Excerpt from: Intelligent and Effective Learning based on the Model for Systematic Concept Teaching

Practitioner's Manual for the Systematic Concept Teaching (SCT) Approach to the Prevention and Remediation of Learning Difficulties

By Andreas Hansen and Kelly Morgan, 2019

Case Study 7: A project using Systematic Concept Teaching (SCT) with special education students diagnosed as having moderate to severe language and learning deficits in an elementary school in Washington State

By Kelly Morgan

Introduction

Beginning in the 2010–2011 school year and continuing to date, I undertook a pilot project to systematically teach Basic Conceptual Systems and their related Basic Concepts utilizing the principles and structures of the Concept Teaching Model (CTM) to implement Systematic Concept Teaching (SCT) with specific groups of children in the North Kitsap School District of Washington State who demonstrated moderate to severe language and learning difficulties. This project was not a formal evaluation study per se, but a replicative implementation that has resulted in some additional qualitative data in relation to the impact of SCT, cf. the previously reported research on effects of SCT. The initial goal of the project was to see if the development of learning, language and thinking skills seen in previous implementations of SCT could be duplicated with a mixed population of English-speaking students with intensive intervention needs as a result of cognitive, academic, language, motor and/or social deficits. The majority of research on CTM and SCT had been implemented with Norwegian speaking students.

This project initially began with the teaching of Basic Conceptual Systems (BCSs) (Color, Shape, Size, Position, Place, (Surface) Pattern, Direction, Number, Time, etc.) and their related Basic Concepts (BCs) based on the principles of the Concept Teaching Model and Systematic Concept Teaching proposed by the late Professor Magne Nyborg of Norway and later expanded by Dr. Andreas Hansen. Two groups of students were the initial targets of this pilot study – a group of Kindergarten and a group of First Grade students. These students had all been diagnosed by the school district as having intensive intervention needs as a result of cognitive, academic, language, motor and/or social deficits and were taught in a combination of pull-out services in an Intensive Support Program (ISP) classroom and inclusive services provided in their age-appropriate Kindergarten or First Grade classroom. These initial groups were targeted with the teaching of Basic Conceptual Systems (BCSs) and their related Basic Concepts in small group sessions in the context of their ISP classroom and, as they moved into higher grades, with work on Analytic Coding in small group sessions in the context of their ISP classroom or in individual sessions in the Speech Therapy setting.

At the end of year 2 (the second school year) of the pilot program, this work was expanded to include the following additional student groups: 1) each new group of Kindergarten aged students that received language support in the ISP, 2) continued support for each group of ISP students who had previously received SCT as a Kindergarten or First Grade student, but were now in 2nd through

5th Grades and still qualified for language support and, 3) students receiving language support for language-learning disabilities in the Resource Room Program (A less intensive pull-out model for students with specific language-learning disabilities in the areas of reading, written language and/or math). This latter group received targeted teaching of BCSs and their related BCs together with work on Analytic Coding in individual sessions rather than in small groups in their Resource Room program. The project was expanded after just two years due to the fact that the majority of students involved in the initial project made such significant growth in both their thinking skills and oral language skills that, similar to what Professor Nyborg experienced after his initial 3-year teaching experiment in 1973-1976 (cf. Lyngstad & Nyborg, 1977), it felt unethical to withhold CTM from all of the students who needed language support.

Purpose of the project, setting, some characteristics and age of the children, etc. The initial purpose of this project was twofold: first, to pilot the use of formal SCT lessons designed by Hansen and Morgan based on the principles of the CTM within a special education classroom-based setting of children in order to help facilitate the children's development of the (key) Basic Conceptual Systems (BCSs) and their relevant Basic Concepts needed for effective learning and more efficient mental organization of information (in Long-Term Memory) and secondly, to teach the students how to perform Analytic Coding in relation to subjects relevant to their classroom curriculum. The subject students were diagnosed as having intensive intervention needs as a result of cognitive, academic, language, motor and/or social deficits, including children diagnosed as having Autism Spectrum Disorder, Asperger's syndrome, developmental delay, language learning disorder, etc.

As mentioned, the project initially included two sets of children; a Kindergarten age group and a First-grade age group. The Kindergarten group consisted of 8 children, all male, from 5-1 to 5-6 years of age at the start of the school year. In the First-grade age group there were 6 children, 5 male and 1 female, from 6-1 to 6-9 years of age at the beginning of the school year. Lessons were provided in small group sessions, 2 times a week for 30 minutes each with active support from the Speech Pathologist, the Intensive Support Program teacher and 1 or 2 paraprofessionals. In addition, following the introduction of a new concept, the ISP would support the student's new learning by including follow-up activities that utilized the specific concept being learned. These activities ranged from pre-reading, reading, written language to art activities where appropriate, each incorporating the learned concept.

The lessons were provided in a combination of hands-on learning activities using concrete items where appropriate together with animated PowerPoint slides projected onto a wall-mounted whiteboard. Both myself, as the Speech Pathologist, and the Special Education teacher were involved in the presentation of and interaction within the formal lessons. Changes were made to some elements of the lessons throughout the initial two school years based on the children's interactions and responses. This resulted in improved interaction with the children within activities in later lessons together with an increased rate of accurate application of the conceptual vocabulary in the learning Phases of the Concept Teaching Model compared to the initially designed lessons in the project.

Overview of the Systematic Concept Teaching lessons used in this pilot project

The Systematic Concept Teaching lessons designed by Hansen and Morgan and used for this study were based on the framework and principles of the Concept Teaching Model (CTM) mentioned previously. As such, each lesson was constructed to provide learning in three specific Phases: Phase

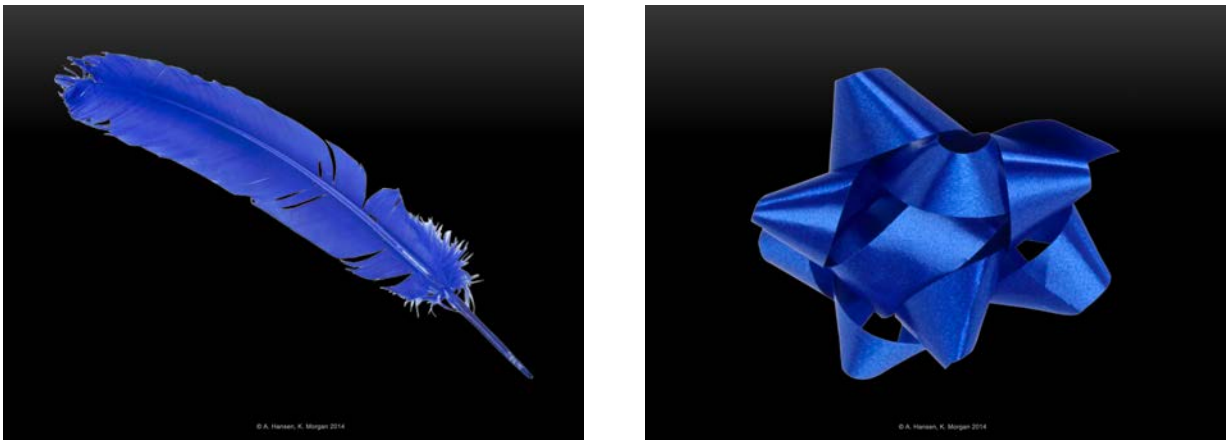
1- The Selective Association (SA) Phase, Phase 2 – The Selective Discrimination Phase (SD) and, Phase 3 – The Selective Generalization Phase. Following is a brief overview of the CTM Phases framework, tasks and some dialogue as designed by Hansen and Morgan and used in this study. This will illustrate in general how Systematic Concept Teaching was applied to these populations of students using a progression of focused tasks. What is not reflected in the overview of the SCT Lessons and the Analytic Coding activities that follow is the fact that throughout all of these activities, the language forms and content used in directions, questions and interactions with the students as well as the linguistic output expected from each of the students, was adjusted to meet their individual needs. A higher level of language was always modeled, but the expectations of language use by the students were always individualized to their cognitive as well as linguistic capabilities. This was reflected in students who were capable of imitating whole phrases used such as, "It has the color blue," those who were only capable of using the superordinate and subordinate terms "color blue," and those who needed augmentative based communication systems in order to respond, such as low-tech communication boards, simple commercial multi-cell communication devices as well as iPad-based Communication apps.
Phase 1 of the CTM – In this Phase, **Selective Association**, I presented the students with a *concrete object* that evidenced as one of its attributes the concept being introduced in this lesson, verbalizing the language model that would be used throughout the lesson. This language model contained a superordinate label paired with a subordinate label, which was used to help the students associate the target conceptual vocabulary with their focused sensory experiences of both concrete objects and 2-dimensional images. By using this language tool, I hoped to facilitate the students' coding of the target concept within its Basic Conceptual System using language for more effective storage and retrieval from Long-Term Memory. In the first section of this Phase, the students were encouraged to hold and look at the object all while hearing me verbalize the language model for the target BCS and relevant basic concept and being asked to imitate this language model themselves repeatedly, facilitating the students' coding and association of the target basic concept within its Basic Conceptual System using precise language.

Using the concept of the "Color blue" as the example for illustrating the different phases of the CTM, the students were first introduced to a plastic square that had the color blue, which they were encouraged to hold and look at while hearing me verbalize the language model, "*It has the color blue* (**color** (superordinate concept/basic conceptual system) + **blue** (subordinate concept)." The students then verbalized the relevant language model both in imitation of the teacher and in response to direct questions while continuing to hold and look at the square, facilitating the association of the BCS "Color" and the basic concept of "blue" with the blue-colored plastic square.

Following the introduction of the initial object, several more *everyday concrete items* were introduced that evidenced the concept being targeted as one of their attributes and the students again were encouraged to handle, look at and verbalize the relevant language model both in imitation of the teacher and in response to questions related to the target concept being taught (See Figure 1). For example, while holding the blue colored Lego pictured in Figure 1, the students were asked, "*What color does this Lego have*?" The students replied, "*It has the color blue*," associating the BCS of "color" and the basic concept of "blue" with the target objects.

Figure 11.7.1. *Examples of concrete objects focused on the target concept of the "Color blue."*

After these association activities with concrete objects were completed to a satisfactory level of mastery, the students were shown projected 2-dimensional images of more individual items evidencing the targeted concept as one of their attributes and, as before, encouraged to verbalize the relevant language model both in imitation of the teacher and in response to questions.



Lesson 02. CTM Color - Blue, Slide 13 Lesson 02. CTM Color - Blue, Slide 14

Figure 2. *Examples of projected images from the Lesson 02. CTM Color - Blue, all sharing the attribute necessary for (abstracting and) learning the target concept of the "Color blue."*

Finally, the students were encouraged to *draw or construct something* utilizing the target concept. In the following example, I took some blue dry erase markers and said, "*Now I want you to come to the whiteboard and draw a line or shape that has the color blue."*

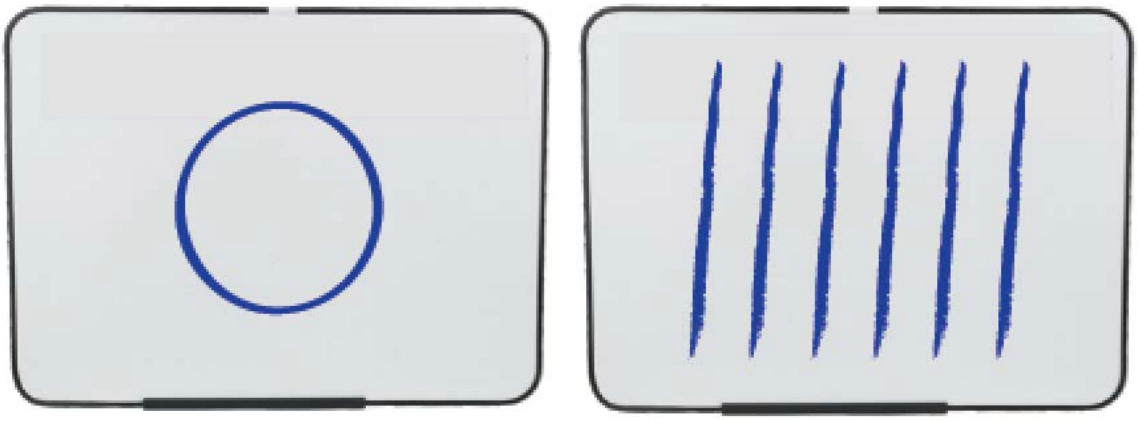


Figure 3. *Examples of items drawn by students utilizing the target concept of the "Color blue".*

Phase 2 of the CTM – In this Phase, **Selective Discrimination**, I presented the students with a small group of concrete items, *only one of which evidenced the target concept* as one of its attributes. This task was presented in order to facilitate the students' ability to identify which items share or do not share the target concept as one of their attributes. By learning to identify which items share a common attribute, the students learned to define which items are a part of a specific category and which are not. In the first section of this Phase, the students were shown the 4 geometric shapes pictured in Figure 4, and asked, "*Point to the one that has the color blue."* The students then pointed to the correct item – the blue-colored circle. This was followed up by questions, when appropriate, to

facilitate more awareness among the students as to how they were thinking in regard to the target concept. For example, I followed-up the students' responses to the previous direction by asking the following 2 questions: "Why did you point to this shape (indicating the blue circle)" and, "How did you know that this one had the color blue?"

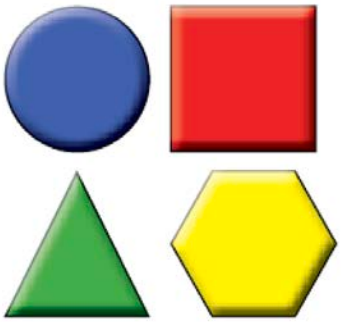
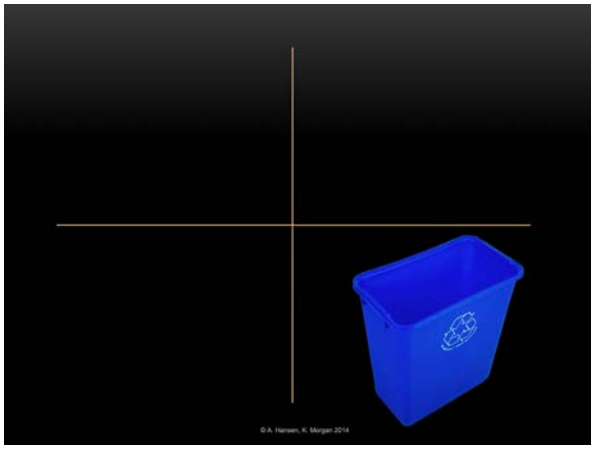


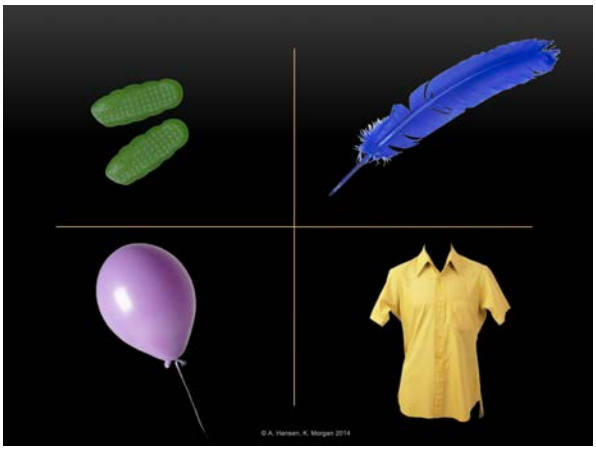
Figure 4. *Example of group of items from which the student identifies the one shape that has the "Color blue".*

After these activities with groups of concrete objects were completed to a satisfactory level of mastery, the students were then shown projected images of groups of items in the same way as in Phase 1. As with the groups of concrete objects used in the previous task, these pictured groups contained *only one item that evidenced the target concept* as one of its attributes. For example, when the first group pictured in Figure 5 was shown, the students were asked to, "*Show me the one that has the color blue*." The students then pointed to the correct item, the recycle bin. This was followed up by questions, when appropriate, to facilitate more awareness among the students as to how they were thinking in regard to the target concept. As before, the students were encouraged to verbalize the relevant language model of "having the color blue" both spontaneously and in response to questions. (Note: In using the animated slide format for this task, after the item was evaluated and selected by the students in terms of the target concept, the slide is activated, and the objects that didn't evidence the target concept disappeared from the screen. The target object was then highlighted with animation) As this task with images of objects was mastered, the students were then introduced to tasks requiring them to apply these same discrimination skills to groups of *letters, numerals,* and *words*.

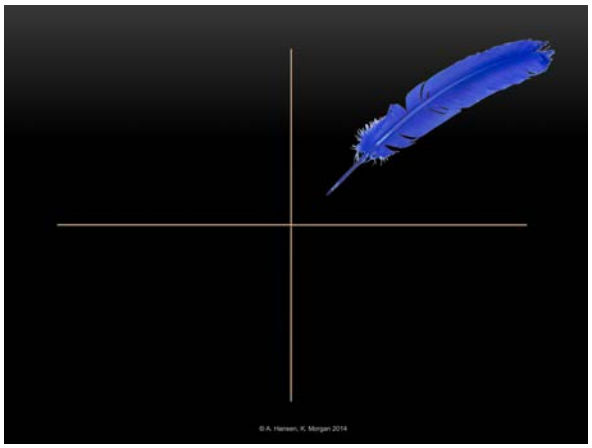
Lesson 02. CTM Color - Blue, Slide 20



Slide 20 with item having the "Color blue" revealed.



Lesson 02. CTM Color - Blue, Slide 21



Slide 21 with item having the "Color blue" revealed.

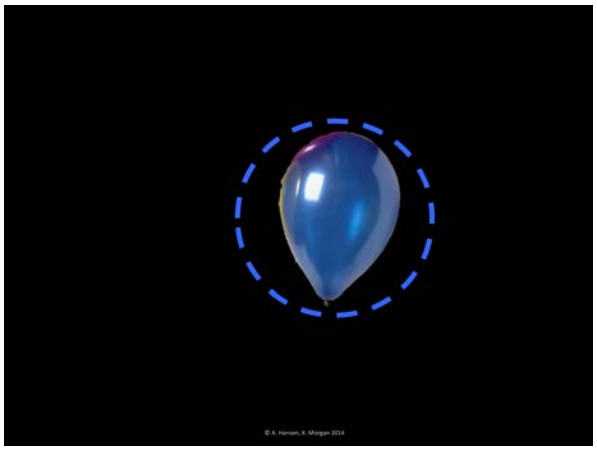
Figure 5. *Examples of two projected images of groups of items from Lesson 02. CTM Color - Blue, only one of which in each group has the "Color blue" or alternatively, has the attribute identifiable as the target concept of the "Color blue". The slide on the left shows how the slide first appears to the students. The slide to the right shows how the activated slide appears after the students have determined which one object in the group has the "Color blue."*

After these activities with projected images were completed to a satisfactory level of mastery, the students were then shown a specific concrete item that had as one of its the attributes the target concept as only part of a more complex whole in this next section of Phase 2. For example, while showing the students the small American flag pictured in Figure 6, the students were asked to, "*Point to the part of this flag that has the color blue*." The students then pointed to the correct part of the item. As was done previously, this was followed up by questions to facilitate more awareness among the students as to how they were thinking in regard to the target concept.

Figure 6. *Example of a concrete item from which the student identifies only a part that has the Color blue.*

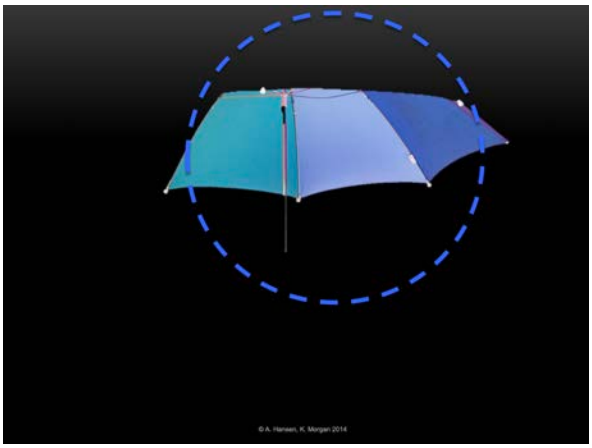
The next task introduced after the discrimination activities with groups of concrete objects were completed to a satisfactory level of mastery, involved showing the students projected images of items, *only part of which had the target concept* as one of its attributes. For example, when the first slide pictured in Figure 7 was shown, the students were asked to, "Show me the part of this picture that has the color blue." The students then pointed to the correct item, the blue colored balloon. Again, this was followed up by questions, when appropriate, to facilitate more awareness among the students as to how they were thinking in regard to the target concept. (Note: In using the animated slide format for this task, after the part of item was evaluated and selected by the students in terms of the target concept, the slide is activated, and the portion of the object that didn't evidence the target concept disappeared from the screen. The target part of the object is then highlighted with animation andor outlined) As before, the students were encouraged to verbalize the relevant language model of "having the color blue" both spontaneously and in response to questions.

Lesson 02. CTM Color - Blue, Slide 33



Slide 33 with part of the item having the "color blue" revealed.

Lesson 02. CTM Color - Blue, Slide 35



Slide 35 with part(s) of the item having the "color blue" revealed.

Figure 7. *Examples of projected images of items from Lesson 02. CTM Color - Blue, only part of which have the "color blue" or, had the attribute identifiable as the target concept of the "Color blue." The slide on the left shows how the slide first appears to the students. The slide to the right shows how the activated slide appears after the students have determined which part of the picture has the "Color blue."*

After these activities with projected images were completed to a satisfactory level of mastery, the students were then asked to find items in their classroom that had the color blue or that had a part with the color blue. As a follow-up activity to this, the students were then asked to find items in their own homes and communities that had the color blue or that had a part with the color blue. These tasks were designed to provide the students with an opportunity to "demonstrate whether their learned experiences had been effectively integrated and organized for accurate recall and use in the coding of new sensations, integration of new experiences and in the comparing of experiences." (Nyborg, 1993)

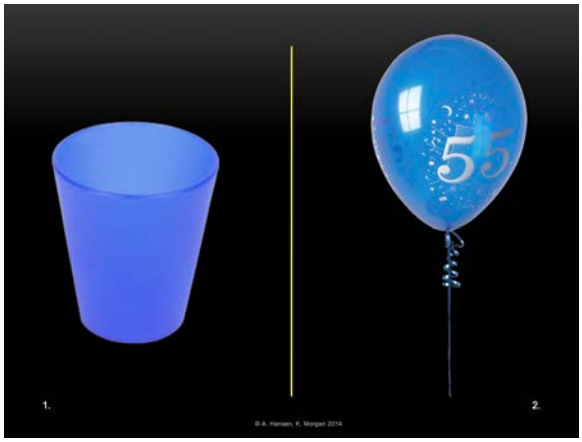
As the final task in Phase 2, the students were asked *True/False* and/or *Yes/No* questions using a variety of both concrete items and images from the previous tasks. For example, asking the student,

"*Is it true or false that this object has the color blue (or a part with the color blue*)? or, "*Does this object have the color blue*?"

Preliminary to Phase 3 of the CTM – Before introducing Phase 3, the students were presented with the tasks pictured in Figure 8 in order to reinforce their understanding of the concepts of partial similarity (similar to) and complete similarity (completely alike, identical) that are key to the students' ability to determine class membership among items or events. In Task 1, the students were presented with the slide of two identical glasses and asked, "Do you think that these 2 pictures are completely alike?" The students looked carefully at the pictures and responded with, "Yes, they are completely alike." This task was then immediately followed by Task 2, in which the students were presented with a slide containing one of the previous items (the glass) together with a new item (the balloon) that shared a common attribute (having the color blue) with the first item and asked, "Do you think that these 2 pictures are completely alike?" The students again looked carefully at the two pictures and said, "No, they are not completely alike." I then stated, "These pictures are not completely similar, they have different items, but can you see in what way the glass and the balloon are similar? Think about what we have been learning and look at the glass and the balloon carefully." The students looked carefully at the pictures and responded with, "They are similar in having the color blue."

After the students had demonstrated mastery of the ideas of completely alike (similar) in all attributes, "exactly the same", and similarity in only one attribute, Phase 3 was introduced.

Lesson 02. CTM Color - Blue, Slide 57 - Task 1



Lesson 02. CTM Color - Blue, Slide 58 - Task 2

Figure 8. *Example of Phase 3, Task 1 from Lesson 02. CTM Color - Blue, in which two items are completely similar (identical - exactly the same) and Task 2 in which one of the previous items is compared to a new item that is similar in having the "Color blue" as a shared attribute.*

Phase 3 of the CTM – In this Phase, **Selective Generalization**, I presented the students with a group of concrete items, all of which had the target concept as a shared attribute but which varied in items used and in quality and intensity of the attribute. In the first section of this Phase, *Discovering and Verbalizing Similarities, tasks* were presented in order to expand the students' ability to identify which items share or do not share the target concept as one of their attributes, further defining class membership. For example, the students were presented with the 3 items pictured in Figure 9, all of which varied in their shade of the color blue, and were asked, "*Look at all of these objects carefully. In what way are all of these objects similar?"* The students looked carefully and said, "They are similar in having

the color blue." It was important that the students learn to see that the color blue was not as narrow a category as first presented, but that it had acceptable variations that were still considered to have the "color blue". This was followed up by questions, when appropriate, to facilitate more awareness among the students as to how they were thinking in regard to the target concept.

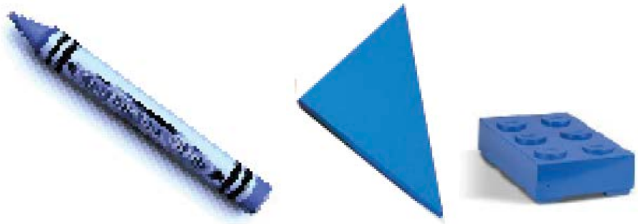
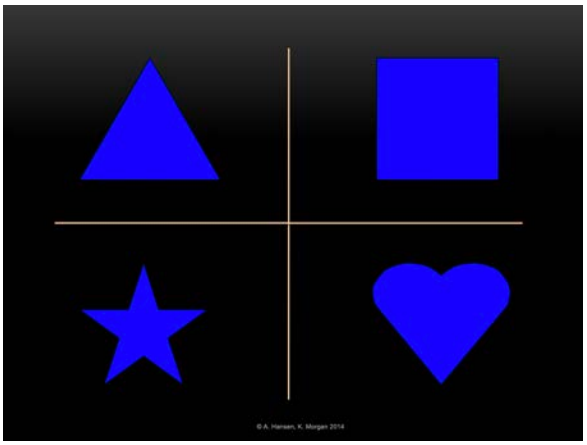
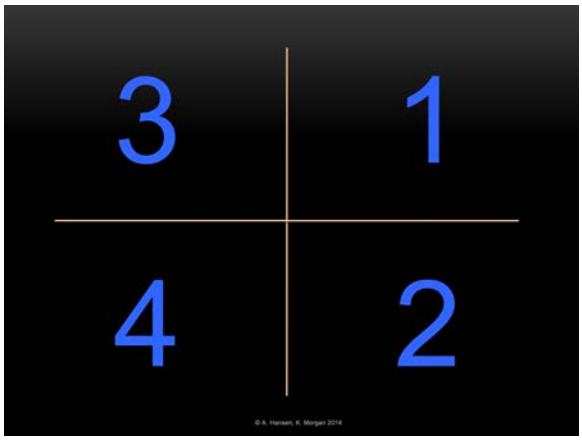


Figure 9. *Example of concrete objects that are similar in having the "Color blue" as a shared attribute.*

After these activities with groups of concrete objects with varying shades of blue were completed to a satisfactory level of mastery, the students were then shown projected images of groups of items, all of which shared the target concept of having the color blue, but each group showing the color in *different shades and intensities*. For example, when the first group pictured in Figure 10 was shown, the students were asked, "*Look at all of these objects carefully. In what way are all of these objects similar?"* The students looked carefully and said, "They are similar in having the color blue." When appropriate, this was followed up by questions to facilitate more awareness among the students as to how they were thinking in regard to the target concept.



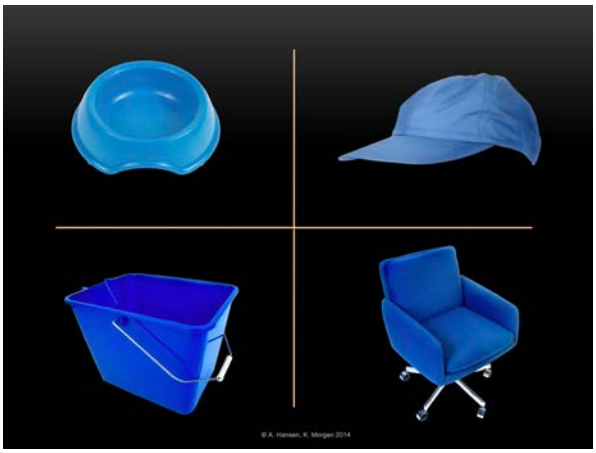
Lesson 02. CTM Color - Blue, Slide 60



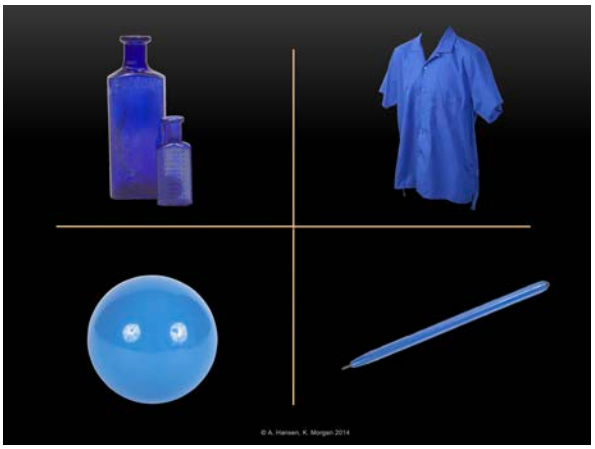
Lesson 02. CTM Color - Blue, Slide 61

Figure 10. *Examples of projected images of groups of items from Lesson 02. CTM Color - Blue, all of which had the "Color blue" as one of their shared attributes with each member of a group sharing the same shade or intensity.*

Following these tasks with groups of various qualities of the target concept, the students were then shown projected images of groups of items having the attribute of the target concept, but now with each item in the group illustrating the concept in a *different quality or manner*. Using the example in Figure 11, when the first group pictured was shown, the students were asked, "*Look at all of these objects carefully. In what way are all of these objects similar?"* The students looked carefully and said, "They are similar in having the color blue."



Lesson 02. CTM Color - Blue, Slide 68



Lesson 02. CTM Color - Blue, Slide 69

Figure 11. *Examples of projected images of groups of items from Lesson 02. CTM Color - Blue, all of which had the "Color blue" as one of their shared attributes, but each item in the group showing a different shade or intensity.*

After these activities with projected images of groups of items that *all* shared the common attribute necessary to (abstract and) learn the target concept were completed to a satisfactory level of mastery, the students were then shown a group of concrete items in which only *two* of the items illustrated the attribute for the target concept and the other items did not. They were then asked to identify the two items that shared the common concept being taught. This task required both the ability to see shared similarities between items as well as discriminate items that did not share the target attribute or concept. For example, when the group of items pictured in Figure 12 was presented to the students, they were asked to, "Show me the items in this picture that are similar in having the color blue." The students then pointed to the two items that were similar in having the color blue, in this case, the numerals "1" and the "6". Again, this was followed up by questions, when appropriate, to facilitate more awareness among the students as to how they were thinking in regard to the target concept.

Figure 12. *Example of group of concrete objects in which only two are similar in having the "Color blue" as a shared attribute while the others do not.*

After these generalization activities with groups of concrete objects were completed to a satisfactory level of mastery, the students were then shown projected images of groups of items, in which, as in the previous task, *only two of the items were similar in having the shared attribute necessary to (abstract and) learn the target concept while the others did not*. Presenting the example of the first slide pictured in Figure 13, the students were asked, "*Look at all of these objects carefully. Show me the items in this picture that are similar in having the color blue."* The students then pointed to the two items that shared the concept of having the color blue, in this case, the "shirt" and the "umbrella." (Note: In using the slide format for this task, after the items were evaluated and selected by the students in terms of the target concept, the slide is activated and the non-concept oriented objects disappear from the screen and the two target objects are highlighted with animation) As this task with images of objects was mastered, the

students were then introduced to tasks requiring them to apply these same skills of seeing similarities and discriminating from between items that have or do not have a shared concept to groups of letters, numerals, and words.

CTM Color - Blue – Slide 79

Slide 79 with target items that are similar in having the color blue revealed.

CTM Color - Blue – Slide 80

Slide 80 with target items that are similar in having the color blue revealed.

Figure 13. *Examples of projected images of groups of items from Lesson 02. CTM Color - Blue, in which two of the four items are similar in sharing the "Color blue" as one of their attributes while the others do not. The slide on the left shows how the slide first appears to the students. The slide to the right shows how the activated slide appears after the students have determined which two object in the group are similar in having the "Color blue."*

At the conclusion of these tasks, the students were asked reflective questions designed to help them become more aware of their recently acquired conceptual knowledge and how this knowledge related to both previous learning and future applications in both school and the community, cf. the lesson for The Color Blue on the flash drive.

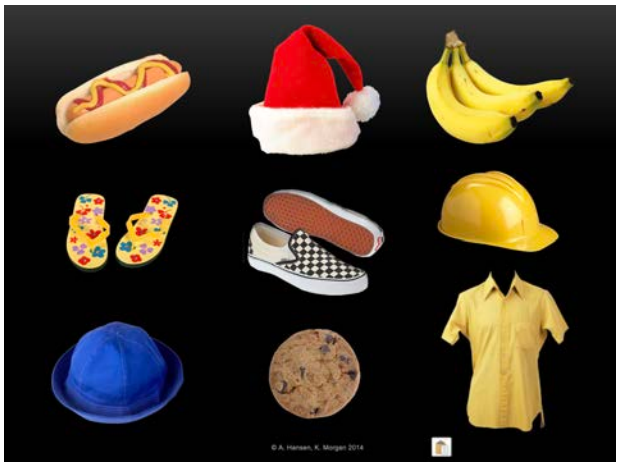
At the conclusion of each lesson targeting a specific concept and Conceptual System, the students were presented with a cumulative task in which a slide was shown that contained a variety of individual items or a scene. The students were then given clues based on previous conceptual

knowledge to use in determining which item the task was referring to. For example, using the slide pictured in Figure 14, the students were given three clues with which to identify what item the task was referring to.

I first told the students, " *I'm going to give you three clues that will help you to figure out which picture I am thinking about. But first, tell me what each of these pictures is.*" I then either went around the group and asked each student what the name of one of the items in the picture was or asked the group as a whole what the name of each picture was (labeling). I then presented the students with the first clue, "*It's something you can wear* (function)." (A simple line drawing illustrating the clue is often drawn next to the image of the slide on the whiteboard to help the students process the language of the clue). I then went through each picture and asked the students if it was something you could wear, circling the picture if it did and crossing it out if it didn't. I varied this task in how it was done by sometimes asking the whole group about each item and sometimes asking an individual student about one of the items. For example, using the first picture in Figure 14, I asked the students, "*Is this hot dog something you can wear*?"

After evaluating each of the pictured objects in terms of whether you could wear it, the students were encouraged to discuss the first clue and determine if they had enough information to identify the name of the one object about which I was thinking. (Note: In using the slide format for this task, after all of the items were evaluated by the students in terms of the first clue, the slide is activated and all of the non-chosen objects disappear from the screen) They decided that they didn't, so I presented the second clue, "*You wear it on your head* (Place)." Again, I went through each picture and asked the students if it was something you could wear on your head, circling the picture if it was and crossing it out if it wasn't. Again, using the first picture in Figure 14, I asked the students, "*Is this Santa hat something you can wear on your head*?" After evaluating each of the pictured objects in terms of whether you could wear it on your head, the students were encouraged to discuss the second clue and determine if they had enough information to determine the correct object about which I was thinking. (Note: Again, after all of the items were evaluated by the students in terms of the first clue, the slide is activated, and all of the non-chosen objects disappear from the screen) They decided that they still didn't know which item it was for sure, so I then presented the third and final clue, "*It has the color blue* (Color)."

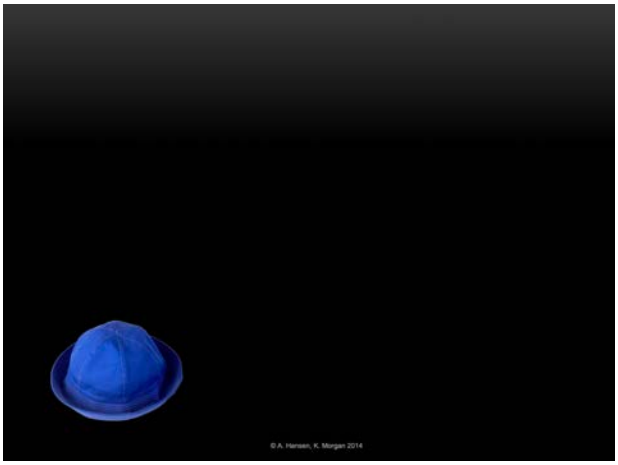
At this point, the students decided they knew what it was and each student correctly identified the blue hat/cap as the target object. (Note: Finally, after all of the students had determined what they believed to be the target object in terms of the last clue, the slide is activated, and all of the remaining non-chosen objects disappear from the screen revealing the target item.) This task provided the students with a fun application of the concept they had just learned. As with the tasks in all three Phases of the CTM lesson, this task was followed up by questions to facilitate more awareness in the students as to how they were thinking regarding the target concept and how they reached their conclusion.



CTM Color - Blue – Slide 90 Clue No. 1 "*It's something you can wear (Function).*"

Clue No. 2 "*You wear on your head* (Place)."

Clue No. 3 "*It has the color blue* (Color)."



Slide 90 with target item revealed.

Figure 14. *Example of the cumulative task from Lesson 02. CTM Color - Blue, in which three clues are given, the last clue containing the previously learned concept of the "Color blue", in order for the students to determine which item the task is about.*

At the beginning of each school year during this project, those students new to the school who qualified for language services were given the *BCS Screening Test-Revised* (Hansen, 2014, revised 2018) cf. the test on the flash drive, in order to determine how well-developed their knowledge of Basic Conceptual Systems and their related Basic Concepts was and what areas of conceptual knowledge were absent or undeveloped.

It is important to note that as older students were added to the project, the majority of them needed less time on the learning of BCSs and their relevant Basic Concepts than the younger students. Most of them were able to move quickly through the Phases of the SCT lessons, with fewer tasks needed within each of the Phase sections to demonstrate mastery.

Analytic Coding

As stated previously, the secondary focus of this project involved teaching the students how to perform Analytic Coding, the application of conceptual knowledge. As soon as the students had demonstrated mastery of a sufficient number of BCSs and relevant Basic Concepts, the idea of Analytic Coding was introduced. Analytic Coding is defined by Hansen in Chapter 4 of *Intelligent and Effective Learning based on the Model for Systematic Concept Teaching - Part I: Teacher's Manual including example case studies and appendices* as:

> "… the ability to perform abstractions (multiple abstractions) or classifications (multiple classifications) by directing one's attention during learning by means of a combination of oral language skills and the words for Basic Conceptual Systems (BCSs) and their related Basic Concepts (Number (of parts), Color, Shape, Position, Size, Surface Pattern, etc.), making them verbally conscious. The ability to perform Analytic Coding enables individuals to provide multi-faceted descriptions of items or events, assign items membership in specific classes as well as determine and verbalize the similarities and differences between two or more items or events."

(Hansen, 2018, p.10)

Initially, the students were presented with the concept of Analytic Coding (AC) within the very first lessons and concepts to which they were introduced. In addition, various activities were added that gave the students opportunities to learn to use the knowledge of concepts they had acquired in both answering questions about and describing items from both home and school using the precise language of BCSs.

However, as a fun supplement to the more formal AC activities presented in the following paragraphs, and after learning relevant concepts from only the BCSs for Color (the Color blue) and Shape (a round Shape), the students were given the opportunity to answer questions and describe common school and home items that were selected and put into a bag by the teacher that had as one their attributes the color blue and/or a round shape that the students had been exposed to already. Used as both a warmup activity to help them recall what they had previously learned and as a follow-up activity to reinforce previous learning, the students each selected a single item from the bag without seeing what was in the bag and were then either asked questions about the items in relation to the color(s) and shape(s) or asked to describe the item with a reminder to remember to use what they had already learned. To make it a more relaxed and fun activity, the teacher would give each student a small toy piece for each correct answer/description that would then be used in a joint activity after all of the students had a chance to answer/describe. Favorite examples of this kind of reinforcement with the students were the use of Lego® pieces to build a tower together, marbles that were used in a marble maze that had already been constructed, bean bags to use in a bean bag toss and plastic swords to play the TOMY® game "Pop Up Pirate". This activity was introduced throughout all the further lessons (See the example of a stuffed parrot that a student brought from home later in this chapter where a much larger number of BCSs and their related concepts were focused on).

The student's initial exposure to AC occurred at the end of each of the SCT lessons used for teaching the BCSs. Hansen and Morgan included two activities designed to give the students practice in using AC. The first activity used the format of a picture describing task designed to elicit the students' knowledge of learned concepts through a series of questions. Using the example in Figure

15 of the AC lesson from the CTM Lesson for a Curved-Line Shape, when the picture was shown, the following questions related to previously learned BCSs and their related concepts were asked:

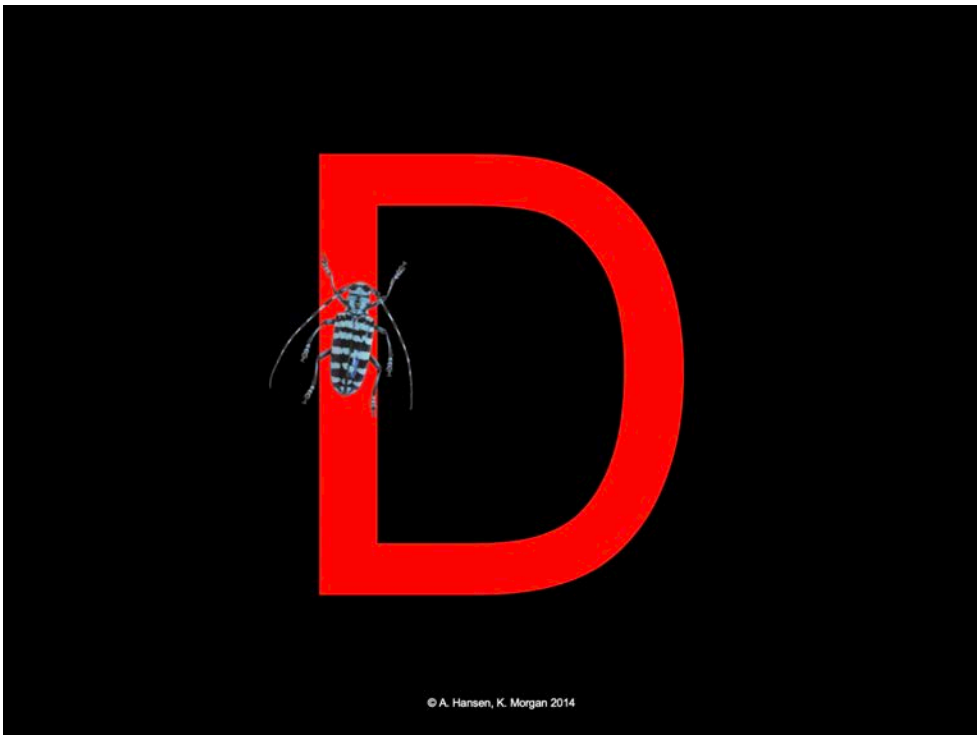


Figure 15. *Example of an Analytic Coding 01 activity from the CTM lesson for a Curved-Line shape. (See Figure 16 to see this task embedded in the CTM lesson page.)*

Teacher: "What is this a picture of?" (Object or event class membership).

The students looked carefully and said, "It's a 'D and a bug."

Teacher: "What colors do you see in this picture?" (BCS-Color)

Students: "It has the colors red, blue and black."

Teacher: "How many parts does this picture have?" (BCS-Number of Parts)

Students: "It has 2 parts, a 'D' and a bug."

Teacher: "How many parts does a 'D' have?" (BCS-Number of Parts)

Students: "It has 2 parts."

Teacher: "What shape does this part of the 'D' have (pointing to the straight-line shape part)?" (BCS-Shape)

Students: "It has a straight-line shape."

Teacher: "What shape do the bug's antennae have (pointing to the curved-line shape antennae)?" (BCS-Shape)

Students: "They have a curved-line shape."

Teacher: "What shape does this part of the 'D' have (pointing to the curved-line shape part)?" (BCS-Shape)

Students: "It has a curved-line shape."

Included within the given activities are further questions using concepts that the students have not yet been introduced to. These can be used as a kind of informal assessment of what concepts the students may already know, or as an extension for students in the group who may have more developed knowledge of BCSs and their related vocabulary. Using the example of Figure 15, the extended set of questions for this picture include:

• Supplemental Questions that can be used: 1) later when other BCSs have been taught or, 2) as an extension for students with more advanced BCS knowledge or, 3) as an informal assessment of the student's current knowledge of BCS and their related vocabulary.

T: "What size does the 'D' have in relation to the bug?" (BCS-Size) –

S: "The 'D' is big in size in relation to the bug.

T: "What size is the bug compared to the 'D'?" (BCS-Size) –

S: "The bug is small in size compared to the 'D.'

T: "What number of legs are on the bug?" (BCS-Number) –

S: "There are the number 6 legs on this bug."

T: "What number of antennae are on the bug?" (BCS-Number) –

S: "The bug has the number 2 antennae."

T: "What position is the straight-line shape of the 'D' in?" (BCS-Position) –

S: "It is in a vertical position."

T: "What position are the bug's antennae in?" (BCS-Position) –

S: They are in a diagonal position."

T: "What is a 'D' for?" (BCS-Use/Function) –

S: "You use it to spell words like 'dog.'"

T: "What is a 'D' a symbol for?" (BCS-Symbol) –

S: "It is a symbol for/stands for the speech/letter sound /d/."

T: "What does a bug do?" (BCS-Use/Function) –

S: "It crawls. It eats other bugs."

T: "What place does the bug have compared to the letter 'D'?" (BCS-Place) –

S: "It is (placed) on the' 'D."

T: "What place does the curved line shape of the "D" have compared to the straight-line shape?" (BCS-Place) –

S: "It is (placed) on the right side OR to the right of the straight-line shape."

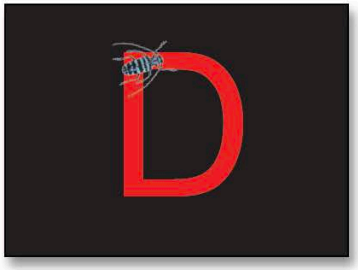
T: "What place does the straight-line shape of the "D" have in relation to the curved-line shape?" (BCS-Place) –

S: "It is (placed) on the left side OR to the left of the curved line shape."

T: "What surface pattern do you see on the bug?" (BCS-Surface Pattern) –

S: "It has a striped pattern."

The second activity focused on having the students describe a picture using the precise language of their learned knowledge of BCSs and related concepts. The students were shown a slide and then asked, "Tell me everything you can about this picture. Describe to me what you see." For the first few lessons, this activity needed to be modeled by the teacher. The modeling used most frequently in the beginning involved using a cloze technique. Again, using the illustration from Figure 15, the teacher would begin by saying, "This is a …" and let the student finish the phrase saying, "a 'D' and a bug." The teacher would then give supporting comments like, "You are so right. The names of the things you see are a 'D' and a bug. (Or, "This is a 'D' and a bug"). Now tell me about the names of the things you saw using a whole sentence (or phrase) all by yourself?" The student would usually then respond by repeating with some accuracy the whole sentence of, "This is a 'D' and a bug." However, later the students began to internalize a structure for doing this and no longer needed the teacher to model, but were able to generate a descriptive sequence related to the conceptual vocabulary they had learned. At times, they still needed some cueing to help them recall all of the relevant BCSs that could be applied to their descriptions. Some students responded well to simple cues such as, "Don't forget to tell us about the color." Or even, "Is color a part of this picture? If it is, tell us about it?"

Process /	*Materials /*	*Procedure & Dialogue /*
Follow-up Activities *Activity Task 01* *Analytic Coding* ** See pp. ????? in the Teacher's Guide for a detailed description of Analytic Coding.*	*Activity Task 01 - Analytic Coding: The concept that is named as having a "curved line shape" should be developed further by activities focused on the understanding and use of the concepts and conceptual vocabulary of the BCSs to answer* ***targeted questions*** *related to color, size, shape, number, position, place, direction, surface pattern, etc. (BCSs) that require Analytic Coding*.*	*Activity Task 01 - Analytic Coding: The Teacher helps the students to define/describe a picture that contains elements that have a curved line shape by using targeted questions to elicit the major conceptual systems and conceptual vocabulary.* ***Note:*** *The Teacher should evaluate what level of description to require from each student and what BCSs to elicit based on their linguistic skills and what BCSs they have previously been taught. The questions are listed in the order that the BCSs are taught, with this lesson's target BCS highlighted in bold.* ***Picture Card 1 - The letter "D" and a bug.*** *T: The Teacher shows the student Slide 88 and asks, What is this a picture of?" (Object or event class membership)* *S: "It's a 'D' and a bug."* *T: "What colors does this picture have?" (Color) - S: "It has the colors red, blue and black."* *T: "How many parts does this picture have?" (Number of Parts) - S: "It has 2 parts, a "D" and a bug."* *T: "How many parts does a 'D' have?" (Number of Parts) - S: "It has 2 parts."* *T: "What shape does this part of the 'D' have (pointing at the straight line shape part)?" (Shape) - S: "It has a straight line shape."* ***T: "What shape does this part of the 'D' have** (pointing at the curved line shape part)**?" (Shape) - S: "It has a curved line shape."*** ***T: "What shape do the bug's antennae have?" (Shape) - S: "They have a curved line shape."*** • *Supplemental Questions that can be used later when other BCSs have been taught* • *T: "What size does the 'D' have in relation to the bug?" (Size) - S: "The 'D' is big in size in relation to the bug."* *T: "What size is the bug in relation to the 'D'?" (Size) - S: "The bug is small in size in relation to the 'D'."* *T: "What number of legs are on the bug?" (Number) - S: "There are the number 6 legs on this bug.* *T: "What number of antennae are on the bug?" (Number) - S: "It has the number 2 antennae."* *T: "What position is the straight line shape of the 'D' in?" (Position) - S: "It is in a vertical position."* *T: "What position are the bug's antennae in?" (Position) - S: They are in a diagonal position."* *T: "What is a 'D' for?" (Use/Function) - S: "You use it to spell the word 'dog'. It stands for the speech sound /d/."* *T: "What does a bug do?" (Use/Function) - S: "It crawls. It eats other bugs."* *T: "What place does the bug have in relation to the letter 'D'?" (Place) - S: "It is (placed) on the 'D'."* *T: "What place does the curved line shape of the "D" have in relation to the straight line shape?" (Place) - S: "It is (placed) on the right side OR to the right of the straight line shape."* *T: "What place does the straight line shape of he "D" have in relation to the curve line shape?" (Place) - S: "It is (placed) on the left side OR to the left of the curved line shape."* *T: "What surface patterns do you see on the bug?" (Pattern) - S: "It has a striped pattern."*
Picture 1	 *Slide: 88*	
	•	•
Activity Task 02 *Analysis and Description*	*Activity Task 02 - Analysis and Description: The concept that is named as having a "curved line shape" should be developed further by activities in which the students are challenged to tell as much as possible about selected materials such as an object, a picture or an event using the concepts and conceptual vocabulary of the BCSs.*	*Activity Task 02 - Analysis and Description: The Teacher challenges the students to define/describe a picture that contains elements that have a "curved line shape" using major conceptual systems and conceptual vocabulary. The students themselves have to flexibly shift their attention from one attribute to another and describe their "findings" regarding what they know of the picture in question by means of Basic Conceptual Systems: number (of parts), color, shape, size, surface properties, place, function, etc. where appropriate.* ***Note:*** *The Teacher should evaluate what level of description to require from each student and what BCSs to elicit based on their linguistic skills and what BCSs they have previously been taught.* *T: The Teacher shows the student Slide 88 and says,* *"Tell me everything you can about this picture. Describe to me what you see."*

Follow-Up Activities © Hansen, A., Morgan, K. 2015 27

Figure 16. *Example of a page from Lesson 07. CTM Shape – "Curved-line" containing the two activities for Analytic Coding related to the learned concept of a "curved-line shape".*

In addition to the more formal AC tasks contained within the CTM lessons, the students on occasion were encouraged to bring items from home that they wanted to share or asked to pick something from a bag of items preselected by the teacher with the previously taught BCSs and related concepts in mind, expanding the activity first introduced after they had learned just the Color blue (BCS + related concept) and a round Shape (related concept + BCS). Using the same formats used in the formal AC tasks, the students were asked questions focused on specific BCSs and conceptual vocabulary or asked to "Tell me everything you can about this (item you brought from home). Describe to me what you brought." As with the formal AC Tasks, "scaffolding" help from the teacher including modeling and cueing were important in the beginning to help the students build a language structure with which to describe the items using precise conceptual vocabulary. And again, the students began to internalize a structure for doing this and needed the teacher to model, but were able to generate a descriptive sequence related to the conceptual vocabulary they had learned. In the following, you can see how the same question task used in the formal lesson on Curved-line Shape with the picture of the 'D' and the bug, translates smoothly to the example of a student who brought in a Beanie Babies© parrot to share:

Teacher: "*What is this*?" (Object or event class membership).

The student looked carefully and said, "It's a parrot."

Teacher: "*What colors do you see on your parrot?"* (BCS-Color)

Student: "*It has the colors red and yellow and green and blue and black."*

Teacher: "*What parts does your parrot have?"* (BCS-Parts of a Whole)

Student: "*It has a beak, feet, wings, a tail, a eye and a beak."*

Teacher: "*That's a lot of parts. Can you count them? Be sure and touch each part as you count it."* (BCSs-Number and Parts of a Whole)

Students: "*1, 2, 3, 4, 5, 6."*

Teacher: *"You counted to 6. So what number of parts did you count on the parrot?"*

Student: "*6."*

Teacher: *"You counted to 6 so it has the number 6 parts. Good counting."*

Teacher: "*What shape does this part of your parrot have (pointing to the eye)?"* (BCS-Shape)

Students: "*It has a round shape.*"

Teacher: "*What shape does the beak have here (pointing to the curved-line shape of the beak)?*" (BCS-Shape)

Students: "*It has a curved-line shape.*"

As with the formal AC Tasks, modeling and cueing were important in the beginning to help the students build a language structure with which to describe the items using precise conceptual vocabulary.

After completing the lessons on learning the BCSs and the first AC activities, the younger students in Grades 1 and 2 were introduced to more complex Analytic Coding activities through the concept of simple Mind Maps. Using everyday items from home, school and the community, the students were taught how to use Mind Maps to perform Analytic Coding. Beginning with simple Mind Maps that had the major BCSs and Complex Conceptual Systems already labeled, the students learned to use precise language to analyze selected items, writing and drawing on the Mind Map to illustrate their knowledge of the subject. Using the example of a pencil (See Figure 17), a simple Mind Map of a pencil from the classroom was projected on the whiteboard in front of the students, and they were asked conceptually focused questions designed to elicit conceptual knowledge for each frame of the Map. The goal was to get the students to apply the conceptual knowledge they had previously learned as well as new Complex Conceptual Systems and related concepts to different contexts, essentially getting the knowledge out of the students' heads and not just putting information into their heads – in the language of "Retrieval Practice" strategies. The students were given paper versions of the projected Mind Map to write and/or draw on as they were engaged and asked, "What Group does a pencil belong to?", "A pencil is a kind of …?" They were then guided in a discussion focused on group membership that helped the students to conclude that a pencil was a kind of school tool or writing tool. They would then write the word school tool or writing tool in the appropriate frame and/or draw a simple line drawing of a hand writing a word. The students were encouraged to use both the superordinate and subordinate terms in responding in order to continue building the internal structures of conceptual knowledge in Long-Term Memory. This would continue until all the frames were completed.

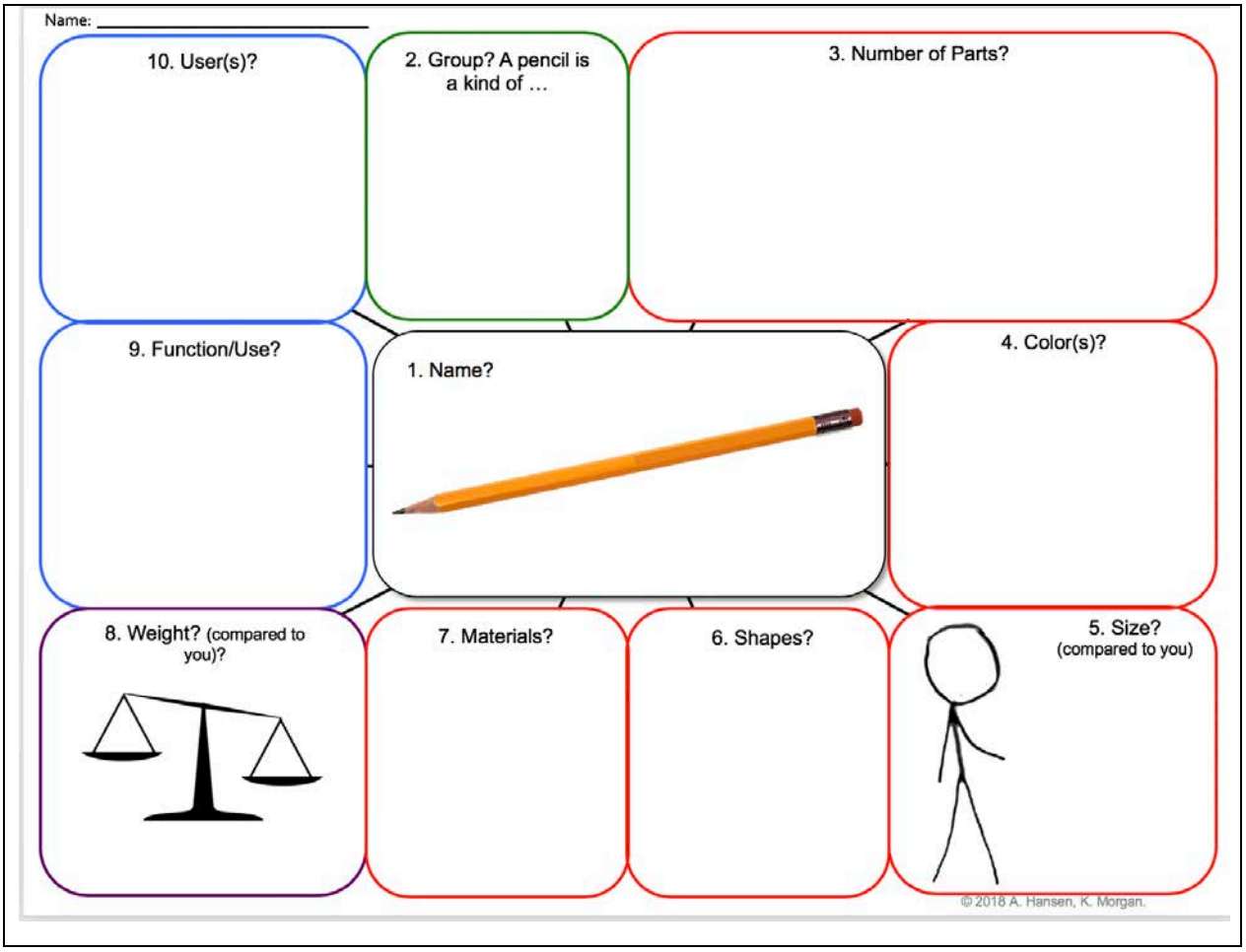


Figure 17. *Example of a simple Mind Map using BCSs and Complex Conceptual Systems relevant to analyzing a pencil.*

After the Mind Maps were completed, the students were taught to verbalize the knowledge they had in relation to the specific item, using precise conceptual vocabulary to describe and define what they had mapped. Initially, they learned to use their Mind Maps as a guide to verbalizing their descriptions by imitating the teacher as she/he verbalized the information frame by frame. For example, using the Mind Map for the pencil as for example, the teacher would point to the first frame and say, "This is a pencil." Pointing to the next frame, the teacher would say, "It is a kind of writing tool." And then, pointing to the third frame, the teacher would say, "It has an eraser, a tip(lead) and a body.", etc., with the students speaking along with her/him until the whole Map was covered. Next, the teacher would use a Cloze technique. Again, pointing to the first frame, I would say, "This is a …" and have the students finish the statement saying, "… a pencil." This would continue until the whole Map was covered.

In the following sessions, the students were presented with three different recall activities designed to help them recall and verbalize their conceptual knowledge in relation to a specific item on which they had performed Analytic Coding. The first strategy to help them recall and verbalize their descriptions and definition was to project a checklist of the relevant BCSs and Complex Conceptual Systems for a specific item on the whiteboard and ask the students to answer conceptually based questions. Using the example of the pencil, the teacher would point to the word "Group" and ask

the students, "Tell me what you know about a pencil in terms of the Group it belongs to?" (See Figure 18). Initially, some students needed their Mind Maps to help recall the significant conceptual information but soon realized that they only needed them for specific conceptual information that wasn't as well coded in their LTM.

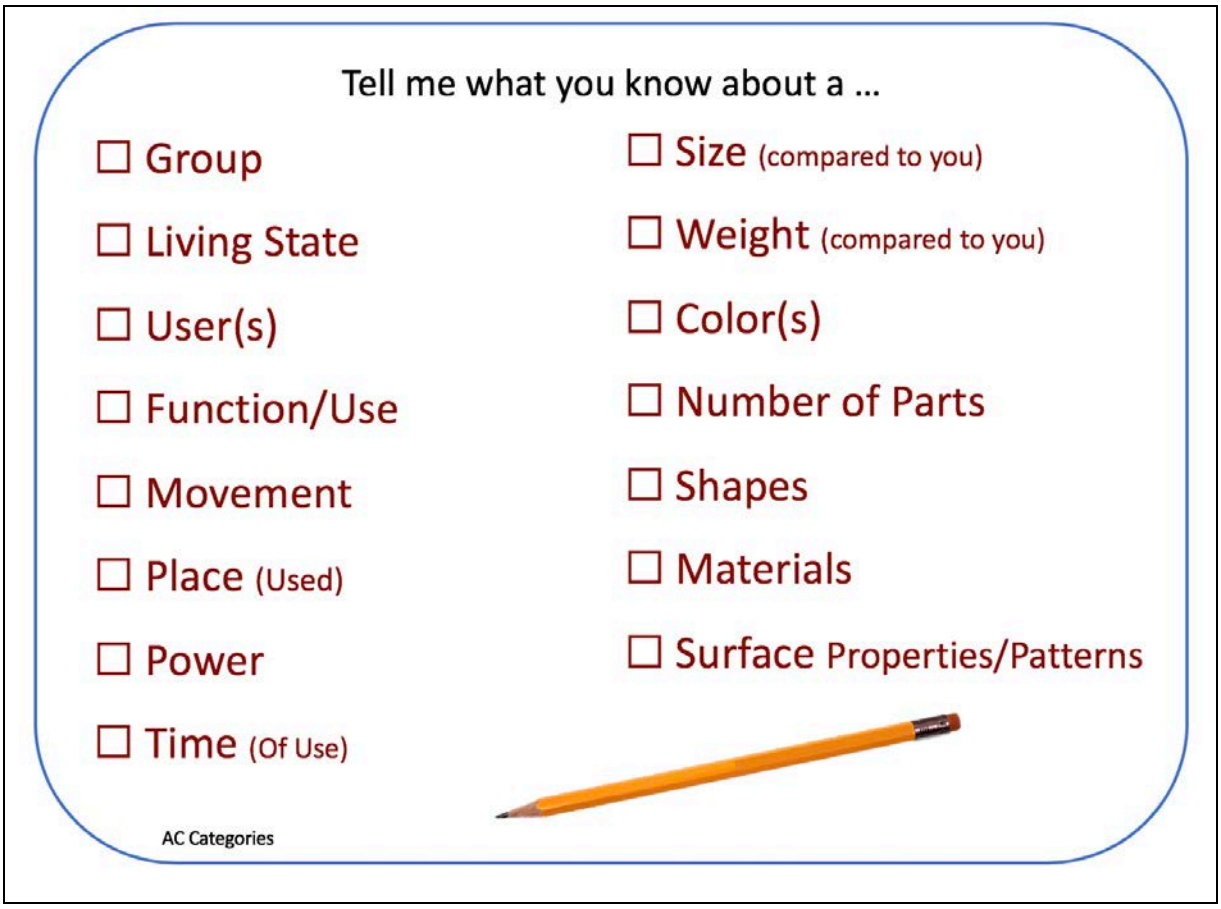


Figure 18. *Example of a list of BCSs and Complex Conceptual Systems relevant to analyzing a pencil.*

A second strategy that was used to help the students recall and verbalize their descriptions and definitions was to project a list of the conceptually based questions on the whiteboard and ask the students' each of these questions. Again, using the example of the pencil, I would point to the first question and read it aloud slowly, touching each word as it was read like "*What Group is a pencil a part of?", "Is a pencil a living thin (alive) or not a living thing (alive)?*", etc. (See Figure 19). The students would then answer based on their stored knowledge of that specific object, *"A pencil is a kind of writing tool.",* "*A pencil is not alive*."

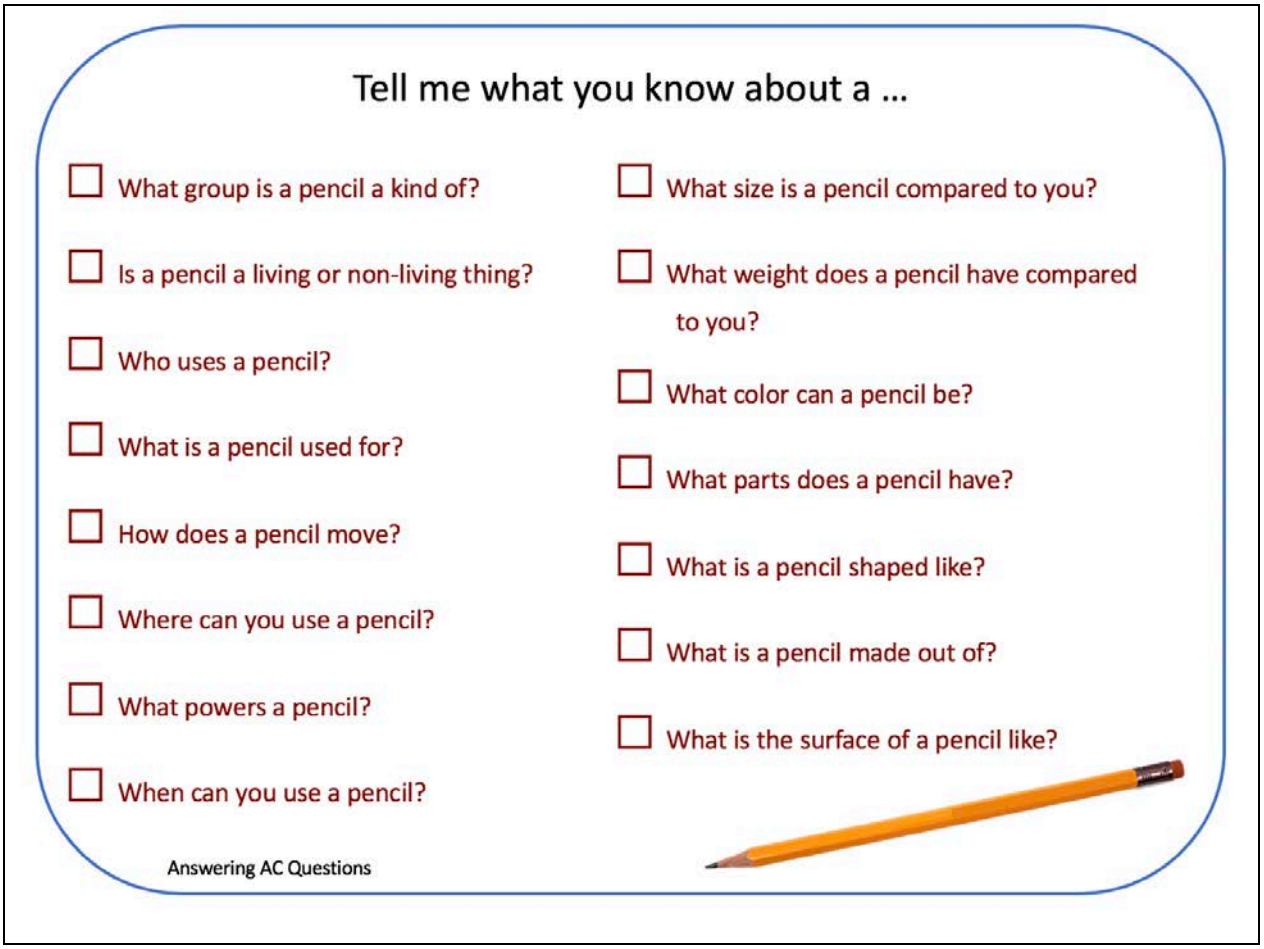


Figure 19. *Example of a conceptually based questions using BCSs and Complex Conceptual Systems relevant to analyzing a pencil.*

The third strategy that was used to help the students recall and verbalize their descriptions and definition was to project a list of the cloze sentences with the essential conceptual information missing and ask the students to fill in the missing information. For example, using the pencil again, I would say, "*A pencil is a kind of …, "A pencil is used by …", "A pencil is used for …", etc.* (See Figure 20). The students would then fill in missing conceptual information from their stored experiences with that specific item. The power of language to help the students organize information and structures in Long-Term Memory became very evident at the level of recall and verbalization used in all of these tasks.

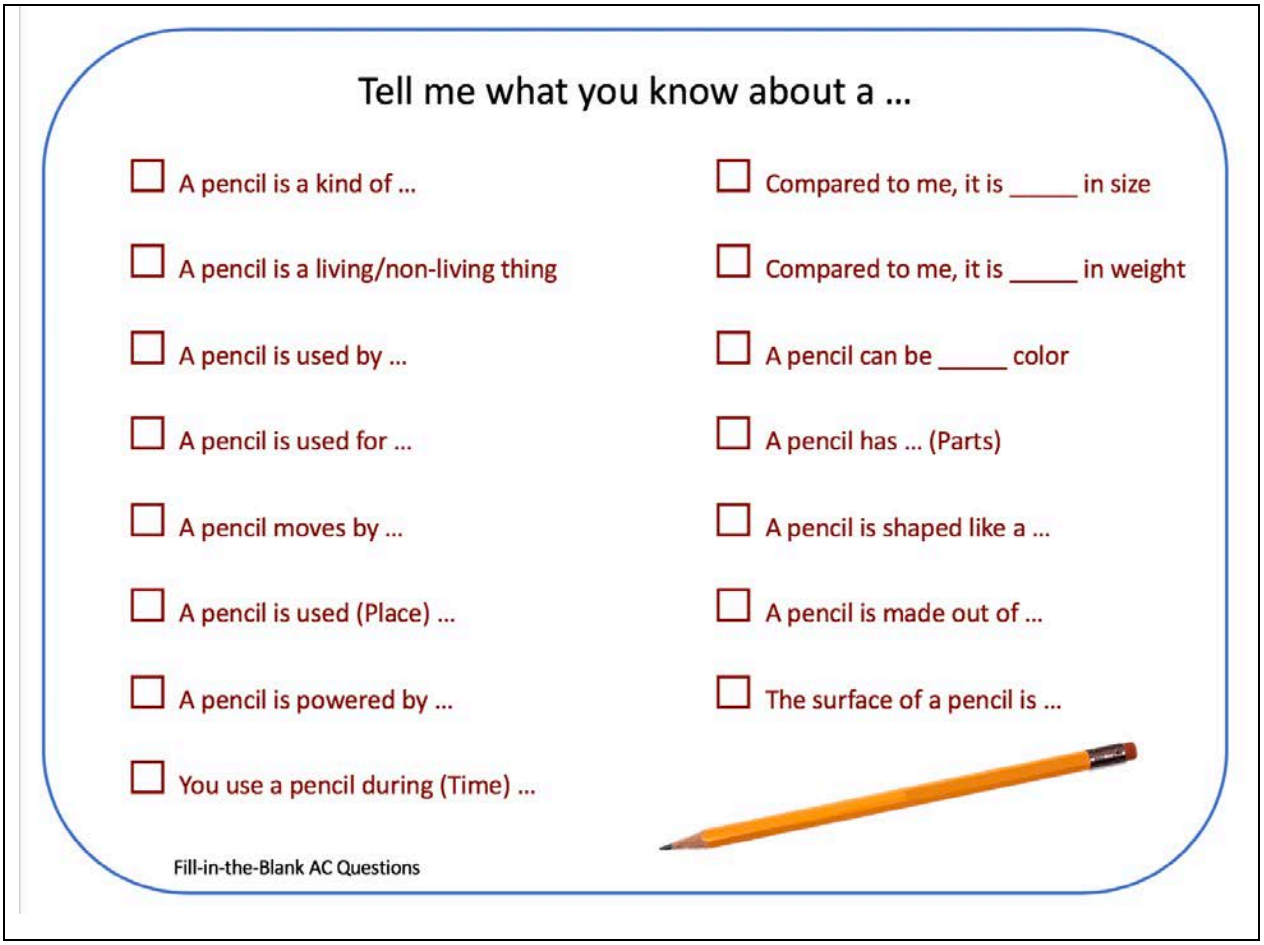


Figure 20. *Example of Cloze based sentences using BCSs and Complex Conceptual Systems relevant to analyzing a pencil.*

The final task used to help the students develop their recall skills and verbalize their learned and stored conceptual knowledge was the use of simple Informational Paragraphs built on the knowledge gained from the Mind Maps with the essential conceptual vocabulary left out (Cloze technique) (See Figure 21). This format allowed for the recall of learned knowledge within the flow of information, rather than in answer to individual questions. Using the example of the dolphin paragraph in Figure 21, the teacher would initially read through the text, vocalizing a simple "Hmm" when a blank was encountered resulting in sentences that sounded like, "*The dolphin is a kind of "hmm" that lives in "hmm". It is "hmm" in weight and "hmm" in size compared to people."*

The Dolphin *(Fill-in-the-blank)*

The Dolphin is a kind of _____ that lives
(Group)

_____ .
(Habitat- Place in the World)

It is _____, _____ in weight and
(Temperature) (Weight)

_____ in size compared to people.
(Size)

A Dolphin is _____ in color and is
(Color)

covered with _____.
(Surface Properties)

The Dolphin has _____
(Number of Parts)

_____.
(Number of Parts)

A Dolphin moves _____ by _____
(Speed) (Movement)

or by _____ .
(Movement)

A Dolphin's diet is mainly _____.
(Diet)

(Easier read - Use with abbreviated Mind Maps)

Figure 21. *Example of Informational Paragraph built on the simple Mind Map but using a Cloze technique for BCSs and Complex Conceptual Systems relevant to analyzing a dolphin.*

As the students began to gain skill in using simple Mind Maps to help them organize conceptual information mentally for ease of recall and use, the concepts of Similarities and Differences first introduced in the SCT Lessons were reintroduced. Using Mind Maps that the students had previously completed, the students were then provided with simple Comparison worksheets on which relevant BCSs and some Complex Conceptual Systems were listed between the two pictured items that were to be compared (See Figure 22). The students were asked to compare 2 different items across specific BCSs and Complex Conceptual Systems in order to determine how the things were similar and how they were different, further refining their internal use of conceptual language and structures to categorize, compare and contrast information for long-term storage and use. For example, in the Worksheet pictured in Figure 22, the students were initially guided through the process by me asking the following types of question, "*Are the pencil and scissors similar or different in the Group that they belong to?*" The students then discussed the concept of group membership and determined that they were both a kind of tool used at school. As a result, they decided that the pencil and scissors were "similar in group" because they were both a kind of school tool and circled the word "Group" while saying, "*They are similar in group because they are both a kind of school (or writing) tool.*" They then circled the word "Group" to indicate that they were similar in Group. When asked the same question about other conceptual systems like "Function, "*Are the pencil and scissors similar or*

different in their function or what they are used for?," the students decided that the pencil and scissors were different in group because the pencil was used for writing while the scissors were used for cutting, and then drew a line through the word

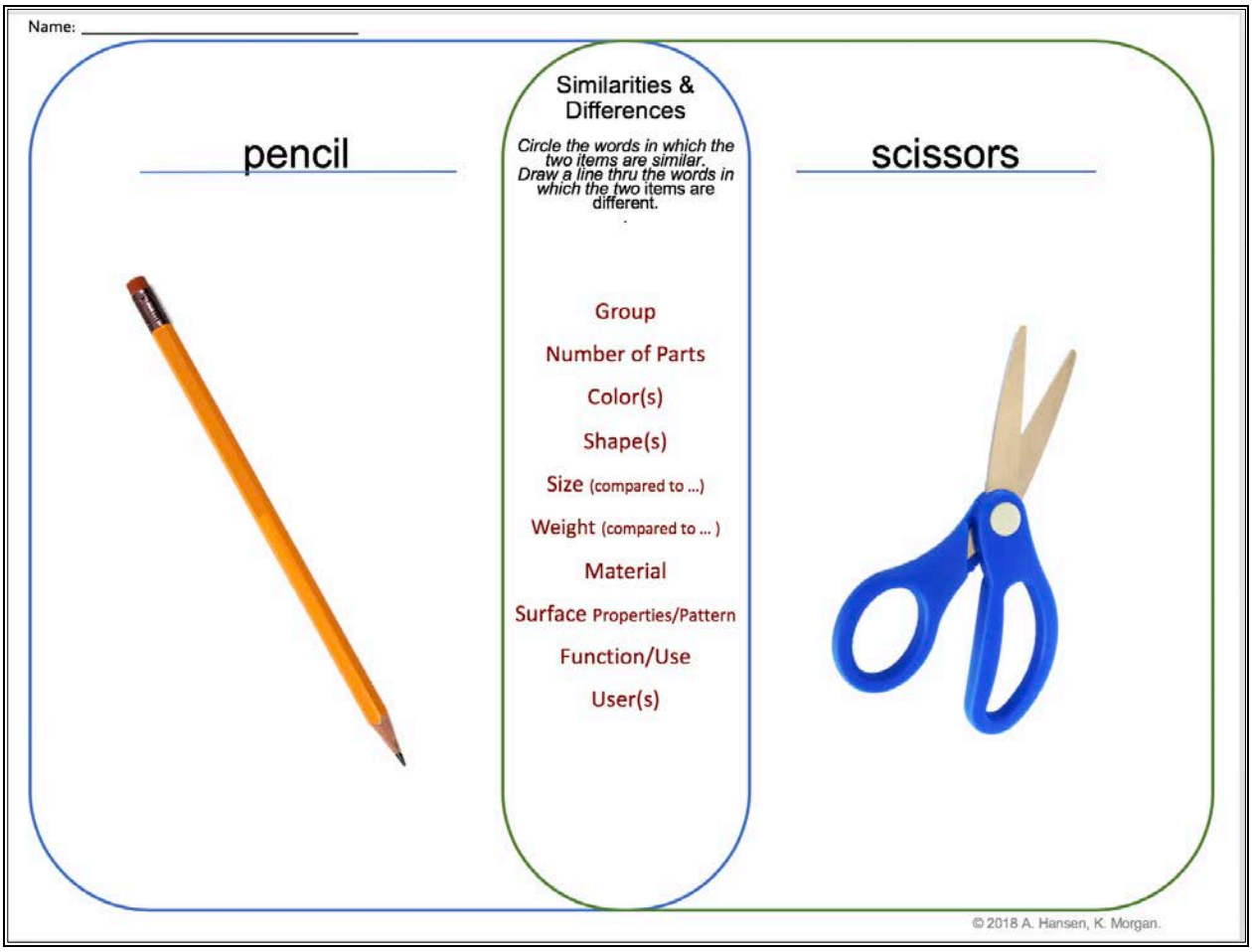


Figure 22. *Example of a simple Comparison Worksheet for analyzing the similarities and differences between a pencil and a pair of scissors.*

"Function" while saying, "*They are different in function because a pencil is used for writing and scissors are used for cutting.*" To help the students' in verbalizing the concepts of similar and different, they were each given two small cards on which the two comparison language models were printed and pictured (See Figure 23) to use as models.

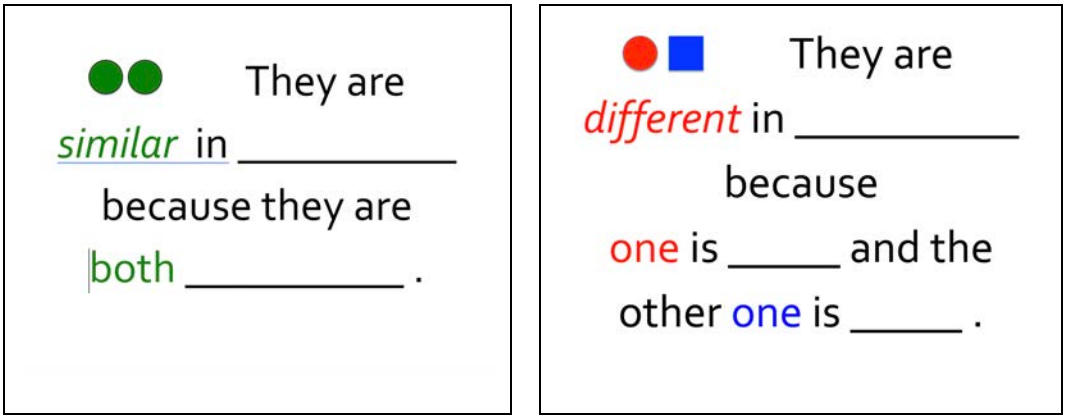


Figure 23. *Example of the Comparison cue cards for Similar and Different.*

As the pilot project continued beyond the original 2-year period and the students demonstrated mastery of BCSs, some Complex Conceptual Systems, simple Mind Maps, and Comparison Worksheets, the final step was to adapt content from their regular education classroom into more complex Mind Maps, Comparisons Worksheets and Fill-in-the-Blank Informational Paragraphs based on conceptual knowledge. This was designed to help give the students a deeper comprehension (cf. deep learning/knowledge as commented on in Chapter 4, the subchapter entitled "Deep learning and Surface learning, promoted through Analytic Coding by means of BCSs") of the topics they were being exposed to in their classroom curriculum. Also, this continued to encourage the effective coding of information in their Long-Term Memory structures using the language of conceptual systems as well as different means to practice the recall and use of this knowledge. This was especially important for the students in Grades 3 through 5. Using content from their classrooms, these students were given more complex Mind Maps, Comparison Worksheets and Fill-in-the-Blank Informational Paragraphs directly related to these topics (See Figures 24, 25, 26). These more complex tasks introduced the students to more complex conceptual systems that integrated not only Basic Concepts from the BCSs but concepts that incorporated multiple properties (For example group, habitat, healthy/unhealthy, predators, protection strategies, life or growth cycle, natural/manmade, etc.). By using these tools of complex conceptual systems and conceptual vocabulary as a framework, the students were encouraged to continue expanding their oral language skills by describing and defining items from their curriculum as well as describing the similarities and differences between two things or events introduced in their classroom work. For both the Mind Maps and the Comparison Worksheets, the same procedures used before were continued with these more complex activities. The inclusion of more complex concepts allowed for the development of a deeper learning experience in relation to coding which resulted in the students having a richer verbal output when relating information (defining, describing, comparing, etc.) related to specific topics and events. This use of complex conceptual systems and concepts together with the previously mentioned conceptually based question strategies was prompted by the work of Hansen et al. (2002) in training their pupils to be "small researchers" through questions that required the knowledge of complex systems to answer successfully. My use of a conceptually based question strategy and more

complex Mind Maps, Comparison tasks, like Hansen, et al. 's question strategy, provided:

> … (considerable) help (for) the pupils in their construction of precise and verbally conscious meanings hierarchically organized into (more complex) conceptual systems.
>
> (Hansen et al., 2002, p.9)

Additionally, with both the more complex Mind Maps and Comparison Worksheets, the teacher would occasionally interrupt the lesson to ask the students if they could think of something else that shared the target concept or think of something else that was similar/different to the topic item in terms of the targeted concept. For example, using the Mind Map from Figure 24, after working through Frame 6 – What size is it (compared to you)? – and having the students determine that a dolphin was large in size compared to them, the teacher would suddenly go around the group and ask each student if they could think of another animal that was large in size compared to them. Occasionally, the teacher would also ask the students for the opposite of the targeted concept, in this case, for example, the teacher would ask them if they could think of an animal that was small in size compared to them. Another example, using the Comparison Worksheet from Figure 23, involved asking the students, after they had determined that the dolphin and elephant were similar in temperature since they were both warm-blooded (the students having been previously exposed to the concepts of warm blooded, cold blooded or the same temperature as their surroundings), if they could think of another animal that was similar in being warm-blooded like a dolphin and elephant. Initially, these interruptions and slight changes of focus threw the students off, resulting in a struggle for finding the appropriate answer. However, as these extra questions continued to be inserted into their lessons, the students became very adept at shifting their mental focus and answering the conceptually based questions with little struggle; in fact, they began to call them "bonus fish questions" as they had initially been given a fish cracker for attempting to answer the questions. In fact, they began to spontaneously ask for "bonus fish" questions.

In addition, using their completed Mind Maps and Comparison Worksheets as references, the students were asked to, "Tell me what you know about a (specific topic)" or "*In what ways are a (specific item) and a (specific item) similar and how are they different?"* and would then describe and define their topic using the sequence of concepts pictured on their Map or Worksheet as if they were giving an oral report. As they gained more confidence and skill with recalling and using this expanded range of conceptual systems and concepts in the framework of a sequence of statements, the students were asked to do these tasks again but without any Mind Maps or Worksheets to work off of. This was initially challenging, but as soon as the students realized how much knowledge they had stored away and were able to access quickly, they became more successful, even trying to outdo each other in how

After the students demonstrated an acceptable level of mastery with the task of verbally relating the information present on the Mind Maps and Comparison Worksheets, the students began to work with more elaborate Fill-in-the-Blank Informational Paragraphs (See Figure 27). These became crucial during this time as students learned to recall previously learned conceptual information related to specific topics that they had stored more effectively and relay it verbally in a more organized, sequenced manner that matched the oral expression expectations of their oral classroom reports.

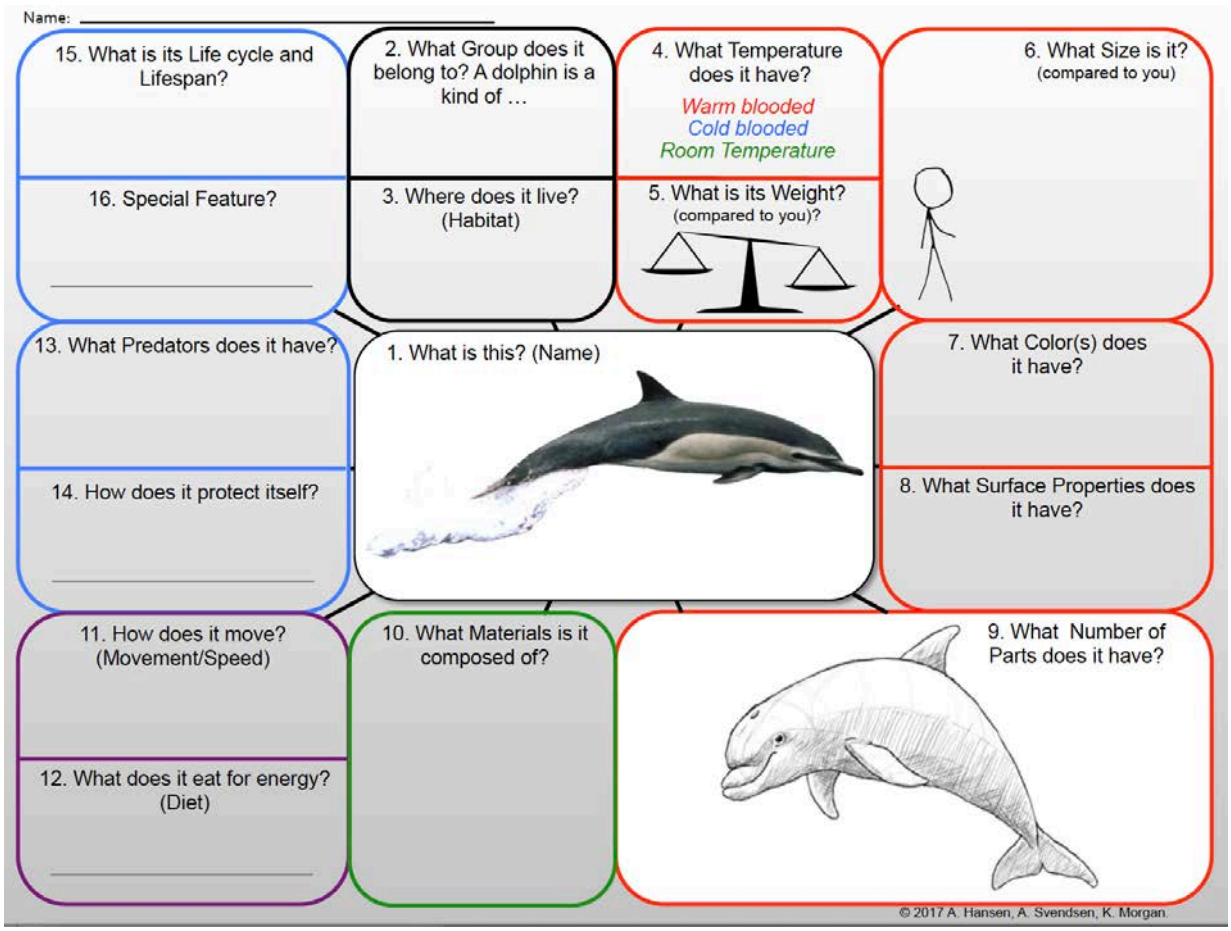


Figure 24. *Example of a more complex Mind Map using BCSs and more Complex Conceptual Systems relevant to the topic of a "dolphin".*

