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ABSTRACT: Collaborative technologies such as group support systems (GSS) are often developed to improve the effectiveness and efficiency of teams; however, the satisfaction users have with the processes and outcomes of the teamwork itself often determines the ultimate adoption and sustained use of collaborative technologies. Much of the research on teamwork has focused on meetings in particular and, consequently, satisfaction with the process and outcomes of meetings, referred to collectively as meeting satisfaction. Research on meeting satisfaction in GSS-supported groups has been equivocal, indicating the need for advancement in our theoretical understanding of the construct. To that end, this paper presents a causal model of meeting satisfaction derived from goal setting theory. The model is tested with an empirical study consisting of 15 GSS groups and 11 face-to-face (FTF) groups engaged in the "lost at sea" task. The results of analysis using structural equation modeling indicate support for the model's integrity across both GSS and FTF groups. Implications for researchers and practitioners are discussed, including how the model can be used to improve future research on the use of collaborative technology to support teamwork.

KEY WORDS AND PHRASES: collaborative technology, goal setting theory, group support systems, meeting satisfaction, teams.

COLLABORATIVE TECHNOLOGIES SUCH AS group support systems (GSS) are often developed to improve the effectiveness and efficiency of teams; however, the satisfaction users have with the processes and outcomes of the teamwork itself often determines the ultimate adoption and sustained use of collaborative technologies. Much of the research on teamwork has focused on meetings in particular and, consequently, satisfaction with the process and outcomes of meetings, referred to here collectively as meeting satisfaction. For example, practicing facilitators have identified meeting satisfaction as a critical measure of meeting success [38] and field researchers have

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noted that low meeting satisfaction may cause users to abandon GSS technologies, even when group productivity is increased [43]. One measure of the importance of meeting satisfaction is the attention given to it by GSS researchers. In a meta-analysis of approximately 200 controlled GSS experiments over two decades, Fjermestad and Hiltz [19] found that over 25 percent (280 of 1,103) of all GSS research hypotheses addressed meeting satisfaction. Nonetheless, meeting satisfaction has proven to be an elusive phenomenon. That is, although many experimental studies have examined meeting satisfaction, the results have been equivocal. For example, some researchers [2, 14, 18, 21] found a positive correlation between meeting satisfaction and GSS usage, but others [11, 17, 20, 27, 44] found a negative correlation.

The objective of this paper is to further the understanding of satisfaction with the process and outcomes of teamwork by developing and validating a model of meeting satisfaction based on goal setting theory [31] and previous meeting satisfaction research [8, 13]. The development of such a model may enable researchers to improve their ability to successfully hypothesize about the effects of various technological structures, in a variety of contexts, on meeting satisfaction. This, in turn, will better equip designers to build systems that facilitate meeting satisfaction without sacrificing meeting productivity. The paper proceeds by presenting a research model depicting the causal nature of meeting satisfaction. It then reports on the results of an empirical investigation, consisting of 15 GSS groups and 11 face-to-face (FTF) groups, conducted to test the model. Structural equation modeling was used to validate the model and results indicate support for the model's integrity. Implications for researchers and practitioners are discussed.

Theory and Hypotheses

THE THEORETICAL MODEL PRESENTED in this study is grounded in goal setting theory [31] and extends on previous research on meeting satisfaction [8, 12, 13]. Locke and Latham describe goals as "something that a person wants to achieve" or "desired end states" [31, p. 2] and identify two dimensions of goals: content and intensity. Content refers to the actual desired result and intensity refers to the effort made in identifying the goal as well as the value and importance assigned to fulfilling the goal. Affect (satisfaction) is caused when an individual perceives that an object facilitates or hinders the attainment of value [29, 30, 31]. An object consists of anything that can be perceived and may include actions, attributes, situations, ideas, persons, or prior emotions [31]. The strength of the emotion is in proportion to the intensity of the value attributed to the object and the degree to which the value is perceived to have been attained [31]. Thus, one would expect to experience more satisfaction when attaining high intensity goals than when attaining low intensity goals, and one would expect to experience more dissatisfaction when failing to attain high intensity goals than when failing to attain low intensity goals [28, 29, 35]. The causal link from value attainment to satisfaction has been validated in numerous studies (see Locke and Latham [31] for an overview of 25 such studies).

