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Preschool Theme Teaching: What Works and What Doesn't?

Cheryl Lynn Ciesielski

Carnegie Mellon University

Abstract

The present research examines the effects of different strategies for teaching thematic content to preschool age children. Developmental psychologists have documented that individuals with rich content knowledge in particular domains demonstrate both quantitative and qualitative advantages on learning, memory, and problem solving tasks in those domains (Siegler, 1998). In addition to experimentally testing the effects of instructional strategies, this project is an exploration of strategies for conducting rigorous research in classrooms. To create minimal disruption, the content richness of specific classroom materials (thematic books, songs, and computer software) was manipulated while interactive factors, including class discussions and the activities chosen by each child, were simply recorded. To assess what the children learned, the researcher conducted a structured interview both before and after the four-week instruction. The results show that there is variability in the amount of prior content knowledge and in the amount of content knowledge that children learn. The impact of the experimental manipulations, subject variables, and other naturally occurring factors will be described.

Preschool Theme Teaching: What Works and What Doesn't

Children often surprise us with their vast amount of knowledge. From anecdotal evidence, they learn this information quite rapidly. In preschools, many basic lessons are taught. Preschool age children learn their letters, numbers, and specific information about the world around them, such as what frogs eat and what a policeman's job is. What would be interesting to know is how children learn these basic lessons.

Siegler (1998) has summarized the findings of developmental psychologists concerning the changes in children's basic processes, strategies, metacognition, and content knowledge with age. Having a certain amount of content knowledge, or factual knowledge, on a given topic increases the efficiency of basic cognitive processes in children. This same content knowledge also allows children to be more efficient in the acquisition and execution of strategies and in development of metacognitive knowledge. An additional benefit is that the more one knows about a given topic, the better that person learns and can remember new material concerning that topic. The reason for this greater ability is that with a rich content knowledge one is able to encode more precisely, make more accurate inferences, and be more sensitive to any inconsistencies in incoming information.

Rich concept knowledge is built by making features and contrasts very explicit to children. These distinctions enable better encoding and contribute to refined concepts. Also, making connections to prior knowledge, by contrasting the information and comparing the new information to the old, leads to better organization and elicits spreading activation, which occurs when one factor in a concept is recalled and then triggers other relevant factors in the concept (Siegler, 1998).

Building Concept Knowledge Via Thematic Units

Based on this theoretical background, the Children's School at Carnegie Mellon University (a preschool and kindergarten laboratory school) has adopted the thematic approach for all of their programs. The children explore one theme, such as birds, tools, or paper, together with related sub-themes for 3-4 weeks. Understanding how thematic units are created helps one understand why educators believe they are so effective. To plan the content knowledge in a thematic unit, the teachers estimate the typical baseline knowledge and concepts that the children are likely to have on a given topic and then identify the factual information that preschool children could feasibly learn. Most units have sub-themes that cover a smaller period of time, such as a week, so that the information surrounding a large unit is organized in a way that makes sense to the preschoolers. During this study, the theme being explored was *The Ocean*; the sub-themes were *The Shore* (land and water), *Sea Life* (plants and animals), *Water Transportation*, and *Fun at the Beach*.

Prior to each unit, a staff member prepares a background booklet containing 1) conceptual knowledge discussed above, 2) additional information about the topic so that teachers are able to answer even the most advanced questions, 3) a book and song list, 4) various art, language, math and science activities, 5) special snacks and playground games, 6) a list of resources within the school, community, and on the Internet, and 7) suggestions for ways these activities and resources can be used to meet the school's developmental objectives for each age group.

To understand how thematic units are utilized at the Children's School, it is necessary to understand the flow of a typical day. The study was conducted during the

June Nature Camp, whose schedule is adapted from the preschool and extended morning programs' school days during the academic year. See Appendix A for an outline of the day. During Nature Camp, the children first had a free play period in which they were allowed to choose from a number of manipulatives, puzzles, and dramatic play toys situated on tables or in play structures on the playground where camp took place. The available materials or activities may or may not be relevant to the theme. After this free play period, the children were split into their separate classes for what is called circle time. Circle time takes place inside the school building in separate rooms for each group. During this time, the teachers sit down with the children for routine activities and short lessons on the thematic unit. For instance, routine activities include singing a greeting song and discussing the calendar (day, month, date, and weather). After these daily routines, circle time involves the teacher discussing the theme, possibly reading a related book, and singing related songs with the children. After circle time, the children return to the playground for Activity Time, which is a time where children can freely choose from a number of teacher directed and non-teacher directed activities. During this time period, there are a number of activities that are relevant to the theme in varying degrees (e.g., an ocean matching game vs. playing in the sandbox). After this, the children have snack time, then another free play time when they can choose from playing in wading pools and other free play materials that are available. Following the pool time, the children get dressed, have lunch, and then go home. Times such as snack time, the second free play time which incorporates the wading pools, and lunch are typically times when the theme is not stressed.

What do thematic units do that makes them work? There are five meta-principles from cognitive psychology which are active in the teachers' utilization of thematic units Carver (2001): building on prior knowledge, making thinking explicit, emphasizing links, providing practice opportunities, and expecting individual variability. Teachers determine what knowledge the children have about the topic by having a discussion and then build on that knowledge in future lessons by emphasizing links between a child's experience and knowledge and the new information. For instance, the children are asked what they know about the topic and their responses in most cases are written down in chart or web format so they can see their own ideas on paper. The teachers consistently ask questions to make the children think explicitly about the topic at hand and to discover their own links to the information, thus making the links stronger. Once the children talk about what they know, they are taught information that expands and adds to their concepts with books, songs, visual aids, or through other creative techniques. In addition, the regular routine of the day provides the children with many practice opportunities, which strengthens the children's ability to learn effectively from a thematic unit. During the day, there are many theme related activities and theme related materials such as puzzles, books, manipulatives, and computer programs available for the children to choose from, which cater to a wide range of learning styles.

Based on these applications of cognitive theory, educators have reasonably assumed that thematic units are effective for teaching rich content. Anecdotal evidence from conversations among both teachers and parents does indicate that children acquire a significant amount of content knowledge from these units at the Children's School. The children's actual content learning, however, has never been tested.

Exploring the Effectiveness of Thematic Units

How much content knowledge do children actually learn from thematic units? Which aspects of the unit have the strongest impact on content learning? In order to study such large questions with so many variables in a classroom environment, it was necessary to determine which factors could be manipulated in order to maintain experimental rigor while still being minimally intrusive in the educational process. To identify these factors, I administered a teacher questionnaire about the strategies that teachers use to encourage children's acquisition of content knowledge (see Appendix B for questions and answer tables). The key result was that all teachers use books and songs to a great extent in their lessons and believe that these media teach the children the most content knowledge.

For this reason, the primary experimental manipulation was the content richness of the books and songs used in two different classes. Content rich materials are those that are full of factual information. Non-content rich materials are those that are based on the topic but have little to no factual information. An example of a content rich book would be a book about different types of sea life; whereas, an example of a non-content rich book would be a story in which the main character was a fish that lived in the sea, but the story was about playing nicely together with the other fish. For examples of content rich and non-content rich songs, see Appendix C. The secondary experimental manipulation was the content richness of the computer software that the children used. This manipulation was chosen because computer activities are easily separable from the normal classroom routine.

The design of this experiment involves two experimental groupings of children. Group A teachers presented most of their content via songs (content rich songs and non-content rich books), while Group B teachers presented most of their content via books (content rich books and non- content rich songs). In addition, the researcher presented content to half of each group via content rich computer software and the other halves via non-content rich computer software. Children's knowledge was assessed both prior to and after instruction to determine how much content they learned. This *two group, split-class design* is depicted in Figure 1.

The hypothesis is that Group B will gain more knowledge because there is only a certain amount of factual information that can be put into a children's song; whereas, in a book format, much more information can be presented. The hypothesis is that the content rich computer program activities will yield a greater gain because they will provide another reinforcement of learned concepts as well as adding new content to the child's knowledge.

I also hypothesized that both age and ocean experience would impact the knowledge increase from pretest to posttest based on the theory that with more experience and prior knowledge, a child has a schema for the topic, which enables him/her to encode the new information and organize it more effectively (Siegler, 1998). In addition, I predict that those with more recent experiences will tend to have greater knowledge increases because their experiences are more vivid in their minds and, therefore, the more that child can assimilate new information. I had no reason to expect that boys and girls would learn differently.

Other potential factors of interest are the type and number of activities children are participating in during activity time, daily attendance, and content in circle time discussions, as well as available content during free play time, snack time, lunch time, pool/free play time, and dismissal.

To summarize, the purpose of this study is to test the impact of the experimental manipulations (the source of rich content) and subject variables (age, ocean experience, and gender) on children's knowledge of the thematic content, as well as to document other aspects of the camp experience that could not be manipulated as easily.

Methods

Participants

Clearance to work with Human Subjects at the Children's School was obtained by completing the Carnegie Mellon Human Subjects request form. The parents of the children had already signed a blanket consent form stating that their child/children can participate in studies that are approved by the Institutional Review Board and Dr. Carver, the director of the Children's School.

