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Teachers as Educational Designers

by Harold McWilliams

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Teachers as Educational Designers

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"I am convinced that the ultimate reform of science education will only occur at the level of science classrooms."

That view, clearly stated by Rodger Bybee in *Achieving Scientific Literacy* (1997), is shared by many educators who understand the critical role of teachers in implementing any curriculum or educational standard. When provided with the proper supports, teachers can change classrooms and create a robust science experience for all students. In the Earth Science by Design project at TERC, we believe that part of that support is helping teachers acquire the skills to be educational designers.

Some would argue that given everything else teachers must do, there is little time for them to design curriculum. We would contend, however, that teachers are *de facto* designers. If all classrooms and students were exactly the same, perhaps there would never be a need to adapt or modify a lesson, but we know that teachers often modify curricula to meet their students' needs. At conferences, on the Internet, and with colleagues, they look for ways to improve or augment a particular lesson or unit. Teachers do this, and we believe they can do it better if they are brought inside the design process. They should be empowered with the same theoretically based and empirically verified methods used by experienced curriculum designers.

"No longer will I just look for activities that engage students. Now I have a purpose for each activity I teach."

—ESBD Participant

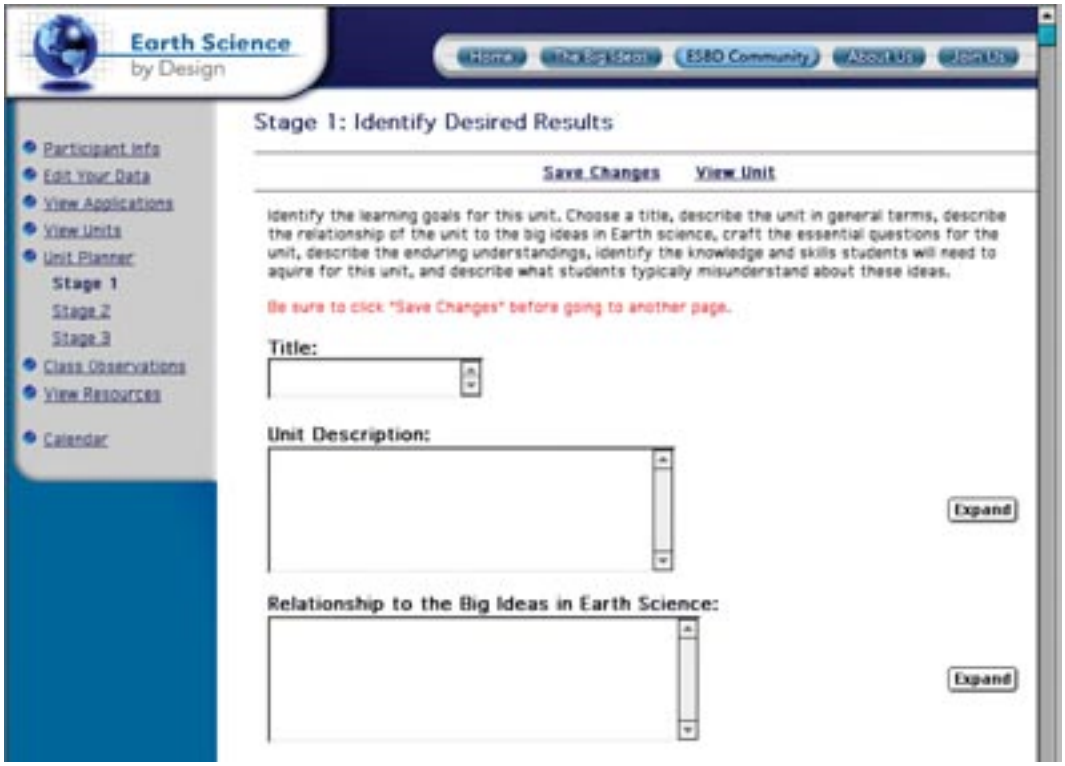
Teachers working with the online unit planner at an ESBD Summer Institute

Becoming a Designer

Earth Science by Design (ESBD) is a year-long professional development program for middle school teachers who teach Earth science. The program begins with an intensive summer institute where each participant creates a curriculum unit following the Understanding by Design (UbD) framework developed by Grant Wiggins and Jay McTighe (1998). During the year they teach the unit and reflect on their implementation experiences, sharing their reflections with colleagues and project staff online and in person.