Although Locke and Latham [31] use goal setting theory in the domains of work motivation and job satisfaction, their theories are useful in understanding meeting satisfaction as well. For example, Castore and Murnighan [13] theorized that satisfaction with a group decision was influenced by relative individual goal attainment (RIGA), which is the relative extent to which an individual's preferences are congruent with the group's preferences. They studied four group decision-making processes, including majority ruling with parliamentary voting, majority consensus, unanimity, and executive choice, and found no significant relationship between group decision-making processes and satisfaction with group decision. However, consistent with goal setting theory, satisfaction with group decision did correlate with RIGA across all four decision-making processes [13]. This finding is significant because it suggests that increasing an individual's ability to participate in a meeting is neither necessary nor sufficient to cause increased satisfaction with a group decision. This finding is useful to GSS researchers because it tells us that we should not hypothesize a relationship between satisfaction with a group decision and GSS solely because GSS increases participation. Rather, it appears that satisfaction with a group decision is influenced by the degree to which the group's decision help bring about the attainment of an individual's goals. Likewise, satisfaction with the process and outcomes of a meeting are a function of the degree to which the meeting is perceived to have contributed value through goal attainment.

Briggs and de Vreede [8] suggest that meeting satisfaction is caused by the perception that a meeting has accommodated one's vested interests, and refer to this perception as perceived interest accommodation. Further, they propose that meeting satisfaction consists of two dimensions, including satisfaction with meeting product and satisfaction with meeting process. Briggs and de Vreede [8] then propose the following four causal relationships: (1) perceived interest accommodation causes product value, (2) product value causes satisfaction with product, (3) perceived interest accommodation causes satisfaction with process, and (4) satisfaction with product causes satisfaction with process.

The ideas proposed by Briggs and de Vreede [8] contribute significantly to an understanding of meeting satisfaction. However, a number of modifications have been made to their model in light of goal setting theory to produce the research model presented here. First, the cause of meeting satisfaction is framed in terms of goal attainment rather than the accommodation of vested interests. Vested interests and goals are closely related in that it is often one's goal to fulfill certain vested interests, but whereas vested interests might be defined as those things that help individuals survive and thrive in their environment; this is not necessarily the case with goals. It is entirely possible that people hold goals that would be harmful to their well-being [31, 40]. Consequently, fulfilling such goals may produce satisfaction, but ultimately harm their vested interests.

Second, it is proposed that meeting satisfaction is caused not only when goals are fulfilled, but also by the perception that goals will be fulfilled in the future. When analyzing an object, the value gain/loss attributed to that object is often analyzed in terms of future consequences as well as present consequences. When a company

announces forthcoming layoffs, for example, employees are likely to feel dissatisfied, even though they have not yet lost their jobs. Likewise, a new tool, such as GSS, may produce satisfaction in the present because the individual perceives that the tool will allow him or her to attain goals in the future. People anticipate the future consequences of past and current events. When such consequences are perceived to impact goal attainment, satisfaction or dissatisfaction will manifest.

Third, the term "product satisfaction" is expanded to the more general term "satisfaction with meeting outcome." Meeting outcomes vary according to the purpose of the meeting but could potentially include products or deliverables, decisions, recommendations, courses of action and the like. Meeting outcomes could, in certain circumstances, also be characterized as the absence of any specific accomplishment, which may or may not be consistent with an individual's goals. Fourth, the construct "product value" is eliminated from the model altogether. Rather, it is proposed that satisfaction with meeting outcome and satisfaction with meeting process are both caused directly by perceived net goal attainment. The resulting model is presented and discussed in the following section.

Causal Model of Meeting Satisfaction

The causal model of meeting satisfaction that serves as the theoretical basis for this study is presented in Figure 1. Researchers often view meeting satisfaction as consisting of two dimensions, including satisfaction with meeting outcome (SO) such as satisfaction with group decision, and satisfaction with meeting process (SP) (e.g., [8, 18, 24, 27, 45]). The meeting process refers to the procedures, deliberations, and methods used by a group throughout the duration of a meeting. The distinction between outcome and process is necessary because it is possible that an individual could be satisfied with a meeting outcome and not satisfied with a meeting process, and vice versa. For example, if group members decided to draw straws to see which of them was to be awarded a particular artifact, the winner may be satisfied with the outcome but be dissatisfied with the process. This is because the process, if used in the future, may result in low goal attainment. In contrast, a group that uses majority rules decision-making may have a member of the minority who feels dissatisfied with the meeting outcome but satisfied with a process that provided a fair opportunity to express one's views. The process was fair and may lead to goal attainment in the future. A failure to distinguish between SO and SP makes it difficult to predict meeting satisfaction in various situations. For example, it is not clear how the winner in the group that draws straws or the loser in the majority rules decision-making group would report on a general meeting satisfaction instrument. Thus, SO and SP are identified as two primary objects of a meeting for which an individual may perceive as facilitating or hindering the attainment of value.

