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ABSTRACT

An instructional program was constructed that explored the responses and perceptions of preservice elementary school teachers while finding and using characteristics to construct categories or concepts. The program integrated ideas about teaching thinking skills using computers. HyperCard and videodisk images were used to develop a program so that students could organize and explore concepts based on the concept attainment model, which helps students learn to determine the characteristics of a category. Of 52 preservice elementary teachers viewing the pilot program during a science teaching methods course, 36 students indicated a preference for using a partistic strategy of alternating examples and nonexamples, and 16 preferred a holistic approach in which a set of examples preceded nonexamples. When 26 preservice elementary teachers participated in a second study that compared the construction of categories from line drawings and from the videodisk pictures, it was found that use of line drawings influenced the type of information they recorded. The preservice teachers thought that concept attainment was appropriate for the elementary school curriculum. Further studies will investigate the factors that affect elementary students' responses to a concept attainment task. (Contains 3 figures, 6 tables, and 10 references.) (SLD)

Integrating the Concept Attainment Teaching Model and Videodisk Images

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Our purpose is to construct an instructional program that explores elementary student responses and perceptions while finding and using characteristics to construct categories or concepts. The program integrates ideas about teaching thinking skills using computers. We used HyperCard and videodisk images to develop a program so students organize and explore concepts based on ideas from the concept attainment model described by both Joyce, Weil, & Showers (1992) and Tennyson & Cocchiarella (1986). We introduced concept attainment to elementary preservice teachers to document their responses and refine our program.

The concept attainment model helps students learn to determine the characteristics of a category. Students view examples and non-examples of a category and compare the characteristics of the examples to those of the non-examples. Students then describe what they observe as similar and what they observe as different. The idea is for students to find a pattern of characteristics that distinguishes the examples from the non-examples. Students describe their thinking and share their strategies. After constructing a pattern for the common set of characteristics of the examples, students use their pattern to identify unlabeled samples as examples or non-examples.

Our approach comes from two notions shared by Joyce et al. (1992) and Tennyson et al. (1986). First, when students learn a category for its characteristics, naming the category and using the category in other contexts are an easier task. Second, on retention measures, students using well selected example/non-example sets outperformed students using attribute lists or definitions. Tennyson et al. (1986) stated that students rarely retain concepts when just given the definitions and names. Apparently, the process of comparing and contrasting information seems to help students remember concepts.

Tennyson & Cocchiarella (1986) discussed two variables that influence the initial understanding of a concept. They called these variables *best examples* and *expository examples*. A *best example* is an image that is both typical of the concept and familiar to the student. A typical example contains all the critical characteristics of the concept. A familiar example is something the learner has experienced or perceived in their past.

In our study, we used ideas from Winn (1982) to construct *best examples*. Winn found that line-drawings helped elementary students correctly identify more concepts than students seeing diagrams without line-drawings. Line drawings, according to Winn, contain the characteristics unique to the concept.

We used line-drawings of various insects as *best examples*. Figures 1 and 2 are examples of the line-drawings we used as *best examples*. Figure 1 shows the characteristic longitudinal line on the back of beetles. The line results from the position the beetle holds its first pair of wings while at rest.

