

# Developments in Business Simulation & Experiential Exercises, Volume 12, 1985

## ON THE CORE SIZE OF SMALL TASK GROUPS AND DETERMINANTS OF THE EMERGENCE OF THE CORE SIZE

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### ABSTRACT

Experiment is conducted in a computer simulated business game setting to examine primarily the issue of the core group size, which is the actual group size minus the marginal members of that group, and determinants of the emergence of such a group size. The findings of the study indicate that while the core group size is not a universe phenomenon it is nonetheless the case in the majority of the groups under study. They further reveal that the emergence of the core group size can be explained by six major factors: grade point average (CPA), sex composition of the group (SEXG), ability to grasp the problems encountered (GRASP), degree of passive communication (COMMN), degree of emphasis on team work (TEAM), and team acceptance of self (LIKED).

### INTRODUCTION

Whenever two or more heads are put together working towards common goal, the nature and/or the quality of the interaction process within the group is believed to be influenced by a number of factors. One of such factors is the number of members in a group, i. e., group size. Group size, in fact, has been examined extensively since 189E when Tripplett first made a study on the interaction of the smallest group with two persons [10;11;14]. The trend of studying the interaction of the tyad and the trial was set by Simmel in 1902 [9;11;17] and was followed by students of small groups on group size for the next several decades.

Later, researchers on group size seemed to be more interested in the issue of the optimal size. This is why various number of group members, such as two [21], five [1;8;20], six [3;7], ten [11], or twelve, which is the traditional size for a jury [23], was advanced to be considered as the optimal number of group size. More recently, group size was studied more in line with some other variables. They included spatial arrangement, communication networks/patterns, decision rule, group performance or effectiveness, satisfaction, etc.

Despite the extensive work on group size and its potential effects, findings have not been consistent, particularly with the group performance. Thomas and Fink [22] and McGrath and Altman [15], for example, have failed to produce any systematic evidence to support what is believed to be a positive correlation between group size and group performance as claimed by many researchers. 5.

The inconsistent and seemingly contradictory findings about their relationships could be attributed to many factors, such as the nature of the task involved, the time constraint under which various experiments were conducted, and ages of the subjects involved. While the debate on the relationship between group size and group performance continues, there is a minority of researchers who quietly advocate different concepts of group size and its effect. For example, Bray, Kerr, and Atkins believe that what is important is not the actual group size, but rather the 'functional' group size,

which is the actual group size minus the number of inactive members [4]. Ross and Harary [19], on the other hand, believe that a group is more affected by the strengthening or the weakening member(s) of that group.

Talking about the effect of group size on group process, one can not ignore the fact that Lindeman was one of the earliest, if not the earliest, researchers to make the proposition, which states that "The efficacy of the group is conditioned . . . by the proportion of its marginal members [13]. . ." However, he was never duly credited for such a proposition. In fact, his theoretical consideration was largely neglected by most researchers of small groups on either group size or group dynamics. This partially explains the reason why the effect of the proportion of marginal members on group performance, or on group process in general for that matter, still lacks empirical validation.

In view of the above discussion one need ask:

1) Is it always the case that there may exist a core group size within a small group? Stated differently, if it a universal truth that core group sizes may always emerge from small groups regardless of the type and the nature of the task involved, the use of time constraint, the ways groups are formed either voluntarily or involuntarily, etc. ?

2) What then would be the association between the actual group size, the core group size and the ideal or optimal size? To put it another way, is the core group size always function of the actual group size? By the same token, is the ideal or optimal size function of the core group size? and

3) If the core group size indeed exists in small group settings, what then are the underlying factors that may explain the surface of the core group size, particularly from the viewpoint of group dynamics?

It is these questions that this experiment is intended to seek answers for. since this is the first study of its kind that focuses exclusively on the issue of the core group size, it is an exploratory one.

### EXPERIMENTAL DESIGN

#### Subjects

This study was composed of sixty-three business major students who enrolled in an upper level course on business policy during the summer of 1983 at large state University's evening division. Since the majority of the students were working on their undergraduate degrees on part-time basis, while holding full-time Jobs during the day, it was interesting to note various nature of the students' attributes. There were 26 male and 37 female students in the class. Their age ranged from 1 to 52 with a mean age of 29 years. Except for three students who never had a full-time work experience before, the others had at least six months to as many as 25 years of work experience. The average

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number of years of work experience was 8.3.