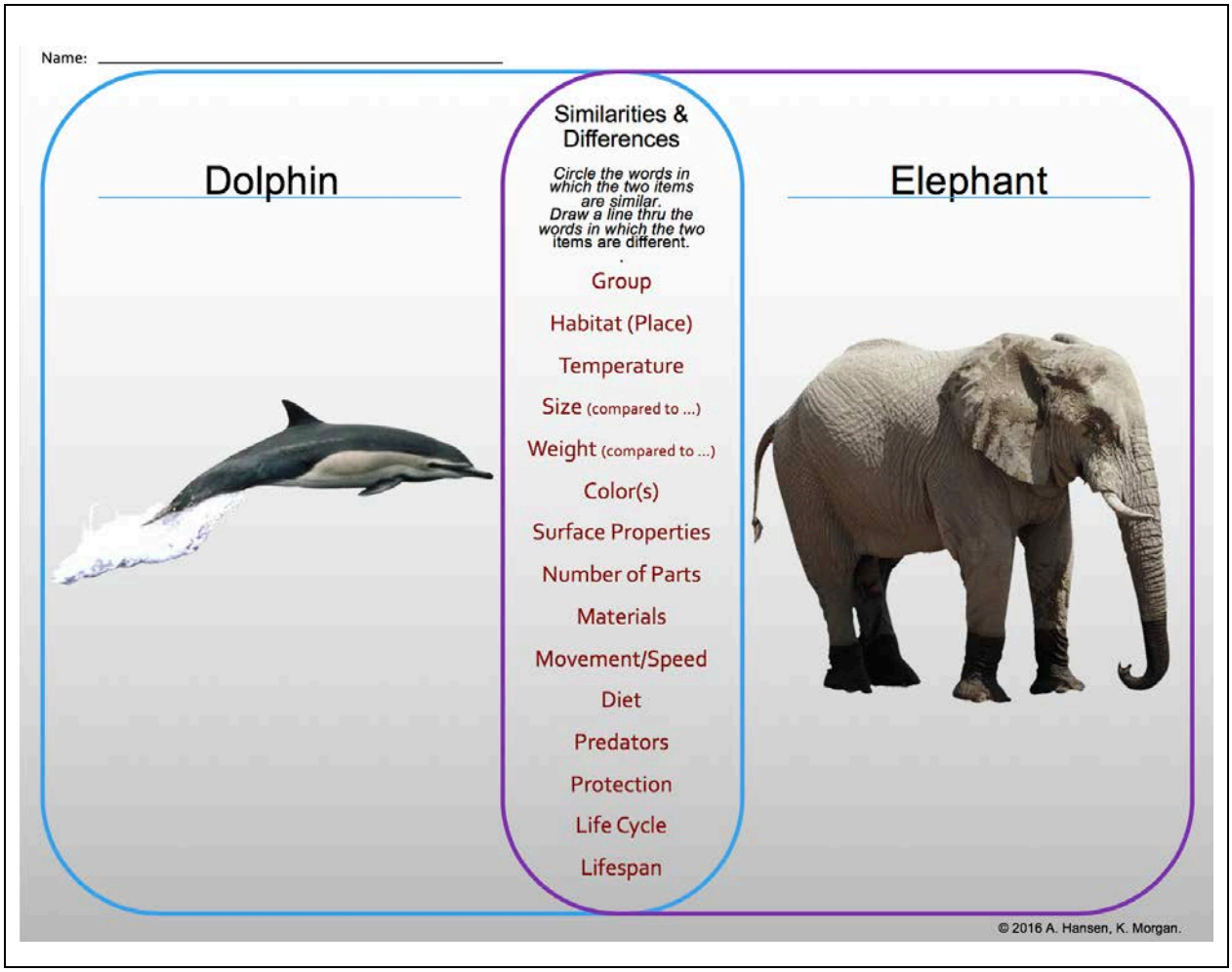
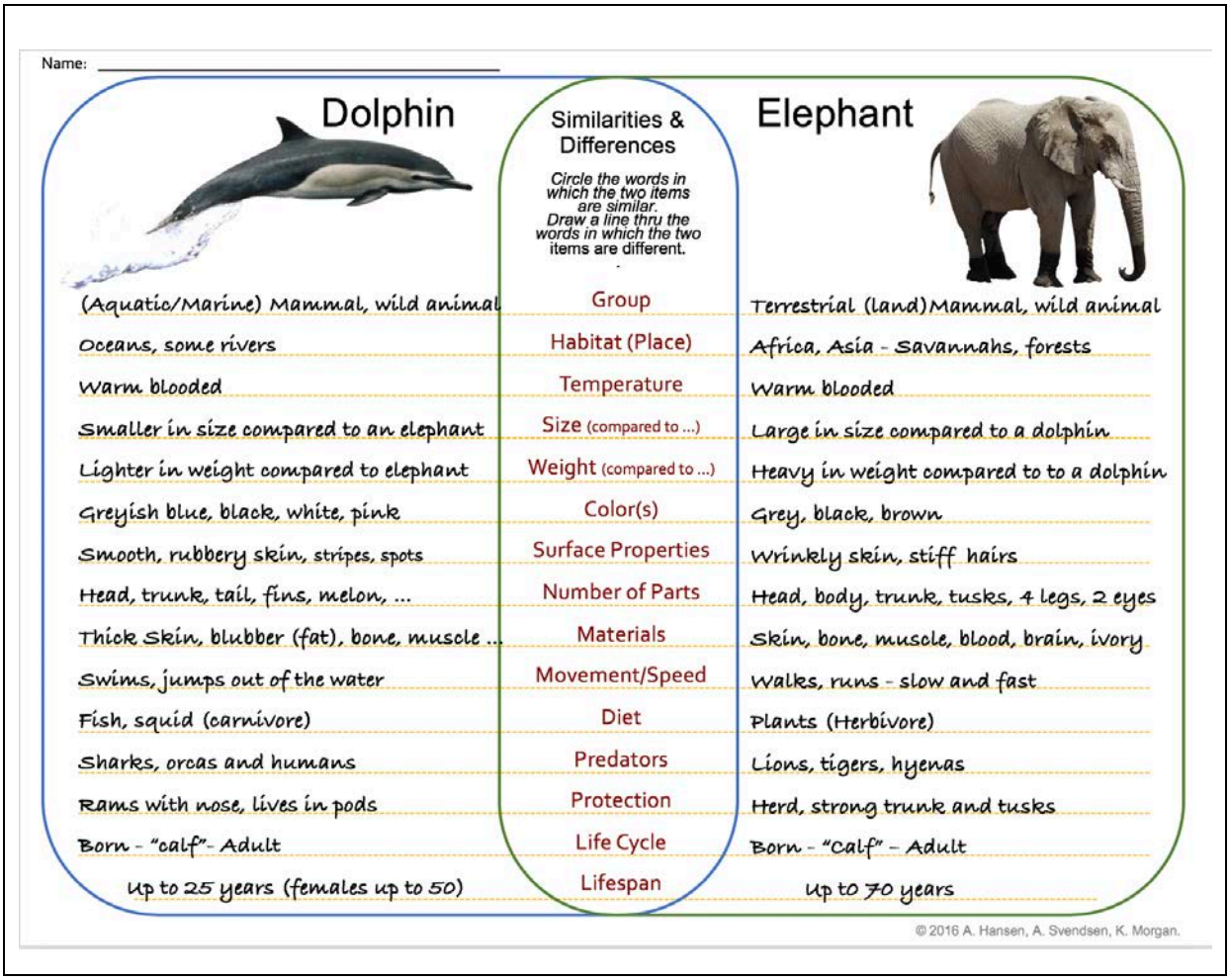


Figure 25. *Example of a more complex Comparison Worksheet (Similarities and Differences) using BCSs & Complex Systems relevant to the topics of a "dolphin" and an "elephant." This format requires no written language.*



Name: _____

Dolphin	Similarities & Differences *Circle the words in which the two items are similar. Draw a line thru the words in which the two items are different.*	Elephant
(Aquatic/Marine) Mammal, wild animal	Group	Terrestrial (land)Mammal, wild animal
Oceans, some rivers	Habitat (Place)	Africa, Asia - Savannahs, forests
Warm blooded	Temperature	Warm blooded
Smaller in size compared to an elephant	Size (compared to ...)	Large in size compared to a dolphin
Lighter in weight compared to elephant	Weight (compared to ...)	Heavy in weight compared to to a dolphin
Greyish blue, black, white, pink	Color(s)	Grey, black, brown
Smooth, rubbery skin, stripes, spots	Surface Properties	Wrinkly skin, stiff hairs
Head, trunk, tail, fins, melon, ...	Number of Parts	Head, body, trunk, tusks, 4 legs, 2 eyes
Thick Skin, blubber (fat), bone, muscle ...	Materials	Skin, bone, muscle, blood, brain, ivory
Swims, jumps out of the water	Movement/Speed	Walks, runs - slow and fast
Fish, squid (carnivore)	Diet	Plants (Herbivore)
Sharks, orcas and humans	Predators	Lions, tigers, hyenas
Rams with nose, lives in pods	Protection	Herd, strong trunk and tusks
Born - "calf"- Adult	Life Cycle	Born - "Calf" – Adult
Up to 25 years (females up to 50)	Lifespan	Up to 70 years

Figure 26. *Another example of a more complex Comparison Worksheet (Similarities and Differences) using BCSs & Complex Systems relevant to the topics of a "dolphin" and an "elephant." This format requires a written analysis of each item to then be used in comparison.*

The Dolphin *(Fill-in-the-blank)*

The dolphin is a kind of _____ that lives in _____ all over the
(Group) (Habitat)
world except in the _____.
(Place in the World)
It is _____ in size, _____and _____ in weight compared to people.
(Size) (Temperature) (Weight)
A dolphin is _____in color and is covered with _____,
(Color)
_____. Some dolphins have _____of different sizes, colors and shapes.
(Surface Properties) (Surface Pattern)
The dolphin has _____
(Number of Parts)
_____.
(Number of Parts)
A dolphin moves _____ by _____ and sometimes by _____.
(Speed) (Movement) (Movement)
They use their _____ to help them move through the water.
(Special Feature)
A dolphin's diet is mainly _____ and it has _____.
(Diet) (Special Feature)
The dolphin's biggest predators are _____, so the dolphin protects itself
(Predator)
protects itself by _____ and _____.
(Protection) (Protection)
When a dolphin is _____ it is call a "_____" and can live up to ____ years in the wild.
(Lifecycle) (Lifecycle) (Lifespan)
Dolphins make a _____ to find their way in the water and _____ to
(Special Feature) (Special Feature)
each other to communicate.

(More difficult read - Use with more complex Mind Maps)

The Dolphin *(Answer key to fill-in-the-blank)*

The dolphin is a kind of aquatic mammal that lives in oceans and rivers all over the
(Group) (Habitat)
world except in the Arctic and Antarctic.
(Habitat, Place in the World)
It is large in size, warm blooded and heavy in weight compared to people.
(Size) (Temperature) (Weight)
A dolphin is grayish blue, black, white and pink in color and is covered with smooth,
(Color) (Surface Properties)
rubbery skin. Some dolphins have stripes and spots of different sizes, colors and shapes
(Surface Properties) (Surface Pattern)
The dolphin has a round head, long trunk, tail, fins, a melon, ears, eyes, blowhole, thick skin,
(Number of Parts)
mouth and teeth.
(Number of Parts)
A dolphin moves quickly by swimming and sometimes jumping out of the water.
(Speed) (Movement) (Movement)
They use their tail and fins to help them move through the water.
(Special Feature)
A dolphin's diet is mainly fish and squid and it has 2 stomachs.
(Diet) (Special Feature)
The dolphin's biggest predators are sharks, orcas and humans, so the dolphin protects itself
(Predator)
by ramming with it's "nose" and living in pods.
(Protection) (Protection)
When a dolphin is born it is call a "calf" and can live up to 25 years in the wild.
(Lifecycle) (Lifecycle) (Lifespan)
Dolphins make a clicking sound (echolocation) to find their way in the water and whistle to
(Special Feature) Special Feature)
each other to communicate.

(More difficult read - Use with more complex Mind Maps)

Figure 27. *Examples of a more complex Informational Paragraph utilizing conceptual knowledge focused on the topic of the "dolphin". Shown are a blank version and a completed version.*

The qualitative data presented below was compiled by myself and the cooperating teacher and staff. As stated at the beginning of this Case Study, the primary goal of this project was to see if the results obtained by previous studies with Systematic Concept Teaching in terms of the student's development of learning, language, and thinking skills could be replicated across a range of students with moderate to severe language-learning problems. These findings would be considered multiplied if 1) the students were able to learn, recall and use the (key) Basic Conceptual Systems (BCSs) and their relevant Basic Concepts needed for effective learning and more efficient mental organization of information (in Long-Term Memory) as shown by their mastery of the SCT Lessons and, 2) if the students were able to apply this knowledge of Basic and Complex Conceptual Systems and their relevant conceptual vocabulary to perform Analytic Coding in relation to subjects relevant to their classroom curriculum. A third factor to be considered was if the students in both the ISP and Resource Room programs who qualified for language services and who successfully engaged in the concept learning curriculum demonstrated greater success in their classroom settings than previous groups of similar students who hadn't received instruction in Basic and Complex Conceptual Systems and their relevant conceptual vocabulary. This third area focused on classroom success was added after the initial 2-year pilot project. This goal was very subjective, but essential in determining the overall impact of SCT. Following are the findings from this project concerning the major effects of SCT on the participating students.

The acquisition and use of precise conceptual language

The K and Grade 1 students from the original 2-year project quickly learned the structure and language of the lessons as evidenced by their accurate recall and use of the modeled language forms taught in the SCT lessons. They were able to learn, recall and spontaneously use the key language models of learned conceptual vocabulary, "superordinate term + subordinate term", such as "color blue, "round shape", "large size", "placed between", "spotted pattern", "upward in direction", "in a diagonal position", "large number", etc. within the framework of the SCT lessons after approximately two months. The majority of students were able to verbalize these terms within a short phrase or sentence with varying degrees of grammatical accuracy depending on their linguistic skills. Even the children with limited linguistic skills were consistent in their use of modified forms of the key language elements.

All of the students in the following years demonstrated the same type and range of development of the critical language models of learned conceptual vocabulary as evidenced by their mastery of all of the phases of the SCT Lessons except for 4 specific students. These students who were unable to demonstrate mastery of the precise language of concepts had severely restricted linguistic skills, being functionally non-verbal with the occasional use of single words or rote memorized phrases related to movies or social settings. These students were included in the work to see if any of their interactions with the tasks and language of the SCT lessons would be successfully coded for long-term recall and use within their systems. However, their lack of interaction in the group work socially, physically as well as linguistically resulted in only minimal development of some receptive conceptual knowledge. Three of this group of four students did demonstrate growth in their ability to identify items by color, shape, and size, but did not develop the ability to see similarities and differences or spontaneously label items using the critical conceptual vocabulary. This lack of significant impact seemed to validate Hansen's statement that SCT is …

> "… best suited for children from the age of four and five, but of course for children who are able to interpret oral language information to a certain degree, and who are able to imitate

> short sequences of words (or signs) with the teacher and other children in a group, as a model." (Hansen, 2009)

Of significant note though were the verbalizations of one of these students who functioned as a non-verbal student but who could use single words and a few 2 to 3-word combinations on demand. During the SCT lessons, he would imitate single words when prompted and sometimes the 2-word model (superordinate term + subordinate term) during the activities where this was expected, but only rarely would spontaneously verbalize the key vocabulary in response to tasks in which he was directly asked a question related to the target concept. His responses to these tasks, even when only a motor response was requested, were inconsistent. However, on several occasions with both the ISP staff and his parents, the student would spontaneously and appropriately use the modeled 2-word conceptual form in a short phrase while playing. We were initially unaware of this until the parents one day asked what "first place in a line" was all about. Their student had lined up his toy cars from the movie "Cars," pointed to the first car, looked at his mom and said "first place in a line." He later demonstrated several similar vocalizations related to place, color, pattern, size and shape in the school setting while playing with other students.