Meeting satisfaction consists of SO and SP, each of which are caused by perceived net goal attainment (PNGA). The term "net goal attainment" is used to recognize that it takes effort to fulfill goals. Implicit to the desire to fulfill goals is to do so in a manner that the benefit of the goal exceeds the cost incurred by fulfilling the goal. Net

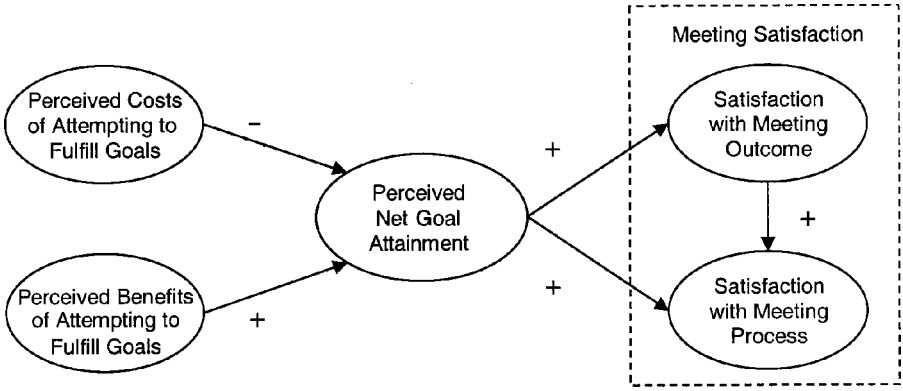

Figure 1. A Model of Meeting Satisfaction

goal attainment (NGA) then is positive when the benefit of fulfilling goals, either in the present or the future, exceeds the costs of attempting to fulfill those goals. Costs in this instance refers to both effort expended in pursuit of goals and opportunity costs in the forms of goals not pursued. PNGA is the perceived benefits of attempting to fulfill goals less the perceived costs of attempting to fulfill goals. As goal setting theory suggests, positive PNGA should result in a positive amount of meeting satisfaction and negative PNGA should result in a negative amount of meeting satisfaction.

Figure 1 also denotes a causal link from SO to SP, as suggested by Briggs and de Vreede [8]. In meetings that are held to accomplish a specific outcome, satisfaction with that outcome can be a goal itself. For example, individuals faced with a difficult decision to make, such as how to allocate scarce resources, often have the specific goal of being satisfied with their final decision. When such an outcome is obtained, a goal is fulfilled and thus causes satisfaction with process. That is, the individual may attribute the fulfillment of the desire to be satisfied with the outcome to the process that produced the outcome. As mentioned previously, however, SP and SO need not covary. This is because one may attribute negative PNGA to a meeting outcome and positive PNGA to a meeting process. For example, an individual may perceive that certain meeting outcomes will impede the attainment of some goals while perceiving the meeting process as useful for attaining other goals. Likewise, one may attribute positive PNGA to a meeting outcome and negative PNGA to a meeting process. The relationship between SO and SP, as well as the relationships between perceived PNGA, SO, and SP are developed into hypotheses in the following section.

Hypotheses

Hypotheses were developed to test the research model presented in Figure 1. The model suggests that PNGA causes meeting satisfaction. Thus, all else being equal, individuals who attain their goals in the context of a meeting should report greater meeting satisfaction than individuals who do not attain their goals. One measure of

goal attainment is the relative extent to which an individual's preferences are congruent with the group's preferences, identified earlier as RIGA [13]. According to the model, higher levels of RIGA should produce higher levels of PNGA, which in turn should cause higher levels of meeting satisfaction. Thus, it is hypothesized:

H1: Individuals achieving higher levels of RIGA will tend to report higher levels of meeting satisfaction.

H1a: Individuals achieving higher levels of RIGA will tend to report higher levels of satisfaction with meeting outcome.

H1b: Individuals achieving higher levels of RIGA will tend to report higher levels of satisfaction with meeting process.

H1 stems from the relationship between PNGA and meeting satisfaction. As discussed previously, SO can be, in and of itself, a goal. Consequently, all else being equal, individuals who experience high levels of SO as a result of a meeting should also experience higher levels of SP. Thus, it is hypothesized:

H2: Individuals reporting higher values of satisfaction with meeting outcome will tend to report higher values of satisfaction with meeting process.

The relationships proposed by H1 and H2 are depicted as structural equations in Figure 2. A controlled investigation was conducted to test these relationships.