The participants were all 30 children, 12 female and 18 male, ages 3 – 6 (\underline{M} = 4.77), who were enrolled in the Carnegie Mellon Children's School Nature Camp program for at least three of the four weeks. These children were from three programs, preschool 3's (\underline{M} = 3.95), preschool 4's (\underline{M} = 4.78), and kindergarten (Mean age = 5.80). Six children attended the first three weeks (\underline{M} = 4.88) and 24 children attended the whole program (\underline{M} = 4.64).

Since this study takes place in Pittsburgh, where there is not an ocean nearby, the parents were asked by the Children's School staff to report the number of times the child

had been to the ocean and the date of the last trip. A median split based on the number of times was used to assign children as having low or high ocean experience.

The participants were assigned to either Group A or B based on a stratified random sampling. The stratification was by age, gender, and previous ocean experience. Groups A and B received the same treatment during free play time, activity time, pool/free play time, snack time, and lunchtime. Only the circle time differed between the groups. The teachers of Group A chose reading material from the non-content rich set of books and songs from the content rich list. Teachers from Group B used content rich books and non-content rich songs.

To manipulate the Computer activities, a split class design was used. In this design, half of each group, A and B, were randomly selected and placed in the content rich computer group and the remaining halves were placed in the non – content rich computer group. All of the children in Groups A and B explored the computer programs for a total of 4 ten - minute sessions, which were evenly dispersed in the first three weeks of camp. Only the program used differed between the content rich and non– content rich groups.

Two children, both from Group A, were dropped from the sample. One child dropped out of camp and the other was not available to posttest due to a weeklong absence from camp. There were also 14 children enrolled in camp for less than three weeks; these children were all in Group C and were not part of the experiment.

Materials

Pretest and Posttest. The content knowledge questions were a series of probing questions designed to determine what children know about the ocean by providing cues

about their senses and the relevant sub-themes used (see Appendix D). To administer the pretest and posttest, a small lab adjacent to the Children's School Office was used. The lab had a small table with three chairs. To involve the child in the process of asking the content knowledge questions, the experimenter created a game, including 11 laminated question cards, which had the content knowledge questions typed on one side and a number from 1 – 13 written on the other side, that the child could flip one at a time for each question. A Ravensburger 100 piece Ocean Puzzle, entitled "Underwater Discovery" (No. 102174) was used as a visual cue for the last two questions (See Appendix E). A transcribing machine with cassette tape was used to record the children's responses to the questions. Also, children were each given a nametag sticker, which was decorated with a hand drawn picture of a whale and the words "Ask me about the What I Know Game" and a sheet of paper with the study description for their parents to read (see Appendix F).

Circle Time Materials. Content Rich and Non Content Rich books were gathered from the Children's School private library collection for use during circle time. See Appendix G for a list of titles used. Content Rich and Non – Content Rich songs were gathered from the Ocean Document compiled by the Children's School Staff and from various Internet web sites. Transcribing machines with cassette tapes were used to record each circle time of both experimental groups. A VHS camcorder was used to videotape select circle times as well.

Activity Time Materials. Basic school supplies and manipulatives were used for the children's activities. A participation checklist was also distributed to the teachers to record children's attendance at each activity (see Appendix H).

Computers. The children used Macintosh Performa Computers. The content rich software used was World Explorer (Dorling Kindersley – DK Interactive Learning). The non – content rich computer software used was Freddi Fish and the Case of the Missing Kelp Seeds (Humongous Entertainment), Kid Pix Sea Animals (Broderbund), and Just Grandma and Me (Broderbund). For a description of the computer software activities see Appendix I.

Teacher Questionnaire. Pre and post-camp questionnaires were distributed to the teachers. This questionnaire asked the teachers which strategies they used, which activities they thought were most effective, which daily activities were integrated into the theme, and what times the thematic unit was not stressed. The post - camp questionnaire gathered feedback regarding the study from a teacher’s perspective. Both the post - camp questionnaire and responses can be found in Appendix J.

Procedure

The study design diagrammed in Figure 1 implies the basic timeline of the study. To assess the amount of knowledge children had, the children were given identical pretest and posttests. To assess what children already knew about the thematic unit, the pretest was given before the start of Nature Camp (See Appendix D). To determine what strategies teachers use to present preschool children with content knowledge from a thematic unit, a questionnaire was given to the teachers to complete during the camp planning time.

During Nature Camp, the teachers kept a daily attendance record of each child, along with keeping a log of activities that child participated in during activity time. The activities available during free choice time and playground time, the activities available

during activity time, and any content knowledge that was presented during circle time, snack time, and lunch time were all recorded daily by the experimenter. The children were taken out of activity time by the experimenter to use the computers in ten-minute sessions, twice a week. All of the information recorded will help identify where the children obtained their knowledge.

Each child was post-tested during the last few days of his/her last week of enrollment in Nature Camp. The posttest was identical to the pretest to avoid any difference in responses due to a change of wording or asking more leading questions.

At the end of Nature Camp, the teachers were given another questionnaire, to assess how they may have changed their strategies given their particular group's stipulations set forth by the manipulation. This questionnaire also assessed the design of the experiment and how it affected the normal routine of Nature Camp

Classroom Impact

The reason this research is practical and works for this setting is that it was minimally intrusive on the daily schedule of camp and on the teacher's style of teaching. The teachers were involved only minimally in that their only responsibilities were to make sure that a tape recorder was turned on before they started circle time and turned off after circle time ended and to make sure that they only used the books and songs that were provided by the researcher. They were informed of the study via a teacher study description, which can be found in Appendix K and their responsibilities were very clearly explained to them. They were given the freedom to choose the books and songs within their sets with regard to the day they wanted to present it and how many times they used the material. The teachers had limited veto power as far as the grouping

assignments. They requested two changes to the stratified random sample before camp began based on the individual children. One of the changes was due to siblings being in the same group, and another was due to a personality conflict between two children. The researcher was also constantly available to answer any questions or concerns the teachers had about the study and to help them find additional resources as needed.

Data Collection and Scoring

Transcription/Recording of Circle Time. All of the circle time content is organized in outline format from the transcription of the audio taped circle time sessions. There are separate outlines for each week of camp for both of the experimental groups; each is organized by sub-themes to show all the information taught regardless of whether it was consistent with each particular week's sub-theme.

The content from question and answer sessions, the use of books and songs, and using visual and hands-on materials was recorded in the outlines either verbatim for children's responses or paraphrased for content rich information gathered from independent teacher instruction, books, or songs. For more detailed information on the recording of content during circle time contrasting outlines for the two experimental groups, see Appendix M.

Recording the Daily Activities

The Nature Camp staff recorded the activities that the children chose during activity time. The checklist was then given to the researcher to analyze. The activities were then ranked by the researcher for level of focus on thematic content – high, medium, low, or zero content. A high content activity is one in which a large amount of information about the ocean is presented (e.g. an ocean animal matching game); whereas

a low content activity is an activity where there is little content (e.g. making a gummi-fish necklace). The zero content activities are those that are not relevant to the theme. The activities available during free choice were also recorded. There was a low level of focus during lunch, snack, pool/free play time, and dismissal, however the activities during these times were recorded as well. The information, as well as the source of information (i.e. book, song, etc.), was recorded.

Transcribing the Pretest and Posttest

The first step in transcribing the pre and posttests, was to record the children's responses to the questions verbatim in table format. In the instance that the children's responses didn't correctly correspond to the question asked, one of two things was done. If the child referred to the correct question, then the response was recorded under the correct question. For example, if the child was responding to the question about ocean land and said, "I know something else about ocean water - there are waves", the answer was recorded under the ocean water question. If the child didn't refer to the correction question then it was recorded under the current question. So, if the child in the previous example had not said, "I know something else about ocean water", the response would be recorded under the land question.

To make the data more visual and easily comparable, the transcribed pretests and posttests were represented as maps of the child's concept of the ocean both before and after nature camp. The computer software used to make these concept maps was Visio Professional. Sample concept maps are in Figures 2. The child's responses were placed in the quadrant of the subtopic in which the response best fit and linked to the question

that was the catalyst for that response. For a detailed depiction of the concept mapping process see Appendix N. Each response was then scored for the levels of depth (e.g. ocean has waves vs. waves are caused by the sun and the moon) and the explicitness level of the question that prompted the response (e.g. Tell me about the ocean vs. What do you know about ocean water?). Deep responses given to the least explicit questions receive the most points. See Appendix O for the detailed scoring system. These response scores were added for each quadrant separately and the quadrant scores were added for a total of each individual map.

Results

Inter-rater Reliabilities

To determine that the mapping and scoring methods used were reliable, replicable, and unbiased, one independent coder was trained how to map children's responses from the pre and posttests into the concept map format and another was trained how to score responses. Both coders were female undergraduates at Carnegie Mellon University with background in psychology. The experimenter trained each coder in an hour-long session. The experimenter and the coder used a sample concept map for practice and time was allowed for any questions concerning the system being used. The raters completed the response scoring for a randomly selected 4 children, for a total of 8 concept maps (4 pretest maps and 4 posttest maps).