Throughout the many school years of this project, the most challenging lessons for most of the groups of students who were diagnosed with more severe language-learning delays were those focused on Sound (Speech Sound) and Symbol. To bring these students to a level of mastery consistent with the other students usually required more extended time, using more examples within the tasks of each phase than was typically used in the other concept lessons. This was not unexpected given my experiences with SCT before the Project. Similar students that I used SCT with previous to the project also demonstrated difficulties with training their minds to focus on the sounds of speech and learn to discriminate and identify specific sounds from within a sequence of sounds that formed words as well as assign multiple levels of meaning to abstract symbols such as letters (it's a label for a letter, it's a symbol for a speech sound, it's part of the alphabet sequence as well as part of the letter sequence in a word).

Long-term recall and use of the learned concepts

After approximately 2 months, the majority of the students demonstrated the ability to recall and accurately apply the conceptual vocabulary of the first session of each concept lesson to the second (and sometimes third) session of the same lesson 2 to 5 days later. The children demonstrated long-term recall and use of their learned concepts as evidenced by their application of these concepts within subsequent SCT lessons that were focused on the development of completely different concepts and conceptual systems. They demonstrated this skill throughout the school year, appropriately applying previously learned conceptual vocabulary in each of the following lessons as well as making spontaneous comments using conceptual vocabulary in both the ISP and regular education classrooms. In quick review sessions that were introduced throughout the school year, the children consistently recalled and applied their learned concepts sometimes months after the initial concept/conceptual system was introduced, though with a few difficulties at random times. This was not unexpected given their documented linguistic and cognitive delays and deficits. Of note though was the students' ability to recall and apply their learned conceptual vocabulary in different kinds of tasks unrelated to the SCT lessons, such as art activities and written language tasks, evidencing the transfer of learning seen throughout the project.

As the students moved up in Grades and continued to receive SCT, it became clear that the structures and language they had learned earlier were well coded into their systems for ease of recall

and application. As the students became more engaged in Analytic Coding exercises, applying their knowledge of BCSs, Complex Conceptual Systems and conceptual vocabulary to other activities in defining, describing and talking about similarities and differences, the majority of students rarely seemed to forget much of what they had learned, but sometimes needed a cue to help them recall the terms they needed. A portion of the students always needed more time to recall key vocabulary or verbalize their thoughts related to items, but this was continually reinforced as being a positive thing with the terms "think before you speak" becoming a regular saying in the groups.

One of the more rewarding results of the students' work with SCT for me was the fact that many of those with severe cognitive and linguistic deficits were able to code, store, recall and use a more substantial portion of the learned conceptual vocabulary than was expected given their deficit levels. I had great hopes for all of the students based on my own experiences and the work done previously in Norway, but experiencing the learning first hand with students whose deficits seemed like great barriers to their success, was astonishing. Not very scientific, but immensely rewarding personally to all of us who worked with these students. They would continually surprise us during lessons with their ability to identify and verbalize the learned concepts even within their limited linguistic forms.

Development of Analytic Coding

After approximately 3 full systematic concept lessons (6–8 sessions) were completed, the K and Grade 1 students began to show the ability to spontaneously analyze objects and pictures within the tasks, using the more precise conceptual vocabulary they had learned. They showed an increasing skill with performing Analytic Coding as the school year progressed as demonstrated by their increased level of detail and precision in describing both objects and pictures related to the SCT lessons as well as in classroom-based academic activities. This was all done within the structure of the SCT Lessons. At the end of some lessons, we began to show the students specific items that shared some of the attributes that had been previously learned. We would vary from asking them direct questions related to conceptual systems – "What colors does this (name of this item) have?" – to simply asking one of them to tell us everything they could about the item, reminding them to use the words from the concept learning they had been participating in. This eventually led to having the students bring in items from home to define and describe to the other students using BCSs – similar to show and tell, but specifically, conceptually focused. This was a task used in several of the Norwegian CTM projects. The students came to learn to apply what they knew in terms of conceptual knowledge to their descriptions of their home items with ever increasing skill as they moved up in Grades. For the students who were less skilled in using conceptual vocabulary, we would often have them tell us all they could about their item, for example, a small "Hatchimal" (a kind of toy animal that comes in an egg that the students break open) one student brought in and said, "A hatchimal, dragon, in egg, tail, wings." After that, the rest of the students got to add to her list to see how many things they could think of about a "hatchimal", drawing/writing them on the whiteboard. When the students had exhausted their ideas, we took time to go over all of them and then see how many items (BCSs and related concepts) the students could remember and verbalize individually without looking at the list but still holding the "Hatchimal". On many occasions, the student who brought in the item would be able to recite several more concepts than initially produced.

This skill continued to grow as they moved up in Grade levels and began to engage in more direct and complex Analytic Coding activities. Students in Grade 2 through 5 showed a high level of mastery of the ability to use Analytic Coding on not only items and events related to their classroom curriculum, but also with items unrelated to their curriculum that I would introduce to determine

how well their skills were generalizing to less familiar subjects. Their use of not only Basic Concepts and Conceptual Systems continued to develop, but their understanding and application of more Complex Conceptual Systems and their relevant concepts also grew. After 3 to 4 years of work with Conceptual Systems, the majority of students were able to successfully use Analytic Coding to describe and define a broad range of items and events as well as to compare and contrast the similarities and differences of a broad range of items and events. These skills enabled the students who were mainstreamed for a significant portion of their day in the general education classroom to be successful at their classroom projects that involved creating in-depth reports on animal or social groups (Native American tribes) and comparing animals, people, and events with little support.

The ability to shift their analysis skills (tools) from one topic to another was an ongoing challenge for most of the students – some minimally and some significantly. Determining the range of BCSs and Complex Conceptual Systems to use in analyzing an item always took a lot of thought on the students' parts. Some topics required less thought than others in determining what to use in analyzing. For example, most of the students could readily think of the systems and concepts to use in analyzing a living creature (habitat, diet, place in the world, surface properties, etc.) but seemed to need time to "reset" their minds if the next item to be analyzed was very distant in the systems needed – like shifting from analyzing a "Golden Snub-Nosed Monkey" to analyzing a "cardboard box". This seemed to occur even throughout several days as if their minds were holding onto the last items analyzed at the surface of their memory. It became instrumental in helping them grow in this skill to begin each new analysis by asking the students if they thought that concepts from specific Basic and Complex Conceptual Systems would be needed to analyze the current item. For example, in shifting from analyzing a "Snow Leopard" to analyzing "Legos", we spent time using our Mind Maps of the leopard as well as looking at a small group of Legos on the table to discuss whether we would need to look at things like "diet", "habitat", "color", "surface properties", etc. that we had used for the Snow Leopard, when analyzing a Lego. This led to both great discussions and some very hilarious ones. As with most of the conceptual work, the more we used the skills and vocabulary, the more automatic the skill became for the students, no matter what their cognitive and linguistic levels were. The expectations for the students' output was always based on what the students were capable of and could be pushed towards rather than what their diagnosis and formal test results would say they should be able to do. It is important to state here that, one of the unexpected consequences of using CTM with the range of students participating in the work, was the realization on the part of the adults that we had all significantly underestimated what we thought the children were capable of. This occurred even though we believed we had always held high expectations for the students. Almost every student amazed us with what they learned in the lessons and were able to use and communicate throughout the work. This realization played a significant role in the decision to continue this work beyond the original timeline.

Application of the new knowledge to classrooms situations

Both the Kindergarten and First-grade children were noted to apply their new knowledge of concepts to activities within their mainstream classroom settings. They would add to classroom discussions using the vocabulary they had learned. The students demonstrated the ability to understand and apply conceptual vocabulary in a variety of listening and performance tasks such as following directions for an activity that involved the comprehension of precise conceptual vocabulary for the tasks to be successfully completed, describing items in class related to pre-reading, reading, math and pre-math activities. In fact, at one point, the regular education Kindergarten teacher in whose classroom the ISP Kindergarten children were mainstreamed, came in to observe

several of the SCT lessons for the express purpose of wanting to learn where these mainstreamed Special Ed children were getting this very precise vocabulary that they were using in class discussions. In addition, 2 lessons, "Part of a Whole" and "in a Group," were provided to the regular education Kindergarten class to support their science work. The teaching of these concepts was part of the regular education science framework for Kindergarten.

The application and transfer to small group lessons within the special education classroom

After each SCT lesson, the Special Ed teacher, the Speech Pathologist and Occupational Therapist began incorporating and applying the lesson's conceptual knowledge into the students ongoing small group academic lessons throughout the year within the self-contained special education classroom to support the children's regular education classroom curriculum in pre-reading, reading, written language and math as well as in literacy, art, and physical education activities. It is important to note that the Special Education ISP teacher's enthusiastic support of the project demonstrated through follow-up application of the learned concepts into the various area previously learned played a significant role in the students' learning. After approximately 2 months of SCT lessons, the Special Education ISP teacher began reinforcing the newly introduced concepts throughout the week in various classroom activities, with the result that the students' recall of the learned concepts developed noticeably faster with less review needed for the lessons following the initial introduction of a concept. For example, after being introduced to the concept of a straight line and round shape, the teacher applied those concepts to art projects containing straight lines and round shapes as an integral part of the lesson, and reviewed letter formation by having the students practice finding and making letters that were formed of straight lines and round shaped parts. In another example, after being introduced to the concept of being in first place in a sequence, the teacher again applied those concepts to art activities reinforcing the concept of first step in a sequence of directions, reviewed word formation by having the students practice finding what letters were in first place in the sequence of letters in various words. She also reinforced the target concept in terms of a time sequence by having the students describe their own morning routines ad determining what they did first in the morning as well as first at school. Without this level of positive follow-up support, I don't believe the students would have made as rapid of growth in their development of conceptual knowledge in their work with the SCT Lessons. In addition, each lesson's conceptual knowledge and understanding was added (cumulatively) to the teaching vocabulary and level of descriptive language responses expected from the children in the ISP classroom.

Student Involvement during lessons

The students remained engaged throughout the sessions, responding well to the mixed use of hands-on activities with concrete objects together with animated PowerPoint slides that they could touch and draw/write on when needed. Even the children with documented attention difficulties were able to remain focused and engaged during the lessons as long as the pace of the lessons remained relatively quick. This had been a concern prior to beginning the lessons based on the student's difficulty with focusing and maintaining attention in mainstream classroom activities. Keeping the pace of the lessons rapid, but not overwhelming fast, continually engaging various students throughout the lesson in recall of information or just asking what the other student is supposed to do, the predictability of the format and language of the small group instruction along with the combination of various hands-on activities and the use of animated slides helped with attention issues. For those students with the most severe attention issues, a paraprofessional would be placed

beside or behind the students and use verbal and visual cues of expected learning behaviors to keep the students engaged, gradually fading from active involvement in the lesson as the students learned what was expected and began to keep themselves focused.

Comparison of students engaged in concept learning with previous groups of similar learners

As stated previously, the third focus of this project was to see if the students in both the ISP and Resource Room special education programs who qualified for language services and who successfully engaged in the concept learning curriculum demonstrated greater success in their classroom settings than previous groups of similar students who hadn't received instruction in Basic and Complex Conceptual Systems and their relevant conceptual vocabulary as well as in performing Analytic Coding activities. It is impossible to compare one child's learning with another's without realizing all of the factors that play a role in her/his success – some within the control of the school staff and some outside of their power. However, in looking at the achievements and struggles of the special education children in these programs who received services before the onset of this project, some factors became quite clear, even though this is entirely subjective. For the majority of the students involved in concept learning, they appeared to bring a greater ability to comprehend the directions given by their classroom teachers (based on classroom teacher feedback). For the younger students in K and Grade 1, they appeared to bring a more functional set of learning tools to the learning of reading, written language and math as a result of concept learning. This became evident as they acquired pre-reading, pre-math, reading and math skills with less struggle and greater mastery overall than previous students in these programs. This was also reflected in their acquisition of written language. Their work on sequencing ideas in the Analytic Coding work for younger students, the describing of items using a sequence of concepts, seemed to help with their ability to sequence ideas for short writing assignments as well as be able to use a broader range of descriptive terms. For older students, the ability to use Analytic Coding gave them the tools they needed to be able to engage in many of the more complex classroom topics that were overwhelming before for previous students in these Grade levels. However, one factor stood out the most with these various populations of students. After receiving instruction in conceptual knowledge, and experiencing success with a wide variety of conceptually focused tasks, some quite challenging, almost every student demonstrated a positive attitude towards learning and the self-confidence that they were capable of learning. This was a dramatic step away from previous special education students who seemed to always struggle with negative feelings in terms of their ability to learn. This was especially evident with older students who, even though they were behind the others students in their regular education program, held an attitude that they could learn and that they were learning at a different pace because learning didn't come as quickly to them as it did for their classmates. One factor that was unexpected was the increased number of students who qualified out of the most intense program in terms of intervention, the ISP, into either the less intense Resource Room program or out of Special Education entirely. During the fourth and fifth years of the project, we began noticing that a more than the usual number of our Grade 2 and Grade 3 students were testing out of the severe program into less intense models. Usually, students in the most severe program remained in that program throughout most of their school life. This was a significant change.

Closing comments.

The most significant findings of this project with SCT were that the various student populations targeted developed an understanding and use of Basic and More Complex Conceptual Systems and

the relevant conceptual vocabulary that helped them to be more effective learners. Additionally, they were able to use more efficient mental organization of information (for storage in Long-Term Memory) and apply the language of conceptual knowledge to describe and define and determine similarities and differences (Analytic Coding). They demonstrated significant growth in their oral language skills as they began to incorporate conceptual knowledge and vocabulary into their learning strategies. The learning skills and positive attitudes development seen in previous studies in Norway were duplicated with these English-speaking students. Besides, there were no adverse side effects of this type of teaching, in fact, all of the students made some form of progress, even those who had been diagnosed with the most severe deficits. After the first 2 years of this project, it became apparent that the students' were making significant growth as a result of concept teaching that was positively impacting their classroom learning as well as their time with SCT. As stated at the beginning of this Case Study, the students demonstrated such significant growth in both their thinking skills and oral language skills that it felt unethical to withhold concept teaching from all of the students who needed language support. The longer this project has continued, and the more varied are the students I work with, the stronger I believe that the implementation of Systematic Concept Teaching is a powerful tool that schools should consider using to help positively change struggling student's attitudes towards learning, give them the prerequisites for effective learning and mental organization of information and the language they need to succeed in their inclusion in school.

It is important to note that throughout this pilot project and continuing in the present, numerous discussions on the topic of SCT and its implementation in the form of the framework and activities discussed in this Case Study took place with Andreas Hansen. This project would not have taken place without his informal guidance and incredible insights, recommendations, and knowledge of the CTM and SCT.

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