Methodology

AN EMPIRICAL INVESTIGATION WAS CONDUCTED to test the two hypotheses. The Lost at Sea survival task [36] was chosen for the study. The Lost at Sea task is an intellective task [32] that requires participants to rank order 15 items in terms of their usefulness in assisting with their survival while lost in a life raft in the South Pacific. Three measures were required to test the hypotheses, namely RIGA, SO, and SP. To measure RIGA, the difference between an individual's preference and the group's preference was calculated. In the case of the Lost at Sea survival task, RIGA represented the degree to which the individual's ranking of the 15 items corresponded with the group's ranking of the 15 items. RIGA was calculated using a three-step process. First, the absolute difference between the group and individual ranking of each of the 15 items was calculated, resulting in 15 values that could range from zero to 14. Second, the 15 absolute differences were summed. If the rankings were identical the sum would equal zero and the highest possible sum, or maximum difference between the individual and group rankings, is 112. Third, the sum was reverse-scaled (i.e., subtracted from 112) so that higher scores represented higher levels of RIGA.

Because the outcome of the Lost at Sea survival task is a group decision, the construct satisfaction with meeting decision (SD) is used to represent satisfaction with meeting outcome. Green and Taber's [23] five items for solution satisfaction were used to measure SD and their five items for decision scheme satisfaction were used to measure SP. The ten items are presented in Appendix A. The Green and Taber [23]

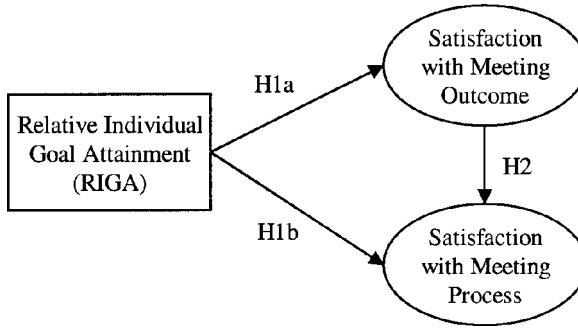

Figure 2. Structural Equations Tested

instrument has frequently been used by researchers to measure SD and SP (e.g., [3, 4, 5, 22, 33, 34, 37]).

The study included a total of 26 groups, 15 meeting in a computer lab receiving GSS support and 11 meeting FTF in a conference room. Participants were university students in the college of business at a Hong Kong public university. The ages ranged from 19 to 23. There were a total of 159 participants (85 female, 74 male), which were randomly assigned to groups and groups were randomly assigned to either the GSS or FTF conditions. GSS groups consisted of 48 females and 45 males and averaged 6.2 participants per group. FTF groups consisted of 37 females and 29 males and averaged 6.0 participants per group.

Procedure

The study was conducted using a script and was piloted prior to data collection. The procedure consisted of the following six steps:

Step 1. Participants sign in for the session, are introduced to the lost at sea survival task, and complete the initial ranking of the 15 items from the lost at sea survival task. FTF participants complete the ranking with pen and paper and GSS participants used a voting tool from a commercially available GSS (GroupSystems by GroupSystems.com). Rankings are completed individually and anonymously and responses are submitted to the researcher.

Step 2. The researcher tabulates the votes and presents the group with the items ordered according to their rank sums. For the GSS groups, these calculations are completed by the system and displayed on the front projection screen. For the FTF groups, the researcher inputs the individual rankings into a spreadsheet and writes the results on a white board. Both groups were also presented a measure of their consensus (Kendall's coefficient of concordance) that ranged from zero to one and were asked to discuss the items for 30 minutes to try to improve their consensus from the initial ranking.

Step 3. Participants discussed the items for 30 minutes. GSS participants logged into a discussion tool, using anonymous pen names, that presented each of the 15

items in a list. When a participant double-clicked an item, a discussion window appeared for that particular item and the participant typed their comments about the item into the discussion window. The system then made all comments immediately available to all group members. FTF participants discussed the items openly around a conference table.

Step 4. Participants completed the final ranking using the same procedure described in Step 1.

Step 5. The researcher tabulated the votes and presented the group with the items ordered according to their rank sums. Participants were also presented their consensus measure and informed of whether or not they succeeded in increasing their agreement (all teams for both GSS and FTF conditions did succeed in raising their consensus).

Step 6. Participants completed a short questionnaire containing five items to measure SD and five items to measure SP. FTF groups completed the questionnaire with pen and paper and GSS groups completed the questionnaire electronically. Participants were thanked for their participation in the study, paid HK$100 (approximately US$13) for participating, and dismissed.