The participants were divided into 14 companies with various group sizes ranging from three to seven. Companies one through seven were organized by the participants themselves, whereas companies eight through fourteen were randomly assigned by the game instructor while also taking the following factors into consideration: major and sex. The last seven companies composed of thirty-one individuals were used as the control groups, while the first seven companies which had thirty-two individuals were treated as the experimental groups. Whether a participant belonged to one of the experimental groups or not depended upon the last name of the participant. Those whose last names started with A through L went to the experimental groups coil those who belonged to the control groups were those whose first letter of the last name started with E through Z.

Part of the course requirement was to make 12 quarterly business decisions. All teams started from the same footing in Quarter 9 by taking it over presumably from the prior management. Before the making of the official decision for Quarter 9, each team was offered an opportunity to make a trial decision for Quarter 9, the results of which were not included in the final grade. This allowed them to get first hand information about the game and to make common mistakes without penalties. The game portion of the class, which was the 12 quarterly decisions, was further divided into two parts. The first part consisted of eight decisions, namely from quarter 9 through Quarter 16, while the second part had four quarterly decisions. The each accounted for 35% and 25% of the final grade, respectively. While both parts were included in the calculation of the final grade, the first part, that is, the first eight decisions, were designed to let students try out different options and get a better feel of the game so that they would be ready for the final four quarters, which were the basis of the written analysis report and the oral presentation.

### Variables Included In The Analysis

At the end of the summer session, a questionnaire was administered to and completed anonymously by each of the students in class without any team collaborations. Information covered in the questionnaire included such data as group dynamics, group characteristics, individual attributes and attitudes, etc.

Altogether 25 variables on group dynamics and subjects' attitudes, which are shown in Table 1, along with seven situational variables were obtained from the survey Instrument. The seven situational variables were sex of subject (SEX), group formation of each team (ORG), sex composition of each team (SEXG), grade point average (GPA), age (AGE) and length of the real world work experience in years (WORK), of each subject, and number of team members known before class (KNOW). Variables 1 through 22 were measured by a seven-point Likert scale. The remaining three were categorical variables. Among the seven situational variables, the first three were categorical types and the last four were continuous in nature.

The dependent variable used in the regression analysis as the proportion of the total group members that actively participated in the group decision process. It was obtained simply by dividing the non-marginal number of a group by the actual size of that group.

TABLE 1  
GROUP DYNAMICS INDIVIDUAL ATTITUDINAL  
VARIABLES

- 1) Extensiveness of team hostility or conflict (CONFL)
- 2) Low commitment or lack of goals (GOAL)
- 3) Degree of apathy (APTITY)
- 4) Evidence of lacking innovation (INNO)
- 5) Evidence of non-risk taking (RISK)
- 6) Degree of passive team communication (COMMN)
- 7) Degree of distrust among team members (TRUST)
- 8) Misunderstanding of team goals (UNDRST)
- 9) Degree of emphasis of team work (TEAM)
- 10) Equal participation (EVEN)
- 11) Equal receptions of all opinions (LIST)
- 12) Openness of team members (OPEN)
- 13) Willingness to confront (CONFR)
- 14) Reaction to criticism (CRIT)
- 15) Individual satisfaction with the team (SATIS)
- 16) Team acceptance of self (LIKED)
- 17) Agreeable with team goals (AGREE)
- 18) Change of goals if game was replayed (REPLY)
- 19) Individual's disagreement w/decision(s) (DISAGP)
- 20) Enough time for making reasonable decisions (PITT')
- 21) Frequency of using up allotted time in class (USIMM)
- 22) Ability to grasp the problem(s) encountered (GRASP)
- 23) Division of decision-making responsibilities (RESP)
- 24) Approach used most often in team decisions (APPF)
- 25) Emergence of a dominant figure (DFIG)

### Methodology

Two statistical techniques were employed to perform the principal statistical work. They were the factor analysis and the multiple regression analysis techniques. The computer work was carried out through the use of the UCLA's Medical Statistical Package (BEEP), Version 33.