Mapping Reliability. The mapping rater was instructed to place each response in the correct sub-theme quadrant on the map and draw the correct link from the question to the response. A percentage of the total responses and links that the rater recorded in the same way as the researcher's responses and links was calculated for the inter-rater

reliability score. The inter-rater reliability was .82 for responses and .83 for links. Most of the discrepancies involved the differential placement of responses in the correct quadrant and labeling some responses as false due to a lack of knowledge of the ocean. The researcher's original scores were used for the analysis.

Scoring Reliability. The scoring rater was instructed to score the children's responses on the concept maps according to the scoring criteria in Appendix O. Correlations between the researcher's and second rater's scores were calculated for the total scores and for the scores for each sub-theme. Also, the percentage of individual scores that were identical to the researcher's scores was calculated. The correlation between raters was .99 for the total scores across pretests and posttests. The correlation between raters was .94 for the sub-theme totals in the pretests and .97 for the sub-theme totals in the posttests. For sub-theme totals across pretests and posttests, the correlation was .97 ($p < .001$ for all correlations). In addition, the percentage of individual responses that received the exact same score from both raters was 54%.

Pretest Data

There was high variability in the pretest scores (Range = 3.25 to 92, $M = 41.4$, $SD = 22.3$). There was also variability in the scores for the individual sub-themes (see Table 1). ANOVA was used to find that there was a significant difference ($F(3, 108) = 12.51$, $p < .01$) found showing that the children initially know more about life in the sea and the seashore than about water transportation and fun at the beach. The significant differences were found between life in the sea and both water transportation ($F(1, 54) = 27.84$, $p < .001$) and fun at the beach ($F(1, 54) = 15.29$, $p < .001$) and between the seashore and both

water transportation ($F(1, 54) = 16.17, p < .001$) and fun at the beach ($F(1, 54) = 5.62, p < .05$).

Subject Variables. There was a marginally significant difference in total pretest scores by age ($F(2,25) = 2.66, p = .089$) (See Table 2). However, further analysis showed that there was no significant difference between the 4 and 5 year-olds ($F(1, 17) = .18, p > .05$), but the 3-year-olds had significantly lower pretest scores than the 4-year-olds ($F(1, 21) = 4.49, p < .05$). Previous experience was estimated by the number of times a child had been to the ocean prior to instruction. Children who had been to the ocean 10 or more times (Range = 10 to 20, M = 3.52, SD = 2.46) were considered to be high in previous experience and children who had been to the ocean fewer than 9 times (Range = 0 to 8, M = 15.71, SD = 4.39) were considered low. There were no significant differences found for previous ocean experience ($F(1, 26) = 1.61, p > .05$) or gender ($F(1, 26) = .01, p > .05$) in the total pretest scores.

Equivalence of Groups at Pretest. To establish equivalence at pretest between the experimental groups, ANOVA's were conducted. There was no significant difference in pretest scores between groups A and B ($F(1, 26) = .08, p > .05$) or between the computer groups ($F(1, 26) = .00, p > .05$) (see Table 3). There was also no age difference between groups A and B ($F(1, 26) = .31, p > .05$) or the computer groups ($F(1, 26) = .00, p > .05$).

Posttest Data

There was also a large amount of variability in the total scores on the posttests (Range = 14.75 to 127.75, M = 66.6, SD = 32.2). There was a significant difference between this posttest mean and the pretest mean of 41.4 ($F(1, 54) = 11.60, p < .001$). A similar pattern of variability in the sub-themes existed as well, with a significant

difference ($F(3, 108) = 28.68, p < .01$) but a slight change in the rank order of the sub-themes (see Table 4)

Subject Variables. There was no significant effect ($F(2, 25) = 2.15, p > .05$) for age on the posttest scores (see Table 5), however, there was a marginally significant difference between the three and four year olds ($F(1, 21) = 3.37, p = .08$). There was a moderate positive correlation ($r = .466, p = .012$) between the age in months and the posttest scores (see Figure 3). There was no significant effect of gender on the posttest scores ($F(1, 26) = .09, p > .05$). There were no significant effects of the amount of previous experience for posttest scores ($F(1, 26) = .10, p > .05$) (See Table 5).

There was also no significant correlation ($r = -.07, p > .05$) between how recently the previous ocean experience took place and higher posttest scores.

Experimental Variables. There was no significant difference ($F(1, 26) = .62, p > .05$) between the posttest scores for groups A and B, however the mean for Group B was higher than the mean for Group A (see Table 6). There was no significant difference ($F(1, 25) = .00, p > .05$) in the posttest scores for children in the content rich or non-content rich computer program (see Table 6).

Knowledge Gain Data

The amount of knowledge gain was also variable (Range = -1.5 to 83.75 , Mean = 24.9 , SD = 20.1). There was also significant variability in the learning for sub-themes ($F(3, 108) = 3.20, p < .01$) (see Table 7). Children learned most about sea life and water transportation; both mean scores more than doubled.

Subject Variables. There were no significant effects for gender ($F(1,26) = .23, p > .05$) or age group placement ($F(2,25) = .22, p > .05$) for knowledge gain. However the

means for age group were partially in the predicted direction (See Table 8). Also, there was no significant correlation between the age in months and the knowledge gain.

Further ANOVA's showed that there was a marginally significant tendency for five-year-olds to learn more about water transportation than the three-year-olds and four-year-olds ($F(2, 25) = 2.94, p = .071$) and that there was a marginally significant tendency for the three-year-olds to learn less about fun at the beach than the four and five-year-olds ($F(2, 25) = 3.02, p = .067$).

There were no significant effects ($F(1, 26) = .97, p > .05$) for the amount of previous experience (see Table 8). There was also no significant correlation ($r = .20, p > .05$) between how recent the previous experience had occurred and knowledge gain.

Experimental Variables. There was no significant difference ($p > .05$) between the class groups but the mean for Group B (content rich books, non content rich songs) was higher than the mean for Group A (non content rich books, content rich songs) (see Table 9). Interestingly, five of the six children whose knowledge gains were less than 10 points got their rich content via songs, whereas four of the six children who had the highest gains (over 40 point gains) got their rich content via books. This pattern shows that even with the variability in both groups, the manipulation does have an effect when looking at the extreme ends of the range.

There were no significant results found for computer group on knowledge gain (see Table 9) though the means were in the opposite direction then predicted (higher score for non-content rich).

Other Variables. Attendance at camp is another factor that might affect the knowledge gain of children. Not surprisingly, it was expected that children with more

absences would gain less. No child in the experimental groups missed more than 3 days of camp. There was a significant difference ($F(1, 26) = 3.99, p = .056$) in knowledge gain between children who had 1-3 absences and those who had no absences (See Table 10).

It was also expected that the type of activities that children chose would affect their knowledge gain. To find if the types of activities chosen affected the knowledge gain; one-way ANOVA's were performed for children who had low knowledge gain (gain scores of 10 points or less) and for children who had high knowledge gain (gain scores of 40 points or above). There are no significant differences between these two groups of children for their choices to participate in activity time activities rated for high, medium, and low content ($F(1, 10) = 2.21, .40, 2.19$ respectively, $p > .05$). However, for activities that are rated for zero content, there is a marginally significant ($F(1, 10) = 3.89, p = .077$) difference between the high and low knowledge gain children (See Table 11). The children who gained less than 10 points chose to participate in a greater percentage of the zero content activities than the high knowledge gain children. Overall, there was no significant difference ($F(1, 10) = 2.81, p > .05$) between the percentage of total activities chose by the low knowledge gain and high knowledge gain children, although the means show that, against the prediction, lower knowledge gain children participate in a larger percentage of activities in all four levels (see Table 12). The recency in months for the most recent trip to the ocean was not significantly correlated ($r = .151, p > .05$) with knowledge gain.

Teacher Questionnaire Post-Camp

The teacher questionnaire following camp assessed the practicality of the research methodology. To see the questionnaire and results, see Appendix J. Most teachers agreed that the study was not intrusive on the classroom functioning and that it was not a large burden for them. In addition, they also mentioned the benefits of performing this study, including that it forced them to be more organized, made them more aware of what strategies they use, and encouraged them to utilize new strategies if they were not able to use their favored strategy. For instance, one of the teachers in the non-content rich book group tended to use primarily books as a means to present the content, and she adapted by bringing in more artifacts and visual materials to spur discussions. Most teachers also indicated that they would have liked more balance between the content richness of the books and songs, since the content rich books tended to get somewhat “heavy” for the content rich book group. One thing that the teachers thought could be improved was their understanding which materials were acceptable for them to incorporate, such as the artifacts. They were worried about “messing up” the study. In sum, the methodology used in performing this study was feasible and rigorous enough to use in a school setting such as the Children’s School.

Discussion

This study documents the gain in content knowledge from a 4-week thematic unit about the ocean. While the amount that children learn is variable, there are many factors that can contribute to a greater gain. For instance, simple attendance at camp is advantageous to knowledge gain. Age is another factor that contributes to this variance, which makes sense when looking at the theory behind learning content knowledge. If

content knowledge is acquired easiest when there is existing knowledge on a given topic, then it makes sense that older children who are likely to have existing knowledge would learn more. The results showed that there is a difference in the pretest scores, particularly lower scores for three year olds, but there is not a difference in knowledge gain.

