

Exploring Life NABT 2000 Workshop Report

December 1, 2000

Methodology:

11 participants attended the Exploring Life NABT 2000 workshop in Orlando, Florida on October 26, 2000. Prior to the evaluation workshop, participants received the following items:

1. Exploring Life Prospectus
2. The Working Cell Chapter
3. Exploring Life Web Site Walkthrough Guide
4. Tips for Using Exploring Life WebQuests

Prior to the evaluation workshop, each participant was instructed to read through the chapter and each of the above listed handouts. Each participant was instructed to review the CalorieQuest, the two Laboratories, and the Explore It! activity on the Web site before the workshop.

During the workshop, participants were briefly introduced to Exploring Life and spent 1.25 hours reviewing the Web-based interactivities. An updated color print copy of the text chapter was provided to each participant. Participants were told to ignore the interface on the Web site and to focus on the biology content. Prior to reviewing the materials, participants were read the following questions to guide their evaluation:

1. Do the materials address the important goals of biological science teaching and learning?
2. Are inquiry and activity the basis of the learning experiences?
3. Are the topics of the unit and the modes of instruction developmentally appropriate?

Two new navigation schemes (Traylor Media and Redhill Studios) for Exploring Life were presented to the participants. Participants were instructed to divide a blank piece of paper down the middle. On the left side of the paper, participants were instructed to write down what they liked about the design and on the right hand side what they didn't like about the design or found confusing about it.

Participant observations were collected by the program evaluators as the teachers interacted with each Exploring Life chapter component.

Participants completed a survey (Appendix A) designed to address the main formative evaluation questions stated in the NSF grant proposal. A focus group was then conducted. A complete list of the focus group questions is listed in Appendix B.

Preliminary findings:

Meeting Important Goals of Biological Science Teaching and Learning:

Each participant in the NABT 2000 evaluation group stated that the Exploring Life chapter 4 materials do address the important goals of biological science teaching and learning. Specific examples that were mentioned in the survey and focus group include:

- The materials seem to align with the National Science Education Standards.
- Exploring Life combines relevant content, conceptual material, and the process of science in an effective package.
- The materials explain the concepts and provide hands on examples for the students to learn their information.
- The concepts are general as opposed to lists of specific facts.
- The material includes real world applications.
- Emphasis is on concepts and the big picture rather than memorization of details.
- Exploring Life exposes students to the everyday relevance of biology.
- The basic concepts are presented and organized for students to build in a conceptual manner rather than by rote memorization.

- The concepts presented in chapter 4 are aligned to CT state standards. The CT standards want students to understand: that all energy starts with the sun; that animals (including human) get their energy from eating; that plants photosynthesize and respire while animals only respire; and that what you eat affects your energy.

Exploring Life as Inquiry-Based Activities:

Each participant stated at least one Exploring Life activity on the survey that they would characterize as "inquiry-based". These responses included:

- Investigating Cellular Respiration with Wisconsin FastPlant® Seeds laboratory (n=10)
- Investigating Chemical Energy Stored in Food laboratory (n=8)
- Explore It! Aerobic Exercise & the Effect of Dietary Supplements activity (n=4)
- The CalorieQuest (n=2)
- Snowboarding activity section 4.4 (n=2)
- Cellular Respiration pinball animation (n=1)

Specific comments pertaining how these activity were inquiry-based included:

- The labs begin as cookbook, but seem to be laying the foundation for exploring on your own- which is very important.
- The FastPlants lab where students formulate their own questions and then design experiment.
- The lab that allows students to vary variables.
- The "snowboarding" graphic gives students control and better understanding of energy flow.

One participant commented that "more user directed manipulation is necessary. I would like to see more options for students' choice on things to do or use."

It was recommended that the Web-based interactivities could become more inquiry-based by:

- Providing students with guiding questions before they interact with the Web-based interactivities, and
- Having students formulate predictions before they interact with the Web-based interactivities.

