanship, firefighting, NBC ...	2.50	22%
Y1 -Visit Shore Establishments	3.50	10%
Y3 - HMAS Creswell (OOD training ...)	3.00	20%
Y1 - Survival at Sea	1.75	30%
Y1/Y2 - Survival/Adventure Training (May Break)	2.75	22%
Y1 - Ship Safety	1.50	10%
Y2 - Leadership Challenge	1.50	30%

Total:	31.00	

Topic: Provide me with an appreciation of the activites of my Service

Item	Average	Variability
Y2 - Service Attachment (May break)	3.75	17%
Y2 - Training Cruise	4.00	14%
Y1 - Introduction to Naval History	2.25	22%
Y3 - SEAAC Phase 1	4.00	0%
Y1 - General Service Knowledge (organisation, uniforms ...)	3.50	22%
Y1 - Basic Seamanship, firefighting, NBC ...	3.50	17%
Y1 -Visit Shore Establishments	4.00	0%
Y3 - HMAS Creswell (OOD training ...)	2.50	10%
Y1 - Survival at Sea	3.00	0%
Y1/Y2 - Survival/Adventure Training (May Break)	-2.00	42%
Y1 - Ship Safety	3.00	24%
Y2 - Leadership Challenge	-2.75	36%
Total:	28.75	

Topic: Develop my knowledge of 'the profession of arms'

Item	Average	Variability
Y2 - Service Attachment (May break)	3.75	9%
Y2 - Training Cruise	3.50	17%
Y1 - Introduction to Naval History	3.50	22%
Y3 - SEAAC Phase 1	2.00	0%
Y1 - General Service Knowledge (organisation, uniforms ...)	2.75	36%
Y1 - Basic Seamanship, firefighting, NBC ...	2.75	9%
Y1 -Visit Shore Establishments	2.00	60%
Y3 - HMAS Creswell (OOD training ...)	1.50	10%
Y1 - Survival at Sea	0.75	33%
Y1/Y2 - Survival/Adventure Training (May Break)	2.00	24%
Y1 - Ship Safety	1.25	26%
Y2 - Leadership Challenge	0.00	42%
Total:	25.75	

Topic: Develop the attributes of a military leader

Item	Average	Variability
Y2 - Service Attachment (May break)	1.00	20%
Y2 - Training Cruise	0.75	46%
Y1 - Introduction to Naval History	1.50	22%
Y3 - SEAAC Phase 1	3.00	0%
Y1 - General Service Knowledge (organisation, uniforms ...)	0.50	33%
Y1 - Basic Seamanship, firefighting, NBC ...	0.00	62%
Y1 -Visit Shore Establishments	-1.75	48%

Item	Average	Variability
Y3 - HMAS Creswell (OOD training ...)	1.00	20%
Y1 - Survival at Sea	2.50	10%
Y1/Y2 - Survival/Adventure Training (May Break)	2.25	26%
Y1 - Ship Safety	-0.50	54%
Y2 - Leadership Challenge	4.25	9%
Total:	14.50	

Topic: Give me a general awareness of other Services and the broader issues of national defence

Item	Average	Variability
Y2 - Service Attachment (May break)	1.25	43%
Y2 - Training Cruise	0.00	62%
Y1 - Introduction to Naval History	2.00	14%
Y3 - SEAAC Phase 1	-4.00	20%
Y1 - General Service Knowledge (organisation, uniforms ...)	0.75	67%
Y1 - Basic Seamanship, firefighting, NBC ...	0.00	51%
Y1 -Visit Shore Establishments	1.00	51%
Y3 - HMAS Creswell (OOD training ...)	-0.67	66%
Y1 - Survival at Sea	-3.25	41%
Y1/Y2 - Survival/Adventure Training (May Break)	0.25	71%
Y1 - Ship Safety	-2.75	38%
Y2 - Leadership Challenge	-0.75	85%
Total:	-6.17	

Item: Y2 - Service Attachment (May break)

Topic	Average	Variability
Make me more committed to the ideals of my Service	3.75	17%
Motivate me toward a career in the ADF	3.75	17%
Provide me with an appreciation of the activites of my Service	3.75	17%
Develop my knowledge of 'the profession of arms'	3.75	9%
Develop the attributes of a military leader	1.00	20%
Give me a general awareness of other Services and the broader issues of national defence	1.25	43%
Total:	17.25	

