Fading Footprints

Key Developer

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Snapshot

Ecology through the eyes of eighty-five middle schoolers. That's the result of this schoolwide unit of study that focuses on major ecology concepts such as life cycle, classification, habitats, and human impact, including a study of endangered and threatened species in Maine. Student reports are collected in a multimedia CD-ROM highlighted by original works of art, video and text with hyperlinks included to connect discrete knowledge to broad concepts.

Fading Footprints was collaboratively designed and taught by the following teachers: Scott Comstock, Ellen Norton, Nancy Germani, Kirsten Platt, Kelley McDaniels, Ann Marie Wolfe, Bill Lundgren, Bob Kamman, and David Grant.

Profile

As the Gifted/Talented teacher in Portland's King Middle School-- a school that neither labels students as gifted nor provides exclusive enrichment services—I focus my energy on providing opportunities for all kids to do their best work. I collaborate with teachers and students throughout the school, developing units of study and designing authentic final learning products that integrate students' representations of curriculum into teaching and learning practices.

Through the resources provided from my classroom, students and teachers at King are given a wide variety of representational media to work with— writing and illustration; digital imagery, video, and audio production; CD-ROM technology, etc. With these tools, students create their own stories of their learning and publish their work for themselves, for their classmates, and for our community.

Unit Information

Primary Content Area: Science and Technology
Guiding Principle 1: An integrative and informed thinker.
Guiding Principle 2: A clear and effective communicator.
Grades Used: Grade 7
Grades Suitable: Grades 6-9
Target Audience: Maine Audubon Society; Children's Museum of Portland

Maine Learning Results Alignment

Content Area 1

Grade Level: Middle Grades 5-8

Content Area: Science and Technology

Content Standard: B. ECOLOGY

Students will understand how living things depend on one another and on non-living aspects of the environment. Students will be able to:

2. Analyze how the finite resources in an ecosystem limit the types and populations of organisms within it.

4. Generate examples of the variety of ways that organisms interact
(e.g., competition, predator/prey, parasitism/mutualism).

Goals

Fading Footprints was a twelve-week interdisciplinary ecology unit centered around the guiding question: How does diversity strengthen an ecosystem?

Over the course of the unit, students acquired knowledge of the broad concepts of ecology in relation to specific animal populations in Maine. While students pursued their studies in science class as well as through independent research assignments, they began to represent their ideas in a wide variety of traditional media (writing in the language arts classroom, producing scientifically accurate field guide illustrations in art class, etc.) as well as in a variety of non-traditional media (digital still photography and video editing, web page construction and hyperlinked documents, etc.). At the conclusion of the unit, all eighty-five students worked together to produce a single CD-ROM product which accurately represented their comprehension of the entire ecology curriculum.

Fading Footprint, the CD-ROM, is rich in scientifically correct species illustrations, broad concept pages which accurately depict the major vocabulary and themes of ecology and Maine ecology, eighty-five separate species pages (one per student) which provide scientific data on the species' populations in Maine and analysis of population change, as well as original video of a Maine threatened species. All of the work was similarly formatted, logically hyperlinked, collected within an intentionally constructed CD-ROM 'environment,' and assembled by students with the supervision of their teachers.

An interdisciplinary unit of this size and depth is obviously the work of more than one teacher. In fact, seven teachers in five disciplines worked on Fading Footprints--aligning their teaching styles and the goals of their respective disciplines to the development of the Fading Footprints unit and product. Consequently, rather than offering a step-by-step formula for reproducing Fading Footprints, this packet offers a broad picture of the unit's design and discusses the benefits of using such a design, emphasizing how the integration of representational technologies and teaching practices offers new ways for students and teachers to approach and acquire core knowledge.

The process of receiving instruction, conducting independent research, and applying the research as it related to individually assigned Maine species through the production of the CDROM provided every student with the means to acquire knowledge and demonstrate comprehension of the Maine Learning Standards for Ecology listed above. These standards are specifically represented in the packet resource "CD_Demo" provided at the bottom of this page.

The same process and methods can be applied with equal effectiveness around any area of study that conforms to the following criteria: 1) that the unit of study is based upon broad, system-wide concepts; 2) that the broad concepts can be applied to a number of specific examples equal to the number of students participating in the unit; 3) that the resources required for each student to pursue research around each of the specific examples are available and developmentally appropriate; 4) and that that the broad concepts and specific examples provide rich opportunities for students to represent knowledge in a variety of media.

Based upon the criteria above, in addition to Fading Footprints students at King have created similar CD products about ocean life, bacteria, and political and geographical studies of continents.

