Using video-based anchored instruction to enhance learning: Taiwan’s experience

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Abstract
The purpose of this study is to investigate the effects of computer-assisted videodisc-based anchored instruction on attitudes toward mathematics and instruction as well as problem-solving skills among Taiwanese elementary students. Results from a t-test indicate a significant main effect on student attitudes toward mathematics. Results from a two-way Repeated Measures ANOVA show that students’ problem-solving skills improve significantly with anchored instruction. Results also indicate that all the students benefit from the effects of anchored instruction on their problem-solving performance regardless of their mathematics and science abilities. The findings suggest that video-based anchored instruction provide a more motivating environment that enhanced students’ problem-solving skills. This study is significant because it establishes an example of video-based anchored instruction for Taiwanese students and also provides empirical evidence of its effects on affective and cognitive responses among fifth graders in learning mathematics. This study is helpful to educators who want to help students learn to think and learn throughout technology.

Introduction
One popular learning theory, which has recently captured the interest and attention of educational technologists, is situated learning. Based upon the notion that knowledge is contextually situated and is fundamentally influenced by the given activity, context, and culture, situated learning offers an approach to structuring learning experiences in both experiential and reflective dimensions of cognition (McLellan, 1996). Brown, Collins and Duguid (1989) used the term cognitive apprenticeship to define situated learning as authentic practices through activity and social interaction in a way similar to craft apprenticeship. With the widespread application of multimedia technology, the ideas of situated learning can be better achieved, because computer technology can be
deployed to expand the power and flexibility of learning resources. There were groups of researchers who have been developing and studying the learning environment based on the theory of situated learning in order to maximize learning experience in school classrooms. One successful example of these approaches is anchored instruction. Anchored instruction, originally proposed by the Cognition and Technology Group at Vanderbilt University (CTGV, 1990, 1991, 1992, 1993), aims to help students develop the confidence, skills, and knowledge necessary to solve problems and become independent thinkers. Taking advantage of the emerging video and multimedia computing technology, its major features are the use of problem-scenarios to elicit students’ problem-solving goals, strategies for solving these problems, and the connection of knowledge with daily life. Based on the theories of situated learning, cognitive apprenticeship and cooperative learning, anchored instruction makes it possible to provide life-like inquiry situations, in which students can easily explore the content and which facilitates the teaching of mathematical concepts and problem-solving strategies (Bransford and Vye, 1989; Cobb, Yachel and Wood, 1992).

The primary focus of anchored instruction is the development of interactive videodisc tools that encourage students and teachers to pose and solve complex, realistic problems. The well-known program of anchored instruction developed by the Cognition and Technology Group at Vanderbilt (CTGV) is called The Adventures of Jasper Woodbury Mathematical Problem Solving Series (The Jasper Series). The Jasper Series is based upon a set of theory-based design principles, such as video-based format, narrative with realistic problems (rather than a video lecture), a generative format, embedded data design, problem complexity, pairs of related adventures, and links across the curriculum. These design principles have been described in detail elsewhere (eg, CTGV, 1991, 1992, 1993). The video materials serve as “anchors” (macro-contexts) for all subsequent learning and instruction. As explained by CTGV (1993), “The design of these anchors was quite different from the design of videos that were typically used in education...our goal was to create interesting, realistic contexts that encouraged the active construction of knowledge by learners. Our anchors were stories rather than lectures, and designed to be explored by students and teachers” (p.53). The video program is used as an “anchor” or situation for creating a realistic context to make learning motivating, meaningful and useful.

The Jasper Series was developed to teach mathematics, mathematical problem solving and critical thinking skills in fifth- to eighth-grade classrooms. At the core of each adventure is a 15–25 minute video-based story that presents a complex problem with a mathematical solution. Students solve problems that the major characters in the video encounter. To solve the problem, students must generate appropriate subgoals, identify relevant information, cooperate with others in order to plan and solve complex problems, discuss the advantages and disadvantages of possible solutions, and compare perspectives by pointing out and explaining key events. The problems are all sufficiently complex, with 10–15 steps involved in obtaining a solution.
Review of CTGV’s research
A one-year evaluation study was conducted by CTGV (1992) to investigate the effects of *The Jasper Series* on problem-solving abilities and attitudes. The subjects were 739 elementary students from 37 fifth-grade, sixth-grade, or mixed-grade classrooms at 11 school district sites across nine southeastern states. There were the Jasper classrooms (the experimental groups) and matched control classrooms (the control groups). The Jasper groups received instruction from at least three Jasper adventures whereas the control did not. In addition to standardized tests, four test instruments (the Basic Math Concepts Test, Word Problem test, Planning Test, and Mathematical Attitudes Questionnaire) were developed and used to examine the effects of the Jasper Series. The results indicated that the Jasper groups outperformed the control groups in the posttest of the word-problem test and planning and subgoal comprehension questions. In addition, the Jasper groups showed significantly improved attitudes and less anxiety toward mathematics.