Results

PRIOR TO TESTING THE OVERALL MODEL presented in Figure 2, the five SD items and the five SP items were tested for reliability and construct validity. The result of an exploratory factor analysis, with varimax rotation, on these ten items is presented in Table 1 and reveals two distinct factors. All five of the SP items loaded heavily on the first factor and did not load heavily on the second factor. However, only the second, third, and fourth SD items loaded heavily on the second factor. The first (SD1) and the fifth (SD5) satisfaction with decision items did not load heavily on either factor and were subsequently discarded from the measure of satisfaction with decision. A correlation matrix of the ten items is presented in Table 2. For the eight items retained for analysis (five SP items and three SD items) all correlations between items that measure the same construct are higher than all correlations between items that measure different constructs. The Cronbach's α for the five SP items was 0.79 and the Cronbach's α for the three SD items was 0.76, both indicating a reasonable level of inter-item reliability [16, 39]. Confirmatory factor analysis using AMOS 4.01 provided further validation of the eight items retained to measure SP and SD (Figure 3). All fit measures and factor loadings were supportive of the two-factor model.

SEM Analysis

Structural equation modeling (SEM) using AMOS 4.01 was used to test the model presented in Figure 2. The structural model contains RIGA, SD, and SP. RIGA is an exogenous, observed variable and SD and SP are endogenous, latent variables. The model was tested with the combined data set containing both GSS and FTF partici-

Table 1. Factor Loadings of Meeting Satisfaction Items with Varimax Rotation

Item	Factor 1	Factor 2
SP1	0.63	0.25
SP2	0.67	0.07
SP3	0.54	0.10
SP4	0.58	0.21
SP5	0.78	0.18
SD1	0.35	0.28
SD2	0.14	0.70
SD3	0.22	0.64
SD4	0.20	0.75
SD5	0.07	0.34

Notes: Satisfaction with process items: SP1–SP5. Satisfaction with decision items: SD1–SD5.

pants (n = 159), with the GSS participants only (n = 93), and with FTF participants only (n = 66). As suggested by the literature, a variety of fit measures were examined to determine the appropriateness of the model [6, 7, 26]. The fit measures and parameter estimates are presented in Table 3.

The fit results of the model using the combined data set indicate strong support for the model's integrity (Table 3). The χ^2 analysis for the model was nonsignificant (χ^2 = 29.11, df = 25, p = 0.26) and absolute fit indices (GFI = 0.96, AGFI = 0.93) and incremental fit indices (CFI = 0.99, NFI = 0.93) exceed the widely used threshold of 0.90. The root mean square error of approximation (RMSEA) of the model of 0.032 indicates a close fitting model [9] as does the standardized root mean square residual (RMR) value of 0.45 [10]. It was concluded that the model, using the combined data set, was valid.

The model was consistent in that it performed well using the GSS-only and FTF-only data sets. Both analyses yielded nonsignificant χ^2 tests. GFI exceeds 0.90 for both the GSS model and the FTF model and AGFI values, although below 0.90, were consistent with levels accepted in the literature (e.g., [25, 42]). The incremental fit indices are supportive of the GSS (CFI = 0.98, NFI = 0.86) and FTF (CFI = 0.97, NFI = 0.86) models. The RMSEA measure is 0.034 for the GSS model and 0.063 for the FTF model and the RMR measure is 0.060 for the GSS model and 0.055 for the FTF model. Thus, it was concluded that the model was valid with the GSS-only and FTF-only data sets, as well as the combined data set.

The parameter estimates were then examined to test the study's hypotheses (Table 3). The results supported H1a, revealing a significant relationship from RIGA to SD, across all three data sets. RIGA explained 13.5 percent of the variance of SD in the combined data set, 13.3 percent of the variance of SD in the GSS-only data set, and 17.0 percent of the variance of SD in the FTF-only data set. H1b was not supported. That is, RIGA did not significantly predict SP for any of the three data sets. The results supported H2, revealing a significant relationship from SD to SP, across all three data sets. SD explained 19.2 percent of the variance of SP in the combined data

Table 2. Correlation Matrix and Cronbach's αof Meeting Satisfaction Items

	SP1	SP2	SP3	SP4	SP5	SD1	SD2	SD3	SD4	SD5
SP1	1.00									
SP2	0.54****	1.00								
SP3	0.37****	0.37****	1.00							
SP4	0.37****	0.39****	0.36****	1.00						
SP5	0.46****	0.52****	0.42****	0.53****	1.00					
SD1	0.31****	0.15	0.18*	0.21**	0.46****	1.00				
SD2	0.27***	0.17*	0.08	0.26***	0.23**	0.18*	1.00			
SD3	0.35****	0.15	0.23**	0.30***	0.25**	0.22	0.52****	1.00		
SD4	0.28***	0.19*	0.18*	0.25**	0.29***	0.37****	0.56****	0.47****	1.00	
SD5	0.11	0.11	0.10	0.06	0.10	0.09	0.20*	0.25*	0.32****	1.00

Notes: Satisfaction with process items: SP1–SP5. Satisfaction with decision items: SD1–SD5.

