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ABSTRACT

Whole language and cooperative learning are effective ways to help students develop and integrate academic skills. The computer makes available the possibility of multimedia opportunities to apply these and other strategies to develop cognitive, affective, and social skills. The project reported in this paper explored a successful strategy for using HyperCard and interactive technology to accomplish these goals. Twenty-one third-graders were involved in the project, with abilities ranging from superior to low average. The class was engaged in the topic of animal life stages in science. Students worked in cooperative learning groups, but were encouraged to interact with other groups for borrowing and sharing ideas. The qualitative analysis verified that students became effective learners and communicators through the research and design process. The technology proved to be a motivator for students and increased their rate of basic skills development as well as their knowledge of the subject matter. (Author/AEF)

Paper (W2-202A)

A Hypermedia Approach for Developing Research and Reporting Skills

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Abstract

Whole language and cooperative learning are effective ways to help students develop and integrate academic skills. The computer makes available the possibility of multimedia opportunities to apply whole language, cooperative learning, and other strategies to promote the development of cognitive, affective, and social skills.

The project reported in this paper explored a successful strategy for using *HyperCard* and interactive technology to accomplish these goals. The qualitative analysis verified that students became effective learners and communicators through the research and design process. The technology proved to be a motivator for students and increased the rate of development of basic skills as well as their knowledge of subject matter.

In addition to the written paper, this presentation will include videotaped segments focusing on key project activities and examples of children's hypermedia products.

A Hypermedia Approach for Developing Research and Reporting Skills

This paper describes and analyzes an attempt to integrate hypermedia into a dynamic classroom environment in order to promote the development of cognitive, affective, and social skills among a class of third graders. The teacher incorporated hypermedia technology into a classroom environment that emphasizes whole language instruction (Goodman, 1986) and cooperative learning (Johnson and Johnson, 1987; Slavin et al, 1983).

Hypertext is a programming concept exemplified by *HyperCard*, which permits users to move in a user-friendly, non-linear manner through text. The basic idea behind hypertext is that a reader examines a segment of text or graphic information and then can branch immediately to any one of many others segment as needed. This project permitted students to design hypertext, multimedia programs, rather than merely read a program designed by someone else.

Teachers using whole language strategies have to get used to the idea of no longer being the sole source of information and instruction for their students. Teachers must assume the role of a facilitator and an academic coach. When teachers apply hypermedia techniques as a tool for whole language instruction, the main requirement is not that the teacher must possess skills as a hypermedia programmer. Rather, the teacher must serve as an academic coach. This role requires a different type thinking than either computer programming or doing traditional lesson plans. As the teacher mirrors the process of making meaning from text, the hypermedia process evolves into reading, writing, and thinking extensions.

Description of the Class

There were twenty-one third-graders involved in this project, with abilities ranging from superior to low average. Six of these students were classified as gifted and talented (GT) in the school system. The overall structure of the class was based on the principles of whole language and cooperative learning. In science classes, cooperative groups were encouraged to focus on the meaning and results of the experiments in order to produce group reports. The writing process and instruction took place in meaningful content areas and with literature-based texts. Students were encouraged to share their work with classmates for further writing suggestions and revision.

Early Stages of the Project

The early stages of this project involved getting the students acquainted with microcomputer capabilities through various software packages and introducing the students to processes of brainstorming, making a rough draft, revising, proofreading, and publishing.

Since the class was engaged in the topic of animal life stages in science, the metamorphosis of butterflies was selected for the first hypermedia project. In previous years, this was taught in a whole-language format with students reporting their findings in hardcopy manuscripts with illustrations and captions.

After touching on the topic of metamorphosis in science class, the teacher took the class to the library to gather some books and to do some investigating on the topic. At this point, she demonstrated some of her own *HyperCard* stacks and told the students that they were going to create their own software program on the life stages of butterflies or frogs in cooperative learning groups. In the form of group storyboards, the students illustrated a flow chart of how the life stages of butterflies progress. This would become their main menu.

Students were then given the opportunity to use the tool palette in *HyperCard* to create this flow chart of illustrations on butterfly life stages. During whole class lecture, the teacher demonstrated how to make a transparent button over their illustrations and link these illustrations (now invisible buttons) to new cards which would be used to type in text about a particular life stage. On the new cards, students learned how to make a field to put their text of research and findings about each stage of the butterfly's life. (See Figures 1 and 2).