In short, research on *The Jasper Series* showed much important and positive evidence of its effectiveness in promoting problem-solving abilities as well as enhancing attitudes toward mathematics and instruction (CTGV, 1990, 1991, 1992; Hickey *et al.*, 1993; Van Haneghan *et al.*, 1992). There was also ample evidence that situations involving the use of instructional technologies that are authentic, relevant, and stimulating to learners are likely to influence attitudes and performance (Simonson and Maushak, 1996). However, the context of *The Jasper Series* is anchored in American culture. Can anchored instruction be effective for Taiwan’s education system, especially for improving problem-solving performance as well as promoting positive attitudes toward mathematics? If so, how does it work?

Background of this study
Education is of primary importance to Taiwanese parents, and most young people ascribe to the value of doing well in school. Some parents and students may even have the belief that education is the ladder of success, the path to riches, and the great escape from manual work. In Taiwan’s educational system, most teachers and students are under tremendous pressure to obtain good examination scores, because these scores will determine a student’s eligibility to enter an excellent school as well as determine a teacher’s reputation as a successful teacher. Thus, many students rely upon memorization to master subjects (even math and science) instead of thinking and using problem-solving skills in order to achieve good scores on pencil-and-paper tests. Moreover, many teachers often believe that the most effective approaches for achieving high scores are to rely extensively on teacher-directed instruction and to have students practice as many related problems as possible before taking the tests in order to cover the large amount of textbook contents (Cheng *et al.*, 1998). Therefore, instructional content is often presented to learners in simplified, decontextualized, and isolated chunks that encourage memorization rather than problem solving or higher-order thinking. This kind of learning situation makes it difficult to help students to appreciate the value of the knowledge they learn. It is also hard for students to comprehend the content’s applicability to actual problems and meaningful situations, and to transfer learning experience to different situations.

However, in recent years, there is growing concern among Taiwan’s educators, school administrators and government policy-makers regarding these educational problems. Many educators and researchers have diagnosed these flaws and proposed several approaches as remedies. Some suggest that constructivist pedagogy, emphasizing student-centered rather than teacher-centered learning, be responsible for the nationwide educational improvement; some assert that technology will make the difference in this educational reform; while others contend that education should be reengineered by the integration of technology, pedagogy, and curriculum. In addition, many educators claim that learning to think critically, and to analyze and synthesize information for problem solving should become our new crucial educational goal, to be achieved as we enter the 21st century. In order to accomplish such goals for students, several innovative instructional programs have been developed and implemented into educational practices.

Dunlap and Grabinger (1996) suggested that there are two main instructional issues that need to be addressed in order to make learning meaningful for students. One of the issues is how we can help students apply the information they learn; and the second is how we can make the need and reason to learn content apparent. Based on the above suggestions, the author has developed computer-aided videodisc-based anchored instruction for Taiwanese students, entitled *Mathematics in Life Series (I): Encore’s Vacation*, which was funded by the National Science Council (Shyu, 1993). With video-based format anchored instruction, the students can watch the story and experience the situation more vividly, interacting with the embedded data more easily. *Encore’s Vacation*, similar to *The Jasper Series*, offers a video-based story and a searching map that allows students full control of their speed in watching the story as well as searching for embedded data.

**Purpose of this study**
The purpose of this investigation was to conduct an empirical study on the effects of videodisc-based anchored instruction on attitudes toward mathematics and instruction as well as problem-solving skills among Taiwanese elementary students. In this study, two separate experiments were performed. One experiment investigated the affective domain by examining how students’ attitudes toward mathematics and instruction changed; the other investigated the cognitive domain by examining whether the instruction contributed to the improvement of students’ problem-solving skills.