Item: Y2 - Training Cruise

Topic	Average	Variability
Make me more committed to the ideals of my Service	4.00	0%
Motivate me toward a career in the ADF	3.75	22%
Provide me with an appreciation of the activites	4.00	14%

of my Service		
Develop my knowledge of 'the profession of arms'	3.50	17%
Develop the attributes of a military leader	0.75	46%
Give me a general awareness of other Services and the broader issues of national defence	0.00	62%
Total:	16.00	

Item: Y1 - Introduction to Naval History

Topic	Average	Variability
Make me more committed to the ideals of my Service	3.50	17%
Motivate me toward a career in the ADF	2.25	17%
Provide me with an appreciation of the activites of my Service	2.25	22%
Develop my knowledge of 'the profession of arms'	3.50	22%
Develop the attributes of a military leader	1.50	22%
Give me a general awareness of other Services and the broader issues of national defence	2.00	14%
Total:	15.00	

Item: Y3 - SEAAC Phase 1

Topic	Average	Variability
Make me more committed to the ideals of my Service	5.00	0%
Motivate me toward a career in the ADF	3.00	0%
Provide me with an appreciation of the activites of my Service	4.00	0%
Develop my knowledge of 'the profession of arms'	2.00	0%
Develop the attributes of a military leader	3.00	0%
Give me a general awareness of other Services and the broader issues of national defence	-4.00	20%
Total:	13.00	

Item: Y1 - General Service Knowledge (organisation, uniforms ...)

Topic	Average	Variability
Make me more committed to the ideals of my Service	3.25	26%
Motivate me toward a career in the ADF	1.75	26%
Provide me with an appreciation of the activites of my Service	3.50	22%
Develop my knowledge of 'the profession of arms'	2.75	36%
Develop the attributes of a military leader	0.50	33%
Give me a general awareness of other Services and the broader issues of national defence	0.75	67%

Total:	12.50	

Item: Y1 - Basic Seamanship, firefighting, NBC ...

Topic	Average	Variability
Make me more committed to the ideals of my Service	3.00	14%
Motivate me toward a career in the ADF	2.50	22%
Provide me with an appreciation of the activites of my Service	3.50	17%
Develop my knowledge of 'the profession of arms'	2.75	9%
Develop the attributes of a military leader	0.00	62%
Give me a general awareness of other Services and the broader issues of national defence	0.00	51%
Total:	11.75	

Item: Y1 -Visit Shore Establishments

Topic	Average	Variability
Make me more committed to the ideals of my Service	2.50	10%
Motivate me toward a career in the ADF	3.50	10%
Provide me with an appreciation of the activites of my Service	4.00	0%
Develop my knowledge of 'the profession of arms'	2.00	60%
Develop the attributes of a military leader	-1.75	48%
Give me a general awareness of other Services and the broader issues of national defence	1.00	51%
Total:	11.25	

Item: Y3 - HMAS Creswell (OOD training ...)

Topic	Average	Variability
Make me more committed to the ideals of my Service	3.00	20%
Motivate me toward a career in the ADF	3.00	20%
Provide me with an appreciation of the activites of my Service	2.50	10%
Develop my knowledge of 'the profession of arms'	1.50	10%
Develop the attributes of a military leader	1.00	20%
Give me a general awareness of other Services and the broader issues of national defence	-0.67	66%
Total:	10.33	

Item: Y1 - Survival at Sea

Topic	Average	Variability
Make me more committed to the ideals of my Service	2.50	10%

Topic	Average	Variability
Motivate me toward a career in the ADF	1.75	30%
Provide me with an appreciation of the activites of my Service	3.00	0%
Develop my knowledge of 'the profession of arms'	0.75	33%
Develop the attributes of a military leader	2.50	10%
Give me a general awareness of other Services and the broader issues of national defence	-3.25	41%
Total:	7.25	

Item: Y1/Y2 - Survival/Adventure Training (May Break)

Topic	Average	Variability
Make me more committed to the ideals of my Service	0.00	71%
Motivate me toward a career in the ADF	2.75	22%
Provide me with an appreciation of the activites of my Service	-2.00	42%
Develop my knowledge of 'the profession of arms'	2.00	24%
Develop the attributes of a military leader	2.25	26%
Give me a general awareness of other Services and the broader issues of national defence	0.25	71%
Total:	5.25	