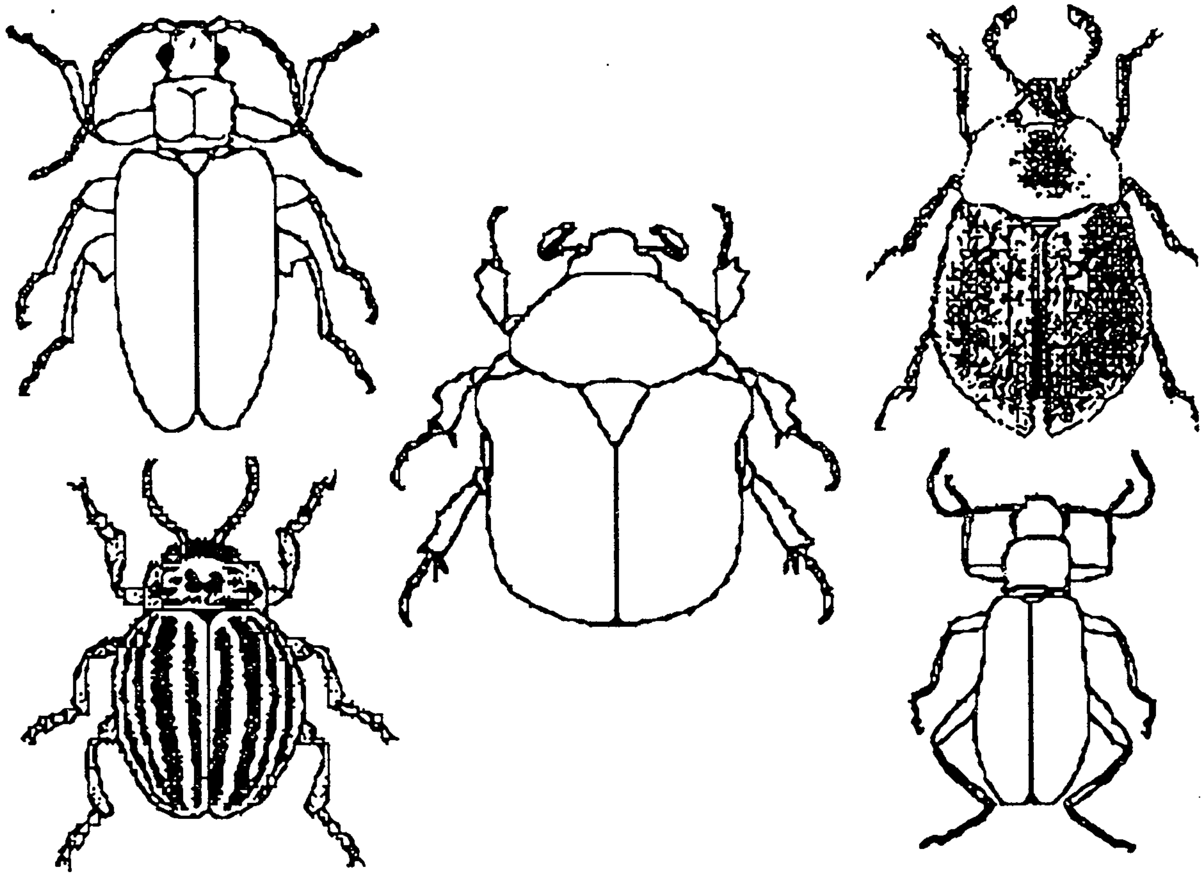

Figure 1. Line drawings used as *best examples* of beetles. These drawings show the characteristic longitudinal line on the back of a beetle at rest.

Figure 2 shows the characteristic "X" on the back of true bugs. The "X" results from both the position the bug holds its first pair of wings and the textures the wings possess.

