

An investigation of critical thinking skills in computer- based educational software using content analysis

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Abstract: Computer-based educational software programs are widely used in elementary schools to enhance learning math. Critical thinking skills are important to allow the student to go beyond fundamental concepts and procedures to solve problem in various situations. We are using content analysis techniques to determine if critical thinking skills are nurtured in computer-based educational software programs. Criteria are developed based on the Integrated Thinking Model of Iowa Department of Education. Several elementary-level math software programs will be selected and evaluated.

Define Terms

Critical thinking involves the dynamic reorganization of knowledge in meaningful and usable ways. It involves three general skills: Evaluating, Analyzing, and Connecting (Jonassen, 2000). In this paper, we focus on several attributes of the Analyzing skill. Initial definitions of these attributes, adjusted for the purpose of evaluating elementary-level math software programs, are listed below.

- Recognizing patterns of organization – recognizing patterns in geometric shapes. For example, after students play with a triangle shape and then with a square shape, they can recognize that the square contains two triangle shapes.
- Classifying the content - classifying objects into categories based on common attributes (Jonassen, 2000). For example, when students solve different kinds of arithmetic questions, they have to categorize those questions into a certain group such as multiplication, subtraction, addition or division.
- Identifying the main ideas - identifying the main or central ideas in text, data, or creations, and differentiating core ideas from supporting information (Jonassen, 2000). For example, especially when students encounter a word question, they have to know what the main idea is or what is asked about the specific question. There are many different types of word questions.
- Finding sequences - Finding sequences or consecutive order in sequentially organized information (Jonassen, 2000). For example, when they solve a division question, students have to follow a certain sequence of steps. They cannot find an answer to an arithmetic question without following sequential steps.

Content Analysis Techniques

In this research, the unit of analysis is defined as an individual activity in a software program for which each critical-thinking criterion is evaluated and analyzed. Software programs are selected for convenience from the PT3 grant software library at the University of Houston. This study is limited due to this constrained access to software. All coding categories are discussed among the three researchers and a consensus is reached before the analysis begins. Table 1 lists a sample preliminary analysis of two software programs and their nurture of critical thinking skills.

Table1: Preliminary Content Analysis of Critical Thinking Skills

| Software Program | Activity | Critical Thinking Skills | | | |
|------------------|------------------|--------------------------|-------------------------|---------------------------|-------------------|
| | | Recognizing Patterns | Classifying the content | Identifying the main idea | Finding sequences |
| Math Companion | Calculations | Y | | | Y |
| | Math Anagram | Y | | | Y |
| | Math Color-in | Y | | | |
| | Word Problems | | Y | Y | Y |
| Math Storm | The Store | | Y | Y | |
| | The Time Igloo | Y | | Y | |
| | The Gold Room | Y | | Y | |
| | The Crystal Cave | Y | Y | Y | |
| | The Ice Gate | | | | Y |

Y: skill is nurtured in this activity

Description of Math Companion software activities

In the Calculations and Math Anagram activity, students need to recognize the patterns of objects and distinguish among them. When solving each question, students have to follow certain sequences and rules. In the Math Color-in activity, students need to match numbers, colors and patterns.

Description of Math Storm software activities

In the Time Igloo activity, students read a digital clock and set the cuckoo clock to the matching time by recognizing the patterns of the hours and minutes. In the Crystal Cave activity, students learn how to count by recognizing the patterns of fives and tens. Students identify categories to facilitate counting.

References

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