EFFECT OF GROUP HETEROGENEITY ON GROUP ABILITY TO DEBUG COMPUTER PROGRAMS

by

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INTRODUCTION

It is becoming more popular to have groups, rather than individuals alone, work together to debug computer programs (Schneiderman, 1980). Even though group debugging is becoming more popular, it's effectiveness is not yet clear. Myers (1978) found that group debugging was slightly more effective than individual debugging but at a greater cost in time. While the question of group versus individual debugging effectiveness is certainly important, perhaps a question of equal or greater importance centers around the effect of the composition of the group. That is, the question of group versus individual debugging effectiveness can not be tested until it is known which type of group is the most effective, and thus, which type of group should be used in comparison with individual performance.

Research in social and industrial psychology has shown that the most effective group type is dependent upon the type of task (Aamodt & Kimbrough; Neufeldt, Kimbrough, Stadelmaier, Colburn, Aamodt, & Johnson, 1983; Shaw, 1976). Unfortunately, it is not yet known what type of group would be next effective in a task such as program debugging. Thus, it was the purpose of the present study to investigate which type of group; either homogeneous or heterogeneous in respect to personality, would be the most effective at computer debugging.

METHOD

Subjects. The participants in the study were 42 students enrolled in one of two sections of an introductory computer course. Each subject participated voluntarily, and in one section, received extra credit points for participation.

Procedure.

Independent Variable — Each subject was administered the Personal Profile System (PPS) at least four days prior to participation in the study. The PPS is a personality inventory consisting of 24 forced-choice tetrads and yields scores on four dimensions with the dimension receiving the highest standard score being considered the individuals' predominant behavioral style. The four dimensions and their main descriptors are:

Dominance (D) — Obtains immediate results, makes quick decisions, takes authority, solves problems, causes trouble.

Influence (I) — Creates a motivational environment, generates enthusiasm, helps others, makes a favorable impression.

Steadiness (S) — Has patience, concentrates on task, calms excited people, identifies with group.

Compliance (C) — Concentrates on detail, checks for accuracy, criticizes performance, complies with authority, thinks critically (Geier, 1979).

Each subject was assigned to one of two types of three-person groups on the basis of his/her predominant behavioral style. One type of group, the homogeneous group, consisted of three subjects with the same behavioral style. The other group, the heterogeneous group, consisted of three subjects with differing behavioral styles (e.g., a D, an I, and an S).

Task — Each group was given a computer program written in BASIC, a copy of the output that would be obtained if the program was free of errors, and a short description of the purpose of the program. The group was asked to find as many errors as possible and to let the experimenter know when the group thought all of the errors had been found. The program was obtained from the instructors manual for the Shelly and Cashman (1982) text and altered

so that there were 23 errors in the program; the majority being syntactical and typographical.

Dependent Variable — The output from each group was examined to determine how many of the 23 errors were found by the group (hits), how many "errors" were detected by the group that were not really errors (false alarms), and the amount of time used by the group. The two dependent variables in the study were the time used by the group and a score that consisted of the number of "hits" minus the number of "false alarms".

RESULTS AND DISCUSSION

The study yielded data for 6 heterogeneous groups and 8 homogeneous groups. In order to control for the ability of the group members, each subject was asked to indicate the grade that he/she believed they would receive in their computer course. The scores provided by each subject were then summed to form a group total. For example, if one group member reported a grade of 'B' (3) and two group members reported grades of 'C' (2) the group total would have been 7. This score was statistically removed from the dependent measures using the covariance option of the SAS GLM procedure (SAS Institute, 1982). The analysis of covariance revealed a significant difference between the corrected least squares means for each group with homogeneous groups ($\underline{M}$ = 15.54) finding more errors than heterogeneous groups ($\underline{M}$ = 10.60), $\underline{F}$ = 10.01, $p < .009$ and heterogeneous groups taking less time ($\underline{M}$ = 41.73 minutes) than homogeneous groups ($\underline{M}$ = 55.83 minutes), $\underline{F}$ = 5.68, $p < .03$.

These results would seem to imply that homogeneous groups are superior to heterogeneous groups at program debugging. While the reasons for this finding can only be speculative, previous research has indicated that homogeneous groups are characterized by cohesiveness and freedom from conflict while heterogeneous groups are characterized by creativity and tension (Bass & Ryterband, 1979). In the present study, it could have been that the homogeneous groups were able to work together to complete the task. The heterogeneous groups, however, may have had to deal with the tension created by their group composition and were unable to overcome this tension enough to be able to concentrate on the task.

Along these lines, the finding that heterogeneous groups were faster than homogeneous groups is interesting and could be the result of this lack of group cohesiveness. The lack of cohesiveness may have caused the group to want to complete the task as quickly as possible in order to terminate any further interaction with each other. The fact that the group interaction time and the group debugging score were positively correlated ($r = .51$, $p < .05$) could mean that the differences found between the heterogeneous and homogeneous groups in terms of debugging could have been an artifact of time. That is, if each group were forced to work together for a specified period of time, the group differences might disappear.

It is also important to note that the subjects in this study were computer novices. If professional programmers had been used, the results may have been different. However, until more research is conducted, the results of this study provide preliminary evidence that in terms of personality, homogeneous groups are superior to heterogeneous groups in group ability to debug computer programs.

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FOOTNOTES

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