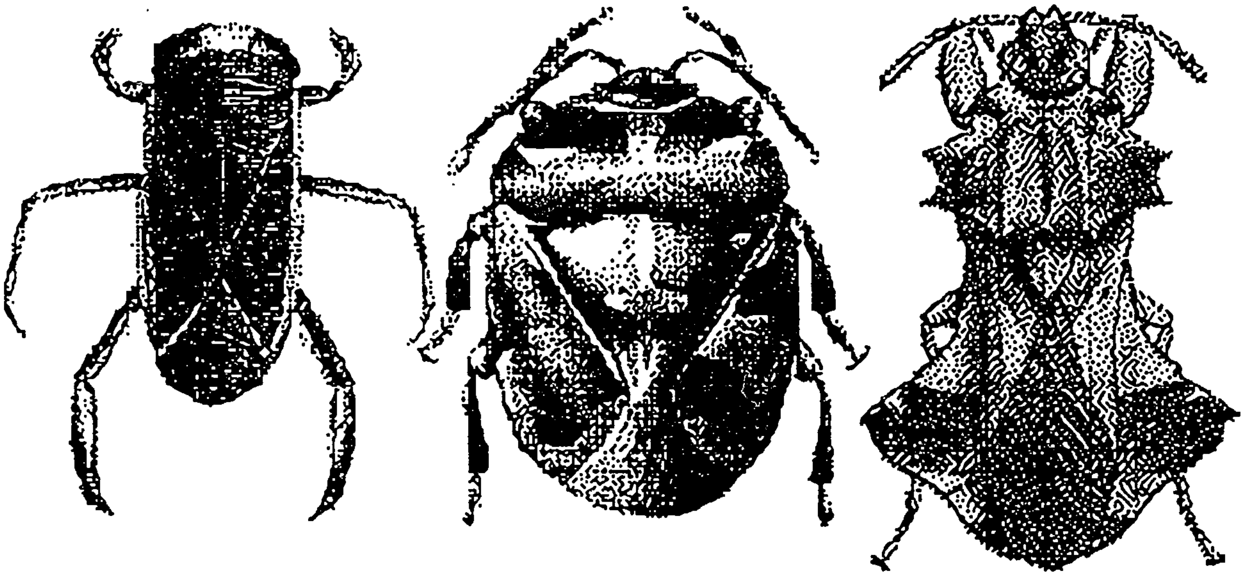

Figure 2. Line drawings used as *best examples* of true bugs. These drawings show the characteristic "X" on a bugs back while at rest.

A set of *Expository examples* provide dimensionality or richness to the concept (Tennyson et al., 1986). *Expository examples* help students construct patterns that distinguish a concept from another similar concept. Students identify unique characteristics of the examples and use the combination of characteristics to construct a pattern. Videodisk pictures of various orders of insects were used as *expository examples*. Figure 3 shows an example of the videodisk pictures integrated into HyperCard.

