Toward Inclusive Dialogue: Participation and Interaction in Face-To-Face and Computer-Mediated Discussions

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Abstract
In recent years, there has been a growing interest in the use of IT to support organizational knowledge management by mediating discourse through GSS, E-mail, listservers, Lotus Notes, chat rooms, threaded discussions, and the like. But do these technologies foster more inclusive dialogue? Educational research has found that conventional classroom discussions often demonstrate a gender bias. Male participants are much more likely to dominate, often precluding meaningful participation by female members [1]. These technologies may have the potential to reduce this gender bias, but there is little direct research that examines how the nature of the interaction changes in virtual settings and how efficiently or effectively these tools support inclusive participation and interaction. Using a Latin square design, this study compares the participation and interaction of 57 subjects discussing sensitive issues in a traditional face-to-face classroom discussion, supported by a synchronous EMS (GroupSystems), and an asynchronous Web-based threaded discussion. EMS users participated more and Web-based threaded discussion users less than regular classroom subjects. Subjects using technology produced discussions with the least gender bias in participation: EMS discussions produced the most uniform participation. Subjects preferred the EMS, they revealed more in the EMS, perceived higher quality participation with the EMS, and reported higher satisfaction levels with the EMS. Implications for systems developers and organizations are discussed.

1. Introduction

A pervasive concern within contemporary organizations is to find efficient and effective methods to harvest the knowledge and opinions from diverse and increasingly distributed groups of people. In recent years, there has been a growing interest in the use of information technology to support the building of organizational knowledge by mediating intellectual discourse through E-mail, listservers, Lotus Notes servers, chat rooms, threaded discussions, and the like. But do these technologies foster more inclusive dialogue? Educational research has found that conventional classroom discussions often demonstrate a gender bias. Male participants are much more likely to dominate, often precluding meaningful participation by female members [1]. This problem is particularly pronounced when the discussion centers on sensitive or ethical issues. The implication is that the perspectives of female constituents may not be heard or may be unfairly underrepresented with such a format. If knowledge management begins with inclusive dialogue, then an appropriate communication forum would promote equitable participation and representation. Clearly, the traditional face-to-face discussion format leaves something to be desired.

Group support systems have been shown to increase equality of discussion participation among users (see [2], [3] for reviews). This effect is achieved largely through the technologies' ability to support anonymous contribution. It is not known whether these technologies increase equality of discussion participation across genders. Another dimension of some emerging information technologies is their ability to efficiently support communications of geographically dispersed groups. Most of these technologies can be used to support communication between temporally dispersed group members as well. In this case, participation in a computer-mediated discussion can be at the discretion and convenience of the recipient. The obvious advantage is the avoidance of the interruption of higher-priority work and the elimination of scheduling difficulties inherent with a traditional same-time group.
The ability of computer-supported technologies to equalize participation across participants noted above comes from studies where all participants were colocated, present at the same place at the same time. As noted above, these studies found that participation was more even across participants compared to face-to-face discussions. What is not known is if these effects translate to more equitable and representative participation by females compared to the traditional format. Also, it remains to be seen whether this effect can be obtained when the participants are geographically and temporarily dispersed. If these technologies can deliver these desirable effects under both colocated and dispersed conditions, they have tremendous potential to resolve the gender bias dilemma and aid organizations in more establishing more inclusive dialogue and effective knowledge management.

When one reviews the research literature related to classroom discussions, technology, and gender communications, there is no research literature comparing and evaluating traditional in-class discussions with in-class, anonymous, on-line discussion formats. There is also no research literature comparing traditional in-class discussions with anonymous, Internet-based threaded discussion formats. There is very little research literature on asynchronous and synchronous computer discussions in the classroom [4], [5]. This lack of research literature reinforces the relevance of this study.

The purpose of this study is to examine trends in participation and interaction within three communication modalities; to determine if computer-mediation equalizes male-female participation in ethical issue discussions; and to examine the relative efficacy of technology when used to support geographically and temporally dispersed groups. Specifically, we compare relative participation in traditional classroom-style face-to-face discussions with those supported by a same time-same place group support system (GroupSystems --an EMS), and discussions by geographically and temporally dispersed participants supported by an Internet-based threaded discussion tool. We also investigate user satisfaction with these technologies and satisfaction with the educational experience as delivered in these three different ways.

