THE EFFECTS OF ADVISEMENT AND SMALL GROUPS ON LEARNING FROM A MULTIMEDIA DATABASE

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ABSTRACT

This study investigated the effects of advisement and small group learning when college students used a multimedia database to learn about the African-American Civil Rights Movement. Students worked through the database either alone or with a partner; those receiving advisement were given suggestions concerning which database resources were most relevant and how those resources might be evaluated or interpreted. Results revealed that students receiving advisement learned significantly more, had more positive attitudes, spent significantly more time investigating the database, and accessed more relevant resources than students receiving no advisement. Implications for the design and implementation of learning tasks based on multimedia databases are provided.

INTRODUCTION

While the use of multimedia databases is increasing in schools, integrating them into teaching practices presents several challenges. Students may be unable to benefit from such unstructured learning environments because they can become overwhelmed and fail to locate pertinent information or discriminate between related information and the information most relevant to their purpose (Brush & Saye, 2000; Santiago & Okey, 1992). Ensuring that students identify appropriate resources may be difficult given that large informational databases provide access to unprecedented amounts of information through interfaces generally under the control of the user. The majority provide access to content with no direction as to which specific resources might be the most relevant or useful for a given objective. To overcome problems associated with the unstructured nature of most multimedia databases, students may be given advisement as to which resources are most relevant and how best to utilize them for a given learning task.

Advisement has been defined as guidance that supports student choices in learning situations. Santiago and Okey (1992) suggest that advisement may be classified as adaptive, evaluative or directive. Adaptive advisement provides information concerning the amount or sequence of instruction. Evaluative advisement compares current performance levels to that required for mastery, while directive advisement contains guidance on how best to complete an assignment or navigate a lesson.

Research on advisement in computer-based instruction (CBI) has produced mixed results. In some studies, advisement resulted in higher levels of student achievement (Holmes, Robinson & Steward, 1985; Johansen & Tennyson, 1983; Tennyson, 1980, 1981) while others found no significant differences in achievement relative to advisement (Coorough, 1991; Goetzfried & Hannafin, 1985; Shin, Schallert & Savenye, 1994). For example, Tennyson (1980,1981) found that students receiving advisement on progress toward goal mastery took significantly less instructional time while recording higher levels of achievement than those receiving no advisement. Conversely, Johansen and Tennyson (1983) found that participants receiving such goal mastery advisement spent more time in instruction, staying on task until the objective was learned, while those not receiving advisement terminated the instruction more quickly and showed lower levels of posttest achievement. Shin et al. (1994) found that students with high prior knowledge completed instruction more quickly in the presence of advisement, while those with low prior knowledge completed the lesson significantly more quickly when receiving no advisement.

Other researchers have demonstrated the benefits of advisement on learning from multimedia databases. Psotka, Kerst, Westerman and Davidson (1994) reported that students given advisement concerning the sequence and selection of visual cognitive tools designed to support student learning in a multimedia database learned more than those given no advisement. Similarly, Brush and Saye (2001) found that advisement in the form of visual cueing of the most relevant links within a hypermedia database resulted in students accessing a greater number of relevant resources.

A second challenge associated with integrating multimedia into instruction concerns access to computer technology. Many schools have less than adequate amounts of technology available to make efficient use of such resources (Becker, 1998). Teachers often address resource shortages by assigning more than one student to a computer using some form of cooperative learning Cooperative learning is generally defined as groups of students working together to support each other as learners (Johnson, Johnson & Smith, 1991).

Results of studies on the effects of cooperative learning with computers on achievement have varied. Findings supporting the effectiveness of integrating computers with cooperative learning have been reported by various researchers (Brush, 1997; Hooper, Temiyakam & Williams, 1993; Simsek & Hooper, 1992). Others have not reported significant findings when cooperative methods were combined with CBI (Cavalier & Klein, 1998; Crooks, Klein, Jones & Dwyer, 1996; Crooks, Klein, Savenye and Leader, 1998; Klein & Doran, 1999; Shoffner

& Dalton, 1998). In addition to achievement, computer-based cooperative learning has been found to impact learner attitudes. Various researchers have reported significantly higher attitudes toward cooperative group learning strategies as opposed to individual instruction (Crooks et al., 1996; Hooper et al., 1993; Simsek & Hooper, 1992). A preference for cooperative instructional techniques is not universal, however, as other studies have found no significant differences for attitude (Cavalier & Klein, 1998; Singhanayok & Hooper, 1998).