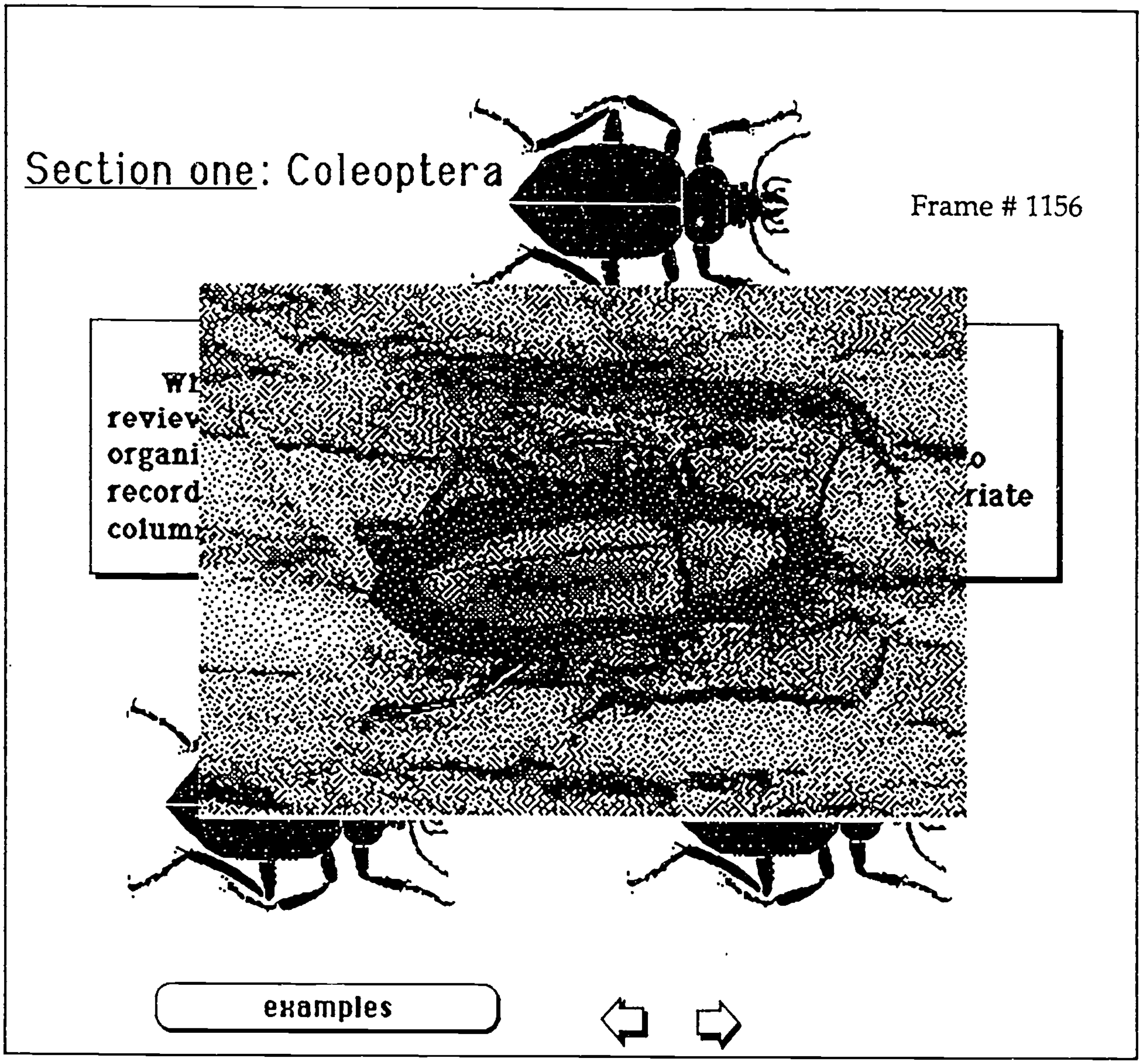

Figure 3. An example of the videodisk pictures extracted from the Science Videodisk (LaShier, 1988) used as *expository examples*. Does Figure 1 or 2 amplify the key characteristic?

Description of the Study

The HyperCard stack that we initially designed used pictures of insects from the Science Videodisk developed at the University of Kansas (LaShier, 1988) as *expository examples*. The line drawings, used as *best examples*, were scanned from Borror, DeLong, & Triplehorn (1981). Elementary preservice teachers, enrolled in separate science methods courses, were asked to respond to the concept attainment activity.

This paper summarizes the preservice elementary students' responses while using the HyperCard stack. The paper is organized into two sections Experiment 1 and Experiment 2. Experiment 1 describes preservice students responses while using only *expository examples* (videodisc images) during the concept attainment activity. Students preferences for the organization of example and non-example sets are shown, as well as their achievement of the concept. The type of observations students made using only *expository examples* provided the stimulus for Experiment 2.

Experiment 2 points to the value of preservice teachers using line drawings as *best examples*. Shifts in both the students' use of observations to construct patterns and the number of ideas they use to construct patterns are shown in this section.

Preservice Elementary Students' Responses to Using the Initial HyperCard Program

Experiment 1

A total of 52 preservice elementary teachers viewed the pilot program. These students took a science methods course during two different semesters. Their responses were aggregated. Students viewed the HyperCard program and constructed a list of their observations. Based on their observations, they described a pattern that distinguished the set of examples from the non-example set. They recorded their preference for how the sets of examples and non-examples were arranged. The idea was to document answers to the question: What factors affect students' perceptions and responses to a concept attainment task? This section is organized using the following scheme:

1) preservice elementary teachers' approach to the data that is provided in the examples and non-examples sets,

2) what preservice elementary teachers use to construct patterns from the example and non-example sets, and

3) whether preservice elementary teachers' patterns helped them choose examples from a new set of examples and non-examples.

Preservice elementary teachers' approach to the data

The students had the opportunity to view the images in two ways. They viewed a set of examples then a set of non-examples. They also viewed a set that had alternating examples and non-examples. Students documented their preference for the arrangement of the displayed sets of images.

Table 1 shows the percentage of students who prefered either a set of alternating examples and non-examples (Partistic) or a set of examples then a set of non-examples (Holistic). Of the 52 students who documented their preferences for the arrangement of images, 36 (70%) indicated a preference for using a partistic strategy and 16 (30%) preferred the holistic approach.

