Collectivities using groupware: Exploring social psychological dimensions of effective group performance and perceived usefulness of groupware

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Abstract: Although the technology has been around for awhile, groupware has evolved over recent years. A foundation is created by defining groupware, listing related terms, and developing a short history of how groupware has emerged. Success factors of a team are analyzed in order to replicate the performance and outcomes. Determining how to quantify effectiveness, efficiency, and employee satisfaction is a critical part in implementing a successful team and establishing when the deliverables have been achieved. Although the sophistication of technology has made remarkable progress, the human factor is a large consideration of a successful team using groupware. Dimensions of Adaptive Structuration Theory were explored which included attitudes of team members and their perception if the collaborative software was useful. Transferring from the traditional work environment to using groupware is not as simple as one would anticipate. Therefore, strategies are listed for potential growth of non-collated teams using groupware. This review analyzed research of teams who worked in a collaborative environment, unencumbered by time and distance barriers, to meet objectives collectively using computer-augmented technologies.

Background

Groupware Terms

Although the definition of groupware has evolved over the years, the term can be generically defined as the use of information technology to facilitate communication and collaboration. Groupware allows dynamic teams to interact across time and space (Olesen and Myers, 1999). Collaborative components commonly include electronic bulletin boards, on-line chat rooms, audio and video conferencing systems, email, electronic document management system, and threaded discussion databases (Harris and Sherblom, 2002; Warkentin and Beranek, 1999). This seemingly boundaryless network is situated in either an intranet or internet (Harris and Sherblom, 2002) for sharing documents, files discussions, issues, and tasks (Harris and Sherblom, 2002; Zielinski, 2000). Furthermore, collaborative software tools can be used for brainstorming, alternative rating, and consensus building (Satzinger and Olfman, 1995).

Collectivities encompass two terms that often appear synonymous, groups and teams. It is important to distinguish between the two. Groups are collections of participants that are individually

accountable. Teams are collections of participants who work jointly to meet a common task or goal, who are evaluated based on the deliverable and who are accountable as a team (Metz, 2000). Communication tools used for information exchange are generically referred to as groupware. However, a variety of similar terms have evolved and eventually have blended together: Computer-Supported Cooperative Work (CSCW), Group Decision Support Systems (GDSS), Group Support Systems (GSS), Electronic Meeting Systems (EMS), Computer-Support Collaborative Work (CSCW), Computer-Mediated Communications (CMC) or Group Negotiation Support Systems (Caouette and O'Connor, 1998; Olesen and Myers, 1999; Qureshi and Vogel, 2001; Satzinger and Olfman, 1995).

Technology-driven support for collectivities can be based on time and location. Two types of synchronous collaborations can occur - at the same place or at various locations. Computer support can be supplied for the traditional, face-to-face meetings that occur at the same time in the same place. These meetings include collocated teams who meet to discuss issues, report progress, or finalize agreements. The second type of synchronous meetings occurs at various locations and is generically defined as electronic meetings. Groupware supplements electronic meetings that occur at the same time but in different locations to dynamically exchange information in real time. Conversely, asynchronous meetings occur when teams need to interact with each other electronically at different times and at different locations. These asynchronous meetings are necessary for planning future meetings and following through with tasks after the conclusion of meetings (Satzinger and Olfman, 1995). Allowing the users to have more time to compose documentation, asynchronous teams require highly structured meetings and provide a greater exchange of documents (Warkentin and Beranek, 1999).

How Groupware Emerged

Chapanis, Ochsman, Parrish, and Weeks (1972) conducted the earliest research by examining different modes of communication among team members. These studies encompassed typewriting, handwriting, voice-only, and unrestricted communication modes (Kline and McGrath, 1999). With modern corporations interested in obtaining a sustainable competitive advantage, organizations have been including teamwork into the company structure (Olesen and Myers, 1999). Thereby, the need for informational systems to integrate physically distributed teams has evolved as more companies become global (Caouette and O'Connor, 1998).

As the eruption of technological advances continue (i.e., collaborative software and the Internet), corporations are integrating telecommunication/information tools to facilitate communication, to provide network access to documents, and to share ideas (Olesen and Myers, 1999). Although groupware researchers analyzed the use of information technology, communication and collaboration is an area that needs more research (Olesen and Myers, 1999). It can be suggested that underlying human factors sabotage team performance when utilizing groupware. Groupware users may attempt to maintain the status quo in organizations. The emphasis of the "group," the human factor of teams, is always more important than the "ware," the collaborative technologies (Caouette and O'Connor, 1998). Consequently, the functionality of groupware is not fully maximized (Olesen and Myers, 1999).

Success Factors

"The success of the GSS is measured in terms of effectiveness, efficiency, and satisfaction" (Olesen and Myers, 1999, p. 319).