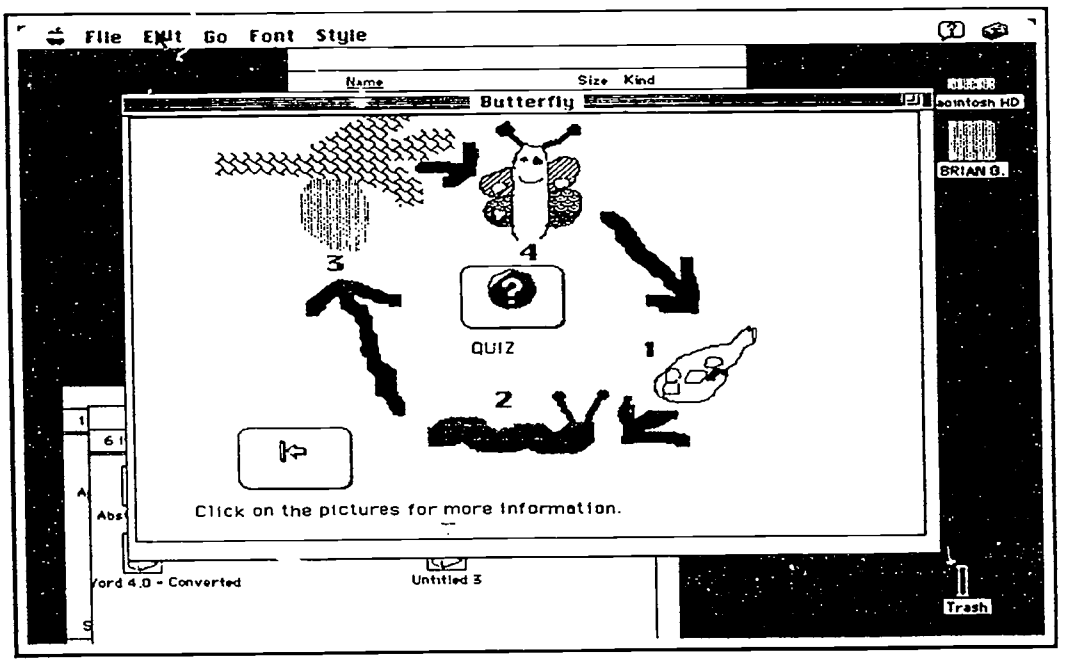

Figure 1. A main menu of the life stages of butterflies. This figure demonstrates transparent buttons over illustrations. When a user clicks on these illustrations, the computer will take them to a new card that gives information on the particular life stage chosen.

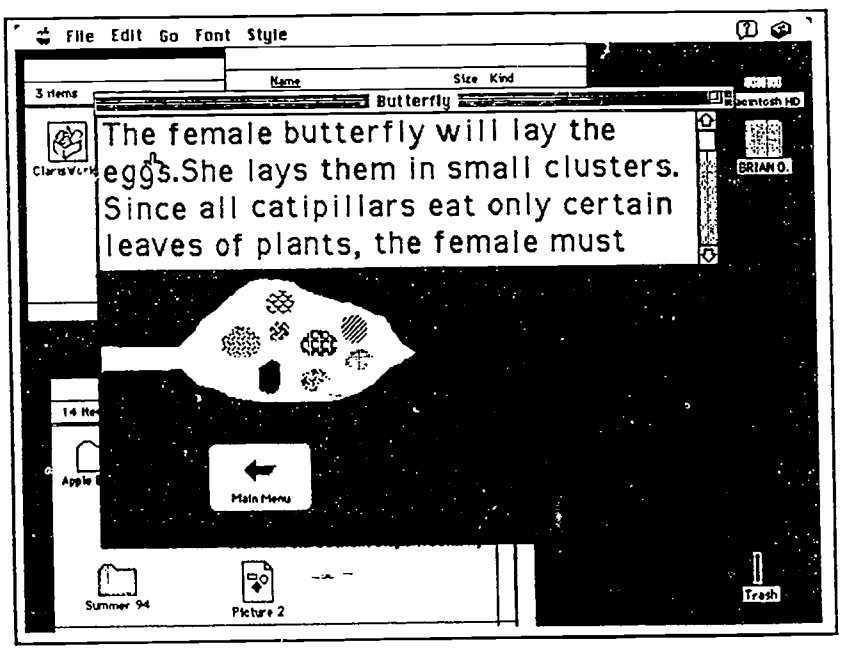

Figure 2. Information on the egg life stage of a butterfly. This is an illustration of what the computer would have done when the user clicked on the illustration of eggs from the main menu shown above in Figure 3.1. Notice the arrows on the far right of the text box. This is a scrolling field that indicates by clicking on the arrows, the user can see hidden text.