The main objective of the factor analysis was for data reduction. Specifically, the use of the factor analytic technique here was intended to choose free all the variables a subset of variables, so that each of the variables might be clearly identified with only one of the latent factors through the exploration and detection of underlying patterns of interrelationships.

The method of analysis selected was orthogonal. Instead of specifying the maximum number of factors to be extracted and rotated by the technique, a minimum eigenvalue of 1.5 was established in order to determine the initial and the terminal factors. Moreover, to retain a variable in one of the factors, it was decided that the Value of the factor-loading equivalent to .4 if be adopted. In other words, in order to retain variable in one of the factors, the factor-loading of that variable had to be equal to or exceed .4C.

Deco the total number of factors and the retained variable(s) associated with each factor were determined, selection of a variable among all the retained variables in each factor could proceed. The selection process was to be accomplished through the utilization of that analysis of the correlation matrix. Whether a variable was considered to be an important or a dominant one free each factor to be included in the regression analysis or not was determined by the correlation coefficient of that variable with the dependent variable. Naturally, the variable that had the highest absolute correlation coefficient with the dependent variable could be chosen to represent that factor in the regression analyzing. There is one advantage in using this method over the method that uses the highest factor-loading to represent the factor, other than the fact that the latter is a

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rather subjective approach. The advantage is that it need not concern the problem of factor interpretation in the discussion of the results of the regression analysis.

The regression analysis would be carried out on a stepwise fashion. Two arbitrary, yet reasonable, criteria would be employed to determine the importance of a variable: 1) the standardized regression coefficient of a variable had to be more than .15; and 2) the explanatory power of a new variable to enter into the regression model had to be at least three percentage points.

### RESULTS

#### The core Group Size

The total number of teams used as the control group and the experimental group along with their team sizes are presented in Table 2. As can be seen, the total number of teams in each group category is not evenly distributed. For the control group, two teams had three members, two had four, two had five, and one had six. With respect to the experimental group, two teams had three, two had four, one had five, one had six, and one seven.

TABLE 2  
DISTRIBUTION OF MEMBERS BY TEAM SIZE AND BY GROUP

Team Size	Control Group (# of Teams)	Experimental Group (# of Teams)
3	2	2
4	2	2
5	2	1
6	1	1
7	0	1
Total	7	7

With this background information in mind, a review of the raw material was conducted. The result of the review indicated that out of the fourteen teams, six had 3 full participation rate among all their members and the remaining eight teams had various rates of membership participation, which are displayed in Table

TABLE 3  
ACTUAL TEAM SIZE VS. ACTIVE TEAM SIZE\*\*\*

Actual	2	3	Active			7	PT%
			4	5	6		
3 C*	4	2					55%
3 E**	1	2					33%
4 E	1	2	1				75%
5 E		1	3	1			80%
6 C		2		3	7		42%
6 E	1			1	4		33%
7 E		1		2		4	43%

PT=Percent of group members that was active  
C\*=Control group  
E\*\*=Experimental group  
\*\*\*Only those teams with less than 100% participation rates are shown here

While it is clear that only certain proportion of the total team members participated actively in the decision-making process, it is not clear about two other things. First, it is not clear whether the actual group size had any impact on the proportion of their marginal members or not.

Second, it is unlikely to determine from the figures presented in Table 3 as to the effect of group formation, i.e., the control group vs. the experimental group, on the emergence of core group sizes because the table simply does not contain enough information about this issue. In order, therefore, to find answers to these two questions, we need to turn it to the discussion of the results of the factor and the regression analyses.

#### Factor analysis

The results of the orthogonal factor analytic technique generated seven terminal factors, which are displayed in Table 4, along with the Variance explained (VP) and the communality of each variable.