Item: Y1 - Ship Safety

Topic	Average	Variability
Make me more committed to the ideals of my Service	2.25	9%
Motivate me toward a career in the ADF	1.50	10%
Provide me with an appreciation of the activites of my Service	3.00	24%
Develop my knowledge of 'the profession of arms'	1.25	26%
Develop the attributes of a military leader	-0.50	54%
Give me a general awareness of other Services and the broader issues of national defence	-2.75	38%
Total:	4.75	

Item: Y2 - Leadership Challenge

Topic	Average	Variability
Make me more committed to the ideals of my Service	0.00	37%
Motivate me toward a career in the ADF	1.50	30%
Provide me with an appreciation of the activites of my Service	-2.75	36%
Develop my knowledge of 'the profession of arms'	0.00	42%

Develop the attributes of a military leader	4.25	9%
Give me a general awareness of other Services and the broader issues of national defence	-0.75	85%
Total:	2.25	

Participants during the evaluation entered the following comments:

1 Make me more committed to the ideals of my Service

2 Motivate me toward a career in the ADF

Y2 - Service Attachment (May break)
5.00 excellent to spend time in chosen specification
Y2 - Training Cruise
2.00 It was meant to motivate, but for many people it achieved quite the opposite and to be told by 2.5 ringers that if we didn't like it, the Navy didn't want us was very shocking
Y3 - SEAAC Phase 1
3.00 It was rather difficult, but lots was learnt
Y3 - HMAS Creswell (OOD training ...)
Abs. -3 for the activities I did
Y1 - Survival at Sea
2.00 Hypothermia

3 Provide me with an appreciation of the activites of my Service

Y1 -Visit Shore Establishments
4.00 At the time I didn't know anything

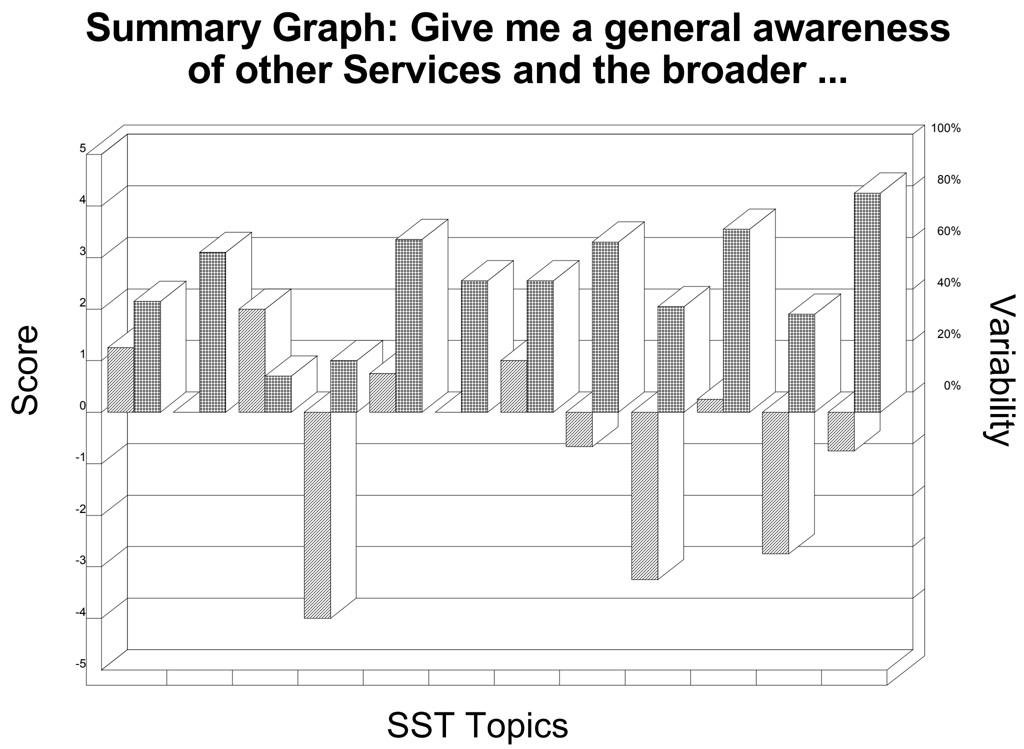
4 Develop my knowledge of 'the profession of arms'

