Communications of the IIMA

Volume 9 | Issue 3 Article 3

2009

Electronic Facilitation of Large Meetings

Tobin Lindblom
Northern State University

Milam Aiken
University of Mississippi

Mahesh Vanjani
Texas Southern University

Electronic Facilitation of Large Meetings

Tobin Lindblom
Northern State University
USA
tobin.lindblom@northern.edu

Milam Aiken
University of Mississippi
USA
maiken@bus.olemiss.edu

Mahesh Vanjani
Texas Southern University
USA
vanjanim@tsu.edu

ABSTRACT

Many meetings involve large groups exchanging oral comments in a face-to-face environment, yet few studies have investigated how electronic facilitation can benefit these discussions. In this paper, we studied two large oral meetings (group sizes of 38 and 37) and two computer-based meetings (group sizes 33 and 35). Results show that, as in smaller groups, members of electronic meetings experience less production blocking and evaluation apprehension and generate more total comments, relevant comments, and words per comment. However, contradicting prior research, participants in the oral meetings were more satisfied with the process.

INTRODUCTION

Large meetings (defined here as a group of more than 15-20 individuals discussing some topic) are common in government, business, and our personal lives; and they are an important means of sharing information, building rapport, and making organizational decisions. Yet, in oral meetings, participants must take turns talking; and personal "air time" decreases as the group size gets larger.

Group Support Systems (GSS) are one means of increasing the efficiency and effectiveness of brainstorming meetings. These electronic systems have been used for meetings in the military (Adkins, Burgoon, & Nunamaker, 2002), business (McCartt & Rohrbaugh, 1995; McGoff, Hunt, Vogel, & Nunamaker, 1990; Nunamaker, Vogel, Heminger, Martz, Grohowski, & McGoff, 1989; Tyran, Dennis, Vogel, & Nunamaker, 1992), and education (Aiken, Sloan, Paolillo, & Motiwalla, 1997; Alavi, 1994), and many studies have demonstrated that these systems can benefit groups in which all participants need to exchange ideas (Chun & Park, 1998; Pervan, 1998). However, the vast majority of these studies have used fewer than 20 group members, with many using fewer than 10 (Fjermestad & Hiltz, 2000; Fjermestad & Hiltz, 1999; Ho & Raman, 1991). Little if any research has been conducted on groups with more than 30 individuals meeting face-to-face with a GSS.

In this article, the benefits of using electronic facilitation in meetings and review studies on the effect of group size are discussed. An experiment using two large groups orally contributing ideas and two large groups typing ideas on a computer network shows that a GSS can be used effectively in meetings with many participants.

GROUP SUPPORT SYSTEMS

A GSS, otherwise known as a Group Decision Support System (GDSS) or electronic meeting system (EMS), is a combination of communication, computer technology, and decision support technologies that aids the process of solving unstructured problems (DeSanctis & Gallupe, 1987). While the implementation of these systems can vary, they often provide three features not commonly available in traditional, oral meetings:

1. **Parallel communication**. All group members can type or read others' comments at any time. No "turn taking" for contributing ideas is required. In an oral meeting with sequential communication, the relevance of an additional comment could expire by the time a participant has the opportunity to contribute (Ho & Raman, 1991; Rao & Jarvenpaa, 1991).

2. **Anonymity**. Group members are allowed to type comments without any identification added to the text. In an oral meeting, of course, everyone knows who contributes a comment as soon as the person speaks.

3. **Automated record keeping.** As comments are typed, they are automatically recorded to a disk file, obviating the need to manually transcribe meeting minutes as in the case of oral discussions. These online comments can also form an organization's memory that can be easily searched (Satzinger, Garfield, & Nagasundaram, 1999).

As a result of these features, several benefits often arise with a GSS (Dennis, Haley, & Vandenberg, 1996; Gray & Mandviwalla, 1999; Nunamaker, Briggs, Mittleman, Vogel, & Balthazard, 1997):

1. **Social inhibitions decrease.** Because the comments are anonymous, group members can be more candid (Shepherd, Briggs, Reinig, Yen, & Nunamaker, 1996; Postmes & Lea, 2000), thereby increasing the free flow of information exchange (Sosik, Avalio, & Kahai, 1997). In the absence of anonymity, high social status participants can intimidate the other group members (Huang & Wei, 2000; Ngwenyama & Lyytinen, 1997), significantly affecting evaluation apprehension, i.e., the fear of others' criticizing one's ideas. Also, without anonymity, there is a tendency for group leaders to emerge (Hiltz, Johnson, & Turoff, 1991; Sia, Tan, & Wei, 1996) and potentially dominate the meeting. Information exchange can be stifled by majority opinions, and a lack of willingness to "rock the boat" with unpopular ideas or information that does not coincide with the majority opinion (Dennis, Hilmer, & Taylor, 1997; Lam & Schaubroeck, 2000).