The program aims to help teachers become critical and reflective designers of learning. Participants begin by studying the Earth system science approach to Earth science so that they have a framework to organize new knowledge. They also study the UbD approach and use an online unit planner (designed for ESBD) to guide their work. They organize their unit around big ideas that capture the enduring understandings in Earth systems science. They develop essential questions to uncover these understandings and create performance assessments that motivate students to learn and allow them

to demonstrate their understandings. To help the teachers design their units, the ESBD web site provides access to visualizations and other Earth science resources that teachers can weave into learning activities. During the institute, participants study how to identify visualizations and other resources that can help students develop skills and knowledge.



ESBD online unit planner

Using the Online Design Tool

During the first week of the summer institute, teachers are introduced to the UbD approach. They work in small groups to design a sample unit on the geological process known as the rock cycle using the planner as a guide. In the second week they work individually or in pairs to design the unit they will teach during the year.

The online unit planner (accessible over the Internet from any web browser) is a template that guides the teachers through the "backward design" process. A database stores what the teachers create. Only the author can change a unit's content, but all participants can view it. In addition to being a guide, the planner is a collaborative tool for thinking about curriculum. All participants and project staff have access to each other's units at each stage of development. We take advantage of this access to promote peer review and mentoring. Each teacher is paired with a mentor and another colleague who check in periodically to view changes and offer feedback.

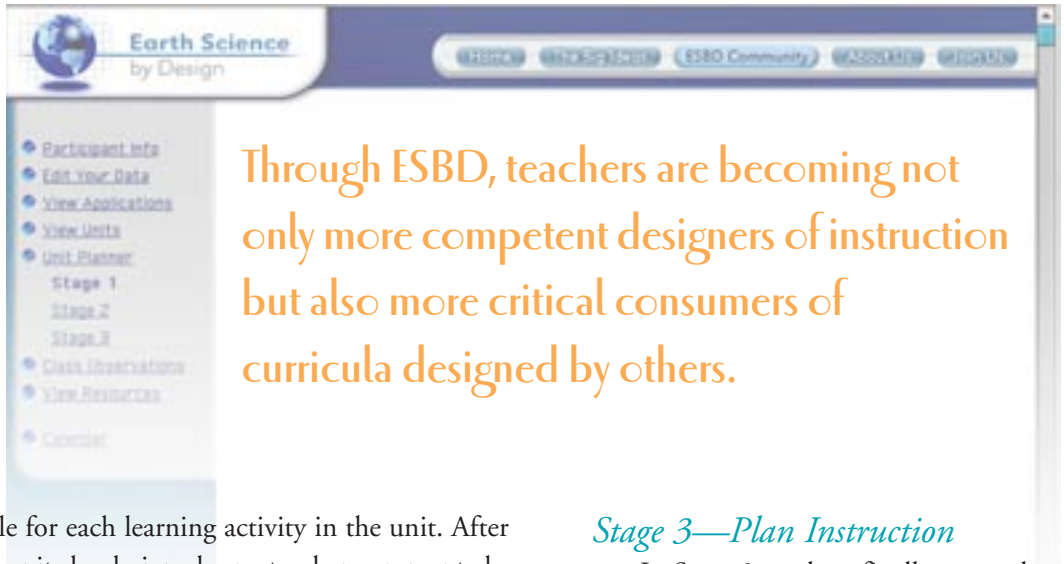
The Design Process

The unit planner lays out three stages of curriculum design, following the principles of Understanding by Design.

Stage 1–Identify Learning Goals

Stage 1 asks teachers to think hard about their goals for students. What are the enduring understandings students should learn and remember five years later? What are the essential questions that will help students arrive at these understandings? What knowledge and skills will students need in order to answer these questions? What do students typically misunderstand about these ideas?