During the focus group, participants were provided with the following definition of inquiry:

"Students formulate questions and devise ways to answer them, they collect data and decide how to represent it, they organize data to generate knowledge, and they test the reliability of the knowledge they have generated. As they proceed, students explain and justify their work to themselves and to one another, learn to cope with problems such as the limitations of equipment, and react to challenges posed by the teacher and by classmates. Students assess the efficacy of their efforts--they evaluate the data they have collected, re-examining or collecting more if necessary, and making statements about the generalizability of their findings. They plan and make presentations to the rest of the class about their work and accept and react to the constructive criticism of others."

When asked "which activities describe that process?" the participants responded with the following replies:

- "The respirometer lab"
- "The lab with the peanuts: having students create their procedure"
- " Caloriequest. Draws attention to foods."
- " Snowboarding. They are doing an experiment to manipulate something. It could be made into a testable question. Direct them to inquiry."

Exploring Life as Active Learning:

Many participants (n=7) stated that most Exploring Life activities involved active learning. The Investigating Cellular Respiration with Wisconsin FastPlant® Seeds laboratory and the Investigating Chemical Energy Stored in Food laboratory was perceived by all participants to involve active learning. The CalorieQuest, Explore It!, lab animations that allowed students to click and drag, sunlight powers life activity, electrons falling activity, the snowboarder interactivity, and a molecule called ATP were specifically mentioned as an activity that involved active learning in the survey responses.

Specific comments included:

- The animations were all active learning. They involve student participation to run. They seem to reinforce the concepts from the book.
- Most of the activities provide an aspect of active learning. However, they are still fairly traditional in the presentation of the materials.
- Active learning is found in the Calorie Webquest as well as the instructional modules that include graphics requiring a click to move forward.
- The active learning proceeds and sets up student based inquiry.

Exploring Life's Use of Animations:

The animations were viewed as a major strength of Exploring Life. The participants felt that the animations would help students understand the content presented in the chapter and also with learning the concepts presented in the laboratory. Most participants (n=9) stated that the animations did help them to understand the laboratory procedure.

Assessments:

The participants recommended providing a variety of different kinds of assessments with Exploring Life. These include:

- Traditional tests and quizzes (n=5)
- Poster presentations (n=3)
- Performance-based assessments/student-initiated projects (n=3)
- Open-ended essay questions (n=3)
- Rubrics (n=2)
- Laboratory practicals (n=2)
- Student-created multimedia presentations (n=2)
- Model building (n=1)
- Concept mapping (n=1)
- Laboratory reports (n=1)
- Portfolios (n=1)

Using Activities With Regular Level Students:

Most participants (n=9) stated they could use most of the activities with their regular level biology students. Four participants stated they would not go into the specific details of the individual steps of cellular respiration presented in the chapter with their students.

Two participants stated they would not use the Exploring Life activities with their regular level students. These participants specifically stated:

- “Currently, I do not feel the complete picture is presented for most concepts. Some portions are too easy and others i.e. cellular respiration are difficult in the method or manner in which it is presented → let us see the whole picture.”
- “I would like to see some modification that would be presented in optimal form for diverse student populations.”

New Website navigation schemes:

Red Hills Studios navigation scheme was preferred over the Traylor Media navigation scheme by all but one participant. Red Hill Studios' navigation scheme appeared more user friendly, was more visually appealing and logically arranged, had a better overall organization, was more intuitive to navigate, illustrated the layout of the chapter graphically, and was colorful and inviting.

Participants liked the following features of the Red Hills Studios navigation scheme:

- The pop-up menu on the main chapter page that presented in the concept in more detail.
- Having multiple options to navigate within the different areas of Exploring Life.
- Search tool feature.
- Ask the experts link.
- The graphical chapter navigation scheme in the left column .
- An attractive home page that allows users to see all units displayed.
- The ability to graphically see the entire chapter as an organized structure.
- The branches on the chapter's main page that allows the user know which activity goes with each concept.
- The Exploring Life icon that allows users to always return to the home page.
- The ability to see graphically where the user is located within the chapter at any given time.

Participants disliked the following features of the Red Hills Studios navigation scheme:

- The text font was too small.
- The chapter 4 main page was too cluttered and felt it would be difficult for students to work with.

Additional Positive Comments about Exploring Life:

The following comments emerged from the participant observations and the focus group...

