Teaching for Deep Learning

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Abstract: The authors have been engaged in research focused on students' depth of learning as well as teachers' efforts to foster deep learning. Findings from a study examining the teaching practices and student learning outcomes of sixty-four teachers in seventeen different states (Smith et al. 2005) indicated that most of the learning in these classrooms was characterized by reproduction, categorizing of information, or replication of a simple procedure. In addition to these and other findings, in this article, the authors provide a definition of surface and deep learning and describe the structure of the observed learning outcome taxonomy, which was used to evaluate depth of learning. The authors also provide implications for practitioners interested in fostering deep student learning.

Keywords: deep learning, education standards, SOLO taxonomy, surface learning

In public education and in a democratic society, few could question the spirit and intention of the moral imperative to provide all children the opportunity to learn and meet high standards. However, in recent years, our approaches to help all students meet higher standards have resulted in the establishment of a system in which we equate high standards with high test scores. At times, it seems such a system limits students' prospects for moving beyond superficial thinking (Kohn 2000). As educators, we must advocate for a focus on learning that fosters students' opportunities to reach for deeper levels of understanding. Evidence has shown that teachers can adopt a surface or deep approach to teaching, which has consequential effects on what and how students learn (Boulton-Lewis et al. 2001).

Recently, we completed a study examining the teaching practices and student learning outcomes of sixty-four teachers in seventeen states (Smith, Gordon, Colby, and Wang 2005). The sample included elementary, middle, and high school teachers. Thirty-five (55 percent) of the participants had achieved National Board Certification, and twenty-nine (45 percent) had attempted but had not achieved National Board Certification. Specifically, we designed the study to answer two research questions: (*a*) Do students taught by National Board Certified teachers produce deeper responses (to class assignments and standardized writing assessments) than students of teachers who attempted National Board Certification but were not certified? (*b*) Do National Board Certified teachers develop instruction and structure class assignments designed to produce deeper responses than teachers who attempted National Board Certification but were not certified?

The findings of our study yielded statistically significant differences between the comparison groups; however, some of the most interesting results of the study were related to teachers' efforts to elicit and obtain deep learning outcomes with their students, regardless of their National Board Certification status. We assessed teachers' instructional aims through qualitative and quantitative analyses of work samples submitted based on a unit of instruction. The findings indicated that a majority of the teachers (64 percent), regardless of certification status, aimed instruction and assignments toward surface learning outcomes. Additionally, analysis of student work samples collected in the study suggested that the student outcomes in most of the teachers' classrooms were at the surface level (78 precent). These findings suggest that most of the learning in these classrooms was characterized by reproduc-

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tion or categorizing of information or replication of a simple procedure.

In our study, we learned that our teacher participants tended to teach at surface levels; therefore, their students generated surface responses. Furthermore, we suspect that this finding is not uncommon among the general population of teachers and students. To reverse this trend, we propose that teachers need to understand, value, and foster deep approaches to learning in their students.

Defining Surface and Deep Learning

Although the distinction between surface and deep learning seems intuitive to most educators, it has also been well documented. Marton and Säljö (1976) completed the original work related to deep and surface approaches to learning. Their study examined students' approaches to a particular task. They instructed students participating in the study to read a text and told them that they would later be asked questions about it. Students adopted two differing approaches to this task. The first approach was to try to understand the big ideas in the passage; their focus was on comprehending and understanding the text. The researchers characterized students using this approach as adopting a deep approach to learning. The second approach involved an attempt to remember the facts and details from the text and a focus on what they thought they would be asked later. This group demonstrated rote learning, or a superficial, surface approach to the task.

According to Marton's framework, a surface approach involves minimum engagement with the task, typically a focus on memorization or applying procedures that do not involve reflection, and usually an intention to gain a passing grade. In contrast, a deep approach to learning involves an intention to understand and impose meaning. Here, the student focuses on relationships between various aspects of the content, formulates hypotheses or beliefs about the structure of the problem or concept, and relates more to obtaining an intrinsic interest in learning and understanding. High-quality learning outcomes are associated with deep approaches whereas low-quality outcomes are associated with surface approaches (Biggs 1987; Entwistle 2001; Marton and Säljö 1984). Teachers who are more likely to lead students to deep learning structure lessons, set tasks, and provide feedback and challenge that encourage the development of deep processing (Hattie 1998, 2002).

The SOLO Taxonomy

In our study, we used a research-based framework to assess teachers' instructional approaches and students' learning outcomes. This framework, the structure of the observed learning outcome (SOLO) taxonomy, is a promising tool that educators can use to understand and examine the depth of teaching and learning. Informed by the work of Marton (1976, 1984) and his colleagues, Biggs and Collis (1982) created the SOLO taxonomy that illustrates a continuum from surface to deep learning. The SOLO taxonomy is structured into five major hierarchical levels that reflect the quality of learning of a particular episode or task. In his most recent book, Biggs (1999) represented the SOLO taxonomy graphically, as shown in figure 1.