Most problems encountered at this point were not major: how to make a new card, how to get back to the main menu (linking), and forgetting to grab the browse tool to continue on to cards or to type text in a field. The students relied heavily on teacher assistance at first, but soon some students began assisting others. The scholarly Brian met these tasks with little difficulty, and he found if he shared his knowledge of how to link cards with the less academically oriented Jimmy, then Jimmy would in turn share his knowledge on how he created an artistically bizarre background for his main menu card. Lisa's responsible work habits helped Kristy to stay on task and learn organizational skills. Much collaboration took place in the form of oral communication, selecting information, typing text, and adding illustrations.

The teacher next taught the students how to use the laser disc player to conduct research about butterflies and how to use the Voyager VideoStack to add interactive video buttons to their stacks.

The teacher also instructed the students to debug their program to make sure it was free of errors. She also suggested that they construct a test for other users to take at the end of their program.

Initially the students had to rely on teacher assistance for copying and pasting video buttons and scripting the audio into their stacks. However, as soon as a couple of students mastered this skill, they began teaching others. Because there was only one instructor available to answer and help with their problems, students began to help each other debug their programs. The teacher observed Greg having difficulty with his audio response; Kevin opened up the script in his own program and showed Greg his script. Greg discovered that his dysfunctional script was missing a quotation mark. Greg repaired this flaw, and his revised script worked.

The dedication of the students to complete this project was overwhelming. Pride beamed to the highest degree during the demonstration of their programs during a PTA open house.

Whales: The Main Project

Every school year, the teacher incorporates a research project on whales as an extension of the study of mammals in science. She was prepared to let the current third graders use their newly developed hypermedia skills for this project instead of the traditional paper-and-pencil, crayons, and poster boards of previous years.

The students worked in cooperative learning groups. Although the students were identified as belonging to particular groups, they worked in a non-restricted learning environment; they were able to sit in on other groups' work sessions and were encouraged to interact with other groups for borrowing and sharing ideas.

The students used planning sheets to guide them to do research on whales. Answering the questions from the planning guide became like a trivia game.They were eager to complete the planning sheets (research), so that they could begin writing their programs (reporting). The school librarian provided the students with a large number of books on whales. Numerous small group discussions as well as large group discussions took place. While walking around to observe the groups' interaction, the teacher noticed students were combing through books and magazines to come up with information for their presentations and for the questions and answers for their quizzes on whales. If she observed the majority of groups having difficulty understanding a concept, the teacher would have the class reconvene and she would lead a discussion to bring them to a clearer understanding of the concept. Groups were encouraged to seek research advice from other groups about where they might be able to locate information. Not only were they finding interesting facts and writing about them—they were also thinking of questions they would like to see addressed in their presentations and looking for answers to these questions. After the students' research was for the most part complete, the teacher instructed each group to generate a main menu and submit it for approval before beginning to write their actual hypermedia program.

Main menus (See Figure 3) are actually outlines of how the students are going to organize their report. Higher ability and average ability students continued to be comfortable with this notion of non-linear type thinking and planning. Some higher achievers almost immediately began developing sub menus. However, lower ability students continued to struggle with this notion and tended to want to make their report like a book; going from page to page without permitting the possibility that readers might want to skip around. This is one area where cooperative learning groups really promoted thinking. The higher achievers had a positive influence on average and lower-average achievers. Stimulated by the higher ability level students, some of the lower-ability students went back to their programs and recreated their programs so that they were nonlinear with main menus. As time went on, some of the lower achievers began to develop sub menus as well.