Effectiveness

One set of researchers defined team effectiveness to include four factors: quality of work, customer service, satisfaction of the members, and productivity. These four factors were incorporated into test items that were measured on a 5-point Likert-type scale on questionnaires. Instead of collecting results from the participants involved in the study, questionnaires were distributed to more participants to obtain a greater range of perceptions of effectiveness. Consequently, reliability was increased and common method variance decreased (Campion and Medsker, 1993).

In Fjermestad's and Hiltz's evaluation of 54 published studies of groupware research, some studies quantified effectiveness with objective and/or subjective tests. For example, some studies determined the team effectiveness by calculating expenses saved or quantified productivity by counting output of documents. With subjective tests, survey test instruments quantified improvement in the quality of decisions.

Fjermestad and Hiltz evaluated 54 published studies of groupware research. They documented 89% of the studies reported increased effectiveness in comparison to other methods. Although some studies quantified the increased effectiveness, most measurements were based on the participants' subjective opinions (Fjermestad and Hiltz, 2000).

Another operational definition of team effectiveness is equated to (Yellen et al., 1995):

Potential Effectiveness – Process Losses + Process Gains

Process losses include two possible factors: production blocking and groupthink. First, a participant interrupting someone else thereby distracting the other team member is an example of production blocking. This other participant consequently forgets his/her own idea (Jessup and Egbert, 1996). Groupthink (Janis, 1982) is defined as rushing to conclusions resulting from the pressures to form a consensus. Therefore, not analyzing all possible solutions to a particular issue could result in diminishing team effectiveness (Yellen et al., 1995).

Another issue that could hinder team effectiveness is a team leader's approach toward the task and technology. A team leader's motivation to obtain the task objective while advocating and utilizing the technology impacts team effectiveness. For example, researchers observed less productivity in a team that included a team leader who did not learn the technology prior to team collaborations in comparison to a team that included a team leader who did learn the software. The team containing the leader who learned the technology as well as advocated the collaborative software showed increased effectiveness (Caouette and O'Connor, 1998).

Efficiency

Efficiency is quantified as a timesaving. For example, a computer-augmented meeting can take less time than a traditional face-to-face meeting. Also, if productivity increased thereby providing more output in less time, researchers documented enhanced efficiency (Fjermestad and Hiltz, 2000).

Fjermestad and Hiltz evaluated 54 published studies of groupware research. The results suggest that efficiency was increased in the computer-augmented meetings over the traditional, face-to-face meetings by 62% of the studies included in the evaluation (Fjermestad and Hiltz, 2000).

Researchers of another study reported enhanced collaboration among the participants. The researchers speculate the increase resulted from a variety of reasons: the groupware's ability provided greater efficiency in the collaboration process, the remote capabilities allowed the participants to work from home providing fewer interruptions at work, and the discussion topics were focused and organized. Conversely, the researchers noted that in face-to-face meetings, people normally said whatever comes to mind whereas the collaborative software provided streamlining (Nyerges et al.,1998).

Employee Satisfaction

In Fjermestad's and Hiltz's evaluation of groupware research, satisfaction was operationalized by three separate measures: process satisfaction, outcome satisfaction, and participation. This evaluation included 54 published studies and the data collection usually comprised of questionnaires and surveys (Fjermestad and Hiltz, 2000). Another study went a step further and included results from a disparate, opinion survey that was administered three months prior the research. The intention was to obtain opinions that were not biased based on the type of research studied (Campion and Medsker, 1993).

The results of employee satisfaction from various studies were equivocal at best. Although some researchers reported a decrease in satisfaction, many researchers reported that the participants expressed an increase in satisfaction in using a groupware environment (Yellen et al., 1995).

However, Fjermestad's and Hiltz's evaluation of 54 studies, the results distinguished that teams are more satisfied with groupware compared to traditional face-to-face meetings. The recurring reason offered by the studies is an improvement in process and/or a perception of enhanced quality (Fjermestad and Hiltz, 2000).

In two other studies, a combination of effectiveness, efficiency, and employee satisfaction provided a convergence of results. First, effectiveness and employee satisfaction were enhanced with members using groupware. Participants felt more satisfied and efficient with their efforts than teams using traditional methods, and teams resolving a challenging task felt productivity improved when using groupware (Caouette and O'Connor, 1998). Second, effectiveness and efficiency were listed as a potential benefit when using groupware that supported collaboration and information dissemination (Nyerges et al.,1998).