2. **Production blocking decreases.** Because all group members can type or read comments simultaneously, barriers to communication (i.e., production blocking) decrease (Anson, Bostrom, & Wynne, 1995; Shirani, Aiken, & Paolillo, 1998). That is, even though typing is relatively slow compared to speaking, 10 or 12 people typing at the same time can generate more comments than the same number speaking one at a time.

3. **Participation increases.** Because of less social inhibition and production blocking and the provision of automated record keeping, more group members contribute ideas. With more participation, the members often consider contributed ideas as owned by the "group" rather than an individual (Chidambaram & Bostrom, 1997) and this could enhance "buy in" to future decisions.

4. **Meeting time decreases and/or the number of ideas increases**. More novel and often better ideas are generated; and as a result, groups can perform more in less time than it takes for the more traditional, oral meetings. For instance, IBM noted that a GSS saved them up to 56 percent of the time that was typically spent in their meetings (Grohowski, McGoff, Vogel, Martz, & Nunamaker, 1990). Likewise, Boeing found that electronic facilitation can reduce overall project time (incorporating several meetings) by up to 71 percent (Martz, Vogel, & Nunamaker, 1992).

5. **Meeting process satisfaction increases**. If group members can participate more, they experience less social inhibition, and the meeting takes less time, they are often more satisfied with the entire process (Chidambaram, 1996; Davey & Olson, 1998). Further, a system that is liked might be used more often.

6. **Decision quality increases.** As more ideas are generated, there is a larger pool of options available when a decision is subsequently made (Bordia, 1997; Burdett, 2000; Dennis, 1996; Lam, 1997).

However, many factors can influence the outcome of meetings including the type of technology used to support the discussion, the task type, individual characteristics of the participants, and the size of the group (Dennis, George, Jessup, Nunamaker, & Vogel, 1988; Dennis & Wixom, 2002). This last factor is the focus of our research, and several studies have already investigated the effect of group size in GSS meetings:

Study 1: One of the earliest studies of the size effect compared GSS groups of three and four participants and found no significant differences in decision quality, satisfaction, and equality of influence (Watson, DeSanctis, & Poole, 1988).

Study 2: In a paper describing the potential of GSS to support group work, a 3-dimensional model of the electronic meeting system domain defined a small group as consisting of 3 to 7 participants, while a large group could contain an unlimited number (Nunamaker, Dennis, Valacich, Vogel, & George, 1991). Further, the paper showed that

fully interactive electronic meeting process gains increased with group size while the process losses stayed relatively constant, after the minimum threshold had been reached.

Study 3: Another study (Gallupe, Dennis, Cooper, Valacich, Bastianutti, & Nunamaker, 1992) investigated GSS-based and oral groups with sizes ranging from 2 to 12 participants. The larger groups generated more unique, high-quality ideas, and participants were more satisfied in the GSS meetings than in the oral meetings. However, few differences were found between the two types of meetings in smaller groups.

Study 4: A fourth study (Gallupe & Cooper, 1993) showed that groups using a GSS experienced productivity increases of 25% to 50% in 4-person groups and nearly 200% increases in 12-person groups.

Study 5: In a study of GSS-based groups of 3 and 9 participants (Hwang & Guynes, 1994), results showed that the larger groups generated more solution alternatives but took longer to reach a final decision than smaller ones.

Study 6: A study of time savings estimates in a GSS meeting showed that costs decreased with GSS group size (Aiken, Sudderth, & Singleton, 1997). A group of 10 could be expected to save about 36% while a group of 40 could save about 70% over the cost of a traditional, oral meeting.