The next section reviews relevant literature on gender bias in classroom discussions, information technologies that support group communication, and sets the stage for the hypotheses. We then present the study and offer results, and conclude with an integrative discussion with suggestions for application of these results and suggestions for future research.

2. Literature Review

2.1. Gender Bias in Classroom Interaction

An enormous amount of literature exists regarding gender and the classroom. Cross-sex research conducted by Fishman [6], for example, suggests that women maintain conversations by asking questions and encouraging others to continue. West and Garcia's [7] gender study suggests that men often are the ones who introduce the topics of conversation that continue to receive attention throughout the conversation. Lee et al. [8] state that gender domination, either boys dominating discussions or teacher recognizing boys more often than girls, was by far the most prevalent form of sexism in the coeducational schools. Canada and Pringle [9] and Greeno [10] also found student-centered gender differences arising with mixed-sex education. Further findings from the Canada and Pringle [9] study are that when the proportion of male students was high, women in the new mixed-sex classrooms were not as likely as they were in single-sex classrooms to enter deliberately into a sustained conversation with the professor. Male students became increasingly willing to enter into such conversations as the proportion of male students increased.

According to some researchers, the classroom climate is a "chilly" one for women with college males participating more often, receiving more teacher encouragement, having more influence than females [1], and asking and answering more questions [28]. Hall and Sandler [1] reviewed a wealth of both quantitative and qualitative evidence and concluded that gender influences interactions in educational environments and the effects are particularly detrimental to the education of women. Their report called for heightened awareness that teachers' behaviors can communicate differential expectations for male and female students. Later research by Krupnick [11] noted that at Harvard University, males dominated discussion, but especially so when the teacher was male and the class had a majority of males. Pearson and West [12] reported that in college communication classes female students asked fewer questions than male students in courses taught by males, and male teachers received more questions than female teachers.
Research has consistently shown that male and female students do behave differently in mixed-sex classrooms. Most researchers reported disproportional numbers of classroom interactions involving male students [13]-[16]. Canada and Pringle's [9] study found that in the mixed-sex classrooms, the increasing presence of male students was associated with an overall decrease in professor-initiated interactions, student-initiated interactions, and female student-initiated follow-up interactions and with an overall increase in male student-initiated follow-up interactions. In addition, researchers have found that mixed-sex education, at least as it is typically configured, may pose notable disadvantages for girls and women (see [17] and [18]).

Cherland [19] and Evans [20] believe that discussions may be influenced along gender lines. Evans believes that a factor like gender plays a role in whose ideas get expressed and are actually listened to [20]. The assumption is that peer-led discussions are assumed to be "democratic" contexts where all students' voices will be heard and valued equally simply because they are members of the same peer group. Whether such an assumption is valid has received little attention [20].

This research presents a clear picture of the inequality of participation, attention and involvement between men and women in the traditional face-to-face classroom. Given that much of this research was done with adult university students, it is likely that it generalizes to the workforce at large. For organizations concerned with knowledge management, inequality of participation during the face-to-face discussion is clearly unsatisfactory.

2.2. CMC and Gender Differences

As noted above, some computer-based technologies have been shown to promote equalization of participation in discussion (though not specifically resolving gender-bias issues). These technologies include same time-same place electronic meeting systems (a subset of a larger group of technologies generally referred to as group support systems or groupware) and communication media such as electronic mail and its variants. In both cases, the ability to allow anonymous contribution to the discussion, thereby ensuring that participants cannot be identified, is regarded as the driver of more equal participation. In the case of the group support system, additional effect comes from the technology's ability to enable simultaneous processing of input. Users do not have to wait for one another to stop "speaking" (i.e., typing in their comments) but can all contribute at the same time without interrupting one another. Therefore, domination of the discussion by one individual that would prevent contributions from others in a traditional face-to-face format others is not possible when this type of technology is used. Nunamaker et al. [2] give a comprehensive review of this technology and related research findings.

A small amount of research has evaluated gender differences and the communication styles of students during the synchronous and asynchronous computer discussions. Hawisher and Selfe [4] used an asynchronous, computer, classroom discussion for their English classes. In both classes, women agreed more and posed more questions than the men. However, the results of this preliminary study cannot be considered conclusive. Maccoby [22] provides a more comprehensive view that differences are symptomatic of a gender politic that pervades the educational and societal landscape. This view emphasizes the link between society and education as opposed to education existing as an entity on its own without societal influence. If this is the case, then neither the anonymity or simultaneous processing support afforded by the technologies under discussion here would have any effect on participation by gender beyond the general tendency to increase participation (by the shy or reticent of both sexes) noted in earlier studies.

Another issue that concerns the traditional and the two technological discussion formats is motivation and productivity. In colocated conditions, the presence of others tends (generally) to increase motivation for well-learned tasks (e.g., discussion) through social facilitation [21], [23]. Potter, Balthazard, and Cooke [24] found evidence of productivity loss among dispersed computer supported decision-making groups compared to equivalent face-to-face groups. Potter and Balthazard [25] noted this same effect with dispersed dyads negotiating via computer. In both of these studies, participants were identified. Threats to social facilitation-derived motivation can also occur under anonymous conditions, where participants can be free riders on the efforts of others, or where the threat of free riding by others diminishes the motivation of would-be contributors [26]. There is no extant research that shows that this effect varies by gender.

Another aspect of motivation comes from the ease with which individuals can contribute to the task [27]. The parallel processing capability of the computer
technologies removes any impediment to contribution, in contrast to the face-to-face condition, where social norms require waiting for one’s turn to speak. Relatedly, an Internet-based communication technology such as electronic mail or threaded discussion tool normally imparts some waiting time due to technological constraints such as distance and server speed. Waiting time can be construed as an impediment to contribution that leads to loss of motivation and/or dissatisfaction with the technology and the educational experience. This waiting is practically eliminated with the colocated group support system.

3. Hypotheses

This study used coed groups of subjects discussing ethical issues in the traditional face-to-face manner; anonymously in a same time-same place format via a computer-based group support system; and anonymously but in a geographically and temporally dispersed condition supported by an Internet-based threaded discussion tool. The preceding discussion suggests hypotheses about the comparative effects of technology on productivity, participation, equality of participation by gender, satisfaction with the technologies, and satisfaction with the educational experience.

H1. Participants using the computer technology in the colocated, synchronous environment (EMS) will generate more input into the discussion than participants in the geographically and temporally dispersed environment.

H2. Participants using the computer technology in the geographically dispersed environment will generate more input into the discussion than participants in the face-to-face (non computer-supported) condition.

H3. Discussions supported by the computer technologies will exhibit more equal male-female participation compared to face-to-face discussions.

H4. Participants in the colocated, computer-supported condition (EMS) will express greater satisfaction with the educational experience than those in the face-to-face non computer-supported condition and those in the dispersed, computer supported condition.

H5. Participants in the dispersed, computer-supported condition will express greater satisfaction with the educational experience than those in the face-to-face non computer-supported condition.

H6. Participants will prefer computer-supported discussions over traditional discussions if given a choice.

4. Method

This study compares and evaluates traditional in-class discussions with synchronous and asynchronous computer-mediated discussion formats. The traditional in-class discussions were held in the regularly scheduled classroom and lasted seventy-five minutes. The synchronous discussions were accomplished using the GroupSystems V (GSV) program and held at a campus laboratory housing networked computers. This environment allowed participants to discuss anonymously and in parallel, at the same time during one seventy-five minute class period. The asynchronous format was created using Microsoft's Front Page threaded discussion web-bot (WTD), which allowed subjects to participate anonymously at any time of the day for one week.

4.1. Design

To examine three levels of technology support for classroom interaction (no computer support, synchronous group support systems, and asynchronous web-based threaded discussion), a Latin square design was used. In this design, three sections (G1-G3) of a Personal Health course taught in the same semester by the same instructor discussed three different issues (Issue 1-Issue 3), each section using a different technology (Tech 1-Tech 3), in the following superposed orthogonal squares

<table>
<thead>
<tr>
<th>Tech 1</th>
<th>Tech 2</th>
<th>Tech 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Issue 1</td>
<td>G1</td>
<td>G2</td>
</tr>
<tr>
<td>Issue 2</td>
<td>G3</td>
<td>G1</td>
</tr>
<tr>
<td>Issue 3</td>
<td>G2</td>
<td>G3</td>
</tr>
</tbody>
</table>

where each of the nine cells conducted the task made up of discussing issue \( n \) supported by technology \( m \). A 50 question pre-test instrument captured demographic information, subjects’ skills and knowledge about computers, and subjects’ opinions regarding the use of technology to support various everyday tasks. Participation was registered by either coding face-to-face discussion in real-time or by reviewing hard copy transcripts generated by GSV or WTD discussion software. A post-test questionnaire consisting of 85 questions captured opinions about technology fit for supporting classroom discussion, satisfaction with use, the significance of anonymity, and which discussion protocol produced a more equitable participation.
4.2. Subjects

As part of their required coursework, fifty-seven students enrolled in a Personal Health class at an urban mid-Atlantic university participated in the study. The same instructor offered the course in three distinct sections and, for convenience sake, experimental groups were derived from this structure. There were eighteen students in section "G1," sixteen students in section "G2," and twenty-three students in section "G3." Sixty-six percent of subjects were female and thirty-three percent were male. The average age was 22.1 years.

4.3. Discussion Task

The Personal Health instructor developed the curriculum and assignments used in the study. Three journal articles that linked to topics covered in her Personal Health class were chosen. For each article, the instructor designed a discussion question that was sensitive in nature and which would stimulate discussion in the classes. Selected were articles about rape myths, about binge drinking in college, and about environmental sensitivity. The learning structure followed Dillon’s (1994) approach, where the instructor promotes discussion – a willingness to have the class discuss and a willingness to help the class discuss. In this structure, the instructor's role is to facilitate and guide discussion, not to dominate it. Consequently, the role of the instructor was limited to answering factual questions posed by the group and correcting factual inaccuracies in the discussion per se.

4.4. Procedure

To compare traditional in-class discussion with GSV and WTD discussions, four 75-minute class sessions for each section were used. For the GSV and WTD treatments, an initial class period was used to instruct students on how to use the computer programs in synchronous and asynchronous ways, to participate in a practice discussion, and to answer any questions about the process. For the GSV treatment, the ensuing 75-minute session was then used for the actual discussion. For the WTD treatment, the group had access to a web site for seven days, 24 hours a day following the practice discussion (requiring no additional class time). The no-technology group did not require any instruction time; therefore the actual 75-minute discussion took place without scheduling any training time.

Anonymity was established in the synchronous (GSV) and asynchronous (WTD) communication treatment groups by requiring that students use a code name to identify their contributions. After each treatment session, students prepared a two page activity report that discussed the article that was addressed and to give their feedback on the discussion itself.

4.5. Measures

4.5.1. Demographics / IT Experience. A pre-task questionnaire collected gender, race, education level, and age information. Using twenty-six questions using five-point Likert scales, subjects reported their experience/involvement with various information technologies at work and at school, and the level of IT exposure in their high school education. Subjects also registered an initial codename with the researchers.

4.5.2. Participation, interaction, and outcome. The primary researcher coded, in real-time, the traditional in-class discussions for the amount of student participation and gender participation. Technology sessions were coded from printed discussion transcripts provided by the systems. Measures derived from this coding include presence, number of ideas by subject, and "airtime" by subject (where appropriate). Secondary measures include distribution of ideas by time and gender of subjects.

4.5.3. Technology/Task Opinions. At the end of the experiment, all subjects were given a post-test to obtain perceptions/feedback on each discussion format. The post-test consisted of 85 questions that used five-point Likert scales to collect perceptions about comfort with the technology, ease of use, anonymity, quality of participation, efficiency, effectiveness, and preferred classroom technology options.