In classrooms, teachers frequently use informal cooperative learning strategies when grouping students together at a computer. According to Johnson, Johnson and Smith (1991) informal cooperative learning occurs when students are grouped together for periods lasting from a matter of minutes, up to the length of a single class session. Informal cooperative learning groups are used to facilitate focused, turn-to-your partner interactions designed to direct student attention toward content, promote cognitive engagement with the lesson, or provide closure at a lesson's conclusion. Informal cooperative groups "...also ensure that misconceptions, incorrect understanding, and gaps in understanding are identified and corrected" (Johnson et al., 1991, p. 5:10).

The present study was designed to investigate the effects of advisement and informal cooperative learning when students used a multimedia database. The independent variables in this study were advisement (provided vs. not provided) and learning strategy (informal cooperative learning vs. individual learning). Each informal cooperative dyad and individual was assigned to complete a multimedia-based instructional lesson which included, or did not include, advisement about the most relevant resources for completing the lesson as well as advisement on strategies for addressing the learning task.

METHOD

Participants

Participants were 159 undergraduate students (54 males; 105 females) enrolled in a computer literacy course at a large university in the southwestern United States. The majority of participants were either sophomores or juniors and represented a broad spectrum of majors.

Materials

Multimedia Database. A multimedia database relating to the African-American Civil Rights Movement entitled *Decision Point!* was used for this study (Brush & Saye, 2000; Saye & Brush, 1999). The database contained primary and secondary source artifacts in the form of newspaper and magazine articles, political and editorial cartoons, personal accounts, and video news footage organized and grouped according to specific historic events. For this study, two events were used: the demonstrations that occurred at Albany, Georgia and those occurring at Birmingham, Alabama. These events showcased differences in

strategies and results for both demonstrators and law enforcement agencies. *Decision Point!* provided no interpretation of events; it was a database of source artifacts only. As a result, any explicit learning task had to be specified by an instructor.

Task Sheet. All participants received a task sheet specifying the following learning task: "Learn as much as you can about the events at Albany and Birmingham in order to answer the following question: Where were civil rights activists more effective at achieving their goals and why?" The task sheet then described the *Decision Point!* database and the supports students would be provided to assist them. Two forms of the task sheet were used representing the two levels of advisement (Advisement and No Advisement) provided to participants. Those in the No Advisement condition were told they would have a notes page for recording information, while those in the Advisement condition were told they would have a study guide which would include suggestions about which parts of the database to examine, what to look for and think about while accessing artifacts within the database, and a space for recording information.

Study Guide/Notes. The study guide represented direct advisement in this investigation (Santiago & Okey, 1992). Direct advisement provides recommendations on how best to navigate the lesson and complete the assignment. Of the 52 resources describing the events at Albany and Birmingham, the study guide specified the 13 most relevant resources for completing the task as well as provided guiding questions and strategies for understanding and interpreting them. For example, advice for reading the Time article "Dogs, Kids and Clubs (5-10-63)" guided students in comparing an article published in a national magazine with one appearing in a local Birmingham newspaper by stating, "This article from a national magazine describes the same events as the previous one. How does this account compare and contrast to the previous one from the local paper? How can you explain the differences between the two articles?" The study guide also provided space for the recording of notes. Participants receiving no advisement were provided only with materials for recording notes.

Informal Cooperative Learning Guidelines. For participants working in informal cooperative dyads, materials were provided describing Read-and-Explain Pairs (Johnson et al., 1991) as follows: both people silently read or listen to the resource; person A then summarizes the content to person B; person B adds any missing information before both people agree on a final summary of the content and relate the information to the overall task as specified on the task sheet; and finally, the people exchange roles before moving on to the next resource.

Procedures

This study included four treatment groups: Individual – Advisement, Individual – No Advisement, Informal Cooperative Dyad – Advisement, and Informal Cooperative Dyad – No Advisement. The study took place in the 16 lab sections associated with a computer literacy course. To permit use of intact lab sections, a quasi-experimental design was used.

Prior to assigning treatment conditions, reading scores for all participants in

each of the 16 labs were obtained using the vocabulary subtest of the Nelson-Denny Reading Test Form H (Brown, Fishco and Hanna, 1993). A one-way analysis of variance (ANOVA) performed on the mean reading scores for the 16 lab sections revealed no significant differences $F(1,15) = 1.18$, $p = .287$. The 16 lab sections were then randomly assigned to one of the four treatments. Those in the Informal Cooperative Dyad treatment conditions were randomly assigned to a partner.