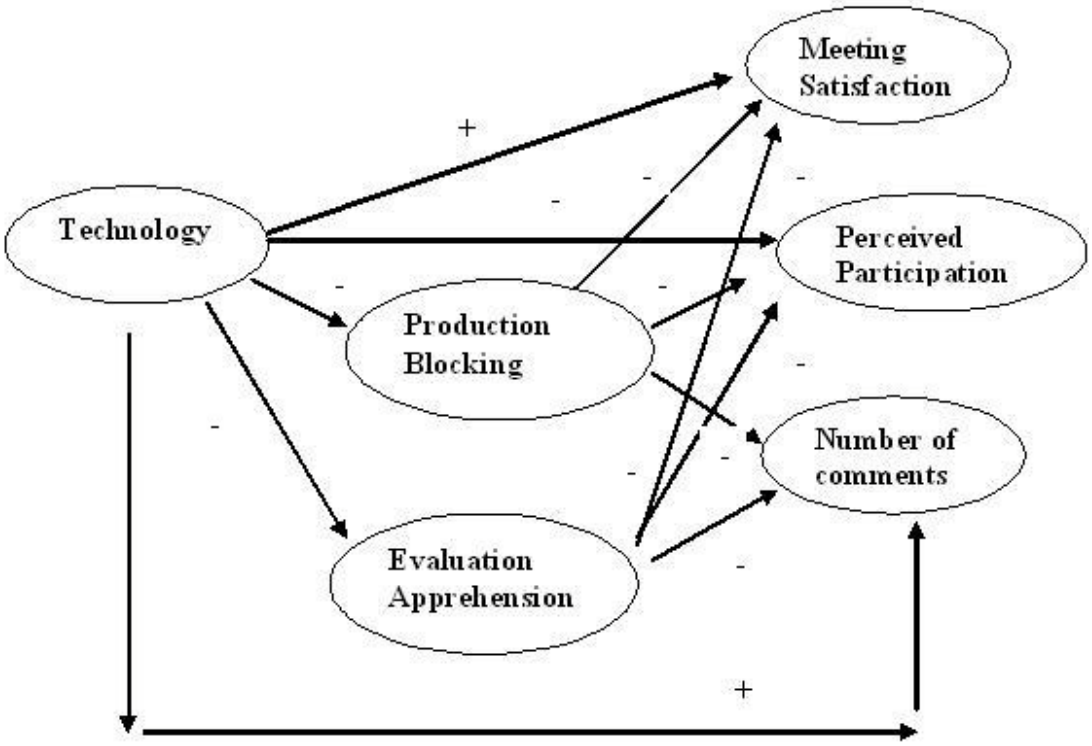
Study 7: A meta-analysis (Aiken, Vanjani, & Wong, 1998) of 20 GSS studies focusing on the number of comments generated and meeting satisfaction showed that satisfaction increased with group size and the rate of comment generation per person stayed roughly the same.

Study 8: A final study of GSS meetings ranging from 2 to 14 participants each showed that the full benefits might become evident only when the size reaches about 6 members (Aiken & Wong, 2003).

METHODS

Earlier studies of group size show that there appears to be a minimum number or "break-even" point at which a GSS meeting becomes preferable to an oral discussion with manual transcription of comments (about 6 or 7 participants), but the upper limit has not been investigated. We expect that the benefits of electronic meetings will hold for group sizes up to at least 50, however. We chose to investigate oral and electronic meetings of about 35 participants each.

Figure 1: Meeting research model.



Hypotheses

Based upon earlier studies with smaller groups described above, we develop the following hypotheses that are illustrated graphically in Figure 1:

Hypothesis 1: Evaluation apprehension will be less using the electronic technique.

Hypothesis 2: Production blocking will be less using the electronic technique.

Hypothesis 3: Meeting process satisfaction will be less using the manual technique.

Hypothesis 4: Participation will be less using the manual technique.

Hypothesis 5: The number of total comments generated will be less using the manual technique.

Hypothesis 6: The number of words per comment per participant will be less using with the manual technique.

Hypothesis 7: The number of relevant comments will be less using the manual technique.

Hypothesis 8: An increase of production blocking will decrease the total number of comments generated.

Hypothesis 9: An increase in evaluation apprehension will decrease the total number of comments generated.

Hypothesis 10: An increase in production blocking will decrease the number of relevant comments generated.

Hypothesis 11: An increase in evaluation apprehension will decrease the number of relevant comments generated.

Hypothesis 12: An increase in evaluation apprehension will decrease the number of words per comment generated.

Hypothesis 13: An increase in production blocking will decrease the number of words per comment generated.

Procedures

Students were recruited from an introductory undergraduate MIS course and each participating student received extra credit toward grades. They were assigned to two oral groups (sizes of 38 and 37) and two GSS-based groups (33 and 35). Although the sizes were not exactly the same due to no-shows, we believe that they are close enough not to unduly bias the results, as results are based upon individual responses.