While the books/songs manipulation did not show significance, the fact that more of the high gain children were in the content rich books/non-content rich songs group and that more of the low gain children were in the content rich songs/non-content rich books group is a good indicator that the difference in media may make a difference in the knowledge gain, but that the gain is being masked by such high variability. This high variability is caused by a number of factors. First, there was often a very fuzzy line separating materials that were content rich from those that were non-content rich. Also, there were a number of non-content rich materials that actually could have been placed in the content rich distinction for the fun at the beach sub-theme. Also, there was the fact that many teachers compensated for their lack of content and rarity of media by bringing in more artifacts, pictures, and visual aids as well as supplementing their discussions with other activities and manipulatives. Utilizing these alternative strategies bridged the gap between the two groups and thus left little difference between them. Since the means were in the direction favoring the content rich books/non-content rich songs group I predict that if the teacher did not utilize these alternative strategies that the group with content rich books would have been significantly higher than the non content rich books group in both the posttest scores and knowledge gain. However, a more controlled experiment with less teacher freedom or further detailed analysis of the origin of each child's responses would be needed to test this prediction.

The lack of a significant effect of content rich vs. non-content rich computer programs was extremely surprising. However, there are many factors that might explain this occurrence. For instance, the researcher, not the teachers, facilitated the computer sessions, so it is possible that vital links to the information that the children learned in the classroom were not emphasized due to the researcher's lack of information concerning the specific information covered in the classroom. There was also no repetition or reinforcement of the information presented in the computer program during the classroom discussions and activities due to the teachers not being aware of the content in the content rich computer programs. If these connections were made, the results may have yielded a significantly higher score in the posttests and knowledge gain of the children in the content rich computer group. Another problem with the computer programs is due to the lack of available software choices. Given the limited selection, the distinction between content rich and non-content rich was made globally and not linked to each sub-theme, which could have accounted for some of the variability in posttest scores and knowledge gain across the sub-themes.

The finding that children who have low knowledge gain participate in more zero content activities than the children who have high knowledge gain and that there was a trend for the children with low knowledge gain to participate in more activities overall suggests that the children with the higher knowledge gain are spending more time at the activities they choose. They might spend their extra time at these activities asking the teachers more questions or simply talking more about the topic during the activity.

Further inferences can lead one to believe that these high knowledge gain children may be also talking more and asking more questions in general, especially during circle

time when the content is very salient and available to them. Future research and/or more detailed analysis of the existing circle time data could reveal the amount and quality of statements that these children made to assess whether the child's inclination to talk and ask questions is an important factor in learning such content knowledge. Future research could also address the child's learning style as a factor in knowledge acquisition. It is possible that some children can learn information better from books than from songs, or that they learn more from manipulating physical objects. However, the scope of this study was too narrow to assess this preference.

Another line of work could focus on improving the pre and posttest measure to assure an accurate estimate of the children's knowledge. While my procedure may have yielded the accurate distinctions between children who learn more and less, I had the sense that they all knew more than they reported. Asking more detailed questions about a few key topics might reveal depth differences that were not evident on my measures.

Pursuing any of these avenues for further research would require more extensive control within the classroom, on the strategies that best foster content learning in thematic units, collection of more detailed data on the high content parts of the program day, and analysis of individual interactions with the learning context. Such studies will require even more attention to the balance between experimental rigor and classroom practicality than was successfully orchestrated in the current study.

References

- Carver, S. M. (2001). Cognition and Instruction: Enriching the laboratory school experience of children, teachers, parents, and undergraduates. In S. M. Carver and D. Klahr (Eds.) **Cognition and Instruction: 25 Years of Progress**. Mahwah, NJ: Erlbaum
- Siegler, R. S. (1998). **Children's Thinking** (3rd ed.) (pp. 202 – 210). Englewood Cliffs, N.J.: Prentice-Hall.

Appendix A

Outline of the Typical Day at Camp

9:00 – 9:30	Free Play Time
9:30 – 9:45	Circle Time
9:45 – 10:45	Activity Time
10:45 – 11:00	Circle Time
11:00 – 11:15	Snack Time
11:15 – 12:15	Wading Pools/Free Play Time
12:15 – 1:00	Lunch
1:00 – 1:15	Dismissal

Appendix B

Teacher Pre-Camp Questionnaire and Responses regarding Thematic Unit Strategies

(N = 5)

1) What strategies do you use to teach children content knowledge from thematic units?

- 4 Thematic Books Rich in Content
- 4 Thematic Songs
- 2 Hands on Materials
- 2 Games and Puzzles
- 2 Visitors/Families/ Outside Input
- 1 Asking Questions and then giving correct answers
- 1 Actively involve children in activities
- 1 Lead/prompt children to make their own discoveries
- 1 Visual Aids
- 1 Computer Programs
- 1 Demonstrate connections between topics in theme
- 1 Art (hands on)
- 1 Group Discussion (previous knowledge etc)

2) What types of activities do you feel teach the children the most content knowledge?

- 4 Hands on Materials (measuring, weighing, etc.)
- 3 Thematic Books Rich in Content
- 3 Thematic Songs
- 3 Group Discussion
- 2 Games and Puzzles

1 Dramatic play – building, acting out stories

1 Visual Aids

1 Art – pictures of what they're studying

1 Background experiences

3) Which daily activities do you integrate to involve the current thematic unit?

5 Songs

4 Stories

2 Art

2 Group Discussion

1 Calendar

1 Real life materials

1 Activities in Activity Time

1 Center related to theme

1 Circle time

1 Games

1 Group Guessing Games

1 Dramatic Play – Dress up clothes relate if possible

4) Are there times during the day when the thematic units are not stressed? If so, when?

3 Free Play Time

3 Pool Time

3 Snack

3 Dismissal

3 Lunch

2 Morning Arrival

1 Transition Periods

Appendix C

Examples of Songs

Content Rich

The Working Boat Song

(Tune = Mary Had a Little Lamb)

Here's a little tugboat, it will push, it will pull.
This boat helps to move a barge when it's really full.

Here's a fishing boat, used in sun, used in sleet.
People on this fishing boat catch us food to eat.

Here's a great big ferryboat. Drive right on in your car.
This very nifty ferryboat will take you near and far.

Here's a special fireboat. See a fire? Give a shout!
This hardworking fireboat will help to put it out!

Non – Content Rich

Have You Ever Seen a Sailboat?

(Tune = Have You Ever Seen a Lassie?)

Have you ever seen a sailboat? A sailboat, a sailboat?
Have you ever seen a sailboat waving its sail?
Wave this way and that way.
Wave this way and that way.
Have you ever seen a sailboat waving its sail?

Appendix D

Pretest/Posttest Script

Hi, (Child's Name), Have you ever been to the Ocean?

We're going to play an ocean game. You draw a card, I'll read you the question and then you answer it.

Questions:

Tell me about the Ocean.

What can you see at the ocean?

What can you hear at the ocean?

What can you feel at the ocean?

What can you smell or taste at the ocean?

What do you know about ocean water?

What do you know about land near the ocean?

What animals live at the ocean?

What plants live at the ocean?

What kinds of transportation can be used on the ocean?

What fun things can you do at the ocean?

I needed some help putting this puzzle together, will you help me?

What things do you see in this puzzle?

If I had a puzzle of a pond, what would be different?

Appendix E

Puzzle

Boat (fishing boat)
Sailboat
Rocks
Shells
Fisherman
People
Scuba diver
Lighthouse
Flag and buoys
Seagulls (flying and swimming and standing)
Crabs
Sandals
Sunglasses
Basket
Book
Trees
Airplane
Fish
Starfish
Squid
Octopus
Lobster in trap
Lobster
Sea anemone
Sea urchins
Sea grass
Sea cucumber
Sea sponges
Clams/mussels
Coral reef
Coral
Jellyfish
Swordfish (not an eel)
Seahorse
Sand
Water



100

Ravensburger
Germany

Ravensburger® Puzzle

Ravensburger

Dore and Sharon Carter
1579 Cumberland Street
Pittsburgh PA 15205

Appendix F

Parent Study Description*The What I Know Game*

Today your child participated in a study conducted by Cheryl Ciesielski, a Student Undergraduate Research Grant (SURG) Summer Research Fellow at Carnegie Mellon University. Cheryl is collaborating with Dr. Carver to study how children learn content knowledge from the thematic units that the Children's School utilizes. The "What I Know" Game is designed to help children verbalize their conceptual knowledge about oceans. The children will play this game both as a pretest and a posttest, before and after their Nature Camp experience studying the theme oceans. During camp, Cheryl will keep detailed records of the theme-related activities to document the types of concepts that are available for learning. Different groups of children will learn different songs, read different books, and use different computer software so that we can trace the specific impact of these materials on children's developing knowledge of oceans. Exploring the impact of different types of theme-related activities on the children's learning will help the staff develop stronger unit plans and will enable us to better train other teaching in the use of thematic units.