At the beginning of each lab section, participants in all labs were introduced to the research study and told the database they would be using focused on the Civil Rights Movement. Next, a brief description of the Montgomery bus boycott was read as an example of the type of information contained in the database, after which all participants were given a copy of the task sheet. Participants read the task sheet and any questions were answered. All participants were then given a demonstration of program navigation.

Following this introduction and demonstration, participants working in informal cooperative dyads were told they would be working with a partner. Partners were randomly assigned, then asked to sit together at a single computer. Next, all dyad members were given a copy of the informal cooperative group materials. These materials were read aloud and any questions concerning working with a partner were answered.

Finally, participants receiving no advisement were given copies of the notes record sheet while those receiving advisement were given copies of the study guide. Use of the study guide was explained and any questions were answered. Following distribution of materials appropriate to the different treatments, students began their investigation of the database.

While participants used the database, interaction behaviors of 40 cooperative dyads (20 receiving advisement and 20 receiving no advisement) were observed and recorded by the researcher. The computer captured the number of database resources accessed and the total time in program for all participants. After finishing their investigation, all participants were asked to individually complete the posttest and attitude survey.

Criterion Measures

A 15-item, short answer paper and pencil posttest worth a total of 20 points was used to measure performance. Knowledge, comprehension and analysis/inference level test items were developed from information found in the primary source documents students related to the task. The researcher graded all posttests; only those answers specified as correct on an answer key were accepted as correct.

A ten-item attitude survey was administered following the posttest. Four versions of the survey were produced, one for each treatment condition. The first eight items were Likert-style, using a four point scale from Strongly Agree to Strongly Disagree. Questions common to all survey versions asked students to rate their level of interest in the materials, effort expended completing the assignment, understanding of the materials, perceived degree of learning, and

confidence in navigation. This portion of the survey also included questions specific to each of the treatment groups. Participants working independently were asked about their degree of satisfaction working alone, while cooperative dyads are asked about working with a partner. Those receiving advisement were asked to rate its impact on their understanding of the material.

The computer recorded which resources participants accessed as well as time in program for each individual and cooperative dyad. Resources accessed data were examined in two ways. First, the total number of resources accessed was determined. Second, the degree to which participants accessed those resources most relevant to completing the task was ascertained by calculating the ratio of the 13 most relevant resources accessed to the total number of resources accessed. This ratio was expressed as the percentage of recommended resources accessed.

The number and type of interactions evidenced by participants in informal cooperative dyads were observed and recorded by the researcher. Participants working individually were also observed. Interaction behaviors were grouped into four categories: helping behaviors, on-task group behaviors, on-task individual behaviors, and off-task behavior (Klein & Pridemore, 1994). Examples of helping behaviors included asking for or giving help. On-task group behaviors included sharing materials or discussing the lesson content. On-task individual behaviors included taking notes or working alone. Off-task behaviors included discussing topics unrelated to the lesson or actions such a talking on a cell phone.

Design and Data Analysis

This study represented a posttest-only, control group design. It was a two (advisement versus no advisement) by two (independent versus informal cooperative dyad) factorial design. Criterion measures included a posttest and attitude survey. In addition, time in program, access of materials, and group interaction behaviors were measured.

Alpha was set at .05 for all statistical tests. Performance data were analyzed using two-way analysis of variance (MANOVA) with posttest score as the dependent variable. Attitude results were analyzed using multivariate analysis of variance (MANOVA), with each survey item representing a separate dependent measure. Follow-up univariate analysis was conducted on each of those attitude items where a significant ANOVA was found.

Tracking data including time in program and resources accessed were analyzed using MANOVA. Group interaction results for each of the four interaction categories were analyzed using Chi-square tests of significance with the data representing the number of instances within each behavior category observed for each dyad in the sample.

RESULTS

Posttest Achievement

Mean scores were 5.57 (SD = 3.05) for participants receiving no advisement and 7.84 (SD = 3.24) for those receiving advisement. Data for learning strategy revealed that those working individually achieved a mean score of 6.94 (SD = 3.33) while the mean score for participants working in informal cooperative dyads was 6.49 (SD = 3.35). ANOVA conducted on posttest scores revealed that students who received advisement scored significantly higher on the posttest than those receiving no advisement, $F(1,155)$ =2 0.08, p = .000, ES = .68. ANOVA did not reveal a significant main effect for learning strategy nor an interaction between advisement and learning strategy.

