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ABSTRACT

This study assessed the effect of group size and presentation mode on acquisition of the process skill of forming and testing hypotheses and selected attitudes. Preservice elementary teachers (N=87) in five intact classes received two 1-hour sessions presented by microcomputer, 1 week apart. Half of the subjects were assigned to three-member cooperative learning groups; the rest worked alone at the computer. Matched problem situations which required the forming, testing, and revision of hypotheses were presented as color simulations to one-half of the subjects and as exercises to the rest. The effect of group size and mode of presentation was found to depend on subjects' initial hypothesizing skills and formal reasoning ability. Subjects with low formal reasoning skills benefitted more from small group interaction than from working alone. Subjects with higher formal reasoning ability also performed better after receiving textual exercises than similar subjects who interacted with color computer simulation. Also, cooperative group learning and color computer simulation were more effective than individual learning and computer text in elevating learners' perceived success in using the computer and attitude toward the program being used. It is suggested that pre-assessment of learner aptitudes is needed before prescribing a mode of computer presentation or group size. (Author/JN)

Changes in Preservice Elementary Teachers' Hypothesizing Skills and Selected Attitudes Following Group and Individual Study with Computer-Presented Text or Computer Simulation

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Purpose

The purpose of the study was to assess the effect of group size and mode of computer presentation on the acquisition of the science process skill of forming and testing hypotheses and selected attitudes.

Theoretical Basis

There is some evidence that microcomputers can help to provide an environment for practice of science process skills (Berger, 1982). Recent surveys have shown that the number of microcomputers available to elementary teachers is growing rapidly (Becker, 1983). Yet teacher training has been called the single largest barrier to the use of computers in education (Wells and Bitter, 1982). Perhaps a way can be found to join the need for better science teaching with the growing availability of this new classroom tool.

Just as there are a variety of materials and teaching tools available to classroom teachers, so there are several ways to organize students for learning. Classroom organization can provide for individualized or some form of group learning. Within these two modes there are at least two styles of learning-competitive and cooperative. Competitive learning places the learner in competition with others against some form of norm-referenced standards. Cooperative learning allows student to give and receive help in working to achieve criterion-referenced objectives. There is a growing body of evidence (Johnson, et. al., 1981; Trowbridge and Bork, 1982) that cooperative learning in small groups is quite effective where the learning task involves high levels of reasoning. Such is the case with science process skills.

Roger Johnson (1976) reports that small cooperative learning groups are particularly appropriate for science classrooms involving problem solving, laboratory situations, and divergent thinking. Individuals within such groups are assigned tasks which require cooperation to insure that the group will "sink or swim together". Johnson reports that such groups promote better problem solving by encouraging multiple perspectives on tasks, while group controversy promotes the seeking of additional information. Johnson also suggests that positive attitudes toward science are enhanced in cooperative learning groups. Heterogeniety within the group may stimulate different perspectives and cognitive rehearsal.

Group size and individual attributes used to insure group heterogeneity have been the subjects of research for years. Lorge and Soloman (1959) found that groups of 2 or 5 members homogeneous in ability fail to outperform individuals in problem solving tasks. There was no provision for structured cooperation, and heterogeneous groups were not included in the study. Hoffman (1959) and Hoffman and Maier (1961) report that general personality dissimilarity facilitates task performance in groups. They suggest that such dissimilarity is the source of heterogeneous problem solving viewpoints. They report that four-member heterogenous groups consistently scored as high as or higher than homogeneous groups on problem solving tasks. Trowbridge and Durnin (1984) found that four-member groups failed to perform as well as two- or three-member groups when interacting with computer terminals in physics simulations.

Procedure

Subjects (N=87) participated in the study as intact classes in one of four cells. These were:

1) group simulation - cooperative learning groups of three members who interacted with the computer simulations;

2) group text - cooperative learning groups of three members who interacted with textual exercises and problems on the computer;

3) individual simulation - subjects who interacted with the same computer simulations as cell 1, but worked alone;

4) individual text - subjects who interacted with the same textual exercises as cell 2, but worked alone

Formal reasoning and hypothesizing skills tests were administered and orientation provided during the first week of the study. During the orientation sessions, all subjects received instruction regarding the operation of the Apple IIe microcomputer and a discussion of what a scientific hypothesis is, with examples of how to form and test them. Subjects who participated in groups received a discussion and handout explaining cooperative group learning and defining individual roles within the groups. Treatment consisted of two one-hour sessions one week apart. The test of hypothesizing skills was administered as a posttest during the fourth week. Data on affective outcomes were collected immediately after each computer work session.

Treatment involved the use of either simulations or textual exercises, both presented by the computer. The computer simulations were "The King's Rule", sold by Sunburst Communications and "Baffles", sold by Conduit. The textual exercises were taken from Science - A Process Approach sold by Xerox Publications, and were all presented on the Apple computer screen. Subjects receiving textual presentations were presented with the same problem situations given to the simulation subjects. These were programmed to carefully model the commercial simulations except for color, sound and graphics.

Conclusions

The results of this study indicate that computer simulations are not necessarily more effective than computer-generated text in helping all types of learners acquire the process skill of forming and testing hypotheses. Learners with high levels of formal reasoning ability seem to benefit more from textual presentations and working alone than from simulations and cooperative group learning. Thus, there is a differential effect of cooperative group learning and simulations which depends on initial aptitudes in both formal reasoning and hypothesizing skills. This effect was observed whether or not the problem situation required spatial visualization by the learner.

Preservice teachers who interacted with computers as members of cooperative groups and those for whom the mode of presentation was simulations differed significantly from other subjects on two affective dimensions. These dimensions were perceived success following each session with the computer, and rating of the computer software used in each session. In both cases differences favored learners who worked in groups over those who worked alone, and favored learners who received simulations over those who received text only. Thus, cooperative group learning and computer simulations seem to be more effective than individual learning and computer text in elevating the learner's perceived success in use of the computer and attitude toward the program being used.

Implications

The most noteworthy implication from this study is the finding that there is a differential effect of learning environments on the acquisition of hypothesizing skills. Results of computer-assisted learning seem to depend on initial learner attributes. Where decisions must be made regarding assignment of students to computers in education settings, the best environment for cognitive gains seems to depend on the learner as well as the learning situation. Schools looking for simple solutions to equipment and software allocation should be aware of this differential effect.

A second implication from this study is that cooperative group learning with computers makes more efficient use of scarce resources while fostering more positive attitudes towards the computer as a teaching tool and towards problem solving science software.

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