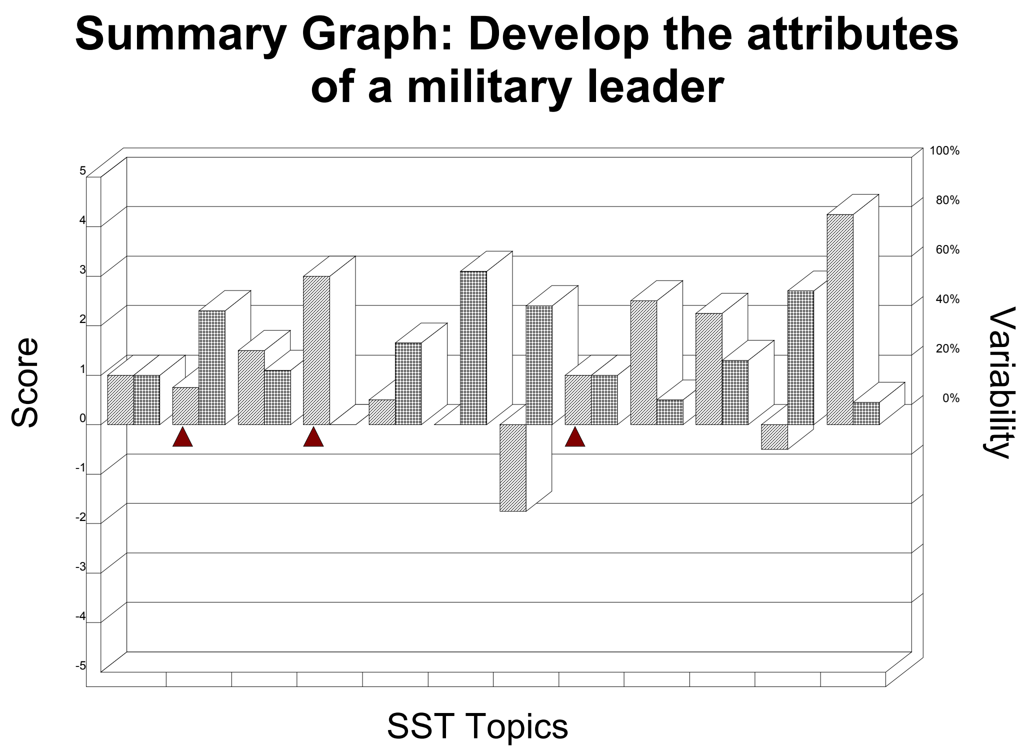
5 Develop the attributes of a military leader

Y2 - Training Cruise
-3.00 There was little or no opportunity, either we were told to sit in a corner or we were being told what to do by the junior sailors
Y3 - SEAAC Phase 1
3.00 While it encouraged us to take command, our lecturers wanted our command style to be like theirs, and not develop our own style
Y3 - HMAS Creswell (OOD training ...)
Abs. The activities I did where not relevant to the topic of military leadership 1

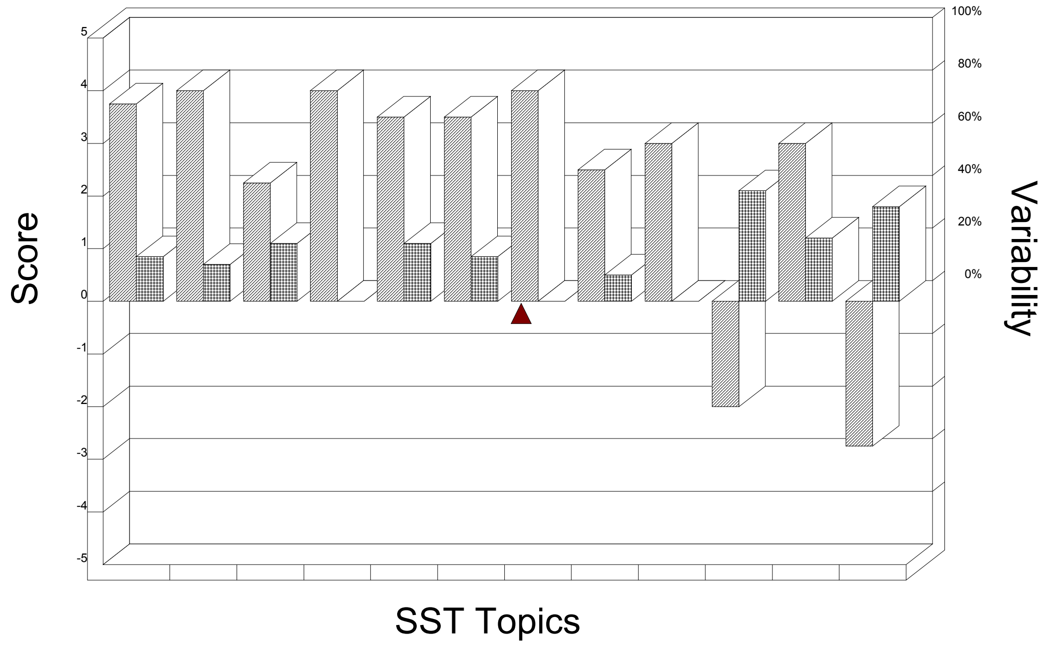
6 Give me a general awareness of other Services and the broader issues of national defence