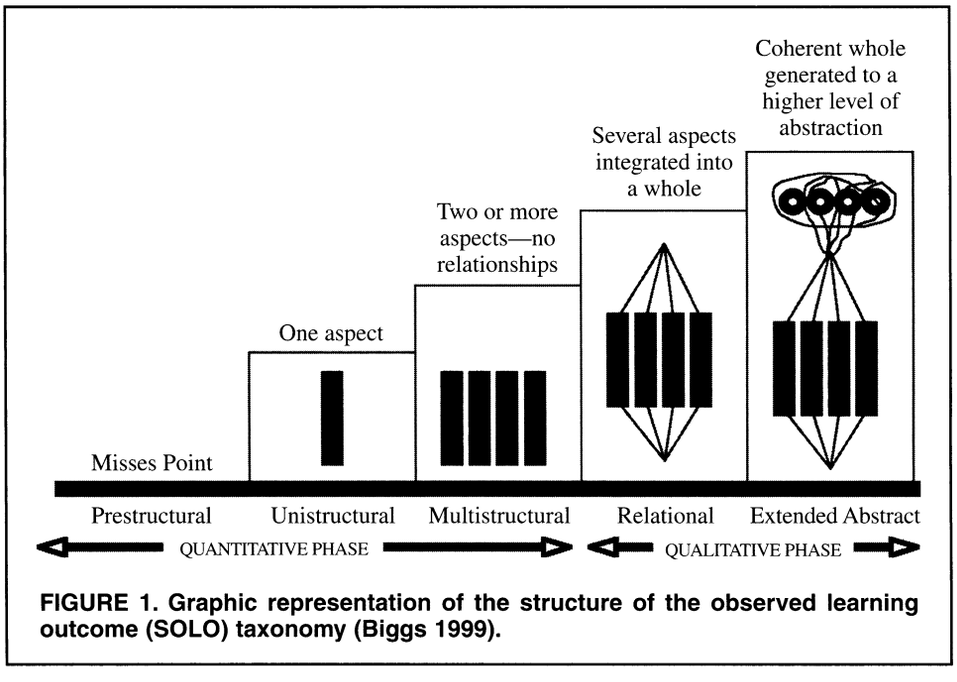

FIGURE 1. Graphic representation of the structure of the observed learning outcome (SOLO) taxonomy (Biggs 1999).

The first level, prestructural, represents a response that is irrelevant or misses the point. The next two levels, unistructural and multistructural, correspond to surface learning, and the final two (relational and extended abstract) correspond to deep learning. An advantage and unique distinction of the SOLO model is that it can be used to reliably analyze and interpret classroom lessons and assignments, and the student work produced in response to those assignments (Bond et al. 2000; Boulton-Lewis et al. 2001; Boulton-Lewis, Wilss, and Mutch 1996; Burnett 1999; Chan et al. 2002; Hattie 1998, 2002; Hattie et al. 1996).

A Call to Action: Implications for Practitioners

What prevented the teachers in our study from fostering deep learning outcomes among their students? One possibility is that these teachers had not been given the training, tools, and time to engage in practices that contribute to these outcomes. Educators must engage in intentional efforts to foster deep learning in their students. This section gives recommendations for promoting deep learning among students. We have also used a high school world history class scenario to illustrate how the SOLO taxonomy can be translated into practice.

Engage in Dialogue about Deep Learning

A critical first step in the effort to foster deep student learning is to raise and cultivate awareness regarding the characteristics of deep and surface learning. One way to accomplish this is to engage all members of the learning community in intentional, substantive, and inclusive dialogue about student learning. Some of these conversations should take place as part of formal professional development sessions focused on understanding what deep learning looks like. Other conversations, although more informal, should occur more frequently among teams of colleagues. For example, in a typical ninth grade world history course, students might be asked to analyze the causes and results of twentieth-century conflicts among nations (North Carolina standard course of study). Prior to developing this set of lessons, world history teachers might engage in collegial dialogue focused on the following questions: (*a*) What does a deep understanding of twentieth-century conflicts look like? (*b*) How will we know that students have a deep understanding of these conflicts? A deep level of learning related to this outcome might be characterized by a response that uses multiple independent details about the causes and effects of specific conflicts to support a general understanding of how conflicts have affected our nation and our world. If a student is able to construct such a sophisticated response, that student will be more able to develop and support generalizations in a different context (e.g., current global conflicts). Collegial dialogue related to deep learning outcomes is essential as teachers progress from identifying what deep learning looks like in their content area to developing activities and assessments correlated with deep learning outcomes.

In the early stages of our study, the research team found our dialogue about learning to be particularly helpful as we worked collaboratively to design a writing assessment that would elicit deep student learning. Prior to designing the writing assessment, we engaged in multiple discussions focused on the question: What is depth of knowledge of writing? As we began to formulate our thoughts, we realized how important our dialogue was to our understanding of what deep learning looks like in the area of writing. We then envisioned how helpful similar conversations would be to students engaged in the learning process. From our experiences, we discovered that students who move beyond a surface approach to learning consider any given task as a series of internal rhetorical questions: What do I know about this subject? How does this information relate to what I already know? What is the broader implication or significance of what I've learned? If students do not naturally ask these questions, their teachers must model aloud thought processes that lead to deep outcomes and support students as they are engaged in reflecting about the quality of their own learning. Our goal as teachers should be to help students ask questions of themselves as they are learning and to help them establish habits for continually using a deep approach to learning.