N = 159; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$; **** $p < 0.0001$.

SD1 and SD5 discarded from further analysis.

Cronbach's αfor items SP1, SP2, SP3, SP4, SP5 = 0.79.

Cronbach's αfor items SD2, SD3, SD4 = 0.76.

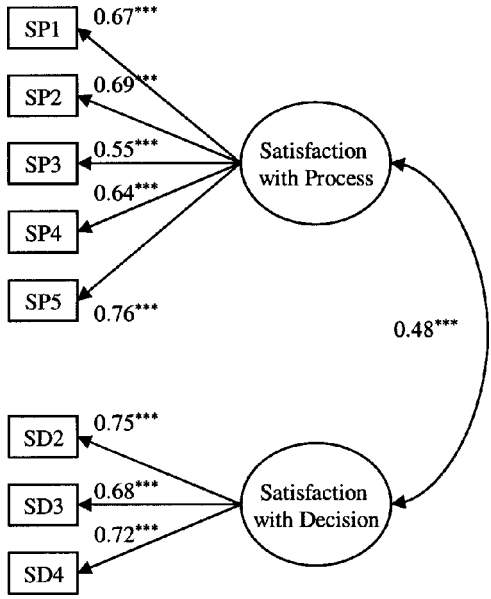

Figure 3. Confirmatory Factor Analysis of Meeting Satisfaction Items. N = 159; *** $p < 0.001$; Fit measures: $\chi^2_{(19)} = 25.90$; $p = 0.13$; GFI = 0.96; AGFI = 0.93; CFI = 0.98; NFI = 0.93; RMSEA = 0.048; RMR = 0.047.

set, 15.9 percent of the variance of SP in the GSS-only data set, and 39.2 percent of the variance of SP in the FTF-only data set.

Discussion

THE RESULTS OF THE SEM ANALYSIS supported the general model of meeting satisfaction presented in Figure 1 and did so consistently across three data sets including GSS and FTF groups. The degree to which an individual's rankings corresponded with the group's ranking was positively associated with SD, lending support to H1a. It appears that the participants in this study succeeded in assessing their RIGA and that these assessments were the basis for differences in PNGA, which, in turn, led to differences in satisfaction with decision. There was a significant relationship between SD and SP, supporting H2. This relationship was consistent across all three data sets and in each case represented the highest effect size between any two constructs examined in the model.

The direct relationship between RIGA and SP was not significant, failing to support H1b. This finding was also consistent across all three data sets. This does not imply, however, that RIGA is unrelated to SP but rather that RIGA appears to influence SP only indirectly through SD for this particular study. It is reasonable to believe that after investing 30 minutes of effort in debating the 15 items, participants wanted a satisfactory outcome. When such an outcome was achieved, they then appeared to

Table 3. SEM Results

Fit measures and parameter estimates[1]	Combined data (n = 159)	GSS only (n = 93)	FTF only (n = 66)	Constrained multiple groups[2]	Multiple groups	Test of invariance
χ^2	$\chi^2_{(25)} = 29.11$, $p = 0.26$	$\chi^2_{(25)} = 27.73$, $p = 0.32$	$\chi^2_{(25)} = 31.51$, $p = 0.17$	$\chi^2_{(59)} = 66.82$, $p = 0.23$	$\chi^2_{(50)} = 59.24$, $p = 0.17$	$\chi^2_{(9)} = 7.58$, $p = 0.58$
GFI	0.96	0.94	0.92	0.92	0.93	
AGFI	0.93	0.89	0.85	0.88	0.87	
CFI	0.99	0.98	0.97	0.98	0.97	
NFI	0.93	0.86	0.86	0.84	0.86	
RMSEA	0.032	0.034	0.063	0.029	0.034	
RMR	0.045	0.060	0.055	0.072	0.060	
RIGA →SD	0.37***	0.37**	0.41**	0.31***		
RIGA →SP	0.12	0.10	0.09	0.09		
SD →SP	0.44***	0.40*	0.63**	0.53***		

Notes: RIGA: relative individual goal attainment; SD: satisfaction with decision; SP: satisfaction with process

[1] All parameter estimates are standardized; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

[2] Groups are constrained on factor loadings and paths between constructs.

attribute a portion of that fulfillment to the process itself. With respect to SP, SD becomes a subset of PNGA. One way to test for a relationship between RIGA and SP is to eliminate the causal link in the model between SD and SP and thus subject all of the variance in SP to RIGA. When this is done, the relationship between RIGA and SP is significant for each of the three data sets (Appendix B). However, all of the fit measures are negatively affected by the absence of a path from SD to SP for each of the three data sets, yielding further support for the research model in Figure 1.