Although many brainwriting techniques are available to facilitate group discussions (Brahm & Kleiner, 1996; Paulus & Yang, 2000), perhaps the most efficient and effective for brainstorming discussions in an electronic environment is gallery writing (Aiken, Vanjani, & Paolillo, 1996). Using this idea generation technique, all previously contributed comments are available to the group at any time, and any participant can add a new idea at will. A locally developed Web-based GSS program implementing gallery writing was used for the electronic facilitation treatment and the oral groups used a modified version of the technique in which the meeting facilitator wrote each individual's ideas on the board at the front of the room as they were spoken, rather than each individual writing his or her own. This was due to the physical limitation of available white board space - 38 students could not all stand at the board conveniently.

Each group was asked to contribute ideas in 10 minutes for the solution of the parking problem on campus, a topic and time period that have been used frequently before in other GSS studies (e.g., Aiken & Vanjani, 1997; Jessup, Connolly, & Galegher, 1990). The students had a significant stake and interest in this discussion, as many commuted to campus on a daily basis. However, the students did not hold the authority to make decisions regarding the parking

problem, possibly reducing the external validity (Aiken, Gu, & Wang, 2008). But since prior GSS studies using non-students have typically resulted in the same results, we believe that using this sample of convenience is appropriate for this idea generation task.

After each of the four meetings, a survey (Appendix) was given to the participants in order to assess their perceptions regarding production blocking, evaluation apprehension, other group members' participation, and meeting process satisfaction using a 7-point Likert scale (1 = bad, 7=good). That is, 1 is no evaluation apprehension, 7 is severe production blocking, etc. In addition, the numbers of total comments and relevant comments (as evaluated by two independent raters) generated by each participant were recorded.

ANALYSIS AND RESULTS

Table 1 shows that, as expected, those who felt less evaluation apprehension and experienced less production blocking were more satisfied. Further, those who were more satisfied generated more relevant comments and those who contributed more comments had more words per comment. However, those who felt participation in the group was high tended to make fewer comments, perhaps because they believed others could do the work.

Table 1: Correlation analysis for all groups (N = 143).

	Production Blocking	Meeting Satisfaction	Perceived Participation	Total Comments	Relevant Comments	Words per Comment
Evaluation Apprehension	0.385 <.001	0.220 0.008	0.279 0.001	-0.348 <.001	-0.358 <.001	-0.351 <.001
Production Blocking		0.332 <.001	0.268 0.001	-0.119 0.156	-0.174 0.037	-0.072 0.395
Meeting Satisfaction			0.474 <.001	-0.162 0.054	-0.192 0.022	-0.163 0.051
Perceived Participation				-0.398 <.001	-0.422 <.001	-0.361 <.001
Total Comments					0.940 <.001	0.736 <.001
Relevant Comments						0.724 <.001

Table 2 provides descriptive statistics of the students' survey responses, and Table 3 explores the linear relationships among the variables. Table 4 summarizes the comparisons between the oral/manual and electronic meeting techniques with an ANOVA test.

Table 2: Comparison of means – Descriptive statistics.

	Mean Electronic	Standard Deviation Electronic	Mean Manual	Standard Deviation Manual
Evaluation Apprehension	1.574	0.869	2.693	1.414
Production Blocking	1.971	1.486	2.627	1.353
Meeting Satisfaction	2.971	1.962	3.613*	1.716
Perceived Participation	2.440	1.958	4.547	1.482
Total Comments	3.471	2.409	0.267	0.553
Relevant Comments	2.765	1.94	0.227	0.509
Words per Comment	64.426	40.942	2.173	4.966

* = not significantly different from neutral value of 4 at $\alpha = 0.05$
(oral technique N=75, electronic technique N=68)
(Likert scale 1 = bad, 7 = good)

Table 3: Linear relationship among variables.

	Variable Evaluation	Significance (p-value)	F-Statistic	B-Coefficient	Impact
Technology	Apprehension	<0.001	31.754	-0.164	Moderate
	Production Blocking	0.006	7.635	-0.078	Low
Evaluation Apprehension	Total Comments	<0.001	19.37	-0.164	Moderate
	Relevant Comments	<0.001	20.715	-0.249	Moderate
	Words per Comment	<0.001	19.772	-0.01	Low
Production Blocking	Total Comments	0.156	2.035		N/A
	Relevant Comments	0.037	4.426	-0.135	Moderate
	Words per Comment	0.395	0.729		N/A

Table 4: Comparison between the meeting techniques.