TABLE 4  
ROTATED FACTOR LOADINGS

Variable	FACTOR							COMM.	R*
	1	2	3	4	5	6	7		
LIKED	.82							.80	.16
CRIT	.79							.64	.26
COMM	-.68							.71	-.38
OPEN	.66							.64	.27
CONFL	-.62							.43	.22
TEAM		-.75						.56	.42
GOAL			.75					.68	-.18
LIKED			.66					.54	.33
CONTR				.64				.54	.05
SEXG					.70			.64	-.37
GRASP						.72		.61	-.12
CPA							.74	.46	-.23
VP**	4.69	3.30	2.75	1.70	1.70	1.70	1.64		

R\*=simple correlation coefficient with the dependent variable  
VP\*\*=variance explained

The variance explained for each variable is the sum of squares of the elements of the column of the factor-loading matrix corresponding to the factor, while the communality is analogous to the coefficient of determination ( $R^2$ ) expressing the proportion of the variance of each variable which is explained by the latent factors combined.

As can be seen from Table 4, there are five variables retained by the first factor; the third factor was composed of two variables; the remaining factors had just one variable each. Since the primary objective of the current factor analysis was to choose from all the variables a small subgroup of variables, one from each factor, attention will therefore be directed to selection was accomplished. In terms of the criterion set forth earlier, was picked to represent the first factor because it contained the highest correlation coefficient with the dependent variable ( $r = -.38$ ) among all five variables retained by factor one. LIKED was also selected to represent their third factor, for the same reason. TEAM, CONFR, SEXG, GRASP, and CPA were chosen for the obvious reason since there were the sole variables retained by their respective factors. As a result, COMMN, LIKED, TEAM, CONFR, SEXG, GRASP, GPA representing factors one to Seven were included in the final analysis, that is, the regression analysis.

#### Regression Analysis

The regression analysis identified six variables representing all factors except one as the significant latent variables (factors) in explaining the variance in

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the dependent variable. These six variables were degree of passive communication (COMMN), grade point average (GPA), the sex composition of the group (SEXG), the ability to grasp the problem(s) encountered (GRASP), agree of emphasis on team work (TEAM), and team acceptance of self (LIKED), along with other important regression statistics, are given in Table 5.

TABLE 5  
LINEAR REGRESSION MODEL

VARIABLE	R	Adjusted Change			b	beta
		R <sup>2</sup>	R <sup>2</sup>	of R <sup>2</sup>		
COMMN	.40	.16	.14	.14	-.03	.01
LIKED	.53	.28	.25	.11	.05	.02
SEXG	.63	.40	.36	.11	-.17	.04
TEAM	.68	.46	.42	.06	.06	.02
GPA	.73	.53	.48	.06	.12	.04
GRASP	.75	.56	.51	.03	-.03	.01
N=53	F=10.14	DF=6, 46				

COMMN, being the most important variable (factor) explained 14 percent (in adjusted R squared) of the total variance in the dependent variable all by itself. LIKED contributed another 11 percents of the variance unexplained by COMMN. They were followed by SEXG, which added 11 percent, by TEAM, which accounted for six more percent, and by GPA and GRASP, which contributed another and 3 percents, respectively, toward the explanation of the dependent variable. Together, they managed to account for 51 percent of the adjusted total variance in the dependent variable.

### The Ideal Size

An examination of the correlation matrix was made in order to detect the relationship of the ideal group size with other variables, particularly the actual group size and the core group size, i. e., the number of active group members. The result revealed that the ideal group size (ISIZE) was strongly and positively correlated with the core group size ( $r=.60$ ). It was followed by the actual group size, whose correlation coefficient with ISIZE was .46. This means that the ideal group size perceived by the subjects was influenced more by the size of the core group than by the actual group size.

In order to further confirm this relationship between the ideal group size and the core group size, a regression analysis was also carried out. Three variables were uncovered to be the important variables. (n top of the list of these three variables was the core group size. It was followed by AGE and WORK, length of the real world work experience in years. The actual group size was not included in the important variable list.

The implication of this result is that the ideal or optimal size of a group is not a fixed number, such as three or four or five or even six, but rather is determined by the core group size, which is the actual group size minus the marginal members of that group.