Summary charts of each criterion:

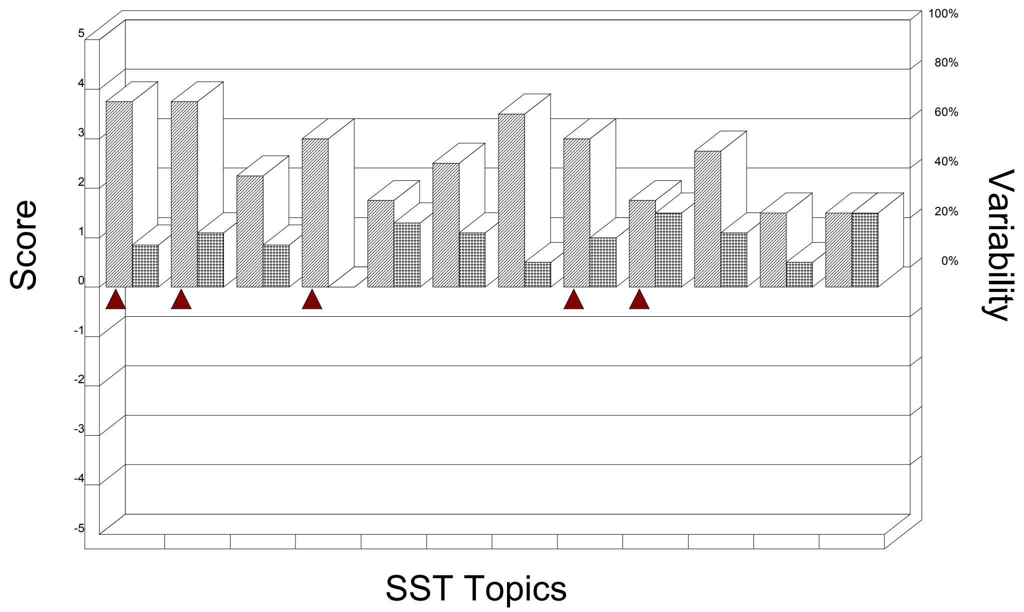




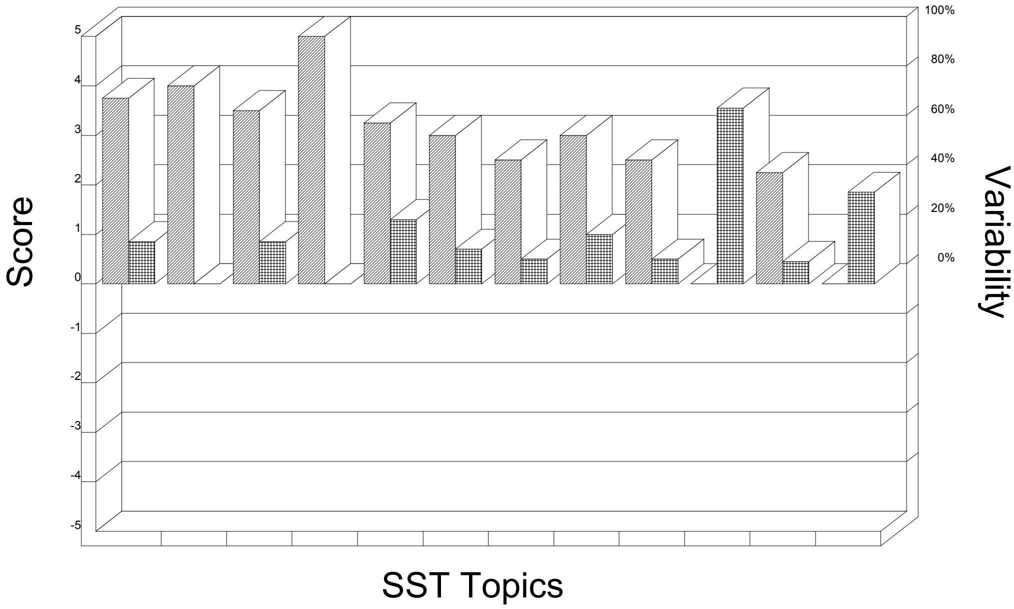
Summary Graph: Provide me with an appreciation of the activites of my Service