Assessment

The Fading Footprints unit included content from five disciplines as well as information technology content. Assessment for the content in each of these areas was conducted throughout the twelve week period of the unit using both formative and summative assessment tools developed by the teachers in their respective fields. Because this unit covered many disciplines over an extended period of time, and recognizing that all teachers assess differently and bring different values and pedagogy to the assessment process, the examples of assessment pieces included in the packet are not conclusive.

For portions of student work appearing in the final product on the CD-ROM--which served as the summative assessment piece for the unit--product descriptors were created and distributed to students, offering discrete breakdowns of the knowledge being assessed and the point values for each discrete chunk. The major portion of students' grades were based upon the scores they received for the CD-ROM contributions according to these rubrics. These product descriptors are included among the assessment resources of this packet.

An important aspect of the assessment for the Fading Footprints unit, as well as for similar units conducted at King using this model, is that the design of the assessment encourages students to use the entire duration of the unit to demonstrate mastery of as much knowledge as possible. Each student was assessed on the core content of the unit through her or his required species pages. Full credit for these pages allowed students to earn 95 points--an A, not an A+. One could only acquire extra points toward a high A by creating additional pages for the CD, which we called "Concept Pages," that demonstrated knowledge of the broad concepts of ecology. This process is clearly explained in the included assessment resource "Concept Page Explained" which is found in the resource called "Expectations."

Content

As an interdisciplinary unit, the content for Fading Footprints varied form subject area to subject area. Through the production of species illustrations in art class, for example, students met several of the broadly defined results in the Visual and Performing Arts section of the Maine Learning Results (See "ArtComponent" in the Packet Resources). In math class, students analyzed the relative shape and size of their species' body parts and compared them to their own bodies. They then created portraits of themselves as their species—with their body parts in direct proportion to those of their animals, meeting criteria established in the geometry and measurement sections of the Maine Learning Results for math (See "MathComponent" in the Packet Resources). Similarly, Learning Results related to social studies and language arts were covered in their respective areas of the unit.

The primary learning focus for Fading Footprints was in life science. The Learning Results covered in this area included but were not limited to: understanding the life cycle, behavior and structure of various organisms; demonstrating knowledge of the classification of living things; understanding the impact of resources on populations of species; understanding how natural and artificial selection affects species over time.

Decisions concerning the content and timing of the unit were made in consideration of students prior knowledge and the availability of resources. Seventh grade students at King receive art classes for only one semester during the year. Consequently, the unit was timed to coincide with the art schedule. Regarding the technology required to produce the final product, all students had received a year of computer class in sixth grade. During that time, students were given instruction on Microsoft Word. Consequently, Word's web authoring utility was selected as the primary application for building the CD as we felt it would pose the fewest technical challenges for the students. In science class, all students had been introduced earlier in the year to major themes of life science through studies of cells and how cells function in more complex multi-cellular systems. Students were then able to transfer their knowledge of living organisms as part of systems into the study ecology.

Finally, students at King are well versed in the quality production expectations that teachers have for interdisciplinary units. All students at the school engage annually in two to three long-term interdisciplinary units, which we call Learning Expeditions. At the conclusion of these units, all students are required to demonstrate their learning through the development of products that represent their very best work. By the time these seventh grade students had begun Fading Footprints, they were practiced in the design and expectations of the model. The value of establishing such standards as well as cognition of the learning model among students cannot be overstated.

Strategies

A variety of instructional activities and strategies were used in Fading Footprints including: direct instruction, cooperative learning, professional and student presentations, class trips, etc. The instructional strategy that I will focus on in this portion of the packet is representing-to-learn.

A great deal of educational research focuses on the effectiveness of representing-to-learn, exploring how content comprehension and retention are connected to students' representations of curriculum. This research indicates that students best master

curriculum which they are required to represent, whether their representations take the form of writing, performing, documenting, illustrating, etc. In addition, the research indicates that the representational process should not be used simply for assessment of learning (as has been the case traditionally), but rather as a core vehicle for acquiring knowledge and skills. (See Structures for Best Practices, by Zimelman, Daniels and Hyde [Heinemann Press; 1998].) Furthermore, as we acknowledge from Howard Gardner's studies on multiple intelligences, a student's depth of learning is increased by his or her access to--and both literacy and facility with--multiple forms of representational media.