### DISCUSSION AND SUMMARY

The current research revealed that while the core group size was not a universal situation, it nevertheless did exist in the majority of these teams under study. This should confirm the findings of Fray, Kerr, and Atkins [1]. It should further be noted, however, that there lacked any empirical evidence to support the close tie between the core group size and the

actual group size. In other words, it could not be determined if the core group size was a linear function of the actual group size. This finding seems to contradict what was uncovered in a study conducted by Barker [12], on the one hand, and to be in line with the findings of the study undertaken by Markham, Damsereau, and Alutto [16], or the other. Barker's findings revealed that smaller size groups tended to have a higher membership participation rate than relatively larger size groups. The difference in findings between this study and that of Barker's may be attributed to the fact that his study was not carried out in the context of a small group setting, aside from the difference in the nature of the tasks involved. The relationship between group size and absenteeism rates could not be established based upon the empirical evidence gathered by Markham and his associates in their study. Absenteeism is clearly not the focal point of the present study, it, like being present yet without actively involving in task-related activities, is nevertheless a form of nonparticipative acts.

As for the determinants of the emergence of the core group size, six variables were found to play major roles. They included COMMN, degree of passive group communication, GPA, grade point average, SEXG, sex composition of the group, GRASP, ability to grasp the problems encountered, TEAM, degree of emphasis of team work, and LIKED, team acceptance of self. It is somewhat surprising, yet not entirely, to see that COMMN was found to be the most important variable in explaining the dependent variable, the percent of group members who was active in the group process. Communication behavior within a small group is commonly considered to be a vital component of the group process. In fact, so important is the communication act that it is often regarded as the major source of membership's satisfaction and/or frustration. Effective communication usually enhances the group cohesiveness and the group solidarity. Ineffective communication, on the other hand, can lead to membership withdrawal at best, and disagreement and antagonism at worst, may help explain why there is a reverse relationship between passive team communication and the percent of group members who was active in the group process.

The reason why GPA was included in the important list is perhaps due to the fact that those with higher academic achievement would like to keep their GPAs high. One sure way to do that is through active participation, so that they would have a chance to control over their grades through the decisions they made.

It is interesting to note that sex composition of the group (SEXG) is also identified as an important variable toward the explanation of the dependent variable. By including this variable in the list, it means that groups with single-sex tended to have a higher ratio of membership participation than those groups that were composed of both males and females. One possible explanation to this is that groups with single-sex members were more likely to spend less time for social activities than members of the counterparts. GRASP, like GPA, is another form of exhibiting the ability of an individual. It is, therefore, not surprising that GRASP also made the final list.

The inclusion of TEAM, degree of emphasis of team as an important variable can be understood. This is simply because when groups tend to place more on team work, more members can be attracted and, to some extent, motivated to actively engage in group decision activities. The end result of the high emphasis of team work is bound to increase the proportion of the core group size to the actual group size.

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As Huseman, Lahiff, and Hatfield stated that "Effective group functioning is facilitated by individuals who are cooperative, efficient, and profound. Among the problems that confront participants ... is the extent to which an individual feels as part of the group [12, 135]." The feeling of belonging is a very important part of the group involvement for any individual member. This explains why when a member who feels that (s)he is accepted by his or her peers would be more active in participating group tasks.

Several other variables that were believed to be important in motivating members to participate were absent from the important list, however. They included such variables as group formation, that is, the control group vs. the experimental group, trust, and satisfaction. Trust is normally considered as the vital ingredient in small group setting [6; 18]. Satisfaction is regarded as a way of rewarding an individual for participating in-group decision situation, hence the higher the satisfaction one gets the more likely that person is going to participate [6]. Instead of using voluntary and involuntary participants, the group formation was used. Involuntary participants, as they are charged [18], usually lack motivation for active participation. However, none of these arguments was substantiated by the data presented.

The reason why both satisfaction (SATIS) and trust among group members (TRUST) were excluded from the important list in explaining the emergence of the core group size for understandable. It is understandable because TRUST is exhibited to have a strong positive relation to COMM (r=.52), while SATIS is moderately correlated with LIKED (r=.48). The reason for excluding the group formation (ORG) in this study is unclear. Perhaps, it is indeed an unimportant variable. Then again, it could be an important variable and its potential contribution is over shadowed by other factors. Further study may therefore be warranted to deal with this variable in an isolated situation.

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