- The Investigating Chemical Energy Stored in Food laboratory Web pages would encourage beginning teachers to do the lab.
- Nine of eleven participants stated that the text reading level was appropriate for their regular level biology students. Furthermore, most participants agreed that the terminology and readability of Exploring Life is better than their current textbook.
- One participant commented that Exploring Life would be appropriate for ESL students to use.
- Most participants agreed that the use of the Web helps students to understand the content.
- All participants wish to keep the size of the textbook small.
- Many participants commented in the focus group that their textbook is limiting and they constantly search the Internet for animations and graphics to help students understand biological science content knowledge.
- Most participants stated that the text does not invite students to go online. This will be a decision that the individual classroom teacher makes. One participant stated that “once they [students] go through this [Exploring Life] the first time, I think they will want to go and do the online interactivities.”
- Most participants in the focus group expressed that there is enough variety to adjust the Exploring Life activities to meet the needs of their particular classroom.
- 9 out of 11 participants stated their students can listen to sound on their computers.
- Exploring Life addresses the state and local standards by being conceptual in nature.

- Participants stated that some of the best things about Exploring Life are:
 - It's fun.
 - It's interactive.
 - Allows you to go out to the Web.
 - Animations are captivating.
 - Makes student interested.
 - The labs are easy to follow for teachers and students.

- Participants view the worst things about Exploring Life to be:
 - Internet access.
 - Availability of computers.
 - Potential expense.
 - Having to rely on a system administrator in the school.
 - The digital divide. Inequitable access for all students.

- The participants stated they would use Exploring Life in a variety of different ways in their classrooms. These include:
 - In a computer lab/one student with one computer (n=4).
 - In pairs on a computer (n=2).
 - Add additional activities to it that I normally use (n=4).
 - Pick and choose materials to use (n=5).
 - Small group work in the classroom (n=1).

- All participants agreed in the focus group that EL would be better for beginning teachers than their current biology curriculum. Furthermore, it was noted that they would be comfortable with substitute teacher using the curriculum during their absence from the classroom.

- It was noted that the color copies made a large impression on the participating teachers as they opened them.

- Participants expressed a need for more graphing and more math option to be used with the curriculum.

- Participants liked being provided the fundamentals and instructions for designing a further investigation (Research toolkit) in the Investigating Cellular Respiration with Wisconsin FastPlant® Seeds laboratory.

Recommendations for Exploring Life:

The participants recommended a variety of improvements for Exploring Life. These include:

- More problem solving is needed with the curriculum.
- The glycolysis → Krebs Cycle activity is fine but needs modification to better provide for diversity of learning styles.
- More diagrams need to be provided in the laboratory procedure section. Providing additional illustrations, a video clip or an animation will assist students with understanding the Investigating Cellular Respiration with Wisconsin FastPlant® Seeds laboratory procedure, especially to show how an apparatus is put together. A picture of a respirometer would be helpful in understanding the procedure.
- Provide the user control over the speed of the animations.
- Provide secure quizzes and tests on the Web site that would require a password for student access.
- Provide a printable form of assessment instrument just in case submitting answers online is not feasible.
- Provide a flexible type of rubric that will help teachers to develop their own rubrics for activities.
- The 6-carbon ring in figure 4.21 in the text looked confusing to some participants. Three participants stated that the glucose molecule should be cut in half. This would make the figure more consistent with the 6-carbon ring in figure 4.12
- Two participants stated that figure 4.9 should provide more detail. It was recommended to include pictures of muscle fibers and a “blow up” of an arm.

- 3 participants commented that the Cell Respiration animation is too fast. These participants stated that this animation would be more effective if the following sequence was used:
 1. Display text.
 2. Present a short animation sequence.
 3. Present more text.
 4. Present another sequence of animation.

- Two participants stated they would like Exploring Life to provide downloadable excel data sheets for students to use in the Investigating Cellular Respiration with Wisconsin FastPlant® Seeds laboratory. They commented that their school districts are placing much emphasis on integrating technology throughout the curriculum. Both participants are trying to teach their students how to use technology tools while they are learning science topics.