Appendix G

Book List

Week 1: Shores – Content Rich

The Magic School Bus on the Ocean Floor	Joanna Cole
What’s Inside Shells?	Doring Kindersley
The Magic School Bus Wet All Over	Joanna Cole
The Magic School Bus Inside a Hurricane	Joanna Cole
All About Water	Melvin Berger
Seashore	David Burnie
What Comes in a Shell?	Susan Canizares, Betsey Chessen
Life in the Oceans	Lucy Baker
The Little Island	George MacDonald, Leonard Weisgard
Amazing Water (Big Book)	Melvin Berger

Week 1: Shores – Non-Content Rich

What Happened?	Rozanne Lanczak Williams
The Bears Who Went to the Seaside	Susanna Gretz
Just My Dad and Me	Leah Komaiko
At the Seaside	Andy Cooke
Wet World	Norma Simon
The Little Mermaid	Michael Teitelbaum
The Sign of the Seahorse	Graeme Base

Week 2: Sea Life – Content Rich

The Ocean Alphabet Book	Jerry Pallotta
Dolphins!	Margaret Davidson
A First Look at Whales	Millicent E. Selsam, Joyce Hunt
Sea Creatures	Pamela Chanko
The Magic Schoolbus Gets Eaten	Joanna Cole
Under the Sea Hidden World	Claude Delafosse, Gallimard Jeunesse
Fish	Claude Delafosse, Gallimard Jeunesse
Sharks	Betsey Chessen
Habitats: Life in the Sea	Maria Rius, J.M. Parramon
Hungry, Hungry Sharks	Joanna Cole
The Underwater World of the Coral Reef	Ann McGovern
Baby Whale	Lynn Wilson
Dolphins!	Mickie Compere
Sharks	Ann McGovern

Little Humpback Whale
Humpback Goes North
The Wonder Book of Fish

Starfish, Seashells, and Crabs
My First Visit to the Aquarium
Eyes on Nature: Fish
A Whale is NOT a Fish
A Dolphin is NOT a Fish
Whales

Ocean Life
Discover Ocean Life
Ocean: The Living World

Life in the Sea (Big Book)
Going on a Whale Watch (Big Book)
Sea Life (Big Book)

Week 2: Sea Life – Non – Content Rich

The Rainbow Fish (Big and Little Books)
The True Story of Corky, The Blind Seal
Willie and the Whale
Big Al
The Three Little Hawaiian Pigs and the Magic Shark
Wally, the Hiccapping Whale (Big Book)
Humphrey, the Wrong Way Whale
Swimmy

Week 3: Transportation – Content Rich

The Little Red Lighthouse and the Great Gray Bridge
Sail Away
Look Inside a Ship
Emergency!
Boat Book
Boats

Ann McGovern
Darice Bailer
Cynthia Iliff Koehler, Alvin Koehler
George S. Fichter
J.M. Parramon, G. Sales
Jane P. Resnick
Melvin Berger
Betsey Chessen, Pamela Chanko
Claude Delafosse, Gallimard Jeunesse
Les Holiday
Alice Jablonsky
Theresa Greenaway, Christiane Gunzi, Barbara Taylor
Melvin Berger
Bruce McMillan
Educational Insights

Marcus Pfister
Georgeanne Irvine
Annie DiCaprio
Andrew Clements
Donivee Martin Laird

Donald Keefe, PhD
Gare Thompson
Leo Lionni

Hildegard H. Swift, Lynd Ward

Donald Crews
Denise Patrick
Gail Gibbons
Gail Gibbons
Ken Robbins

Week 3: Transportation – Non-Content Rich

Sailaway Home
Who Sank the Boat?
Captain Murphy's Tugboats
Benji's Boat Trip
Little Sail Boat
Stringbean's Trip to the Shining Sea

Bruce Degen
Pamela Allen
William Hall
Margaret Bloy Graham
Lois Lenski
Vera B. Williams, Jennifer
Williams

Week 4: Fun at the Ocean – Content Rich

Froggy Learns to Swim
Bill and the Fish
Dinofours It's Beach Day!
A Day at the Beach

Jonathan London
Dorothy Z. Seymour
Steve Metzger
Mircea Vasiliu

Week 4: Fun at the Ocean – Not Content Rich

A Fish out of Water
The Magic Fish
Curious George at the Beach
Rainbow Fish and the Big Blue Whale
Rainbow Fish to the Rescue

Helen Palmer
Freya Littledale
Margaret and H.A. Rey
Marcus Pfister
Marcus Pfister

Appendix H

Participation Checklist (Excerpt of Week 1)

Activity Check off List - Week 1

Activity:	Ocean Lotto - SC	Water Colors - SC	Footprints on the Beach - SC/PG	Necklaces - SC	Chalk - SC
RA					
BA		*	*		
GA		*	*		
MyA	*	*	*	*	*
SA		*	*	*	
MnA					
HB				*	*
PB	*	*		*	
BB		*	*	*	
MC		*	*		
WC		*	*		
KtD		*			
KnD					
PE		*	*	*	
AH		*	*	*	
GH	*				
MI		*			*
LI	*				
NI		*	*		*
WJ	*	*	*		
PJ			*		*
TJ					
LJ		*	*		
KK	*	*	*	*	
EL		*	*	*	
SL		*		*	
WL		*	*		
WL	*	*	*		

Name: _____

Appendix I

Computer Software Activities

JUNE

5	6	7 – Group 1 – Pacific Ocean	8 – Group 2 – Grandma and Me	9
12 – Group 1 – Atlantic Ocean	13 – Group 2 – Freddie Fish	14 – Group 1 – Arctic Ocean	15 – Group 2 – Freddie Fish	16
19 – Group 1 – Indian Ocean	20 Group 2 – Kid Pix Sea	21	22	23

Group 1 – Content Rich Computer Program: World Explorer

World Explorer is a program that has objects in the Ocean areas for the children to click on. During each 10 - minute computer section the children were instructed to click on objects within the boundaries of one of the four major Oceans.

Day 1 (Wednesday, June 7) – Pacific Ocean. This section teaches/mentions – manta rays, trenches and earthquakes, black smokers (rocky stacks surrounded by sea worms), the levels of sunlight in the ocean, the gray whale, the killer whale, penguins, and volcanoes.

Day 2 (Monday, June 12) – Atlantic Ocean. This section teaches/mentions – humpback whales, puffins, lighthouse, the Sargasso sea and eel breeding grounds, tripod fish, angler fish, pelican, scuba diver, killer whales, West Indies (islands), octopus in the Mediterranean Sea, Norwegian fishing.

Day 3 (Wednesday, June 14) – Arctic Ocean. This section teaches/mentions – seals, narwhals, beluga whales, eider ducks, Inuit people fishing techniques, walrus & how much fat they have, killer whales, ice breakers, arctic tern, polar bears

Day 4 (Monday, June 19) – Indian Ocean. This section teaches/mentions – coral reefs, clown fish, reef sharks, sea grass – food for dugongs, sea turtles, sea snakes, tuna, flying fish, chameleon on island, green turtle, typhoons, surfing, Antarctica.

Group 2 – Non Content Rich Computer Program: One of three programs - Just Grandma and Me, Freddie Fish, or Kid Pix Sea Activities

Day 1 (Thursday, June 8) – Just Grandma and Me. This is a storybook in which the children are read the story aloud and get to click on certain objects to make them do some action. The book is about going to the beach, there is very little content as far as info, but the following things can be seen – starfish, crabs, shells, sand dollar, seahorse float, fishing, boat, water skier, snorkeling, fish, clams, bird, volleyball game, picnic, sand digging, castle, big wave. A lot of the click-able items do not perform the action they do in real life.

Day 2 (Tuesday, June 13) & Day 3 (Thursday, June 15) - Freddie Fish and the Case of the Missing Kelp Seeds. The child can make Freddie Fish and his friend Luther (also a fish) go to different areas in the ocean to find the missing kelp seeds that the sharks took. The sharks are following them. Different click-able items can be picked up and stored for later usage or perform some action. These things are usually not realistic.

Day 4 (Tuesday, June 20) – Kid Pix Sea Activities. Child can draw sea pictures with the computer using both rubber stamps of the ocean creatures or things and the paint tools.

Appendix J

Teacher Post-Camp Questionnaire

Teacher Questionnaire

Please answer these honestly, as they will help to design future studies.

Identify the strengths and weaknesses of this year's nature camp.

Strengths:

- 1.
- 2.
- 3.
- 4.
- 5.

Weaknesses:

- 1.
- 2.
- 3.
- 4.
- 5.

In what ways has the ongoing research project "Preschool Theme Teaching: What Works and What Doesn't?" impacted the nature camp?

- 1.
- 2.
- 3.
- 4.
- 5.

If there were project related responsibilities that you considered burdensome, please list them:

- 1.
- 2.
- 3.
- 4.
- 5.

Do you feel as if you were given too much responsibility to the project?

In what ways has the presence of the study (i.e. having to use certain books or songs) impacted your approach to teaching at nature camp?

- 1.
- 2.
- 3.
- 4.
- 5.

In what specific ways do you think research projects of this nature (those that study classroom strategies and behavior) could be improved?

- 1.
- 2.
- 3.
- 4.
- 5.