Variable Name	Electronic Technique	Manual Technique	Significance (p-value)	
Evaluation Apprehension	Lower	Higher	0.006	GSS Better
Production Blocking	Lower	Higher	<0.001	GSS Better
Meeting Satisfaction	Lower	Higher	0.038	Manual Better
Perceived	Lower	Higher	<0.001	Manual

Participation				Better
Total Comments	Higher	Lower	<0.001	GSS Better
Relevant Comments	Higher	Lower	<0.001	GSS Better
Words per Comment	Higher	Lower	<0.001	GSS Better

Based upon the results, the following conclusions are presented:

Hypothesis 1: In line with our expectations, those using the GSS experienced significantly less evaluation apprehension. However, participants using both techniques experienced very little criticism fear, perhaps because of the relatively noncontroversial topic of parking.

Hypothesis 2: Again, as anticipated, there was significantly less production blocking for those using the GSS. However, participants using both techniques experienced little difficulty in communicating their comments. This was somewhat surprising in regard to the oral groups because those participants had to take turns speaking and wait for the comments to be written on the board by the facilitator.

Hypothesis 3: It was originally expected that satisfaction would be higher when using the electronic technique. However, the opposite was found to be true in this case. In addition, GSS group members were significantly dissatisfied with the meeting technique. Considering the ease of use, anonymity, and other benefits of GSS, this finding seemed to contradict previous research.

Hypothesis 4: Another unanticipated result was that perceived participation was significantly less using the electronic technique and those group members believed that it was relatively low. However, an analysis of the comments showed that all GSS group members contributed at least as much as those in the oral meetings. However, because comments did not have author identifiers, it was impossible for the participants to know who was contributing any particular idea.

Hypothesis 5: Significantly more comments per person were generated using the electronic technique. Those using the GSS generated an average of 3.471 comments for each member of the group, but those in the oral groups generated an average of only 0.267.

Hypothesis 6: Likewise, the number of words per comment was significantly higher with the electronic technique than with the manual technique (64.426 versus 2.173). Those using the GSS were wordier because they did not need to wait to contribute, whereas the others kept their comments short and concise due to the limitation of the facilitator having to write the comment on the board.

Hypothesis 7: Significantly more relevant comments per person were generated using the electronic technique (2.765 versus 0.227). However, the vast majority of the manual groups' comments were relevant, while the electronic groups had a large proportion of irrelevant or off-topic comments, probably due to the presence of anonymity (Alonzo & Aiken, 2004).

Hypothesis 8: As expected, the use of technology decreases production blocking that in turn increases the total number of comments generated.

Hypothesis 9: Also, an increase in evaluation apprehension decreases the total number of comments.

Hypothesis 10: As with the total number of comments described in hypothesis 8, an increase of production blocking decreases the number of relevant comments.

Hypothesis 11: An increase in evaluation apprehension decreases participation and the number of relevant comments generated as well. The decrease in relevant comments also followed a similar decrease in total comments generated, as suggested by hypothesis 9.

Hypothesis 12: As was originally expected, the increase of evaluation apprehension lowered the number of words per comment generated. This showed that inhibiting factors, such as concern for criticism over one's comments, tended to decrease the willingness to participate, lowering the number of words per comment. Even though this cannot be said for all large group GSS based meetings, at least for groups of similar size, the results supported an assumption that similar findings in smaller groups tended to hold true for large ones as well, in regard to evaluation apprehension.

Hypothesis 13: Also unexpected was the lack of support for this hypothesis. It stood to reason that an increase in production blocking would decrease the number of words per comment; however, this hypothesis was not supported in this study. While it could be considered an anomaly, further research needs to be performed to find out why this may result. However, it is possible that the size of the group may have been a factor; therefore, it was difficult to make any definitive determination without more detailed information, and further research.

DISCUSSION

Overall, this study supported the original hypotheses and variable model. This study contributed to the body of knowledge in the area of very large group studies, showing that even in very large groups, the traditional benefits of GSS based meetings still hold true. Production blocking, and evaluation apprehension were lower by a statistically significant amount. Participation, as measured by the total number of comments, the number of relevant comments, and the number of words per comment were also lower when using the manual technique, as compared to when using the electronic technique.