Summary Graph: Motivate me toward a career in the ADF



Summary Graph: Make me more committed to the ideals of my Service



Initial Thoughts on Electronically-Supported Meetings

Finally, participants were asked their intial thoughts about electronically-supported meetings. These comments were listed under 'positive' and 'negative' and they could list as many aims as they wished

Unedited List of Positives and Negatives

1. What are the advantages of an Electronic Meeting System ?
   a. you get stuck for ideas
   b. Anonymity
   c. can see what other people are thinking
   d. formalises the meeting procedures
   e. Some menus in the interface didn't highlight what was important.
   f. all the input is saved
   g. You can see what others are saying anonymously at the same time
   h. hide identity
   i. nothing is missed in the class
   j. everyone gets a fair say
   k. Makes you feel open to provide input.
2. What are the disadvantages of an Electronic Meeting System ?
   a. Getting Spelling wrong
   b. Cold classroom.
   c. ideas are rushed
   d. .
   e. .
   f. .
   g. .
   h. .

i. .
j. .
k. .
l. lose one to one contact

Training Tasks

Things that the group liked and disliked about ADFA

1. What are the things you really like about the Academy ? Some things to think about ....academic issues, military issues, social/private issues.
   a. Motovational training
   b. Opportunities
   c. Pay
   d. Meeting people
   e. Like academic staff
   f. Degree
   g. Career
   h. Social opportunities
   i. Visiting places
   j. meeting people
   k. have had the chance to travel over australlia
2. What do you really dislike about life at the Academy ? Some things to think about ....academic issues, military issues, social/private issues.
   a. Admin
   b. Mess food
   c. Bureaucracy
   d. 0600 Reveille
   e. Equity
   f. Changes that always seem to take place
   g. Meetings
   h. Wastage of time

Bands - Music and Dress Sense

List Relationship:

How do each of the bands listed rate in terms of dress sense and music ? Use a scale of -5 to 5 where: -5 = 'the pits'; 0 = neutral; 5 = 'brilliant'

Topic: music

Item	Average	Variability
Silverchair	2.00	20%
Midnight Oil	2.25	62%
Savage Garden	1.50	66%
The Prodegy	0.50	67%
Abba	-0.50	64%
Total:	5.75	

Topic: Dress sense

Item	Average	Variability
Silverchair	1.25	26%
Midnight Oil	0.75	22%
Savage Garden	1.25	50%
The Prodegy	-1.50	59%
Abba	-2.25	38%
Total:	-0.50	

Item: Silverchair

Topic	Average	Variability
music	2.00	20%
Dress sense	1.25	26%
Total:	3.25	

Item: Midnight Oil

Topic	Average	Variability
music	2.25	62%
Dress sense	0.75	22%
Total:	3.00	

Item: Savage Garden

Topic	Average	Variability
music	1.50	66%
Dress sense	1.25	50%
Total:	2.75	

Item: The Prodegy

Topic	Average	Variability
music	0.50	67%
Dress sense	-1.50	59%
Total:	-1.00	

Item: Abba

Topic	Average	Variability
music	-0.50	64%
Dress sense	-2.25	38%
Total:	-2.75	

Participants during the evaluation entered the following comments:

1 music

2 Dress sense

The Prodegy

-1.00 Dress sense is a little dubious

-5.00 They look like they need a bath really badly

Abba

Summary charts of each criterion: