THE EFFECTS OF GROUP SIZE ON ATTITUDES TOWARD THE SIMULATION

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Burns and Gentry (1977) delineated what they believed were the major variables in the use of simulation games and experiential exercises, pointing out that many instructors frequently ignore many of these when deciding whether to use simulations or experientials and when deciding which specific materials to use. One of the variables mentioned was 'participant grouping," and its discussion included the observation that the primary determinants of the type of participant grouping used were class size and the complexity of the exercise decisions. While concern about the complexity of the exercise decisions may interrelate with concern about the learning efficiency of a particular group size, Wilson (1974) also pointed our the concern for administrative problems which increase directly with the number of teams. To some extent then, the size of the groups used in many simulation or experiential exercises has depended upon practical concerns relating to the efficiency of the use of the instructor's time and not to concerns about how learning can best be facilitated.

Research investigating the relationship between group size and learning has been somewhat sparse in ABSEL. Hoover and Whitehead (1976) looked at the effectiveness (as measured by examination scores) of experiential exercises used in laboratory sections, which were either categorized as small (less than 15) or large (more than 20). They found no significant differences in the test performances between those in the small labs and those in the larger labs. Unfortunately, these results have Little apparent applicability to the optimal size of groups in a simulation exercise, as the group sizes ~n the former situation are really class sizes as opposed to team sizes.

More recently. Napier and House (1979) investigated group consensus versus individual decision making in an experiential exercise, finding the group performances to be superior on a normative basis. However, the procedures used in the study strongly bias the results in favor of the group, as the same people who made the individual decisions were then put in groups to handle the same problems.

Consequently, some of the best guidelines available from the ABSEL literature are the observations by Wilson (1974) that he had found that teams of three to five students generally foster more involvement than larger or smaller teams. He did acknowledge that the optimal size of groups is influenced in part by the nature of the game used.

The literature on group decision process in psychology has generally found that group decisions yield results superior to those of individual decision makers (Shaw 1971). Remus and Jenner (1977) investigated group versus individual performances in simulation games. They found that the groups resulted in higher initial goals, more conservative decision-making, and more time and effort expenditure per person. Individual's enjoyment from the games was more highly related to the team rank titan was the group's enjoyment, indicating the role of the social environment provided by the group.

This study will report relationships between team size and various attitudinal and performance variables in three undergraduate Business Logistics classes.

LIMITATIONS OF THE STUDY

Educational research typically encounters a series of problems that limit both the internal and external validity of the results. Cooke (1979) discussed some of the problems he encountered in an experiment designed to investigate the effectiveness of a simulation, including the equivalence of treatment and control groups at the beginning of the semester (since random assignment of students to classes is not feasible at most universities) , differential experimental mortality, and instrumentation problems in the proper development of tests and with the security of the examinations. Pierfy (1977) discusses other problems involved in the evaluation of the effectiveness of simulation as opposed to other approaches. The university's administrative regulations can hamper greatly the design of well-controlled educational experiments.

Even if the experimenters had the flexibility needed to design the experiment properly, ethical considerations might foreclude his/her doing so. For example, Rosenthal and Jacobson (1968) found that children who were expected to succeed by their teachers (falsely so, as the experimenters had lied about the student's IQ's, which were really essentially the same) did receive better scores by the end of the year. This study (and those by the 250 or more researchers that repeated the experiment) have been criticized (Warwick, 1975) for the possible harm done to the students that were lied about. Experimental academic research has come under closer scrutiny in recent years, as evidenced by the advent of university review committees for research involving human subjects. Sewall (1978) discusses the ethical issues involved in the type of education research done by ABSEL participants. Clearly most of us would have reservations about having students (possibly unknowingly) participate in a study where a decrement in their performance (i.e., grade) was due in part to the experimental manipulation.

Unfortunately this study has other limitations besides those imposed by administrative and ethical considerations. The study involves two fall sections of an undergraduate Business Logistics course and one spring section; these were the only sections of the course offered at Oklahoma State University during the 1978- 1979 school year. The class sizes were fairly consistent (58, 46, and 49, respectively). The course was a required course for Marketing majors and, not surprisingly, they constituted the vast majority of students taking the course. Consequently the students had fairly homogeneous backgrounds, especially when compared to simulation participants in a business policy course. Wilson (1974) observed that he had found that the students gain greater satisfaction and make better decisions when the team consists of students with varied backgrounds and majors; such manipulations were not possible here.

Another factor limiting the generality of the results is the nature of the simulations games used, De Hayes and Suelflow's (1971) LOGSIMX. The game is operations-based as opposed to policy-oriented, and consequently the requirements placed on the students are different from many other games. While the amount of detail involved is quite high, the game has few stochastic elements. Other than the uncertainty created by the competitors' decisions, the students should be able to project all of the outputs very precisely once they have determines! their inputs.

The game does not lend itself to a division of labor well, since it cannot be broken down into functional or geographical areas in order for each team participant to manager his/her own subcomponent. The systems orientation of the game requires a highly integrated decision. Consequently, the decision needs to be made by the group as a whole or by one individual with the rest of the members floating. Consequently, those decisions that were actually "group" decisions required a lot of interaction among the members, especially at the start of the game.

Besides the nature of the course and of the game, there are limitations due to the idiosyncrasies of the instructor. The game was worth 20% of the course grade, with half of that grade depending on the game performance and the other half on the individual written sum- manes of game play. The rest of the course grade depended upon several case studies and two tests. Two class sessions were devoted to the introduction of the game. No trial decisions were made during the fall semester since previous use of trial decisions had not noticeably affected the performances of the students, thus leaving the impression with the instructor that a week's output had been sacrificed with no compensation. Since it took the best teams a number of weeks of game p]ay to get into the black, the instructor desired to play the games as many weeks as possible so that as many teams as possible would end up in the black. However, the amount of confusion experienced at the outset of the game playing in the fall section resulted in the adoption of one trial decision during the spring semester.

MANIPULATION OF TEAM SIZES

My previous experience with the Business Logistics course was at another academic institution, where the course was an elective. The class sizes there had ranged from six to nineteen, so it was feasible to have each student run a firm by himself/herself. However, the larger class sizes experienced at Oklahoma State required some aggregating of students in order to make the administration of the game tolerable. The game has four firms in each industry, with the number of Industries constrained primarily by administrator time. In the fall semester, each class had 16 teams. Originally the teams consisted of either three or four members, but the compositions changed somewhat due to students dropping the course. By the end of the semester there were five two-member teams, 18 three- member teams, and nine four-member teams (all in the larger class).

During the second semester the class was assigned to 23 two-member teams and to one three-member team. The start of the game was delayed until after drop-add, so that the group assignments would be more stable. The assignments in all of the classes were based on alphabetical order, but the students in the spring semester were given the option of changing groups if their schedules or personalities appeared to be incompatible. Only one such change was made, due to conflicting schedules. None of the students dropped the course after the team assignments were made.

MEASUREMENTS

Close to the end of the semester the students were asked to rate the cases, lectures, and the LOGSIM game in terms of being a learning experience on a seven- point excellent to poor scale. They also gave their attitude toward their LOGSIM group (on a seven-point very positive to very negative scale) , the overall attitude toward the LOGSTM game (on the scale used for the group attitude) , and their satisfaction with their firm's performance in the game (on a seven-point very satisfied to very unsatisfied scale). As part of their game grade they had to provide a measure of the relative inputs of each member (including themselves) using a 100-point constant sum scale.

These attitudinal measures were related to their class performance, as measured by their final contribution- to-margin (CONTRIB) in the game, group ranking in the game, test grades, written case grades, oral case grades, game test grade, game summary grade, class participation grades (spring semester only) , and their overall grade.

RESULTS

The correlation between group size and the game performance (CONTRIB) was .03 in the fall semester, indicating that the group size had no impact on the group's performance. A one-way ANOVA with group size as the treatment variable and CONTRIB the dependent variable found the mean performances for each group size not to be significantly different from one another.

On the other hand, group size was strongly related to the amount of dissension in the group, as measured by the mean squared deviations in the peer ratings.' The correlation between group size and group dissension was .48 ($p < .01$); this indicates, at first glance, that the larger the group, the more dissension. This was the extent of the group size analysis that I had completed before the start of the second semester, so I made the obvious conclusion to divide the class into small two-member teams~ Further analysis, however, Indicates that the correlation analysis was not sensitive to the non-linear nature of the relationship. Group dissension was smaller for the three-member groups (.009) than for the two-member groups (.026). Dissension in the four-member groups was the greatest (.128). A one-way M~OVA indicated that the mean group dissension was significantly smaller for the three-member groups than for the four-member groups. The amounts of dissension in the two smaller group sizes were not significantly different.

Thus while groups size was not related to the teams' performances, it was related to the amount of dissension in the group. Group dissension was marginally related to performance ($r = -.34$, $p < .05$) in the fall semester, but the relationship in the spring was not significant. On an intuitive level, one might well expect greater amounts of group dissension to lead to decrements in performance. As such relationships did not exist, it prompted further investigation.