Accordingly, we have made representing-to-learn a core teaching strategy at King. Through the development of multi-media resources as well as strategies for integrating these resources into teaching and learning practices, all students and teachers have access to a wide variety of tools to work with—writing and illustration; digital still photography, video and audio production, CD and other electronic publication technology, etc. All of these forms of representational media were used in the production of Fading Footprints. Of greater significance is how these resources impacted teaching and learning prior to final production. (See the next section—Steps—regarding this last point.)

Furthermore, the benefits of creating a comprehensive and useful product such as a CD-ROM that represents learning are numerous. Anybody who has made something cool with kids appreciates how important the product can be for generating and sustaining student motivation. Such a product also connects student learning to real audiences—an invaluable lesson for kids. (Fading Footprints, for example, has been presented by students to numerous local and national audiences; it is available in Portland's elementary school libraries, and was for sale at the Maine Audubon Society and the Children's Museum in Portland. In addition, all of the original artwork in the CD was displayed at the Children's Museum.) Finally, what the students ultimately constructed through the production of the CD was the text of the entire ecology curriculum in their own words, images, knowledge links, etc. It is a text they will not quickly forget because they wrote and published it—for themselves and for our community.

Steps

Fading Footprints was a twelve week unit taught from February to April 2001. It can be broken down roughly into three one month-long chunks. From the perspective of the science portion of the curriculum, the first month was dedicated to developing comprehension concerning the broad themes and vocabulary of ecology. During the second month, students conducted independent species research and produced a prototype product. In the final month of the project, students were busy representing their acquired knowledge in media that would be included on the CD. During this last phase, the CD was produced. The entire process is explained in more detail in the following narrative of the unit.

The first month of the Fading Footprints unit was dedicated to instruction on the major themes and vocabulary of ecology. The learning results introduced at this time and covered throughout the expedition included but were not limited to: understanding the life cycle, behavior, and structure of various organisms; demonstrating knowledge of the classification of living things; understanding the impact of resources on populations and species; understanding how natural and artificial selection affects species over

time. Learning activities during this time included: direct instruction, reading and research; field trips to the Maine Audubon Society, and the College of the Atlantic; presentations from guest lecturers including David Sparks of Sparks Ark, and Mark McCollough from the Department of Wildlife and Inland Fisheries. All students received formative assessment during this time through journal checks, quizzes and tests, as well as interviews with teachers.

During the early phases of this three-month unit, our work as teachers was guided by our knowledge of the final product. We knew that the CD-ROM would incorporate all of the students work into one product. We knew that we had a virtually unlimited canvass for the students to work on: the product could (and does) incorporate beautiful color images made by students; video and audio recorded and edited by students; as well as unlimited pages of text. We were also excited by the possibilities of having students demonstrate the relationships among broad ecological concepts and discrete species through hyperlinks. Finally, we felt that the CD-ROM offered a way to create a useful and desirable product. Early on, we determined that the CD-ROM would be an interactive field guide to Maine's endangered species. Consequently, we had a lot of interest from our community partners— the Department of Wildlife and Inland Fisheries; Spark's Ark; Audubon Society of Maine, and the Children's Museum of Portland.

By March, students were each assigned a species which—due to population concerns—has been monitored in the state. Students began scientifically accurate watercolor illustrations in art classes of their animals, and began to use the school's electronic and bound research resources to collect information on their animals. As students collected their information, they also analyzed professionally published field guides and determined the categories that they thought would be essential to include in their individual species research products—which we called species pages. Throughout the month of March students conferenced with teachers, received regular research check-ins, and produced drafts of their species pages for teacher and peer reviews according to teacher and student designed product descriptors.

During the month of March, while the research described above was being conducted, we developed a model of the CD-ROM product. We built the model using Microsoft Word's web authoring utility which, because it is so similar to regular Word documents, we felt would pose few technological challenges to the class. We established a common folder in the school district's network for collecting and organizing all students' work, created templates and criteria for fonts, hyperlinks, images, as well as designed an overall schematic for the CD. The model was presented to the entire class during the month of March—as well as criteria for contributing extra work and using additional media in the CD-ROM. Once presented with a working model, the students (and the teachers) began to fully grasp what they were creating. We all began to feel quite excited.

By the end of March and beginning of April, some students were completing work on their species pages while most of their classmates required additional time to complete illustrations, research and writing. Students who finished ahead of their classmates began the work of constructing additional pages—which we called concept pages—that clearly explained the broad concepts related to ecology and consequently to the species catalogued on the CD. By the third week in April, all species pages were due and students presented their concept pages using computer projection technology in science classes to their classmates for peer editing. All eighty-five students reviewed each of

the more than 25 concept pages produced by their peers, and subsequently selected no fewer than five concept pages that they wanted to create links to from their individual species pages. In the last weeks of April, a team of 12 students applied for positions as the CD-ROM team and produced a master CD which was duplicated, labeled and packaged by students throughout the first week of May.