Table J1

Teacher Questionnaire - After Camp						
Strengths	Weaknesses	Impact	Burdensome	Too Much Responsibility	Impacted Approach	Improvements
shows the knowledge some children gained on the topic	placement of tape recorder (green room)	limited the knowledge gained from reading content rich books	difficulty remembering to turn on/off tape recorder	no	had to do more research on own and find other ways to present to the children	
children enjoyed "games"		had to be cautious not to use specific materials	had to change teaching style in order to meet specifications (only content rich song & non-content rich books)		made me more aware of what I needed/wanted to present	
teacher cooperation	books were limited	more impact than other years of camp	concern with "Am I doing enough content reading materials	at first, but then found it easier after a few weeks	structure - not used to it	more planning ahead
staff cooperation	Ideas (lessons) were structured	made me more organized	Were songs appropriate non content		the very structured being told what to say or read	more books available
good communication with students and parents		made me more structured as far as songs content, activities	some pressure with students questions at times, redirected at times		not many books to choose from	meeting with the teacher to say if I was doing appropriate material
cooperation with volunteers, workstudy, etc		more responsibilities to find materials for bulletin boards, hands on materials, (i.e. shells, seahorse, algae, boats, etc)				
everything ran smooth, weather, playground, activities		children brought in sharing on their own				
		Sea world, zoo, vacations at beach, subject was of interest for all!				
great staff flexibility	sometimes books were too content rich and we could've used some lighter reading	very little impact	none	no	since I was in the content rich books group my impact wasn't as great as the other group	very little disturbance this time - not much to improve
cooperation among group						
smallness of the group was good even though it changed a lot	I think "nature" or a more local theme was maybe better - ocean was great but with the pond we could actually go to the pond observe plants, animals, etc.	camp was usually very low key - this made it have to be more planned and structured	not burdensome - I think the check off list of what the kids went to is a good habit for the next school year	no	N/A	If the study looked at teachers everyday strategies, not the ones presented to them
subject was interesting - lots of good materials	having the non research group put us through a lot of changes different kids, etc.	the theme really didn't afford itself to on campus walks (field trips) like previous years - oceans was more abstract to kids				

Appendix K

Teacher Study Description***Brief Study Description***

I am studying how children learn content knowledge from the thematic units that are used here. The “What I Know” Game that I played with the children before the end of school and will be playing with them again during their last week of camp is designed to help the children verbalize their conceptual knowledge about oceans, before and after they study oceans at this year’s Nature Camp. During camp, I will document the strategies that the teachers naturally use to help children build conceptual knowledge. I will keep detailed records of the theme-related activities to determine the types of concepts that are available for learning. Finally, I will experimentally manipulate three types of input that teachers commonly use when studying themes: theme-related books, songs, and computer software. Different groups of children will learn different songs, hear different books read, and use different computer software so that we can trace the specific impact of these materials on children’s developing knowledge of oceans, as revealed in their improvement on the “What I Know” Game. Exploring the impact of different types of theme-related activities on the children’s learning will help the Children’s School in the developing future units, utilizing existing units, and improving professional development programs for teachers at other schools.

Experimental Groups

I will randomly assign the children who plan to attend 4 weeks of camp (and possibly some who plan to attend the first three weeks) to the two experimental groups. The assignment will be balanced for age, gender, and familiarity with the ocean (number of visits and recency of last visit). The children who plan to attend for less time will all be in the third group, which will not participate in the experimental part of the study because their participation is too short.

Group A (Experimental) – Mrs. Grabowski, Susan Chudd

Group B (Experimental) – Mrs. Prizner, Miss Kaus

Group C (Non-Experimental) – Mrs. Fairweather, Miss Meyers

Documenting Teacher Strategies***Teacher Questionnaire***

- All Teachers, please complete and return the attached questionnaire before camp begins.

Program Observation

- Assistant Teachers will be asked to audiotape circle time each day. I will have the tape recorders and tapes ready to go.
- I will observe and periodically videotape free choice time, circle time, activity time, snack, etc. to discover strategies that teachers naturally use to help children build concepts and to record the theme-related opportunities available.

Program Documents

- I will have a copy of the Ocean Unit and collect copies of the activity period charts for each week.

Documenting Child Participation

Attendance Record

- Assistant Teachers will be asked to complete an attendance record throughout camp (record sheet will be provided).

Activity Participation Record

- Teachers who lead teacher-directed activities during Activity Time will be asked to record which children participate in the activity (checklist will be provided).

Experimentally Manipulating the Source of Theme Content

- There are many theme-related songs, books, and computer programs, but some contain richer information about the theme than others. To test the impact of using content-rich materials vs. related but not content-rich materials (typically fiction set in the theme context), I have planned the following manipulations, all of which are designed to have minimal impact on the natural flow of camp.

Content-Rich Songs vs. Books

- Group A (Grabowski/Chudd) will use content-rich songs during circle time but read only non-content-rich books. Group B (Prizner/Kaus) will use content-rich books but sing only non-content-rich songs. Both groups will read and sing together in whatever way the teacher typically does. I have prepared lists of books and songs related to each week's themes that fit into the two categories, but that will still allow each teacher a range of choices. The circle time tapes will document which books and songs are actually used, and comparison of the groups' post-test concepts will indicate whether children learned more from the songs or books.

Computer Activities



- I will provide computer activities for a randomly chosen half of the children in Group A and half of Group B during the first eight days of camp and for the other half of the children during the second eight days. I am still looking reviewing programs to choose the most content-rich ones for use during these sessions. In order to get all of the children, I will use both of the free choice periods and possibly activity time as well. I'll keep you posted on the schedule for this. Once again, comparison of the groups' post-test concepts will indicate how much children learned from the computer activities.

THANK YOU!!!!

Appendix L

Circle Time Outline Key

Table L1

Symbol	Meaning
Item	Information was repeated ONCE
and Italicized Item	Information was repeated TWICE *
Number in Parentheses (e.g. (4))	Number of times a song was repeated that week**
	Hands-On material
	Visual Aid ***

*No independent information was repeated more than twice.

**No books were repeated. If any information from a book was repeated in a different context it is only recorded in that context and not labeled as repeated in the book section so that one can tell where information came from and what format it was repeated in.

***Books are not included as visual aids

Appendix M

Excerpts of Group A – Circle Time, Week 2

- a. Song – “ 8 Tentacles “ (4)
 - i. 8 tentacles
 - 1. Help him eat
 - ii. Swim in the ocean
- b. Book – “ My Very Own Octopus “
 - i. Octopus has lots of legs
- c. Squid
 - i. Has 10 legs – 2 long and 8 short
- d. Whales
 - i. Dolphins are in a family with the whales
 - ii. PB – All whales are mammals
 - 1. Mammals –
 - a. Air through lungs
 - b. Nurse their babies
 - iii. Killer whales got name because they eat seals and turtles
 - iv. Live babies
 - 1. Feed them milk
 - v. Whales hold their breath
 - 1. Some can hold for up to 30 minutes
 - vi. Have fins
 - vii. Have teeth or baleen
 - 1. Baleen whales eat plankton and krill that they sift through the top water
 - viii. Spout water vapor – air he’s letting out
 - ix. Very smart – talk to each other with noises underwater
 - 1. Sounds for mating, talking to babies, danger and other reasons too
 - x. Kinds of whales – (with visual)👁️
 - 1. Sperm whale, humpback whale, white whale, killer whale, gray whale
 - 2. Blue whale - largest animal that ever lived
 - 3. Narwhal - special tooth
 - 4. Beluga whale – white
- e. Song – “ Salty Sea Giant “ (2)
 - i. Blue whale – giant mammal in the sea
 - ii. In the salty sea
- f. Book – “ Wally the Hiccupping Whale “ see also Transportation
 - i. Mentions – seaweed, fish, pelican, seal

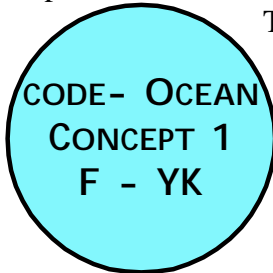
Excerpts of Group B - Circle Time, Week 2

- a. Song – “ When the Fish Go Swimming By “
 - i. Fish swim
- b. Animals in the Sea
 - i. DsR, ZT – seahorse
 - ii. KK, HT – sharks
 - iii. PJ – clownfish
 - iv. EL – starfish
 - v. MC – whale
 - vi. Crabs, lobster
 - vii. BN – eel
 - viii. MnA – seal
- c. Book – “ Life in the Sea “ (Big Book)
 - i. Coral
 - 1. Is like a plant
 - 2. Seaweed
 - a. Brown, red,
 - b. Needs oxygen
 - ii. Small fish near top of sea
 - 1. Seahorse
 - 2. Yellow tailed snapper
 - a. Snaps things
 - b. Yellow in color
 - 3. 4eyed butterfly fish
 - 4. Clownfish
 - 5. School of fish
 - 6. Tuna
 - a. Swim near the top
 - 7. Jellyfish
 - a. What I hate about the ocean
 - b. They float on top and sting you when you swim
 - iii. Bottlenose dolphin
 - 1. Near the top and may come close to the seashore,
 - 2. Always come up to breathe,
 - 3. Spout
 - a. Water comes through it when they need air,
 - 4. Playful and splash - people can swim with them,
 - iv. Blue whale
 - 1. Because it's blue
 - v. Humpback whale
 - 1. Comes to the surface for food
 - a. Tiny shrimp called krill
 - vi. Great white shark & hammerhead
 - 1. Both dangerous,
 - vii. Octopus

Appendix N

Concept Map Key

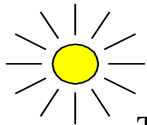
Step 1: Record the child's code, Concept (1 or 2), Gender, and Age Group.