View of the Team Member

Attitude

The Technology Acceptance Model (TAM) (Davis, 1986; Davis, 1989) offered a theoretical foundation for user acceptance of technology. The relationship of two factors, perceived ease of use and perceived usefulness, determined why people accept or resist technology (Gefen and Straug, 1997; Igbaria et al., 1997). The theory of this widely accepted model has been validated in numerous studies. Furthermore, the reliability and validity of measurement scales have been analyzed in other studies that have proven the TAM model to be successful in determining user acceptance (Hu et al., 1999).

In one groupware study, the attitudinal factors measured included: honesty that participants exhibited during the activities, the degree of commitment towards the implementation of procedural, and the level of trust that developed within the team. In addition, the level of computer confidence exhibited by participants was examined since computers were used during meetings (Corbitt et al., 2000).

To measure the test instruments, scores were obtained from participants' responses to a survey using a 6-point Likert-type scale. The research team performed baseline measurements of participants for the attitudinal factors at the beginning of the project and repeated these measures for all tests throughout the project. To reduce survey bias, the scales were varied in the survey instrument. In the summative evaluation, the results were converted to a common scale (Corbitt et al., 2000).

Although resistance was demonstrated by some participants, collectively the results suggested that positive attitudes toward groupware would provide higher team performance than those teams with negative attitudes (Caouette and O'Connor, 1998; Nyerges et al.,1998; Olesen and Myers, 1999; Satzinger and Olfman, 1995).

For example, a quasi-experimental field study included two teams who displayed differing results. This particular study explored the attitudes toward the task and the technology using triangulation data sources of meeting transcripts, outputs, and interviews. The members of the first team displayed a positive attitude towards the collaborative software and consequently incurred an increased value in the team meetings. Conversely, although the members of the second team had some increased outcomes resulting from their computer-augmented teams, the members did not see an added value in using

groupware. The researchers attributed this factor to a leader who was unprepared in using the technology and perhaps the users wanted to attribute their perceived (and not actual) lower outcomes to the technology (Caouette and O'Connor, 1998).

Three other studies supported that attitudes towards teams and groupware impacts the team's performance. Researchers of one study suggested that attitudes and experience could be important in determining team performance (Satzinger and Olfman, 1995). Another field study determined that corporate culture, attitudes and team norms impacted the acceptance of groupware after participants demonstrated a positive attitude toward the technology and team work (Satzinger and Olfman, 1995). Researchers of a third study found that groupware provided motivational factors to produce quality ideas (Caouette and O'Connor, 1998).

John W. Satzinger and Lorne Olfman studied a company that displayed differential results involving corporate culture, attitudes, and norms (team and organizational). After the company's upper management displayed a supportive attitude in using groupware to form a collaborative work environment that provided information sharing (culture), some staff exhibited negative views in using groupware (attitude). For example, Information Technology (IT) department was not responsive in assisting with computer-related issues and some participants did not want to relinquish control over scheduling appointments and/or meetings. Since the researchers implemented the groupware system, individuals in the IT department may have felt isolated with limited control to the new system. Consequently, the technology support for the groupware was limited with slow response time from IT. Furthermore, since personal assistants to upper management deemed themselves as the "gatekeepers" of scheduling and meeting information, they were not receptive to relinquishing control. Therefore, although the personal assistants used the groupware solution, they incorporated traditional methods into the new technology in order to maintain the status quo (norms) (Olesen and Myers, 1999). This introduces an interesting concept. Although groupware provides collaboration by sharing documents in a networked environment, it may be perceived as a tool that relinquishes control over documents.

Perceived Usefulness

As noted above, the Technology Acceptance Model (TAM) (Davis, 1986; Davis, 1989) included the construct of "perceived usefulness." Davis defined perceived usefulness as "the degree to which a

person believes that using a particular system would enhance his or her job performance" (Davis, 1989, p. 320). The TAM model provided a foundation in determining the intentions of participants to use technology (Satzinger and Olfman, 1995). Perceived usefulness, one of two factors in the TAM model, is important in predicting the intention in using an application. The second factor, perceived ease of use, has some equivocal results and may become irrelevant after participants develop their competencies with the technology (Hu et al., 1999).

Based on the research performed by Satzinger and Olfman, the results (using Likert-type test instruments) provided indications that participants had a positive perception of the team and of electronic communication technologies. Researchers suggested that the participants' positive evaluations of perceived usefulness resulted from attitudes toward technology and teamwork, number of teams, and meeting longevity. Out of the three types of computer support for teams, between meetings (different time and different place) proved to be more useful than face-to-face meetings (same time and same place) or electronic meetings (same time and different place) (Satzinger and Olfman, 1995). Furthermore, amount of computer use by participants was not correlated to perceived usefulness (Vlahos and Ferratt, 1995).