Student Attitudes

Means and standard deviations for responses to the attitude survey items are reported in Table 1. These data suggest that most participants liked using *Decision Point!* (M = 1.98) and tried to learn from the program (M = 1.86). Additionally, most had positive attitudes concerning the ease with which information in *Decision Point!* could be understood (M = 1.95) and about having enough time to complete the assignment (M = 1.71).

TABLE 1. ATTITUDE SURVEY RESPONSES

Attitude Survey Item	No Adv CL	No Adv Ind	Adv CL	Adv Ind	Total
1. I liked using Decision Point!.	2.18 (0.77)	1.75 (0.54)	1.99 (0.64)	2.00 (0.65)	1.98 (0.67)
2. I tried to learn as much as I could.	1.95 (0.77)	1.75 (0.49)	1.76 (0.59)	1.97 (0.58)	1.86 (0.62)
3. I learned a lot about the . Civil Rights Movement	2.39 (0.68)	1.98 (0.48)	2.00 (0.62)	2.16 (0.65)	2.13 (0.63)
4. The information in Decision Point! was easy to understand.	2.24 (0.91)	1.80 (0.65)	1.88 (0.63)	1.88 (0.75)	1.95 (0.76)
5. I felt confident about deciding where to go in Decision Point!.	2.18 (0.93)	1.85 (0.74)	1.72 (0.53)	1.72 (0.77)	1.86 (0.77)
6. I enjoyed working by myself/with a partner.	2.00 (0.75)	2.00 (0.82)	1.81 (0.77)	1.90 (0.74)	1.93 (0.77)
7. I felt confident about which resources to use to complete the assignment.	2.39 (0.97)	2.15 (0.67)	1.70 (0.57)	1.94 (0.71)	2.05 (0.78)
8. I used the Notes page/Study Guide to help me learn.	2.24 (0.82)	2.13 (0.97)	1.76 (0.68)	1.74 (0.79)	1.96 (0.84)
9. In the future I would prefer to work with a partner / by myself.	2.58 (0.98)	2.08 (0.86)	2.50 (0.95)	2.49 (0.85)	2.41 (0.92)
10. I had enough time to complete the assignment.	1.79 (0.59)	1.55 (0.55)	1.88 (0.89)	1.69 (0.69)	1.71 (0.69)

Note. Responses ranged from 1 (strongly agree) to 4 (strongly disagree).

MANOVA performed on the ten attitude items revealed a significant main effect for advisement, $F(10, 143) = 3.09$, $p = .001$. MANOVA did not reveal a significant main effect for learning strategy. Results of follow-up univariate tests indicated that participants who received advisement were more likely than those receiving no advisement to agree with the following statements: (1) "I felt confident about where to go in the program", $F(1,15\ 2) = 6.01$, $p = .01$, $ES = .38$; (2) "I felt confident about which resources to use to complete the assignment", $F(1,152) = 14.56$, $p = .00$, ES = .58; and (3) "I used the Notespage/Study Guide to help me learn" $F(1,152) = 11.59$, $p = .00$, $ES = .52$.

Time in Program

Time data show that students receiving no advisement spent an average of 29.1 minutes using the database, while students receiving advisement spent an average of 39.2 minutes. In terms of learning strategy, students working individually averaged 31.8 minutes in the program, while students in informal cooperative dyads averaged 36.8 minutes. ANOVA revealed that students working in informal cooperative dyads spent significantly more time in program than those working individually, $F(1,100) = 8.84$, $p = .004$, $ES = .48$. ANOVA also indicated that students receiving advisement spent significantly more time in program than those not receiving advisement, $F(1,100) = 31.21$, $p = .000$, $ES = .96$. No interaction between learning strategy and advisement was found.

Resources Accessed

The average number of resources accessed for students receiving no advisement was 27.3, while those receiving advisement accessed an average of 17.0 resources. Students working individually accessed an average of 21.3 resources, while students in informal cooperative dyads accessed an average of 21.9 resources. ANOVA revealed that students receiving advisement accessed significantly fewer total resources than those receiving no advisement, $F(1,100) = 37.6l$, $p = .000$. Results did not reveal a significant effect for learning strategy nor a significant interaction between learning strategy and advisement.