The period described in the preceding paragraph demonstrates most clearly how the integration of technology with effective instructional strategies can enhance learning. All students were completing their species watercolors in art class and much of the work was beautiful. For students who produced wonderful artwork but struggled with writing, the incorporation of visual work in their product was invigorating. Furthermore, the creation of a multi-tiered final product—one in which all students were required to produce species pages as well as given the option to produce additional concept pages—created opportunities for all students to do their best work. Students who struggled to complete species pages were given extra assistance by special education and regular classroom teachers. Students who could do more were encouraged to do so. In fact, the only way for students to earn an A+ for the final product was to produce a concept page. When one views the final product, however, all of the work looks roughly equivalent on the surface; the extra work, though immediately accessible through hyperlinks, lies beneath the surface and does not detract from the appearance of anyone else's work.

The process whereby some students produced concept pages not only increased the learning for those students; by design, it gave all students an opportunity to have their knowledge of these concepts reinforced. Everyone had been tested on the major ecology concepts by this point in the unit. Nevertheless, all students received additional instruction on these concepts as designed and delivered by their classmates through the presentation of the concept pages. In addition, because all students had to establish links to the concept pages, they had a vested interest in the quality, clarity, and accuracy of the concept pages, which they took very seriously.

Finally, any student with enthusiasm for technology was not disappointed. In addition to MS Word, the following applications were used in creating media for the CD-ROM and publishing the CD: Adobe Photodeluxe; Avid Cinema; QuickTime Pro; CD Creator: Toast; and Dreamweaver. With the exception of Word, some CD application, and Photodeluxe (which was used to adjust image scans) the other software is all optional in producing CD-ROMS. The final product is not software dependent, however. It can be viewed using any web browser on PC's or Macs. All of the images on the CD are printable.

All students received a copy of the CD at our culminating event at the Children's Museum of Portland. For those who did not have CD-ROM compatible computers, color paper copies were provided in addition to the CD. Fading Footprints is currently available in most of Portland's elementary school libraries, was for sale at the Children's Museum of Portland Maine (where the original artwork for the CD was also displayed over the summer) as well as at the Maine Audubon Society. The CD-ROM itself served as the major summative assessment piece for the entire unit. And why shouldn't it? What more accurate representation of their learning could the students have produced?

Modifications

Fading Footprints was designed to be appropriate for all students in a team of 85 seventh graders. In this respect, the unit had several options for differentiating learning for students of all ability levels, including opportunities for students with a variety of learning styles to feel successful.

Much of this is due to the nature of CD-ROMS and computer based projects. As has been noted in the unit narrative, students were given a wide range of tools with which to work in a broad field of disciplines, better enabling all students to stay engaged in the project, and consequently the learning. For students who produced wonderful artwork but struggled with the writing, for example, the incorporation of visual work in the final product was invigorating. In addition to still images, students were able to work with video and audio as well. Again, all of these media found a place in the final product.

The system whereby all students were accountable for producing a species page and, once that page was completed to standards, offered opportunities to earn more points by producing concept pages, allowed students who were able to do more in the time provided for the unit to demonstrate further areas of knowledge. Consequently, all students had opportunities to do their best work. As I stated in the narrative, though, when one views the final product all of the work looks roughly equivalent on the surface; the extra work, while immediately accessible through hyperlinks, lies beneath the surface and does not detract from the appearance of anyone else's work.

Other modifications were made for students with I.E.P.'s. Several students, for example, received direct adult assistance in researching and producing the species page according the criteria determined in their I.E.P.'s. Once again, the final product form allowed for the inclusion of all work.

Integration

The Fading Footprints unit and CD evolved out of a whole series of interdisciplinary Learning Expeditions at King Middle School. When I arrived at King five years ago, a team of eighty-five seventh graders had already produced a beautiful field guide to life in tidal pools of the Casco Bay that was bound and published. In fact, several of the teachers who worked on the Casco Bay unit and book were collaborating teachers for the Fading Footprints unit.

By trading in paper for plastic, we intended to do more than simply change a learning products packaging. The integration of multi-media technology with existing excellent practice opened up new ways to reach kids—through accessing broader categories of intelligences and learning styles; through providing integrated approaches to differentiated learning; through introducing students to skills and applications in electronic publication; through providing every student with a full color original “text” of the ecology unit that they themselves had authored--in a medium that they were used to paying for at the mall.