5. Findings

Idea production by treatment and by discussion topic is shown in Table 1. H1 is strongly supported since subjects in the GSV treatment cells produced 210% more ideas than subjects in traditional face-to-face groups. However, the benefits of colocated, computer-supported discussions do not extend to geographically and/or temporally computer-supported discussions. WTD discussions produced only 61% of the ideas produced in face-to face discussions and 34% of the ideas produced in colocated computer-supported discussions. Thus, there is no support for H2.
There is only partial support for H3. There is a more equal participation when groups use technology, as indicated by a post hoc Tamhane analysis of homogeneity of variances (P < 0.05). A more thorough Tamhane analysis (shown in Table 2 below) that separates the technologies into discrete treatments by gender indicates that GSV treatments produce a more uniform participation than face-to-face groups for males and females whereas WTD treatments produce a more equal participation for females only. GSV treatments also produce a more uniform participation by females than WTD groups.

The anonymity present in both technologies seems to promote a wider (and more equal) participation in women. However, it is another issue -- such as co-action or co-location -- that influences participation in men since the effect on participation does not hold for both technologies.

There is clear support for H4 -- which states the superiority of the colocated, computer-supported treatments regarding measures of satisfaction with the educational experience, and H5 -- which states that threaded discussions provide a higher degree of satisfaction that face-to-face classroom discussions. The support is provided by a list of measures shown in Tables 3 and 4.

Table 3 compares perception measures for the three treatments. Technology-supported groups outperformed face-to-face groups for all measures and the superiority of GSV over WTD is clearly demonstrated. Subjects enjoyed their experience with GSV significantly more, could sit back and be passive in GSV significantly less, felt more pressure to participate in GSV, and perceived a more equitable participation in GSV. The only measure where WTD outperformed GSV is comfort with the tool. This is easily explained by the ubiquity of the browser interface, which all subjects had used before. Table 4 compares colocated and dispersed computer-mediated discussions on use, anonymity, and quality of participation.

On most usage perception measures, there are no significant differences in how the two technologies are perceived. However, subjects state that although more comfortable with the browser interface, GSV is easier to use for educational purposes. Subjects found GSV to be a more anonymous system, stating that WTD provides more opportunity for others to identify the participant. Productivity was perceived to be much higher in GSV. Subjects state that they would reveal more in GSV and there was less opportunity to participate "too little."

In a final attempt to learn about subject preferences regarding the usage of technology to support intellectual discourse, we asked subjects to rank-order seven levels of computer integration for their course. As seen in Table 5, the two least preferred options include exclusive usage of the Internet and no computer integration at all. Subjects seem to suggest that each tool has a specific usage and both should be available to support the course.

Table 6 shows how subjects evaluated the efficiency and effectiveness of each discussion method. Web-based threaded discussions are the least effective method for class discussion whereas GSV is perceived as the most effective technique. GSV is also perceived as the most efficient discussion support methods. Web discussions and face-to-face discussions are perceived to be equally inadequate methods.

6. Discussion/Conclusion

The results of this experiment offer two interesting avenues for discussion. The first follows the path that examines the superiority of colocated and synchronous group support systems when used to support co-educational discussions of sensitive topics. The second probes the lackluster performance of the information superhighway when used in the same context. Both are of importance to a large audience, in the educational and corporate worlds, which have implemented browser-based systems to offer courses and organizational training. Succinctly, the goal of future research must be to harvest the benefits of GSS while applying them to geographically and temporally dispersed workgroups.

In fifteen years studying group support systems, researchers have identified many factors that produce gains in group meetings, including parallel production of ideas, anonymity, and the creation of an organizational memory. The same variables are examined here. For example, anonymity is one factor that differentiates face-to-face discussions from technology-supported interactions. Although this variable has been found in many laboratory and field studies to influence different work groups in different ways, we have introduced evidence that the effect of anonymity might be gender specific. The possibility of creating ideas in parallel is another factor that differentiates the technology-supported discussions from the face-
to-face interactions. Our data suggest that it is co-action (or lack of) that seems to explain the difference in productivity between colocated and geographically/temporally dispersed groups -- an effect that might also be gender specific.