- It was recommended that Exploring Life has a printed Teacher's Guide with a suggested chapter schedule and implementation guide.

- It was suggested that Exploring Life have a "toolkit" for students to use. The curriculum could provide raw multimedia materials for students to create PowerPoint presentations and have an option for students to use concept mapping.

- Vocabulary terminology should be bolded.

- Historical perspectives and the nature of science need to be interwoven within Exploring Life.

- The ATP pinball interactivity was perceived by some participants as being too fast. It was recommended to have more user control to isolate parts of interactivity and look at each stage separately.

- Cellular components should be identified in the pinball animation.

- Provide a hypertext link to additional information and background on photosynthesis. Participants would like students to be able to obtain background information on the structure of the different plant organelles such as the chloroplast.

- The lab sheet on investigations such as the Investigating Chemical Energy Stored in Food laboratory should be available as a printed copy to allow teachers to give a quick check-off of planned procedure before students proceed with the lab
- Provide a curricular management tool to aid in teacher decisions on implementing Exploring Life components. This tool could enable teachers to create individualized pathways for students with different ability levels.
- It was suggested that student perform the “elodea/snail experiment” and over several days and use a journal activity for their observations to align with the concepts presented in section 4.1.
- Provide Web page screen images on the chapter assessment items.
- Provide a place in Exploring Life for teachers to post a customized blackboard of assignments, instructions, etc. for their students to access.
- Provide in both the student and teacher sections of Exploring Life an area where students can receive additional information or tutorials if they do not master the curricular objectives.
- Create multiple user pathways for students with different levels of ability. For example, there could be an enrichment pathway provided for upper ability students. This area could contain optional activities and not be required for all users.
- Provide journaling activities for students to relate concepts to real-life applications.

Participant Concerns about Exploring Life:

- A few participants commented that some concepts are presented in greater detail than may be appropriate for regular level students.
- Audio is not provided for the auditory learners.
- A few teachers were concerned that students can access chapter quizzes before they view the entire chapter.
- Does the quiz provide immediate feedback to the students?
- Can the students get to the test before they see the chapter?
- The phrase “electrons fall” is vague without more explanation.

Appendix A. NABT Survey questions

Which Website navigation scheme did you prefer and **why**? Please circle one choice:
Navigation A (1st one demonstrated) or Navigation B (2nd one demonstrated)

What textbook curriculum does you currently you in your biology classroom?

Do the Exploring Life materials address the important goals of biological science teaching and learning? _____
How or why not?

Which *Biology: Exploring Life* activities would you characterize as being **inquiry-based**?

Which *Biology: Exploring Life* activities involve **active learning**?

Did the animations help you understand the laboratory procedure?

What kinds of student assessments would you recommend using with the *Biology: Exploring Life* activities?

Which *Biology: Exploring Life* activities would you **not** use with regular level biology students and why? (For example... time, material too hard or too easy, etc.)

Appendix B. NABT Focus Group Questions

1. The National Science Foundation requests certain teaching standards.

Inquiry Students formulate questions and devise ways to answer them, they collect data and decide how to represent it, they organize data to generate knowledge, and they test the reliability of the knowledge they have generated. As they proceed, students explain and justify their work to themselves and to one another, learn to cope with problems such as the limitations of equipment, and react to challenges posed by the teacher and by classmates. Students assess the efficacy of their efforts--they evaluate the data they have collected, re-examining or collecting more if necessary, and making statements about the generalizability of their findings. They plan and make presentations to the rest of the class about their work and accept and react to the constructive criticism of others

Which activities describe that process?

- Give an example of an activity that is inquiry.
1. Give an example of an activity that it not inquiry.
 3. How does the Web help students understand the content?
 4. What is the difference about EL and your current textbook?
 5. Does the text invite you to go online?
 6. Is there enough variety to adjust activities to meet your particular classroom?
 7. Are the teaching styles varied?
- Would teaching with Exploring Life address your state and local standards? How?
 - What do you think is the BEST thing about Exploring Life?
 - What do you see as the WORST thing about Exploring Life?
 - How would you use Exploring Life in your classes?