One explanation might be that the game performance might be more a function of one individual than of the group as a whole. To investigate this hypothesis, performance (CONTRIB) was regressed against the attitudinal and grade variables, using both the group mean and the variable for the best student in the group (as judged by the total grade). In the fall semester, the order of entry in the stepwise regression was 1. i4igh Game Summary, 2. Group Attitude towards Lectures, 3. High Oral Case Grade, and 4. High Written Case Grade, with a final R of .57 (p < .001). In the spring semester, only two variables entered (1. High Group Summary and 2. High Game Test), with the same R^2 (.57). Clearly the game performance was predicted better by looking at the best student in the group rather than a composite of the group's abilities. The single best predictive variable was the written summary of the game, which is not surprising as the students were told that the summary grade would depend on how well the student's understanding of the game was communicated. The entry of the game test - variable in the spring also makes sense, as the purpose of the test was to make sure that the students had read the game manual and were familiar with the rules. The entry of the lecture attitude variable in the fall semester is not as easily explained, unless the lectures about the game and its play weighed heavily when the students considered the word "lecture."

The finding that the group performance was more a function of the group leader than of the group itself provides an explanation for why the larger groups (with four members) performed as well as the smaller groups, despite greater dissension. Obviously, the larger the groups, the better the chance of getting a really talented individual in it. Group size was significantly related to the high game test (r = .40, p < .02) and to the high total grades (r = . 3O,p <.1)3) and marginally related to the high written case grade (r .33, p C .06), the high game summary (r = .32, p < .08), and the high oral case grades Cr .32, p < .08).

Analysis of group size effects in the spring semester are of no value as 23 of the 24 teams were two-member teams. However, some information can be gained by comparing the attitudes and performances in the spring class with those of the fall semester. As can be seen in Table 1, the students in the spring semester performed better in the game, had less group dissension, and had more favorable attitudes toward the lectures and the game. Again, it must be pointed out that this study was not an experiment conducted under controlled conditions; there are several possible explanations for the better results other than the smaller group sizes. The use of a trial period in the spring semester may have reduced the number of errors in the game. The fall semester was the first semester that the LOGSIMX game was used at Oklahoma State University and the students then had no sources of information about the game other than the instructor and the player's manual. The fall students no doubt constituted a source of information for the spring students. The game was run for two more weeks in the fall semester than in the spring semester, making the better performances in the spring even more impressive.

The grade distributions for the two semesters are very similar, which would tend to indicate equivalence of abilities. Despite the far better game performances in the spring, the students were no more satisfied with their performances than the fall students. In the fall, only four of 32 teams finished in the black, while nine of the 24 spring teams finished in the black. Apparently, satisfaction with one's performance is based on relative standing and not absolute performance, as Remus (1977) concluded.

Table 1

COMPARISON OF FALL AND SPRING CLASSES

	Fall n = 94		Spring n = 49	
Variable	Mean	Standard Deviation	Mean	Standard Deviation
Contribution to Margin*	-213,026	232,746	-39,019	117,831
Group Dissension*	.045	.087	.009	.022
Games as Learning Experiences	5.44	1.10	5.32	1.06
Lectures as Learning Experiences*	4.65	1.19	5.42	.96
Game as a Learning Experience*	5.56	1.20	6.08	.79
Attitude toward Group	5.58	1.63	5.86	1.47
Attitude toward Game*	5.27	1.35	6.06	.94
Satisfaction with Game Performance	4.72	1.60	4.73	1.68
Game Test	16.0	2.8	16.2	2.0
Midterm Test Grade	79.3	10.3	78.8	9.7
Game Summary	84.1	10.3	84.5	6.4
Game Performance Grade	83.2	10.7	83.5	8.1
Oral Case Grades	85.2	6.6	86.3	5.1
Written Case Grades	83.5	6.7	84.2	7.5
Total Grade	817.4	46.7	819.5	59.3

*The spring class was significantly larger (smaller for group dissension) at the .005 level.

Discussion

The results of this study tend to support the conclusion that smaller groups (two or three members) work better than four-member groups in a simulation game in terms of minimizing group dissension. On the other hand, group size has no effect on the relative performances. Counterbalancing the greater group dissension experienced by the larger groups were the findings that performance was better explained by the group leader's class performance than by the group mean and that the larger the group, the more likely it was to have a more talented group member.

The generality of the results of this study is severely limited due to the non-experimental nature of the study, the nature of the simulation game, and the nature of the course in which it was used.

FOOTNOTES

'It may be argued that a conflict in the peer evaluations is not a good surrogate for group dissension. My observations from the use of peer evaluations in oral group cases and in other group projects led me to believe that the two variables are highly related. Further, group dissension was significantly (and inversely) related to the group attitudes held in the fall (r = - .49, p < .005) and in the spring (r = - .55, p < .005).

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