**Method and research design**

*Experiment I: Affective Domain (attitude change)*

**Subjects**
Seventy-four fifth-graders, enrolled in two classes at a public elementary school, located in a suburban area of Taipei City in Taiwan, were selected. The subjects who participated in this study included 38 boys and 36 girls. They were divided into 13 groups. There were six students in each group, except for one group with 4 persons.

**Materials**
A videodisc program, *Encore’s Vacation*, was used in this study. *Encore’s Vacation* is a technology-based program designed to motivate students and help them learn to think
and reason about complex problems in mathematics learning (Shyu, 1993). It is designed to be consistent with the curriculum standards suggested by Taiwan’s Ministry of Education for the subject matter on Mathematics for fifth-grade students. It involves the adventures of a college student named Encore and three of his classmates. The story begins with four college students who arrange a train trip. During their trip, they have to change their schedule because someone has an accident. The story finished an open ending. Students in the experiment are challenged by several mathematical problems in this story. For example, how do they make a reasonable decision to get back home on time? Do they have to reschedule their trip? Why? How will they share the equal expenses for this trip? In order to solve such problems, students need to practice arithmetic. The videodisc starts as a highly motivating third-person experience, i.e., a linear story told via video. Finally, however, it becomes a personal (the first person) experience when students actively engage in helping the actors in the story to solve a meaningful, real-life challenge. An important design feature of Encore’s Vacation, similar to The Jasper Series, is the “embedded data design”. Students are asked to generate problems to be solved and then find relevant mathematical information presented throughout the video story. All the data needed to solve the problems are embedded in the story. The sequencing of the videodisc instruction is programmed and controlled by a personal computer and Pioneer model VD-4400 laserdisc player using the Authorware Professional for Windows software.

The instruction is done through many problem-solving steps. The activities in the curriculum include watching the story from the videodisc, learning strategies for solving problems, and solving (mostly mathematical) problems cooperatively which are presented in the videodisc.

Procedures and treatment
This experiment was a one-group time series with a pretest and posttest design. Subjects were given an orientation to the instruction first, and then they were asked to watch Encore’s Vacation in a linear manner. Subjects filled out the Attitudes toward Mathematics Questionnaire (pretest) before the treatment. The scores of this pretest were used as a baseline to examine whether the Encore’s Vacation program changed the students’ attitudes towards mathematics and mathematical problem solving. The treatment then followed, which was the instruction. It began with presentation of the video segments. At the end of the whole story, the video presented problems and challenged subjects to solve the problem cooperatively. The instruction used a total of 8 class-periods in one week. During the instruction, the role of the teacher was to help the students to recognize the problems and to provide them with necessary scaffolding to solve problems. After the instruction, all the students were given a 40-item posttest (similar to the pretest but not the same). Students who underwent the treatment were divided into groups and worked collaboratively. After the treatment, they were given the posttest of the Math Attitudes Questionnaire and the Encore’s Attitudes Questionnaire individually.
Instrumentation
Mathematics Attitude Questionnaire: This mathematics attitude scale was adapted from questionnaires developed by CTGV (1992), Lee (1983), and Fennema and Sherman (1978). The 40 Likert-scale items on the Math Attitude Questionnaire were written to assess a variety of constructs of attitudes of the research group. The items included the four constructs of attitudes toward mathematics: Math self-efficacy, math anxiety, the usefulness of math, and interest in solving math problems. These 40 questions were answered from strongly agree (5) to strongly disagree (1), having an average range from 1 to 5, with 5 indicating the most positive attitude toward mathematics. Items were worded in both a positive and a negative way. Scoring on negatively worded items was reversed. The reliability (Cronbach’s alpha) was .86. The Math Attitude Questionnaire was administered before the treatment (as a pretest) and after treatment (as a posttest), with the order of items rearranged.

Attitude Questionnaire toward Encore’s Vacation: The 12 Likert-scale items on the Attitude Questionnaire toward Encore’s Vacation was designed to assess student perceptions of their anchored instruction experience after participation in the experiment. The various constructs included were interest in Encore’s Vacation, application, and effectiveness of Encore’s Vacation. These 12 questions were answered from strongly agree (5) to strongly disagree (1), with average range from 1 to 5, with 5 indicating the most positive attitude toward the instructional materials, Encore’s Vacation. Items were worded in both a positive and a negative manner. Scoring on negatively worded items was reversed. The reliability (Cronbach’s alpha) was .82. The Encore’s Vacation Attitude Questionnaire was administered after the treatment.