Adaptive Structuration Theory

Although originally theorized by Anthony Giddens in order to predict the relationship between structure and action in team processes, adaptive structuration theory (AST) was modified by DeSantis & Poole (1990). AST can be simply defined as the interaction of humans and environment (i.e. humans changing their surroundings while the environment changes them) (Olesen and Myers, 1999).

Adaptive structuration theory is used to understand the impact of groupware in improving communication and collaboration. Incorporated in social structures (rules and resources), AST is the interaction of technology, tasks, and a team leader. Thus, the team's process and outcomes are established. Desirable outcomes occur when there are positive attitudes toward the technology. For example, although a corporation may determine to implement groupware to enhance collaboration and communication, the groups may not modify their work habits to use the complete functionality of groupware. Although the groupware should transform work habits, groupware is "modified" (or not used to its full capabilities) to continue using traditional work behaviors (Kahai and Sosik, 1997; Poole and

Holmes, 1993). Printing emails and storing them in filing cabinets is one instance in where traditional practices continue despite the technology.

It is important to understand the significance of AST. If a team already has existing rules, resources and structures, then the participants may choose to configure the technology to continue the status quo or doing "business as usual." This offsets the benefits of groupware since the participants, through action or inaction, will not utilize the entire realm of functionality the technology has to offer (Kline and McGrath, 1999; Olesen and Myers, 1999).

As in Satzinger's and Olfman's study, the personal assistants resisted in using the groupware to provide a collaborative mechanism in scheduling meetings. To schedule a meeting with a senior manager, the traditional method incorporated a telephone call to the personal assistant. The collaborative software provided scheduling functionality so that anyone can view and schedule a meeting with another person in the networked environment. However, it was the personal assistants responsibility to be the "gatekeeper" of information and as a consequence, the personal assistants did not use the groupware to transform their work. Instead of a collaborative tool, the personal assistants perceived groupware as a tool to enhance their individual productivity.

Strategies

Benefits and Obstacles

Using collaborative software provides numerous benefits to enhance communication and to provide access to non-collated teams. Groupware's functionality includes: document sharing and management, project management, task tracking, discussion forums (bulletin boards), public calendars, and real-time communication (chat rooms or instant messages). Some software provides version control for documentation so that multiple users can edit one document but require an approval from another user (Seltzer, 1999).

Just as the technological benefits vary depending on the software, hardware, and network, enhancing a team's performance will depend on a number of human factors. Although a team's performance can be attributed to the functionality of groupware, it can also be impacted from the effectiveness and efficiency of the team (including performance, productivity, and employee satisfaction), as well as attitudes and perceived usefulness. Although researchers suggested that groupware enhances performance for teams, it may not be appropriate to implement for all types of situations (Olesen and Myers, 1999).

Overcome Obstacles

The tasks of the team is used in determining the success of the project and is measured in terms effectiveness, efficiency, and participant satisfaction (Olesen and Myers, 1999). If the task is deemed more important, the team will increase in performance. Team productivity can be improved if the task is challenging when using groupware. In addition, an important task will motivate users to thrive better and satisfy the users more than an inconsequential task (Caouette and O'Connor, 1998).

If the collaborative software is too difficult for team members to use, technical training for the users is necessary. In addition, since on-line communication requires a different skill than verbal communication, training will also be required of the nuances to on-line communication. For example, the users must understand how to take turns in an on-line discussion that does not have visual cues. In addition, a user must be cognizant that if an email or an instant message is formatted in upper case text, it is received as "shouting" (Satzinger and Olfman, 1995).

When establishing teams, members with positive attitudes should be selected for the team. In addition to positive attitude towards computers and team work, members who have used computers and who have worked in teams provide the most benefit to the performance of the team (Satzinger and Olfman, 1995; Culpan, 1995). A team member's attitude should reflect a level of commitment to the team and not toward individual objectives (Caouette and O'Connor, 1998).

Team leaders should understand the corporate and social environment before the team meetings convene. Also, the leader should establish the initial interaction among the team members at the project's onset and should demonstrate a level of commitment to the team's objective (Caouette and O'Connor, 1998). Furthermore, good leadership can enhance team performance, but poor leadership can result in not meeting objectives (Yellen et al., 1995).

Conclusion

Although the innumerable factors involving a successful team in a technology-enhanced environment are too broad for this review, it is important to understand that groupware not only includes technology, it encompasses the human factor. It should not be anticipated that team members can make an easy transition from a traditional team to a non-collocated team using groupware. The team members' attitudes toward teams and technology must not be overlooked when incorporating collaborative software into a corporate structure. Unintentional counter forces occur when users attempt to replicate their traditional workflow with the innovative technology. However, if the intention is to have the workflow modified based on the new software, it is imperative to consider the attitudes of those who will be impacted – the end users. They make an important contribution to determining the success of groupware in a team environment.

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