Table 1

Students' Preference for Partistic Thinking V. Holistic Thinking

Thinking Strategy	Sample Population (N = 52)	Percentage of Students
Partistic	36	70%
Holistic	16	30%

Joyce, Weil, & Showers (1992) suggested that students use two distinctly different strategies to attain concepts. Partistic learners focus on just certain attributes of the provided data. Holistic learners use strategies to keep most of the provided data in mind. Baveja, Shower, and Joyce (1985) cited by Joyce et al. (1992) discussed the value of students sharing their thinking to modify and make their strategies more efficient. In their study, the partistic learners needed to constantly review the example/non-example sets. The holistic learners generated multiple hypotheses and eliminated those that were false. When provided the opportunity, students showed the willingness and ability to try new thinking strategies in subsequent lessons.

What preservice elementary teachers use to construct patterns

The patterns students constructed were placed into two categories, patterns that used observations and those that used inferences. Eggen & Kauchak (1988) described an observation as information gathered by using one or more of the five senses. In contrast, they defined an inference as a conclusion based on observations.

Table 2 documents the percentage of students using observations and the percentage of students using inferences to construct a pattern. Of the 52 student responses, 5 of the students (10%) used observations to construct a pattern that distinguished the examples from the non-examples. The rest of the students, 47 (90%), used inferences to construct their pattern.

Table 2

Students Using Observations to Construct Patterns V. Students Using Inferences

Ideas about the Pattern Stated	Percent (N = 52)
Used Observations	10%
Used Inferences	90%

After viewing the sets of images, most students reported that the examples had "hard wing covers". If students were working with a real beetle specimen, hard wing covers might be observed by some sort of tactual manipulation. When viewing images of beetles, however, a straight-line pattern that runs longitudinally down the back would be a viable observation. In this study, students often used inferences instead of observations while observing and recording data.

Student achievement of the concept

After students viewed the sets of images and constructed a pattern that distinguished the examples from the non-examples, twelve new images were presented in random fashion. This task included new images of which 8 were examples and 4 were non-examples. Students used their constructed patterns to choose the examples. Of the 52 students assessed, 5 (10%) correctly chose 6 of the 8 examples and 24 (46%) chose 7 examples correctly. A total of 23 (44%) of the students correctly chose all eight of the examples (see Table 3).

Table 3

The Percentage of Students' Scores

Student Scores (Total = 8)	Sample Population (N = 52)	Percentage of Students
≤6	5	10%
7	24	46%
8	23	44%

The image missed most often was an example of a beetle that differed slightly from the rest of the images in the example set. This example was more elongate than the other images and not shinny. However, a distinct longitudinal line was present. Tennyson & Cocchiarella (1986) discussed this phenomena. They stated that "learners generalize to other examples in a class from acquired conceptual knowledge that bears a strong similarity to other class members" (p. 51).

Experiment 2

A total of 26 preservice elementary teachers participated in this study. The protocol was the same as in Experiment 1, however in this case, students had the opportunity to view line drawings before they observed the images extracted from the videodisk. The purposes were two-fold: to ascertain the value of students using line drawings to construct categories and to document answers to the question: What factors influence students to use observations to construct patterns?

We used a pre-experimental research design characterized as follows: O_1 X_1 O_2 X_2 O_3. Students were asked to record their observations after viewing example/non-example sets. The symbol *O* represents the records of the students' ideas, the symbol *X* represents the time when students viewed line drawings (*best examples*) and videodisk pictures (*expository examples*).

The discussion of the data collected and analyzed addresses the following issues:

1) the type of information students used to construct patterns,

2) differences expressed in the patterns students constructed, and

3) differences in the number of ideas students documented while they constructed the pattern.

<u>The type of information students used to construct patterns</u>

The patterns students constructed were placed into the two categories described in Experiment 1, inferences and observations. Table 4 shows the percentage of students using observations and the percentage of students using inferences to construct a pattern. First, students viewed an example/non-example set of images extracted from the videodisk without viewing line drawings. Their responses represent the data referred to as the Control. Second, the students viewed line drawings then observed the same set of images (as the Control) extracted from the videodisk. The second set of students' responses is labeled Treatment A. Third, the same students viewed new line drawings followed by an example/non-example set of images representing a new type of insect. The students' responses are referred to as Treatment B in Table 4.