Another advantage that CDs offered to our school was their affordability. Producing comparable color books costs ten times as much as CD-ROMs—which, when including color packaging designed by students, makes the unit cost for CDs about one dollar.

Materials

Coordinating large student projects around technology resources poses two broad categories of challenges. The first is access. Our schoolwide computer resources are in high demand. Consequently, we have developed strategies for anticipating and communicating changing technology needs and coordinating access to resources in our school.

The second category of challenges is learning what to use and how to use it. For creating a CD-ROM like Fading Footprints, several kinds of applications and a couple of pieces of hardware are essential if you want to produce an appropriately sophisticated product that can be viewed on any relatively current computer—Mac or PC. These include:

A web authoring application such as Dream Weaver, Page Maker, or MSWord (if you want to keep things very familiar as we did)—or a program such as Adobe Acrobat that works with a free reader that you can include on your CD: When making CDs, it is essential to collect all the files and folders of media into one master folder on one computer before linking them all together through indexes or other structural elements. This prevents document links from being interrupted when transferring to CD.

A CD burner with included software: These are relatively cheap, about $150.00, and usually come with the required software. Some things to keep in mind about CDs that are intended to be readable on both Apples and PCs: there are some naming and formatting issues. All file and folder names on CDs should be written with MS DOS names—eight or fewer letters or numbers in the name with no spaces or other characters permitted except for the underscore character (_). The CD should be formatted using the ISSO 9660 format. Otherwise it will only be readable on either Macs or PCs depending on which was used to make it.

Scanners and photo editing software: We use Adobe Photodeluxe for most of our photo editing needs. It is simple enough for kids to become adequate users in a few lessons and it is also a great introduction to more sophisticated editors like Photoshop.
A digital camera: A camera is optional as long as student produced artwork can fit on a scanning bed. We've had good luck with Sony Mavica cameras as many models shoot on floppy disks making picture downloading easier.

Video software and hardware: The rule of thumb here is keep it simple. On the PC side, consider consumer products made by Pinnacle Systems, or Sony's MovieShaker. On the Mac side use iMovie. As you prepare videos for CD you will notice that most of the software allows users to export video to file types for different media including CD-ROM. For those with iMovie, the default CD format is actually not a very good choice. By choosing the EXPERT option, users can select alternative formats. The two I recommend are Cinepak (320x240; millions of colors; 15 frames per second) if you anticipate that people may view your product on older computers, and Sorenson (320x240; millions of colors; 15 frames per second) if the product will be viewed on computers running the latest versions of QuickTime. If you might want to hang your CD on the web, use the iMovie web default setting which creates a small video frame but has excellent clarity.

Audio software and hardware: To record voice and prerecorded music for your CD,

consider using the audio functions of your video software and then exporting the video as a sound file: AIFF on Macs or Wave on PCs. It may be necessary to export the video to a QuickTime format (.mov) first and then to use an application like QuickTime Pro to re-export it as a sound file. The new sound file can be set to play as a link or at the opening of pages on your CD.

Curriculum materials used in Fading Footprints came from a variety of sources.

The text for much of the science curriculum was "Life Science," published by Harcourt Brace Jovanovich, 1989.

Information about the Endangered Species Act, pollution, habitat management and restoration, etc. was provided by the U.S. Fish and Wildlife Service at the Department of the Interior.

Current information on Maine species populations was provided by the Maine Department of Inland Fisheries and Wildlife through a variety of their publications and their electronic data bases. Their email address is www.state.me.us/ifw/.

Students who studied marine mammals found excellent resources through the Allied Whale program at the College of the Atlantic in Bar Harbor. They also hosted us for a class trip. They can be reached at www.coa.edu/alliedwhale/.

An excellent resource to be aware of, though perhaps difficult to locate in the future, is the exhibit "Plants and Animals in Peril: Maine's Endangered Species"--a collaborative project of the George B. Dorr Museum of Natural History at the College of the Atlantic; the Maine Department of Inland Fisheries and Wildlife; and Acadia National Park. This exhibit is featured at the Bethel Historical Society this winter and spring 2002. For more information contact www.bethelhistorical.org/exhibits.html.

Finally, consider a strategy for reproducing your CDs. Before we purchased a CD duplication machine, we had a lot of elves working in the back of our classrooms using CD burners that produced one disk at a time. To make 125 CDs in this manner takes the elves about a week.

Bibliography

Books

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Title of Book	Multiple intelligences: the theory in practice
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