Furthermore, relationships between an increase of evaluation apprehension and a decrease of total comments, relevant comments, and words per comment were demonstrated at a significant level. Also, relationships between an increase of production blocking, and a decrease of total comments, and relevant comments was demonstrated.

The impact of using the electronic technique showed a lowering of production blocking, and evaluation apprehension. Satisfaction (hypothesis 3) was shown to be significantly higher when using the manual technique, an unexpected finding based on the original proposed model.

Therefore, hypotheses 1, 2, 5, 6, 7, 8, 9, 10, 11, and 12 were shown to have significance at the $\alpha = 0.05$ level. With hypothesis 3 (satisfaction), and hypothesis 4 (participation) showing reverse (unexpected) results, and hypotheses 3, 4, and 13 not showing significance.

The hypotheses that were not supported included hypothesis 3, 4, and 13, satisfaction with the meeting process (hypothesis 3), participation (hypothesis 4), and the number of words per comment (hypothesis 13). Also, there were significant differences between the standard deviations for the number of relevant, total comments, and the number of words per comment between the electronic and manual technique. This was likely due to the significantly higher amount of participation, and number of comments generated in the electronic technique, as well as the limitations of participating when using the manual technique.

CONCLUSION

The guiding thesis of this study was that the same benefits from using a GSS based system in smaller groups would still hold true when using the electronic technique in larger groups. The overall premise of this study was supported by the tests provided, and should be useful in gauging the benefits of GSS based systems in very large groups. While there are hypotheses that were not supported, further research needs to be performed in order to determine the causes, and as a whole, this study was largely supported based on what was originally proposed.

This study supported many of the hypotheses originally proposed; however, there are limitations to the results. The first limitation is that only students from an undergraduate MIS course were used in the sample. This makes generalization among other groups difficult, but, there should be similarities, even when used in different areas, and the findings are relevant.

There were hypotheses that were not found to be statistically significant, and two hypotheses found the reverse to be true. Satisfaction and perceived (but not actual) participation were found to be higher when using the manual technique. This was unexpected, as originally proposed in this study. Likewise, the relationship between production blocking and the number of words per comment was also not found to be significant. While these results were unexpected, further studies need to be performed in order to determine why this happened.

Future research may be performed in order to determine why satisfaction was found to be higher in the manual group, as well as the unexpected results regarding hypotheses 3, 4, and 13. Also, an increase in the number of groups measured (using $n>35$ participants) might be useful in determining if the lack of significance in hypothesis 3, 4, and 13 were an anomaly, or simply a function of using the electronic technique in very large groups.

Other future studies may include using longer meetings or more controversial subject matter in order to determine if task is an issue in the effectiveness of using GSS in large groups. Also, tests might be performed to see if students with more experience in using internet messaging technologies (e.g., MSN messenger, Yahoo messenger, etc.) have higher measures of satisfaction, and lower measures of production blocking, and evaluation apprehension.

REFERENCES

Adkins, M., Burgoon, M., & Nunamaker, J. (2002). Using group support systems for strategic planning with the United States Air Force. *Decision Support Systems*, 34, 315-337.

Aiken, M., Gu, L., & Wang, J. (2008). Topic effects on process gains and losses in an electronic meeting. *Best Practices and Conceptual Innovations in Information Resources Management: Utilizing Technologies to Enable Global Progressions.* IGI Global, Hershey, PA.

Aiken, M., Sloan, H., Paolillo, J., & Motiwalla, L. (1997). The use of two electronic idea generation techniques in strategy planning meetings. *The Journal of Business Communication*, 34(4), 370-382.

Aiken, M., Sudderth, T., & Singleton, T. (1997). A cost-benefit analysis of GDSS use. *28th Annual Conference of the Southwest Decision Sciences Institute*, March 11-15, 1997, New Orleans, LA.

Aiken, M., Vanjani, M., & Paolillo, J. (1996). A comparison of two electronic meeting techniques. *Information & Management*, 30(2), 91-99.

Aiken, M., & Vanjani, M. (1997). A comparison of synchronous and virtual Legislative session groups faced with an idea generation task. *Information & Management*, 33(1), 25-31.

Aiken, M., Vanjani, M., and Wong, Z. (1998). Group support system size effects. *29th Annual Conference of the Southwest Decision Sciences Institute*, March 3-7, 1998, Dallas, Texas, 90-92.

Aiken, M. & Wong, Z. (2003). The effect of group size on electronic idea generation. *International Journal of Human Resources Development and Management*, 3(3), 265-274.