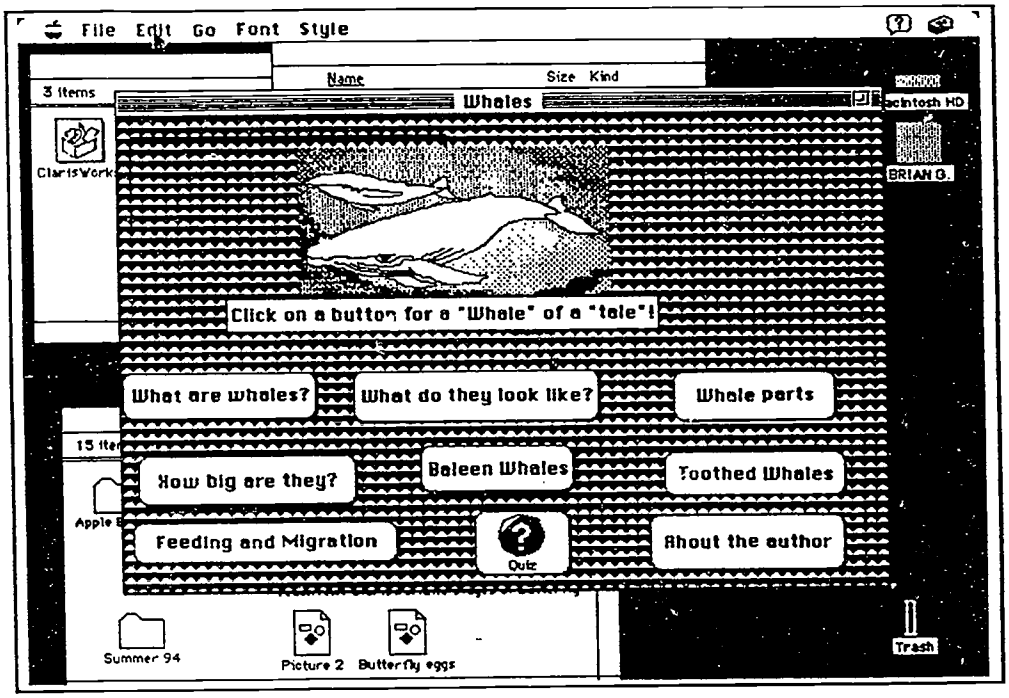

Figure 3. A main menu for a whale project. The user clicks on these buttons, and the computer takes them to the respective topic chosen and gives them a host of information. This type of organization requires the author to think non-linearly. High and average ability students are comfortable with this notion, and they help lower ability students become more comfortable with this idea.

Because these students were already exposed to cooperative learning groups in their daily class structure during other subjects, they were used to the idea of sharing responsibility. Gifted and talented students did not inhibit the performance of other students, and the GT students realized that they too could learn from other students. Adam, who is in the high average range of ability, learned how to scan color pictures from Joey, who is in the average range of ability. Erin and Lisa who have high ability levels, learned how to operate the laser video player from Kristy, who has an average ability level. On the other hand, when it came to scripting color pictures into their *HyperCard* stacks, the GT people were a big asset.

The teacher used scaffolding to promote mastery of scripting. In most cases, students would finish typing the script for their color picture and expect it to appear on the screen, and it would not. This is when they would actively seek assistance from the teacher. Each time she had to help them figure out why their picture didn't come up, or if it was following them to another card screen and appearing on that card when it was not supposed to, she gave them increasingly less help and encouraged them to try to debug the script themselves. Greg and Daven could not understand why their scanned picture of a beluga whale was not showing up on their designated card. The teacher suggested that they open the script and check the line that the computer was signaling to for debugging. This error message meant that the computer did not understand that command, and she instructed them to look for spelling mistakes, comma errors, or misplaced quotation marks. These suggestions helped them to overcome their obstacle of a missing comma, and their color picture appeared. The next time they encountered a similar problem, she asked them what they thought they should do, and they opened the script and looked for mistakes. The teacher assumed that if they ever encountered problems again (and they almost certainly did), they employ this procedure without prompting from her. Some of the GT students spontaneously took notes regarding how their finished script should look; and therefore they learned how to script without too many complications. Soon afterwards, these GT people were imitating the teacher by using scaffolding techniques to help one another. Once she saw Kristy showing someone how to make a video button, and she heard Lisa tell Kristy, "Don't do it for her. Show her how, so that she can do it by herself next time!"

When the teacher compared the students' earlier butterfly stacks with their whale stacks, she noted several interesting observations. The writing and reading, which are extensions of thinking, were much improved. Incomplete sentences and mechanical errors were almost eliminated the second time around. Part of this probably occurred because they were more

proficient at the use of *HyperCard*, and they could afford to concentrate more on the perfection of their final, published product. In addition, the teacher noticed an increased level of creativity.

Generating main menus (outlines) was much easier for the Whale project than for the Butterfly project. This probably shows an increasing awareness of the logic of organizing main ideas and the use of higher level thinking skills when ideas are being presented in a nonlinear fashion (See Figure 4).