The distribution of participation from female subjects is significantly more uniform in technology-supported discussions than in traditional classroom discussions. It is clear that anonymity played an important role in influencing the participation of female subjects. Consider that, as part of the discussion about rape myths in our society, two female subjects participating in the web-based threaded discussion described in painful detail their own rapes. Though no such vivid interactions were offered with GSS, its’ discussions produced even more evenly distributed contributions for female subjects. We can only offer as an explanation a compounding effect of anonymity and co-action. There is in GSS an implied invitation not to free-load.

The distribution of participation from male subjects is also influenced by the technology -- but it is influenced differently than with female subjects. The distribution of participation for males in the Web-based threaded discussion is not significantly different than their distribution of participation in the face-to-face setting. This suggests that anonymity does not influence the participation of males in a co-educational setting. However, GSS produced a more uniform participation of males (although not as uniform as the participation of females). We suspect that co-action produces a similar effect on male subjects to produce more ideas.

As our society embraces the World-wide Web as a medium of choice to deliver many educational programs, developers and users alike must understand limitations of the technology and enhancements that would make it more efficient and effective. All must recognize that the power of geographical and temporal dispersion begets a serious problem -- a lack of presence and interaction, which made GSS a more appreciated solution in this study. If intellectual discourse is to be conducted in a technology-supported distributed fashion, much more effort must be exerted to make the group feel like a group; to structure the discussion with cues; to manage the flow of ideas to simulate a true interaction; and to attempt to schedule times when multiple participants might be available to participate synchronously. Success might lie simply in the virtual re-creation, through software and behaviors, of the colocated environment -- one where each participant "feels" the presence and the contributions of a co-discussant.

7. References


Appendix: Findings Tables

TABLE 1. Idea Production

<table>
<thead>
<tr>
<th>TOPIC</th>
<th>NO-TECH</th>
<th>GSV</th>
<th>WTD</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Group</td>
<td>Number per stud.</td>
<td>Group</td>
<td>Number per stud.</td>
</tr>
<tr>
<td>&quot;Rape&quot; ***</td>
<td>G1</td>
<td>122</td>
<td>6.8</td>
<td>G2</td>
</tr>
<tr>
<td>&quot;Binge Drinking&quot; ***</td>
<td>G3</td>
<td>141</td>
<td>6.4</td>
<td>G1</td>
</tr>
<tr>
<td>&quot;EPA&quot; ***</td>
<td>G2</td>
<td>127</td>
<td>7.9</td>
<td>G3</td>
</tr>
<tr>
<td>TOTAL ***</td>
<td>390</td>
<td>6.7</td>
<td>819</td>
<td>16.4</td>
</tr>
</tbody>
</table>

a Values generated from observation and review of computer transcripts where applicable.

b No effect on production of ideas attributable to the topic of discussion.

*** main effect caused by treatment (P < 0.001).


<table>
<thead>
<tr>
<th>Technology</th>
<th>Men</th>
<th>Women</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NO TECH &gt;</td>
<td>P &lt; 0.011</td>
</tr>
<tr>
<td></td>
<td>&lt; S &gt;</td>
<td>V  P &lt; 0.039</td>
</tr>
<tr>
<td></td>
<td>&lt; T &gt;</td>
<td>D  P &lt; 0.017</td>
</tr>
<tr>
<td></td>
<td>ns</td>
<td>&lt; NO &lt; TECH</td>
</tr>
</tbody>
</table>

a Post-hoc analyses of homogeneity of variance through the Tamhane process.
### TABLE 3. Perception Measures

<table>
<thead>
<tr>
<th>QUALITY OF PARTICIPATION</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>perceived productivity</td>
<td>20.31</td>
<td>9.12</td>
<td>-2.229 *</td>
</tr>
<tr>
<td>would reveal more</td>
<td>3.56</td>
<td>3.27</td>
<td>-2.057 *</td>
</tr>
<tr>
<td>too little participation</td>
<td>2.18</td>
<td>2.66</td>
<td>3.070 **</td>
</tr>
<tr>
<td>too much participation</td>
<td>2.54</td>
<td>2.70</td>
<td>0.895 ns</td>
</tr>
<tr>
<td>getting bored</td>
<td>2.81</td>
<td>3.13</td>
<td>1.716 ns</td>
</tr>
</tbody>
</table>