Alavi, M. (1994). Computer-mediated collaborative learning: An empirical evaluation. *MIS Quarterly*, June 1994, 159-174.

Alonzo, M. & Aiken, M. (2004). Flaming in electronic communication. *Decision Support Systems*, 36(3), 205-338.

Anson, R., Bostrom, R., & Wynne, B. (1995). An experiment assessing group support system and facilitator effects on meeting outcomes. *Management Science*, 41(2), 189-208.

Bordia, P. (1997). Face-to-face versus computer-mediated communication: A synthesis of the experimental literature. *Journal of Business Communication*, 34(1), 99-120.

Brahm, C., & Kleiner, B. (1996). Advantages and disadvantages of group decision making approaches. *Team Performance Management*, 2(1), 30-35.

Burdett, J. (2000). Changing channels: Using the electronic meeting system to increase equity in decision making. *Information Technology: Learning and Performance Journal*, 18(2), 3-12.

Chidambaram, L. (1996). Relational development in computer-supported groups. *MIS Quarterly*, 20(2), 143-165.

Chidambaram, L., & Bostrom, R. (1997). Group development (II): Implications for GSS research and practice. *Group Decision and Negotiation*, 6(3), 231-254.

Chun, K., & Park, H. (1998). Examining the conflicting results of GDSS research. *Information & Management*, 33, 313-325.

Davey, A., & Olson, D. (1998). Multiple criteria decision making models in group decision support, *Group Decision and Negotiation*, 7(1), 55-75.

Dennis, A. (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*, 20(4), 433-457.

Dennis, A., George, J., Jessup, L., Nunamaker, J. Jr., & Vogel, D. (1988). Information technology to support electronic meetings. *MIS Quarterly*, December, 591-624.

Dennis, A., Haley, B., & Vandenberg, R. (1996). A Meta-analysis of effectiveness, efficiency, and participant satisfaction in group support systems research. *Proceedings of the 17th International Conference on Information Systems, Atlanta, GA; Association for Information Systems*, 278-289.

Dennis, A., Hilmer, K., & Taylor, N. (1997). Information exchange and use in GSS and verbal group decision making: Effects of minority influence. *Journal of Management Information Systems*, 14(3), 61-88.

Dennis, A., & Wixom, B. (2002). Investigating the moderators of the group support systems use with meta-analysis. *Journal of Management Information Systems*, 18(3), 235-257.

DeSanctis, G., & Gallupe, R. (1987). A foundation for the study of group decision support systems. *Management Science*, 33(5).

Fjermestad, J., & Hiltz, S. (1999). An assessment of group support systems experimental research: Methodology and results. *Journal of Management Information Systems*, 15(3), 7-149.

Fjermestad, J., & Hiltz, S. (2000). Group support systems: A descriptive evaluation of case and field studies. *Journal of Management Information Systems*, 17(3), 113-157.

Gallupe, R., & Cooper, W. (1993). Brainstorming electronically. *Sloan Management Review*, 57, 27-36.

Gallupe, R., Dennis, A., Cooper, W., Valacich, J., Bastianutti, L., & Nunamaker, J. (1992). Electronic brainstorming and group size. *Academy of Management Journal*, 35(2), 350-369.

Gray, P., & Mandviwalla, M. (1999). New directions for GDSS. *Group Decision and Negotiation*, 8, 77-83.

Grohowski, R., McGoff, C., Vogel, D., Martz, B., & Nunamaker, J. (1990). Implementing electronic meeting systems at IBM: Lessons learned and success factors. *MIS Quarterly*, Vol. 14(4), 369-383

Hiltz, R., Johnson, K., & Turoff, M. (1991). Group decision support: The effects of designated human leaders and statistical feedback in computerized conferences. *Journal of Management Information Systems*, 8(2), 81-108.

Ho, T., & Raman, K. (1991). The effect of GDSS and elected leadership on small group meetings. *Journal of Management Information Systems*, 8(2), 109-133.

Huang, W., & Wei, K. (2000). An empirical investigation of the effects of group support systems (GSS) and task type on group interactions from an influence perspective. *Journal of Management Information Systems*, 17(2), 181-206.

Hwang, H., & Guynes, J. (1994). The effect of group size on group performance in computer-supported decision making. *Information and Management*, 26, 189-198.

Jessup, L., Connolly, T., & Galegher, J. (1990). The effects of anonymity on GDSS group process with an idea generating task. *MIS Quarterly*, 14(3), 313-321.