The Original Concept is Concept 1 and the Learned Concept is Concept 2. The gender is F for female, M for male. The age groups are Y/3 - younger 3's, O/3 - Older 3's, Y/4 - younger 4's, O/4 - older 4's, Y/K - younger Kindergarten, and O/K - older Kindergarten.

Step 2: Record the weeks the child was at Camp.

Each Week Bubble is labeled with that week's Theme such as "The Shore"

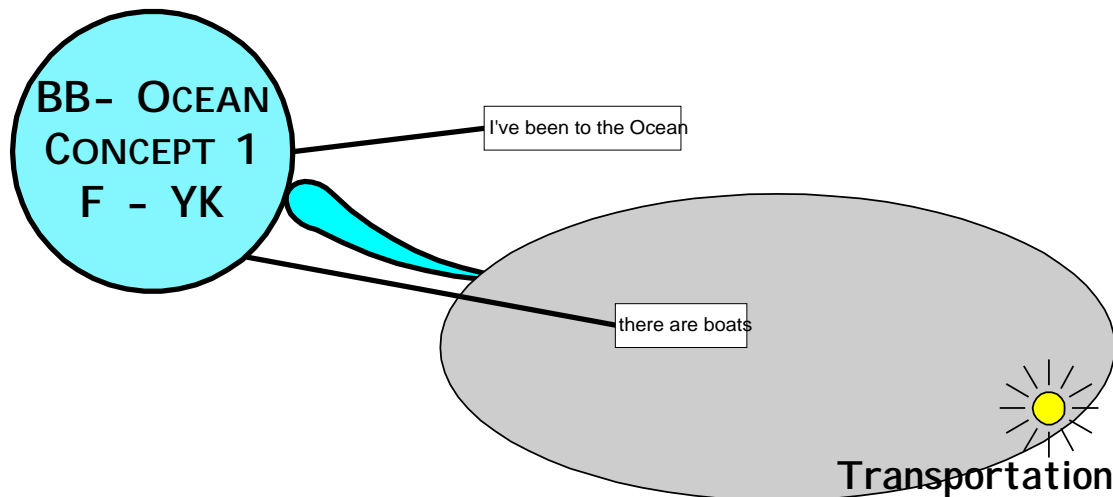


<-- This sunshine symbol indicates that the child was at camp for the particular week
 Week 1 -The Shore, Week 2 - Life in the Sea, Week 3 - Ocean Transportation, Week 4 - Fun at the Beach



<-- This rain cloud symbol indicates that the child was not at camp for the particular week.

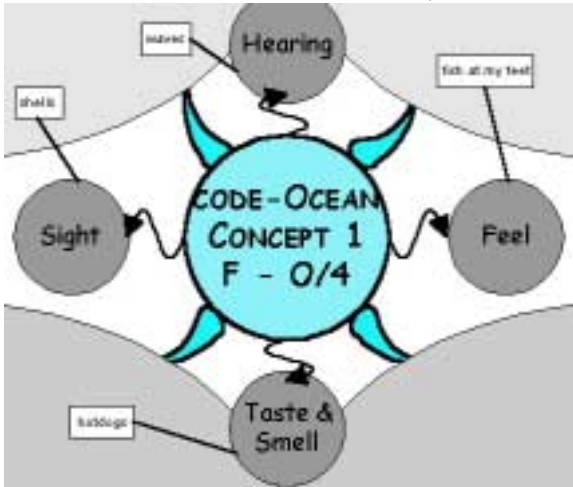
Step 3: Start with the first question from the pretest. (Did you ever go to the Ocean"?)
 Record the Response with a thick line coming from the central circle.



(Translate "yes" into I've been to the ocean, and "no" as I haven't been to the ocean.)

Step 4: The responses for the second question, Tell me about the ocean, also get recorded in the same way from the central circle. The responses however should be placed in the correct subtopic. For instance if a child responded, "There are boats in the ocean"; the response box would be placed in the Transportation Bubble, with a thick line coming from the central circle. (See above figure for visual)

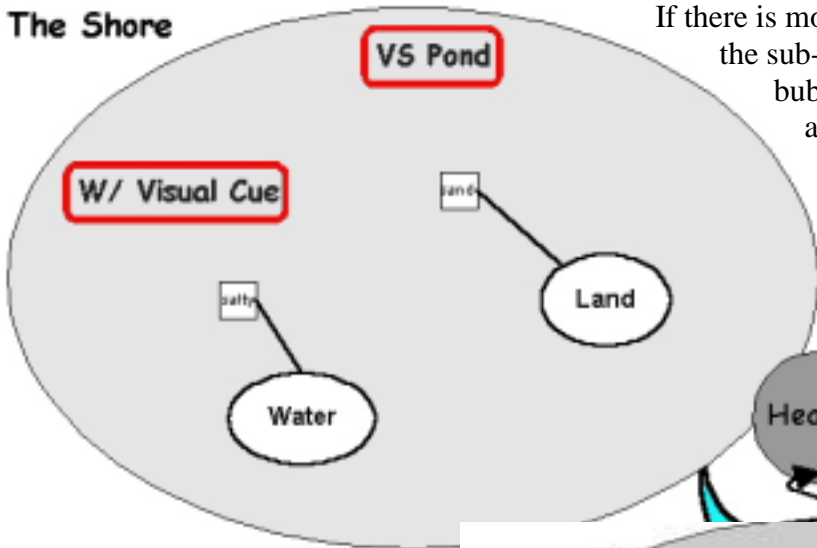
Step 5: Record the Responses from the Sense Questions. (I.e. what can you see, hear, feel, taste or smell, at the Ocean?)



These response boxes should be placed in the appropriate bubbles with thinner lines coming from the indicated sense circle the response came from.

Step 6: Record the Responses for the specific week questions (I.e. What do you know about ocean water, land near the ocean, animals, plants, transportation, fun things?)

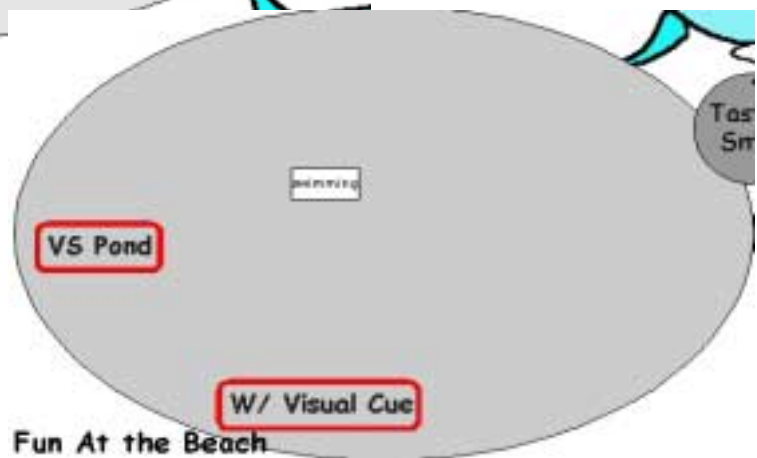
The Shore



If there is more than one question in the sub-topic, the question has a bubble inside of the appropriate bubble.

Record the responses with lines coming from the question bubble. *If the response was already previously mentioned, just add an additional thin line from where the response box is to the question bubble.*

For subtopics that only have one question, the response box is placed inside the bubble with no lines coming from it.

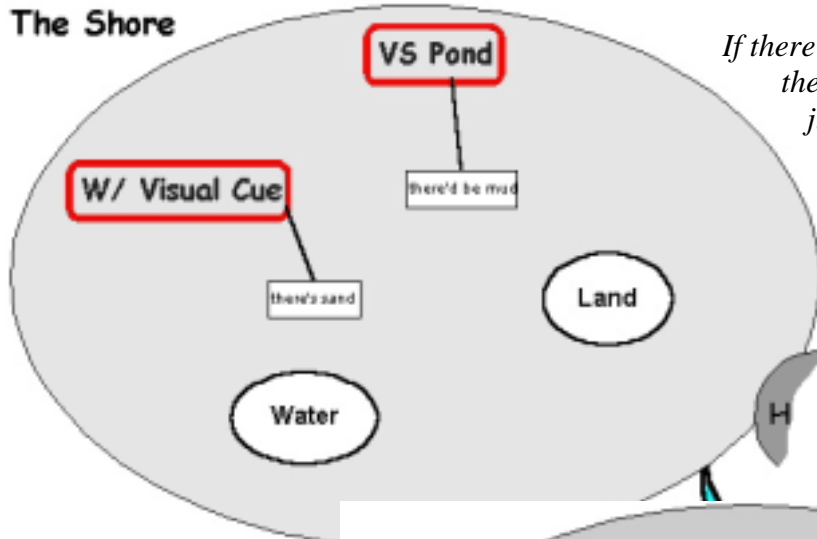


Fun At the Beach

Step 7: Record the Responses to the Visual Cue Questions (I.e. What can you seen in this Puzzle? and If this was a pond, what would be different?)