* main effect caused by treatment (P < 0.05)
** main effect caused by treatment (P < 0.01)
*** main effect caused by treatment (P < 0.001)

ns no main effect

All values except perceived productivity are derived from five-point Likert scales where "1" denotes strongly disagree and "5" denotes strongly agree. Perceived productivity is a self-assessment of number of ideas produced. T-test results obtained from a pairwise comparison with 55 degrees of freedom.

### TABLE 4. Comparing perception of usage and participation in traditional and computer-supported discussions. a

<table>
<thead>
<tr>
<th>Technology</th>
<th>NO-TECH</th>
<th>GSV</th>
<th>WTD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comfort**</td>
<td>3.46</td>
<td>4.07</td>
<td>4.21</td>
</tr>
<tr>
<td>Enjoyment***</td>
<td>3.43</td>
<td>4.16</td>
<td>3.61</td>
</tr>
<tr>
<td>Passivity (sit back)**</td>
<td>2.63</td>
<td>2.11</td>
<td>2.41</td>
</tr>
<tr>
<td>Pressure to participate***</td>
<td>3.60</td>
<td>4.14</td>
<td>3.98</td>
</tr>
<tr>
<td>Equal participation*</td>
<td>2.60</td>
<td>3.21</td>
<td>2.68</td>
</tr>
<tr>
<td>Participation by 1 or few***</td>
<td>3.22</td>
<td>2.75</td>
<td>2.93</td>
</tr>
</tbody>
</table>

* main effect caused by treatment (P < 0.05).
** main effect caused by treatment (P < 0.01).
*** main effect caused by treatment (P < 0.001).

All values derived from five-point Likert scales where "1" denotes strongly disagree and "5" denotes strongly agree.
### TABLE 5. Student rank order of classroom options

<table>
<thead>
<tr>
<th>Rank</th>
<th>Classroom Teaching Options</th>
<th>Sum of Rank</th>
<th>s.d.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Some discussions on the computer and some in-class discussions.</td>
<td>1.54</td>
<td>1.41</td>
</tr>
<tr>
<td>2</td>
<td>Computer discussions using both WTD and GSV.</td>
<td>3.5</td>
<td>1.58</td>
</tr>
<tr>
<td>3</td>
<td>All course discussions done using GSV.</td>
<td>3.51</td>
<td>1.42</td>
</tr>
<tr>
<td>4</td>
<td>All course discussions done in regular classroom sessions.</td>
<td>3.69</td>
<td>1.78</td>
</tr>
<tr>
<td>5</td>
<td>All course discussions on the computer using WTD.</td>
<td>4.47</td>
<td>1.61</td>
</tr>
<tr>
<td>6</td>
<td>Completely decentralize the course to the Internet.</td>
<td>5.26</td>
<td>1.5</td>
</tr>
<tr>
<td>7</td>
<td>No computer integration in the course.</td>
<td>5.49</td>
<td>1.96</td>
</tr>
</tbody>
</table>

*Students ranked from "1" to "7" this set of seven statements indicating what they considered to be the appropriate level of computer integration for the Personal Health course.

### TABLE 6. Efficiency and effectiveness of classroom options

<table>
<thead>
<tr>
<th>Issue</th>
<th>N</th>
<th>% NO-TECH</th>
<th>% GSV</th>
<th>% WTD</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Which session was most effective for learning?*</td>
<td>57</td>
<td>0.404</td>
<td>0.439</td>
<td>0.158</td>
</tr>
<tr>
<td>2. Which session was the most efficient at getting many points across?**</td>
<td>57</td>
<td>0.211</td>
<td>0.526</td>
<td>0.263</td>
</tr>
</tbody>
</table>

*Significant difference, chi-square, 2df, p < .05  
**Significant difference, chi-square, 2df, p < .01