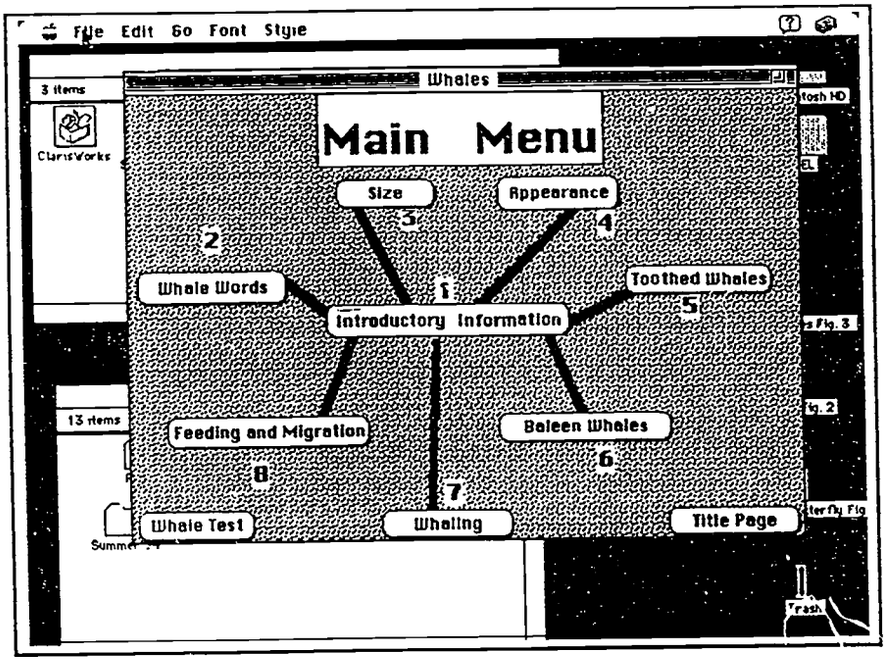

Figure 4. A main menu of a whale project (high average/average ability group). It is important to note the organization of this main menu and the fact by choosing "#2 Whale Words", "#5 Toothed Whales", "#6 Baleen Whales", and "#8 Feeding and Migration" the user is given a sub-menu of topics to choose from.

Students learned to use the laser video player effectively to step the frames in order to capture the right ones and not cut off speakers or motion in the wrong place. Full motion video provided a wealth of knowledge on the subject, and its interactive capabilities brought the students' stacks to life.

Evaluation: Comparison to Other Years

There has always been obvious motivation and excitement when the class begins an interesting, new project, such as the annual whale activity. In the past with paper-and-pencil projects, there was much excitement to begin the whale project, but the enthusiasm died toward the time to actually begin bringing the research together to write the report. This year, however, motivation and excitement were high to the very end of the whale project. Not only were the students able to generate outlines and organize materials better than in previous years, but their volume and quality of information were also much higher than in the past.

In previous years, the final product was a single, class-generated report. This year the class generated twelve different reports. Although students in the past were eager to share their newly-gained knowledge on whales, they were not as comfortable with the culminating activity of creating the report. It was difficult for earlier students to bring their project together—to generate an outline and pull their notes together in an organized manner. The teacher would take topic ideas, and the students would confirm these with their notes to generate the report. This format relied heavily on teacher direction at all times. She could not get them used to the idea of generating information on their own in a synchronized format.

In previous years the GT students did inhibit the performance of the other students. Most of the time, when problems occurred, the GT people would bail out the rest of the class. There was a tendency for the other students to let the GT students do the thinking when problems became complicated. This did not happen nearly as often this year. Because this year's

students had generated an outline in the form of a main menu, what subject to report on next was easy for any student to identify. Because they were able to think nonlinearly, these students had a preconceived plan as to where they were going to put certain information. There were no problems as to what they were going to report on next or what to report on in the paragraphs. The teacher noted student groups talking about what information should be on certain cards and what shouldn't go on particular cards, because they had already created a button in the outline to link the information to a new card.

The teacher's own awareness of individual performance was far more personalized because she was able to spend more contact time with individual students and cooperative learning groups.

Follow-Up

The excitement of reading, writing, and thinking was still paramount to these students several months later. Before the teacher mentioned any thoughts of a new project, the scholarly Brian came up to her and told her the subject of his next *HyperCard* project. She had shared with her students an example of an electronic storybook made with *HyperCard* that incorporated imported colored pictures from a paint program, audio segments that illustrated the meaning of certain highlighted words, and some color animated scenes. The next day Joey, Greg, and Erin had manuscripts they wanted the teacher to preview so they could start their next project. The day after that, Lisa and Daven had manuscripts to read also.

Students clearly became communicators through this design process. Hypermedia with its non-linear capabilities and ability to utilize a variety of formats (for example, text, animation, still and motion video, and sound) enabled these students to employ higher level thinking skills. This technology received outstanding student acceptance, increased student attention span, increased the rate of learning for students, made organizing materials an easier task, and promoted longer retention of the subject matter. The teacher saw carryover into other subject areas and topics: writing books, science fair projects, designing new programs, etc. These hypermedia literate students need less direction with each new project they begin.

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