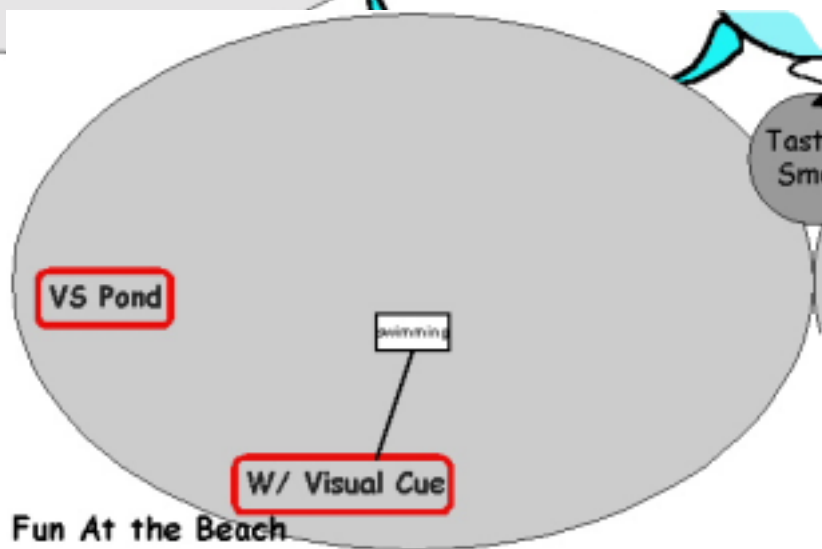
There are rounded labeled boxes in each of the sub-topic bubbles for the visual cue questions. The responses should be linked by a thin line to the appropriate rounded box in the sub-topic it pertains to.

The Shore



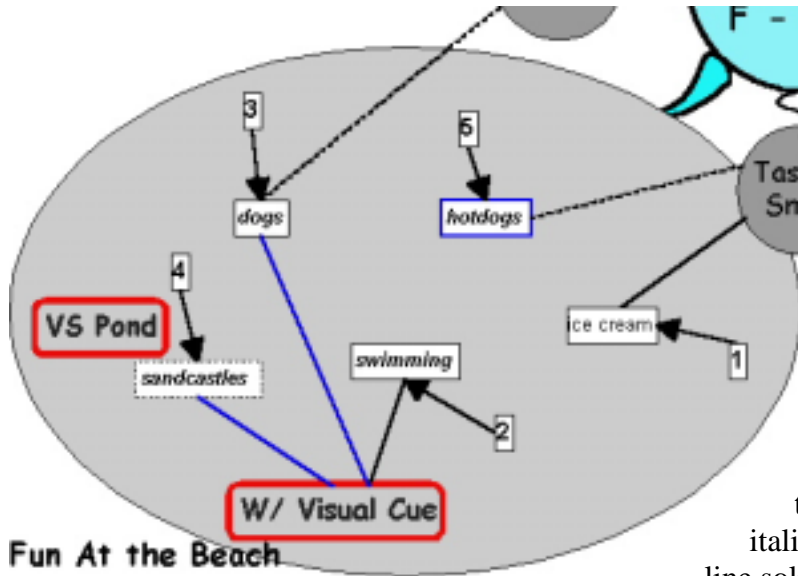
If there are responses that are there from other questions, just add another thin line and link the response to the appropriate rounded box.

If there are responses that weren't linked to another bubble previously, thicken the border of the box and add a thin line linking it to the appropriate box as well.



Step 8: Begin the Learned Concept Map by copying the Original Concept map onto the second page.

Step 9: Make every line a dashed line (including the border around unlinked responses) rather than a solid line. Make all responses bolded.



Step 10: Follow Steps for mapping the concept as before with the following exceptions.

- 1.) For new responses keep the typeface normal and use solid black lines.
- 2.) If a response in the posttest is already there from before and linked to the same place, keep the typeface bolded, but italicize it as well, and make the line solid again.
- 3.) If a response in the posttest is

already there from before, but the link is not the same, keep the typeface bolded, but italicize it as well, and make a new solid line in blue.

- 4.) If a response was unlinked in the pretest and linked in the posttest, keep the border a dashed line, keep the typeface bolded, but italicize it as well.
- 5.) If a response was linked in the pretest and unlinked in the posttest, make the outside border thicker and blue, and keep the typeface bolded, but italicize it as well.

Step 11: Add red triangles by each bubble to record the total scores for each bubble.



Step 12: Add a gray box at the bottom to record the Total Score for the whole concept.

Total Score = 80.75

Other things you may encounter:

- A response that is not correct to your knowledge
- Should always be in red typeface.

Appendix O

Concept Scoring Key

Table O1

Points Given	Responses	Examples
1	Naming of a category name or simple type	Fish, octopus, sea star, sand, water
2	Subordinate categories, a kind of thing, or simple information, location of simple names or simple property of thing	Swordfish, cruise ship, waves splash, waves are big, rocks are on the bottom of the ocean,
3	Information about something, details, advanced properties, actions/behaviors and detailed descriptions	Waves are caused by the sun and moon, jellyfish can sting you, crabs have sharp claws that pinch,
.5	Not completely right, but not wrong either	For transport question: rental car (gets you to ocean), swimming,
.25	Non – descriptive answer	There are sea creatures
-.25	Right in one link, wrong in another	Seaweed answered for both plants and animals
0	Wrong	Elephants live in the sea

Table O2

Points Given	Cueing Type
1	No Prompt
.75	Senses Prompt
.5	Specific Questions
.5	Visual Cue, Pond Question

- Responses that either have links directly from questions or are alone (i.e. have a bold outline or no lines to them but are in the Fun at the Beach or the Transportation bubble) receive the prompting points.
- Responses that have links that are off of other responses only receive the response points they would add to the response.
- Responses that are given for multiple questions receive the points for the response only once but receive the prompting points from all of the different prompts that elicit the response.

Author Note

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Table 1

Differences in Pretest Scores for Sub-themes

Sub-Theme	N	Mean	SD	Rank
Seashore	28	12.30	7.80	2
Life in the Sea	28	16.90	10.60	1
Water Transportation	28	4.80	5.90	4
Fun at the Beach	28	7.70	6.60	3

Table 2

Pretest Scores for Subject Variables

Subject Variables	N	Mean	SD
Age			
3	9	28.08	21.31
4	14	47.48	21.50
5	5	48.40	18.89
Gender			
Male	17	41.10	20.77
Female	11	41.89	25.53
Ocean Experience			
High	21	44.46	23.20
Low	7	32.25	17.69

Table 3

Pretest Scores for Experimental Groups

Experimental Groupings	N	Mean	SD
Classroom Groups			
Group A	13	40.10	16.04
Group B	15	42.55	27.12
Computer Groups			
Content Rich	14	45.04	19.42
Non – Content Rich	14	37.79	25.05

Table 4

Differences in Sub-themes in Posttest Scores

Sub-Theme	N	Mean	SD	Rank
Seashore	28	15.00	8.20	2
Life in the Sea	28	31.90	15.20	1
Water Transportation	28	10.20	9.60	3
Fun at the Beach	28	9.20	6.60	4

Table 5

Posttest Score by Subject Variables

Subject Variables	N	Means	SD
<u>Age</u>			
3	9	49.06	31.66
4	14	74.41	32.70
5	5	76.30	21.84
<u>Gender</u>			
Male	17	65.13	27.12
Female	11	68.86	40.08
<u>Ocean Experience</u>			
High	21	67.73	30.73
Low	7	63.21	38.59

Table 6

Posttest Score by Experimental Group

Experimental Grouping	N	Means	SD
Classroom Groups			
Group A	13	61.42	29.53
Group B	15	71.08	34.65
Computer Groups			
Content Rich	14	66.30	27.08
Non – Content Rich	14	66.89	37.61

Table 7

Differences in Sub-Themes in Knowledge Gain

Sub-Theme	N	Mean	SD	Rank
Seashore	28	2.70	6.80	3
Life in the Sea	28	15.00	13.00	1
Water Transportation	28	5.40	8.50	2
Fun at the Beach	28	1.50	5.30	4

Table 8

Knowledge Gain by Subject Variables

Subject Variables	N	Mean	SD
Age Group			
3	9	21.30	16.80
4	14	26.30	23.30
5	5	27.90	17.50
Gender			
Male	17	23.50	16.57
Female	11	27.25	24.97
Previous Experience			
Low	21	22.83	16.53
High	7	31.39	28.50

Table 9

Knowledge Gain by Experimental Group

Experimental Grouping	N	Means	SD
Classroom Groups			
Group A	13	20.87	19.20
Group B	15	28.53	20.50
Computer Groups			
Content Rich	14	20.84	15.9
Non – Content Rich	14	29.11	23.1

Table 10

Effect of Absences on Knowledge Gain

Absences	N	Means	SD
No Absences	20	29.49	19.08
1-3 Absences	8	13.69	18.44

Table 11

Activity Percentages by High and Low Gain

Gain	N	High	Medium	Low	Zero
Under 10	6	52.31	57.26	62.22	56.48
Over 40	6	37.78	51.17	47.05	45.36

Table 12

Total Activity Percentages by High and Low Gain

Knowledge Gain	N	Mean	SD
Under 10	6	57.07	12.37
Over 40	6	45.34	11.87

Figure 1. Two Group, Split – Class Design

Figure 2. Concept Map Samples

Figure 3. Age vs. Posttest Scores