Teachers often find this first stage to be difficult, frustrating work. They must delve into the science content in a way that allows them to determine what is essential knowledge. Their thinking cannot be superficial since they must clearly define what they want their students to understand. By establishing and recording detailed goals before thinking about activities, the teachers take the first step towards developing focused and coherent units. This process of identifying the specific skills and knowledge that students need in order to answer the essential questions helps teachers establish a



clear rationale for each learning activity in the unit. After teaching the unit she designed, one teacher commented, "Because of this program I now know how to pull out the most important components first and use the Understanding by Design method to look at the bigger picture."

Stage 2—Design Assessment

An essential part of each unit is an authentic performance assessment with a rubric for evaluating student work. Grant Wiggins is fond of saying to teachers, "Think like an assessor!" Teachers must think about how they will know when students have understood. In our project, as in UbD, teachers move from setting the learning goals to designing assessments, deferring the creation or selection of learning activities for a later stage. We emphasize that each unit needs a suite of assessments which provide ample evidence that students understand the science content. For the students, the performance assessment serves both as a motivation to acquire knowledge and skills and as an opportunity to demonstrate deep and enduring understanding. The planner guides teachers through the process of constructing an authentic performance assessment. "I am so excited to be designing an authentic assessment. It has helped me to better understand what that looks like. I have done some in the past, but this one is so much more creative and clearly linked to the big idea," wrote a participant at the end of the program.

Stage 3—Plan Instruction

In Stage 3 teachers finally get to do what they usually do first—plan the learning activities. The difference, in UbD and ESBD, is that now each activity can be evaluated in terms of how it helps build understanding because the teachers have the framework to make that assessment. They have already determined the big ideas and the essential questions, identified the required knowledge and skills, and created a suite of assessments. We find that as a result of this "backward design" process teachers see activities in a whole new light. They are suddenly critical of activities that they formerly liked. No longer do they want to include activities merely because they "work well" or "are fun" or "kids like them."

The Results

For teachers, one result of their work is an Earth science unit they can teach. (These units will also be made available on the ESBD web site in a library of exemplary teacher-developed units.) An equally important outcome, we believe, is the change in teacher thinking and behavior that occurs. Teachers report that ESBD has changed how they teach in fundamental ways. And for many, the Earth system science framework has helped them organize their understanding of Earth and space science content. Reflecting on the program, one participant wrote,

> *It changed my way of teaching and designing curriculum. No longer will I just look for activities that engage students. Now I have a purpose for each activity I teach, it relates to something else. My students can see the big picture and make connections in their learning.*

Another participant comments:

> *It is a lot of work to make a unit in this way, but at the end the unit is more focused and better thought through. I feel it has been a huge help to me because it has altered my way of thinking.*

The teachers report a greater awareness of the organizing big ideas in Earth science and a heightened concern with teaching for understanding. Most report a greater appreciation for formative and performance assessments and state that they intend to use them more.

esbd.terc.edu

Ongoing Research on the ESBD Experience

As teachers design and implement ESBD units in their classrooms, project staff are mentoring and monitoring the process. The staff are studying the variables that play a role in a teacher's professional development. Through analysis of teachers' reflection responses, their written emails, their conversations with staff, and other available data, some themes are beginning to emerge. One of these is the effect of ESBD on a teacher's content knowledge and understanding. The process of structuring Earth science curriculum materials into an ESBD unit often causes teachers to rethink and deepen their content knowledge. By learning the Earth system science approach to Earth science they are seeing how to make connections among previously unrelated parts of Earth science content and are acquiring a framework within which to organize their new knowledge, a key element that distinguishes the cognitive processes of "experts" from "novices." Teachers who enter the program with self-described "weak" Earth science content knowledge leave better able to know what new knowledge they need and where to place it in a cognitive structure.

As teachers organize their curriculum through the ESBD backwards design approach, teach to the big ideas, develop assessments to motivate and check for understanding, and use powerful visualizations to teach, change can occur in their classrooms. Both students and their teachers find that they have a roadmap to deeper understanding and also a means to demonstrate that understanding through authentic performance assessments. Through ESBD, teachers are becoming not only more competent designers of instruction but also more critical consumers of curricula designed by others. They are becoming more highly qualified teachers.

References

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