An important aspect of the preceding discussion is that the model in Figure 1 has been validated for both GSS and FTF groups. However, the model should be invariant across the groups as well. This is because there is no technology component in Figure 1 that implies that technology, in and of itself, does not have a direct causal linkage to meeting satisfaction. Rather, such an impact would manifest to the degree that the technology influences PNGA. To test for invariance the following procedure was used. First, the validity of the model was tested across the GSS-only and FTF-only data sets simultaneously, yielding $\chi^2_{(50)} = 59.24$. Because χ^2 tests are summative [10], the sum of the χ^2 results from the GSS model ($\chi^2_{(25)} = 27.73$) and the FTF model ($\chi^2_{(25)} = 31.51$) equals the results from the nonconstrained multigroup analysis (Table 3). Second, the model was tested constraining the factor loadings and the three parameter estimates between RIGA, SP, and SD as equal across both GSS-only and FTF-only data sets. The constrained multigroup model yielded $\chi^2_{(59)} = 66.86$. Third, the difference between the two models was calculated and found to be nonsignificant ($\chi^2_{(9)} = 7.62, p = 0.57$). Thus, we may conclude that the model is invariant across GSS and FTF groups. It should be noted however, that invariance may not always occur when examining the relationship between the RIGA measure and meeting satisfaction because the RIGA measure does not fully represent PNGA. PNGA is influenced not just by the outcome of a particular meeting, but also by perceived future goal fulfillment as well. Thus, it would be more reasonable to expect invariance across groups when a self-reported measure of PNGA is employed.

Implications for Practitioners and Researchers

This study's findings have some potentially important implications to practitioners. First, the relationship between RIGA and meeting satisfaction is relevant to meetings in which consensus is an issue. If group consensus is low, meaning that individuals tend to disagree on their preferences regarding the issue at hand, then RIGA would tend to be lower as a result. And although practitioners do not know an individual's RIGA in an anonymous setting, they can measure consensus. There was a significant correlation between consensus and RIGA at both the individual unit of analysis ($r = 0.542$, $df = 157$, $p < 0.000$) and the group unit of analysis ($r = 0.917$, $df = 24$, $p < 0.000$).[1] Thus, when practitioners encounter low consensus situations in a group session, they should be aware that meeting satisfaction may suffer as a result. The relationship between RIGA and consensus, and between RIGA and meeting satisfaction, may explain why studies that report lower consensus in GSS groups tend to also report lower satisfaction as well (e.g., [1, 20]).

A second implication for practitioners is the importance of individual goals versus group goals. Groups typically meet because a task or problem requires greater effort and insight than a single individual can provide. However, satisfaction occurs only if an individual perceives the fulfillment, or future fulfillment, of a goal. Unless participants adopt the goals of the group, there is not likely to be high levels of meeting satisfaction, regardless of whether or not group goals are fulfilled. This suggests that practitioners need to find ways to build individual commitment to group goals.

The model can also help explain why GSS experimental research has seldom succeeded in manipulating meeting satisfaction with various experimental treatments. Researchers often hypothesize that GSS structures such as anonymity and simultaneity will increase user satisfaction, but it is not clear what the causal link is between anonymity, for example, and meeting satisfaction. It is possible that some participants have a desire to participate but are prevented from doing so in normal meetings. But it is also possible that some participants want to dominate a discussion but are prevented from doing so in anonymous meetings. Future GSS studies on meeting satisfaction should include PNGA in their research models. For example, Reinig et al. [43] manipulated goal attainment in an ideation study that instructed groups of undergraduate students to discuss problems in a school of business. A graph was projected on the front screen that kept track of their total lines of comments submitted over a 40-minute discussion. If the participants reached their goal, an electronic firework display was presented on the public screen, indicating above average performance. If they failed to reach their goal, they were informed that they were below average producers. Goal attainment was varied by setting the target for comment productivity either well below or well above the average generated from a control group. Participants in groups with the below average target met their goal and reported greater affective reward than participants with the above average target that failed to meet their goal. The model of meeting satisfaction presented in Figure 1 provides a theoretical explanation of the findings reported in the Reinig et al. [43] study and can be applied similarly in future GSS experiments as well.