Research design
This study used a field-experimental design. It aimed to answer the following three research questions: (1) did anchored instruction help to promote attitudes towards mathematics among fifth-graders? (2) Was there a significant difference between boys and girls in their attitudes towards mathematics after the treatment? (3) What were students’ attitudes toward the anchored instruction (Encore’s Vacation)? Did gender make a difference? The independent variables in this study were treatment and gender. The dependent variables were pretest and posttest mathematical attitude scores as well as attitudes toward anchored instruction. Data were analyzed using t-tests with SPSS-x software.

Experiment II: Cognitive Domain (Problem-solving skills)
Subjects
A class of thirty-seven fifth-graders from an elementary school located in a suburban area of Taipei City in Taiwan was randomly selected and divided into six groups according to the students’ mathematical and science abilities. Two groups were high-ability groups, indicating that all six students in each group were all high achievers in mathematics and science courses; two were medium-ability; two were low-ability.

Materials
The same as in the experiment I.
Procedures and treatment
This experiment was a one-group time series with a pretest and posttest design. Subjects were given an orientation to the instruction first, and then they were asked to watch the story *Encore’s Vacation* in a linear manner. Then, subjects were given a pretest based on the content of the story. The scores of this pretest were used as a baseline to examine what kind of strategy students used in the problem-solving process before the treatment. The treatment then followed, which was the instruction. It began with presentation of the video segments. At the end of the story, the video presented problems and challenged subjects to solve the problem cooperatively. The instruction used a total of eight class-periods in one week. During the instruction, the role of the teacher was to help the students to recognize the problems and to provide them with necessary scaffolding to solve problems. After the treatment, all the students were administered a 12-item posttest (parallel to the pretest but not the same).

The students in the treatment investigated two major questions (ie, calculate time and money). As each question was introduced in class, the students were encouraged to generate subordinated questions of the stated question, as well as recalling facts and retrieving relevant data from the videodisc to answer the questions. This segment of instruction was designed to engage students in planning for problem solving and to focus their attention on gathering the needed information. The students were led to generate complete solutions for all of the subproblems identified. As subproblem solutions were generated, the students were encouraged to relate the solutions to the overall problem. The students engaged in problem solving in a small-group format. Each group included six persons.

The students who underwent the treatment were divided into groups and worked collaboratively, but they were given the tests (both pretest and posttest) individually. A four-step problem-solving procedure was tested and scored in both the pretest and posttest. The steps were problem-identification, problem-formulation, subgoal-generation, and solution execution according to Polya’s mathematical problem solving model (1957). The 60-point total score was broken into several parts in accordance with the steps to achieve a solution. Points were given for each correct step. Three experts scored the tests, with an inter-rater reliability of 0.965.

Research design and questions
This study was a field-experimental, one group time series with a pretest and posttest design. It aimed to answer the following three research questions: (1) did anchored instruction help to students’ problem-solving abilities among fifth-graders? (2) For different-ability (high-, medium-, low-ability) students, did anchored instruction help to promote their problem-solving abilities? (3) Was there any significant difference among the ability groups (high, medium, and low) in the improvement in their problem-solving abilities? The independent variables in this study were group (ie, high-, medium-, and low-ability group) and time series (ie, pretest, posttest). The dependent variables were the problem-solving performance scores. Data were analyzed using a $3 \times 2$ Repeated Measures ANOVA with SPSS-x software. All statistical tests were evaluated at the p < .05 level of confidence.
Results

Experiment I: Affective Domain (Attitude change)

Attitudes toward mathematics

Scores from the Math Attitudes Questionnaire were examined to determine whether the Encore’s Vacation program changed students’ attitudes towards mathematics and mathematical problem solving. After reversing the valence of the negatively worded items, scale items were generated for the math attitude scales. Results from a t-test showed a significant effect on student attitudes toward instruction ($t = 3.42, p < .01$) (See Table 1). Follow-up analyses showed that students, after receiving anchored instruction, felt more positive about, interested in and less anxious toward mathematics.

Results from the additional t-test indicated a non-significant effect of gender on the change of their attitudes toward mathematics. The data suggested that there were no significant differences between girls and boys in their attitudes toward mathematics after the treatment.