Students in the advisement condition were provided with a study guide that advised them to review a total of 13 recommended resources. Resources accessed data were analyzed to determine the percentage of recommended sites students viewed within the database. These data show the average percentage of recommended sites accessed for students receiving no advisement was 53%, while students receiving advisement accessed an average of 96% of recommended sites. Students working individually accessed an average of 75% of the recommended resources, while students working in informal cooperative dyads accessed 77% of these resources. ANOVA revealed that students receiving advisement accessed a significantly higher percentage of recommended sites than students working without advisement, $F(1,100)$ 144.76, $p = .000$. ANOVA did not reveal a significant effect for learning strategy nor a significant interaction between learning strategy and advisement.

Informal Cooperative Interactions Data

Forty informal cooperative dyads (20 receiving advisement and 20 receiving no advisement) were observed as they worked with *Decision Point!* and their interaction behaviors were recorded. These data indicate that students receiving advisement engaged in a total of twelve helping behaviors in comparison to one for those receiving no advisement. A chi-square test performed on helping behaviors revealed that this difference was significant, χ^2 (1,N = 160) 9.30, $p <$ .01. Students in the advisement condition also exhibited 115 on-task individual interactions, while students receiving no advisement engaged in a total of 62. Chi-square analysis of on-task individual interactions revealed that this difference was significant χ^2 (1,N= 160) = 15.88, $p < .001$. Chi-square analysis of on-task group interactions revealed no significant difference in the number of interactions between those receiving advisement and those receiving none. Finally, students in the Advisement condition engaged in no instances of off-task interaction, while students in the No Advisement condition evidenced 16 off-task interactions. Chi-square analysis of off-task interactions revealed that the difference was significant χ^2 (1,N = 160)= 16.00, $p < .001$.

DISCUSSION

Results of this study indicated that participants provided with advisement performed significantly better on the posttest than those receiving no advisement. Providing advisement may have supported increased learning in several ways. First, while students receiving advisement accessed significantly fewer resources than those receiving no advisement, the resources they did access were more often directly relevant to the lesson task. Those in the advisement condition viewed an average of 96% of the recommended resources, findings corroborated by observations of individuals and cooperative dyads receiving advisement which revealed that most used the study guide to select resources for investigation. The advisement may have served to focus students' attention on key resources while preventing them from becoming overwhelmed by the large number of resources available.

A second reason advisement may have contributed to increased learning relates to the finding that participants receiving advisement spent significantly more time in program. These results are consistent with those of Johansen and Tennyson (1983) who found that participants receiving advisement spent more time in instruction and stayed on task until the objective was learned.

Although results demonstrated that those receiving advisement did show higher levels of achievement, the overall achievement level for all participants was low. This is likely due to the short amount of time students spent using the database and the fact that access was limited to one class period. It is also possible that the extra credit offered for participation was not sufficient to motivate students to learn the historical subject matter presented in the database.

While advisement had a significant effect on posttest achievement, learning strategy did not. This may be due to the fact that the study represented the only

time students engaged in cooperative learning during the entire class. Unfamiliarity with the processes and expectations inherent in working cooperatively may have limited its effectiveness. Another contributing factor may have been the lack of positive interdependence associated with the Read-and-Explain Pair (Johnson et al., 1991) procedure implemented in the study.

Results for attitudes indicated that participants receiving advisement were more confident about where to go in the program and about which resources to use. This suggests that those provided with advisement felt more comfortable learning from *Decision Point!* due to their clearer sense of which of the array of available resources was most relevant. In contrast, the more negative feelings of those receiving no advisement may reflect their frustration in having to search the database randomly in hopes of finding resources relevant to completing the task. These results support findings by Shin et al. (1994) who reported that students given free access to instructional content preferred having advisement.

The results of this study have implications for the design and implementation of instruction using multimedia databases. These findings support previous research suggesting that instructional designers should include advisement to support students in identifying relevant database resources for completing a learning task. Previous studies, however, have supplied advisement as an integral part of a computer-based program or database. Such advisement, provided through the manipulation of program or database software, is not a viable option for most teachers. Results of this study suggest that teachers may include advisement provided externally to a computer program or database as a means for supporting student learning. Supplying advisement concerning the interpretation of primary source documents may also enhance student learning. Providing advisement to support students as they identify and interpret relevant resources contained in multimedia databases will enhance the effectiveness of these tools for learning.

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