When the 26 students viewed only the videodisc images without the aid of line drawings, they all made inferences (Treatment: Control). No viable observations were recorded. After viewing line drawings of the first type of insect (beetles), 16 students (62%) recorded viable observations and 10 students (38%) recorded inferences (Treatment: A). When students viewed the second set of line drawings (true bugs) with a new set of videodisk pictures, 20 students (77%) recorded observations and 6 students (23%) recorded inferences (Treatment: B).

Table 4

Frequency of Inferences Versus Observations

Treatment	Frequency (N =26) Inferences	Observations	Percentage of Making Students Observations
Control	26	0	0%
Treatment A	10	16	62%
Treatment B	6	20	77%

The students' use of line drawings influenced the type of information they recorded. After viewing videodisk images without looking at line drawings, all students recorded inferences. When students viewed line drawings, as well as videodisk images the type of information students recorded tended to shift from inferences to observations. Students were asked to identify (if any) the value that line drawings provide. Representative comments were as follows:

1) it is easier to see the details [of characteristics], and

2) there are less distractions (detail without the color, background and shadows in the way).

Differences expressed in the patterns students constructed.

The patterns constructed by 26 students were analyzed. If students stated the *correct pattern*, they received a (1) and they received a (0) for the *incorrect pattern*. The *correct pattern* had to contain viable observations that distinguished the concept. If an inference was used to construct the pattern, the pattern was placed in the *incorrect pattern* category.

A t Test for Correlated Samples was used to compare mean scores of these students (see Table 5). Because the students who viewed videodisc images without the aid of line drawings (Control) all made inferences, the mean score was 0. The mean score for students using the line drawings (Treatment A) was 0.6 and after the second treatment (Treatment B) the students mean score was 0.8. In the first comparison (Control with Treatment A), the mean difference was 0.6. The mean score of students viewing line drawings was greater than when they did not view line drawings, resulting in a t value of 6.32. Because of the one-tailed probability score ($p < .05$), the mean score difference was significant.

Table 5

Mean Score Comparisons of Students Viewing Line Drawings and Students Not Using Line Drawings

Treatment Comparison	*N*	Mean	*SD*	*t* value
Control	26	0.0	0.0	____
Control: A	26	0.6	0.5	6.32*
A: B	26	0.8	0.4	1.16

*$p < .05$

In this case, a significant shift of students constructing patterns using viable observations occurred. Students viewing line drawings, was the only apparent treatment in effect.

Differences in the number of ideas students documented while they constructed the pattern using line drawings

The ideas recorded by 26 students were counted. Students viewed line drawings followed by pictures extracted from the videodisk. They reviewed all images upon request. At the same time, they were asked to record observations and scratch out observations that became less viable to their pattern construction. Both the students' observations and their marks through less viable observations were counted.

This comparison was between mean scores of 26 students while using line drawings. Treatment A represented the first time they used line drawings, Treatment B represented the second time. A *t* Test for Correlated Samples was used to compare mean scores of these students (see Table 6). The mean score of students using line drawings the first time (Treatment A) was 6.6. The mean score of students using line drawings the second time (Treatment B) was 4.2. The mean difference was 2.4. When the students used line drawings the second time, using a completely different type of insect, they recorded less ideas (and deletions) to construct a viable pattern. The *t* value was 3.66, resulting in a significant one-tailed probability score ($p < .05$). Thus the mean difference was considered significant.

Table 6

Mean Scores Comparison that Represent Students' Observations to Construct Patterns while Viewing Line Drawings

Treatment	*N*	*M*	*SD*	*t* value
Treatment A	26	6.6	3.2	___
Treatment B	26	4.2	1.9	3.66*

*$p < .05$

Summary

Initial responses for using concept attainment in a computer context are positive. Preservice elementary teachers constructed patterns to correctly identify examples of insect pictures. The data suggest three avenues to pursue with elementary students. First, presenting example and non-example sets in different ways evoked preferences for partistic and holistic learning. These preferences for making comparisons might provide elementary teachers the opportunity to work with students in different ways and to construct situations for students to share their thinking strategies with one another.