Limitations of the Investigation

As with any controlled empirical study, there are limitations to the degree to which these findings can be generalized. The participants and task, for example, are not necessarily indicative of what researchers may expect to encounter in the field. The use of ad hoc groups, such as the case here, has also been criticized for ignoring changes that occur in groups over time [15]. National culture has also been shown to influence individual behaviors and attitudes in GSS meetings (e.g., [41]), which raises questions about generalizing results from Western cultures to Asian cultures and vice versa. However, we assert that the fundamental cause of meeting satisfaction is the same across all cultures and all settings. Culture may influence the intensity individuals have for certain goals, and teams with long histories may personalize group goals more, or in some cases less, than ad hoc groups. But it is the evaluation of the trade-off between costs and benefits that determine PNGA, which, we assert, is the cause of meeting satisfaction.

Another limitation of the study is the relatively small sample size, particularly in the FTF-only data set. However, because the model is invariant across FTF and GSS groups, it is justifiable to combine them into a single data set, in which case there is adequate sample size.

Conclusion

MEETING SATISFACTION IS ONE OF THE MOST IMPORTANT and frequently studied constructs in GSS research. However, researchers examining meeting satisfaction in a variety of team settings have reported nonsignificant and inconsistent results. One reason for this is that the theoretical underpinnings of meeting satisfaction have seldom been explored. In this paper, a causal model of meeting satisfaction is presented that is based on goal setting theory and builds on previous research on meeting satisfaction. A study was then presented consisting of GSS and FTF groups working on an intellective task and the model was validated using structural equation modeling. A number of implications for researchers and practitioners were discussed. It is hoped that the model of meeting satisfaction presented in this paper will be useful in future research on the use of collaborative technology and meeting satisfaction in particular, and teamwork in general. Having a sound and validated theoretical model of meeting satisfaction is a first and necessary step to designing systems, methods, and techniques that can ultimately increase meeting satisfaction for users of collaborative technologies.

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NOTE

1. To calculate the correlation at the individual unit of analysis, each individual RIGA measure was paired with the consensus measure for that individual's group. To calculate the correlation at the group level of analysis, the average RIGA measure for each group was paired with the group's consensus measure.

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Appendix A: Meeting Satisfaction Items

Satisfaction with Process (SP)

1. How would you describe your group's problem solving process?
   1 = efficient, 5 = inefficient
2. How would you describe your group's problem solving process?
   1 = coordinated, 5 = uncoordinated
3. How would you describe your group's problem solving process?
   1 = fair, 5 = unfair
4. How would you describe your group's problem solving process?
   1 = understandable, 5 = confusing
5. How would you describe your group's problem solving process?
   1 = satisfying, 5 = dissatisfying

Satisfaction with Decision (SD)

1.* How satisfied or dissatisfied are you with the quality of your group's solution? 1 = very dissatisfied, 5 = very satisfied
2. To what extent does the final solution reflect your inputs?
   1 = not at all, 5 = to a very great extent
3. To what extent do you feel committed to the group solution?
   1 = not at all, 5 = to a very great extent
4. To what extent are you confident that the group solution is correct?
   1 = not at all, 5 = to a very great extent
5.* To what extent do you feel personally responsible for the correctness of the group solution? 1 = not at all, 5 = to a very great extent

* Discarded due to poor loading in factor analysis.
Source: Green and Taber [23].

Appendix B. SEM Analysis Without Direct Linkage Between Satisfaction with Decision and Satisfaction with Process

Fit measures and parameter estimates[1]	Combined data (n = 159)	GSS only (n = 93)	FTF only (n = 66)	Constrained multiple groups[2]	Multiple groups	Test of invariance
χ^2	$\chi^2_{(26)} = 46.47$, $p = 0.01$	$\chi^2_{(26)} = 35.21$, $p = 0.11$	$\chi^2_{(26)} = 46.69$, $p = 0.01$	$\chi^2_{(60)} = 87.29$, $p = 0.01$	$\chi^2_{(52)} = 81.90$, $p = 0.01$	$\chi^2_{(8)} = 5.39$, $p = 0.72$
GFI	0.94	0.93	0.88	0.90	0.91	
AGFI	0.90	0.87	0.79	0.85	0.84	
CFI	0.94	0.94	0.89	0.92	0.92	
NFI	0.88	0.82	0.79	0.80	0.81	
RMSEA	0.071	0.062	0.111	0.054	0.061	
RMR	0.116	0.099	0.158	0.097	0.099	
RIGA →SD	0.37***	0.36**	0.40**	0.40***		
RIGA →SP	0.28**	0.25*	0.35*	0.30**		

Notes: RIGA: relative individual goal attainment; SD: satisfaction with decision; SP: satisfaction with process.

[1] All parameter estimates are standardized; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

[2] Groups are constrained on factor loadings and paths between constructs.