Lam, S. (1997). The effects of group decision support systems and task structures on group communication and decision quality. *Journal of Management Information Systems*, 13(4), 193-215.

Lam, S., & Schaubroeck, J. (2000). Improving group decisions by better pooling information: A comparative advantage of group decision support systems. *Journal of Applied Psychology*, 85(4), 565-573.

Martz, B., Vogel, D., & Nunamaker, J. (1992). Electronic meeting systems: Results from the field. *Decision Support Systems*, 8(2), 141-158.

McCartt. A., & Rohrbaugh, J. (1995). Managerial openness to change and the introduction of GDSS: Explaining initial success and failure in decision conferencing. *Organization Science*, 6(5), 569-584.

McGoff, C., Hunt, A., Vogel, D., & Nunamaker, J. (1990). IBM's experiences with GroupSystems, *Interfaces* 20(6), Nov-Dec, 39-52.

Ngwenyama, O., & Lyytinen, K. (1997). Groupware environments as action constitutive resources: A social action framework for analyzing groupware technologies. *Computer Supported Cooperative Work (CSCW): The Journal of Collaborative Computing*, 6(1), 71-93.

Nunamaker, J., Briggs, R., Mittleman, D., Vogel, D., & Balthazard, P. (1997). Lessons from a dozen years of group support systems research: A discussion of lab and field findings. *Journal of Management Information Systems*, 13, 163-207.

Nunamaker, J., Dennis, A., Valacich, J., Vogel, D., & George, J. (1991). Electronic meeting systems to support group work. *Communications of the ACM*, 34(7), 30-39.

Nunamaker, Vogel, J., Heminger, A., Martz, R., Grohowski, R., & McGoff, C. (1989). Experiences at IBM with group support systems: A field study. *Decision Support Systems*, 5(2), 183-196.

Paulus, P., & Yang, H. (2000). Idea generation in groups: A basis for creativity in organizations. *Organizational Behavior and Human Decision Processes*, 82(1), 76-87.

Pervan, G. (1998). A review of research in group support systems: Leaders, approaches, and directions. *Decision Support Systems*, 23, 149-159.

Postmes, T., & Lea, M. (2000). Social processes and group decision making: Anonymity in group decision support systems. *Ergonomics*, 43(8), 1252-1274.

Rao, V., & Jarvenpaa, S. (1991). Computer supported groups: Theory based models for GDSS research. *Management Science*, 37(10), 1347-1362.

Satzinger, J., Garfield, M., & Nagasundaram, M. (1999). The creative process: The effects of group memory on individual idea generation. *Journal of Management Information Systems*. 15(4), 143-160.

Shepherd, M., Briggs, R., Reinig, B., Yen, J., & Nunamaker, J. (1996). Invoking social comparison to improve electronic brainstorming: Beyond anonymity. *Journal of Management Information Systems*, 12(3), 155-170.

Sia, C., Tan, B., & Wei, K. (1996). Exploring the effects of some display and task factors on GSS user groups. *Information and Management*, 30(1), 35-41.

Shirani, A., Aiken, M., & Paolillo, J. (1998). Group decision support systems and incentive structures. *Information & Management*, 33(5), 231-240.

Sosik, J., Avolio, B., & Kahai, S. (1997). Effects of leadership style and anonymity on group potency and effectiveness in a group decision support system environment. *Journal of Applied Psychology*, 82(1), 89-103.

Tyran, C., Dennis, A., Vogel, D., & Nunamaker, J. (1992). The application of electronic meeting technology to support strategic management. *MIS Quarterly*, 16(3), 313-334.

Watson, R., DeSanctis, G., & Poole, M. (1988). Using a GDSS to facilitate group consensus: Some intended and unintended consequences. *MIS Quarterly*, 12(3), 463-478.

APPENDIX

SURVEY INSTRUMENT

Please indicate your answers to the following questions:

1. Evaluation Apprehension: I was afraid that others would criticize my comments.

1 2 3 4 5 6 7

Strongly Disagree Neutral Strongly Agree

2. Production Blocking: It was difficult to read and submit comments.

1 2 3 4 5 6 7

Strongly Disagree Neutral Strongly Agree

3. Satisfaction: I was satisfied with the meeting process.

1 2 3 4 5 6 7

Strongly Disagree Neutral Strongly Agree

4. Participation: Most of my group added at least one comment.

1 2 3 4 5 6 7

Strongly Disagree Neutral Strongly Agree