Attitude toward anchored instruction (Encore’s Vacation)

Results from descriptive statistics showed that students felt more positive toward Anchored Instruction after the treatment. The histogram of the descriptive data is shown on Figure 1.

Experiment II: Cognitive Domain (Problem-Solving skills)

Mean scores of the pretest and posttest for the different ability groups are listed in Table 3. A bar graph is shown on Figure 2. Results from a two-way Repeated Measures ANOVA showed that student problem-solving skills improved significantly with anchored instruction [$F(1,34) = 26.76, p < .000$] (See Table 5).

<table>
<thead>
<tr>
<th>Scores</th>
<th>N</th>
<th>mean</th>
<th>S.D.</th>
<th>$T$ value/prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>pretest</td>
<td>74</td>
<td>2.37</td>
<td>0.58</td>
<td>$t = 3.42$</td>
</tr>
<tr>
<td>posttest</td>
<td>74</td>
<td>4.35</td>
<td>0.58</td>
<td>$p = .001^*$</td>
</tr>
</tbody>
</table>

$^*<.001$

<table>
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<tr>
<th>Gender</th>
<th>N</th>
<th>mean</th>
<th>S.D.</th>
<th>$T$ value/prob.</th>
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<tr>
<td>Males</td>
<td>38</td>
<td>3.67</td>
<td>0.72</td>
<td>$t = .06$</td>
</tr>
<tr>
<td>Females</td>
<td>36</td>
<td>3.68</td>
<td>0.72</td>
<td>$p = .95$</td>
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</tbody>
</table>
Using video-based anchored instruction to enhance learning

Figure 1: Histogram of attitudes toward video-based anchored instruction

Table 3: Mean scores of pretest and posttest for different ability students

<table>
<thead>
<tr>
<th>Group Ability</th>
<th>N pretest</th>
<th>N posttest</th>
<th>Mean* pretest</th>
<th>Mean* posttest</th>
<th>SD pretest</th>
<th>SD posttest</th>
</tr>
</thead>
<tbody>
<tr>
<td>High-</td>
<td>12</td>
<td>12</td>
<td>15.76</td>
<td>21.94</td>
<td>11.09</td>
<td>13.49</td>
</tr>
<tr>
<td>Mid-</td>
<td>11</td>
<td>11</td>
<td>13.40</td>
<td>21.59</td>
<td>7.75</td>
<td>13.72</td>
</tr>
<tr>
<td>Low-</td>
<td>14</td>
<td>14</td>
<td>15.29</td>
<td>25.65</td>
<td>8.50</td>
<td>14.95</td>
</tr>
<tr>
<td>Total</td>
<td>37</td>
<td>37</td>
<td>14.88</td>
<td>23.24</td>
<td>9.02</td>
<td>13.86</td>
</tr>
</tbody>
</table>

* Based on a total score of 60.

Figure 2: A bar graph of pretest and posttest problem-solving scores

Furthermore, data also clearly indicated that anchored instruction contributed to the students’ problem-solving abilities for all three groups (high-, medium-, and low-ability group) \( (p < .01) \). This result was identical with that of the pretest and posttest across all ability groups \( (t = 5.33; p = .000) \) (see Table 4). However, there was no significant difference among the ability-groups in their increment of problem-solving skills \( [F(2,34) = .23; p = .794] \) (see Table 5). There was no interaction effect between the three groups and the improvement of problem-solving skills. In summary, the finding suggested that anchored instruction provided a more motivating environment that enhanced students’ problem-solving skills. Results also indicated that all the students benefited from anchored instruction through its effects on their problem-solving skills regardless of their mathematical and science abilities.

**Discussion and educational implications**

The results of this study supported the theoretical assumptions in terms of affective and cognitive aspects. First, the findings showed a positive change of attitudes toward mathematics and anchored instruction. Attitude has been long considered an important component of effective instruction (Simonson and Maushak, 1996). Pallak and his associates (1972) also stated that students with positive attitudes who commit themselves find

<table>
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<th>S.D.</th>
<th>T value/ prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pretest</td>
<td>37</td>
<td>14.88</td>
<td>9.02</td>
<td>( t = 5.33 )</td>
</tr>
<tr>
<td>Posttest</td>
<td>37</td>
<td>23.24</td>
<td>13.86</td>
<td>( p = .000^* )</td>
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</table>