Second, while observing and recording data, students tend to make mental leaps. That is, instead of recording observations as evidence, students use conclusions based on their past experiences (inferences) or opinions as data. This tendency is nothing new, the research literature is replete with documentation of this phenomena.

Third, line drawings (Winn, 1982) used as best examples (Tennyson & Cocchiarella, 1986) influenced preservice elementary teachers. Significant shifts in using observations instead of inferences were noted. Students, when using line drawings, used more observations to construct viable patterns than when not using line drawings. With practice in using line drawings, these students also recorded significantly less ideas to make viable patterns. McCloud (1993), in his unique discussion of the cultural value given comics, provides an interesting explanation for the line drawing's value. He stated:

> "When we abstract an image through cartooning, we're not so much eliminating details as we are focusing on specific details. By stripping down an image to its essential meaning, an artist can amplify that meaning in a way that realistic art can't" (p. 30).

The preservice teachers were asked whether they thought concept attainment was appropriate for their elementary curriculum. Their responses were favorable. Two comments were representative:

It can be good [using concept attainment], because it allows a student to write down what they see. Not everyone sees everything the same. This allows for differences. It also gives room for explanation of why they chose and organized what they did.

This strategy makes the children classify and come up with their own rules - the only right answer is a justified one. I think children need to learn at a young age to make conclusions about what they observe, then seek justification for their conclusion. After thinking about the example/non-example [sets], I would compare and contrast the answers to see the variety, then we could all decide which are justified or not.

The preservice teachers that responded negatively to the same question, seemed concerned about the lack of direction or the complexity of thinking required for success. Lawson (1993) suggested that a teaching strategy specifically designed to show students appropriate reasoning strategies might help in the younger elementary grades.

As stated earlier, we want to investigate what factors affect elementary students' responses to a concept attainment task? We are continuing to develop the HyperCard stack to find out whether: 1) individuals respond differently than small groups of students, and 2) a computer environment provides a different perceptual context for displaying examples and non-examples to elementary students. An assumption central to this study is that the concept attainment model asks students to construct a pattern, this task is novel to what elementary classrooms are accustomed. Greeno (1989) provided our second assumption, "thinking is an interaction between an individual and a physical and social situation" (p. 135).

References

Baveja, B., Showers, B., & Joyce, B. (1985). *An experiment in conceptually-based teaching strategies.* Eugene, Or: Booksend Laboratories.

Borror, D. J., DeLong, D. M., & Triplehorn, C. A. (1981). *An introduction to study of insects (5th. Ed.).* Saunders College Publishing.

Eggen, P.D., and Kauchak, D.P. (1988). *Strategies for Teachers: Teaching Content and Thinking Skills.* Englewood Cliffs, NJ: Prentice Hall.

Greeno, J. G. (1989). A perspective on thinking. *American Psychologist, 44* (2), 134-141.

Joyce, B., Weil, M., & Showers, B. (1992). *Models of teaching* (4th ed.). Boston, MA: Allyn and Bacon.

LaShier, W.S. (1989). The University of Kansas Science Videodisk [Videodisk]. Lawrence, Ks: Author.

Lawson, A. E. (1993). Deductive reasoning, brain maturation, and science concept acquisition: Are they linked? *Journal of Research in Science Teaching, 30* (9), 1029-1052.

McCloud, S. (1993). Understanding comics: The invisible art. Northampton, MA: Kitchen Sink.

Tennyson, R. D. & Cocchiarella, M. J. (1986). An empirically based instructional design theory of teaching concepts. *Review of Educational Research, 56* (1), p. 40-71.

Winn, W. (1982). The role of diagrammatic representation in learning sequences, identification and classification as a function of verbal and spatial ability. *Journal of Research in Science Teaching, 19* (1), 79-89.