*<.001

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<th>Tests on Between-Subjects Effects</th>
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<tr>
<td>-----------------------------------</td>
</tr>
<tr>
<td>Within+Residual</td>
</tr>
<tr>
<td>Group (H.M.L)</td>
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<table>
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<tr>
<th>Tests on Within-Subjects Effects</th>
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<tbody>
<tr>
<td>Sources</td>
</tr>
<tr>
<td>-----------------------------------</td>
</tr>
<tr>
<td>Within+Residual</td>
</tr>
<tr>
<td>Time(pre-,post-)</td>
</tr>
<tr>
<td>Group ( \times ) Time</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

*<.001

Table 4: A t-test on pretest and posttest problem-solving scores

Table 5: A two-way \((\text{Group} \times \text{Time})\) Repeated-Measures ANOVA on problem-solving scores
that their consonant attitudes are reinforced and become even more positive. Therefore, these results may tell us a great deal about the positive impact on learners and learning itself. For years, mathematics instruction is considered as difficult and sometimes frustrated to learn for most students in Taiwan. In this study, we are inspired that learning mathematics can be more enjoyable and the value of mathematics can be much more appreciated by students through a systematically instructional design for incorporating situated learning theory and multimedia video technology into instruction in which students learn in a better way.

In addition to the affective domain, the results in this study also indicated that students’ use of problem-solving strategies significantly differed after they received the experimental instruction, which proved that anchored instruction improved students’ thinking skills. Moreover, the results also showed that anchored instruction obviously contributed to the students’ problem-solving abilities in all the three groups (high-, medium-, and low-ability group). However, there was no significant difference among ability-groups on their increment of problem-solving skills. This study provided an inspiring result that all the students benefited from anchored instruction through its effect on problem-solving skills regardless of their mathematical and science abilities. In mathematics, traditional word problems typically provide the goal and only those numbers needed to solve the problem; hence they afford little more than computational selection. In contrast, Encore’s Vacation afford students opportunities to create problem structure as they solve the problem, potentially leading to more opportunities for group interactions that support generative learning.

This study also supports Hickey et al.’s argument (Hickey et al., 1993) and provides evidence that the Encore’s Vacation environment is indeed highly motivating and enjoyable, and that the experience has a positive impact on students’ problem-solving skills. Much research (CTGV, 1991, 1992; Hickey et al., 1993; Van Haneghan et al., 1992) has provided evidence to show that The Jasper Series (a successful example of anchored instruction) promotes problem-solving skills among American elementary students. However, none of this research on the effects of anchored instruction has been done for students of other cultural backgrounds. This study was significant because it provided empirical evidence of its effectiveness in the affective and cognitive domains of teaching elementary mathematics in Taiwan. Consequently, the results of this study may also imply that technology-enhanced anchored instruction can be effective for Taiwan’s elementary education.

To sum up, this study has profound implications for how educational technology, as video-based technology coupled with anchored instruction, are designed into instruction. The excitement currently generated by computer technology in instruction is due to the recognition that they are our best hope for bridging the gap between the classroom and the real-world conditions within which students are expected to work outside of the classroom. This study suggests that video-based anchored instruction has its potential for offering interactive, authentic instructional experiences to bridge that gap. In addition, this study may suggest students are able to solve complex mathematics problems...
with an improved attitude toward mathematics and instruction in interactive video-based anchored instruction. This study also seems to indicate that the video-based anchored instruction was a success in promoting students’ performance in both cognitive and affective domains. This study is helpful to educators who want to help students learn to think and learn effectively throughout technology.

Suggestions for future studies
The results of this research also suggest some issues that seem particularly fruitful to explore. First, a study considering an impact of *Encore’s Vacation* on teachers by examining the impact of an intensive *Encore’s Vacation* workshop on the teachers’ beliefs, self-efficacy, and attitudes toward teaching mathematics and math problem solving is suggested for further investigation. In addition, a further study is suggested to examine the long-term effects of attitudes as well as problem-solving performance. An emphasis on the research with regard to retention and learning transfer effects may highlight the value of this technology-enhanced learning environment. Research on learning transfer should also help us understand this kind of learning environment that facilitate advanced problem-solving performance. It is expected that future studies will better illustrate the mechanisms by which this type of learning environments influence positively student’s attitudes and problem-solving skills both within the environment and in other achievement settings.

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References