Examine Teaching and Learning

In addition to raising awareness and understanding about the quality of student learning through dialogue, educators must engage in purposeful, systematic examinations of their teaching and the resultant student learning. Teachers must critically examine the teaching resources they are using, the types of questions they are asking students, the assignments they are developing and requiring of students, and their methods of assessing the quality of student learning. One repeating pattern in the teachers' artifacts was that the teachers' expectations or the design of the instructional materials seemed to limit students. It was often difficult to determine students' actual depth of learning because the tasks and questions assigned to them aimed only at surface outcomes. Students rarely demonstrated a deep understanding when the tasks were not aimed at fostering deep learning outcomes.

The SOLO taxonomy is particularly helpful as a tool for examining the quality of teaching and learning. Teachers can use the SOLO taxonomy to construct and categorize questions and assignments (Hattie and

Purdie 1998) and to determine whether their instructional goals and tasks will promote deep student learning. Returning to our world history class scenario, a high school world history teacher adopting a surface approach to learning may teach about the causes and results of World War II by lecturing, assigning readings, and conducting multiple-choice tests that evaluate a student's ability to memorize, recall, and even categorize the specific causes and results previously reviewed. In contrast, a high school world history teacher adopting a deep approach to learning may require students to develop a more conceptual understanding about war. The teacher may require students to use this understanding when proposing solutions to current conflicts around the world. Using the SOLO taxonomy in content-specific instruction and assessment allows teachers to determine whether they are facilitating a surface or deep approach to learning.

The usefulness of the taxonomy was evident in our study. When we evaluated the teachers' materials, we realized that many of the resources were commercially made. We worked with our scorers to defuse the bias that often accompanies the observation of worksheet-driven instruction. We trained scorers to assess the value and intent of materials for eliciting deep student learning based on the SOLO taxonomy rubrics created for this study. Even when teachers had not created the materials, we assumed that they purposely selected them for the particular lessons. If the teaching resources were designed to elicit surface responses, usually students responded in like manner. If, however, the instructional materials were designed to foster the understanding of concepts, relationships, and other deep outcomes, students made connections among the facts and details presented to arrive at more sophisticated understandings. By examining the learning goals, resources, content, and sequence of instruction with the SOLO taxonomy in mind, teachers can ascertain if their instructional materials and approaches have potential to move students beyond surface into deep learning.

Likewise, teachers can use the SOLO taxonomy to evaluate the work and responses of students. Examining student learning is essential if we are to understand the results of our efforts to support students in achieving deep learning. Our analyses of student work should be collaborative and independent. Collaborative examinations of student work help teachers determine the concepts, principles, and generalizations they value in their respective content areas. By examining student work samples collaboratively, with others who teach the same course or content, teachers can identify student work at different levels of the continuum and analyze how and why particular work samples represent various levels. More important, what practitioners learn from this process can inform discussions about how they might help students in achieving deep learning outcomes.

Equally as important are independent examinations of student work that, conducted regularly, allow teachers to determine their own effectiveness in helping students achieve deep learning outcomes. Using the SOLO taxonomy as a framework when examining work produced by their students, teachers can begin to understand what type of learning their instructional methods are yielding and how well their students are performing. They can then use this information to support students in achieving deep learning outcomes related to specific content. Because the SOLO taxonomy represents a learning cycle, we must continually support students as we introduce new ideas. We cannot assume that because a student has reached a deep level of understanding with one idea, the student will understand other ideas at the same level. One simple method for supporting students in the attainment of deep learning outcomes is to assist them in reaching for the next level on the SOLO taxonomy. Our experiences as researchers and classroom teachers indicate that the taxonomy is so straightforward that students in upper elementary, high school, and college can understand its value for evaluating their own learning.

Rethink Classroom Assessment

One of the greatest values of the SOLO taxonomy is that it provides a framework for accomplishing a critical aim of classroom assessment: improving student understanding and performance. Wiggins (1998) suggested, "the aim of assessment is primarily to *educate and improve* student performance, not merely to *audit* it" (original emphasis, 7). Wiggins contended that when we test what is easy to test, we sacrifice our aims, our children's intellectual needs, and information regarding what we truly want to assess. Instead, we settle for score accuracy and efficiency. If we do not study how students learn and demonstrate their learning, we can never understand how to help them learn better. Similarly, Hattie and Jaeger (1998) argued for an approach to assessment that acknowledges its importance in the learning process. They contend "assessment needs to be an integral part of a model of teaching and learning if it is to change from its present status as an adjunct to 'see' if learning has occurred, to a new status of being part of the teaching and learning process" (111). The SOLO taxonomy has potential for helping practitioners assess student learning in process. It not only acknowledges the importance of facts and information, but also provides a way to think about the progression of student learning to higher levels.

For example, The SOLO taxonomy has practical benefits when used as the framework for communicating expectations and creating rubrics to evaluate student work. If the teacher of the world history course asked students to describe the relationships between the causes and effects of twentieth-century conflicts among

nations, the responses he or she might receive are likely to represent a range of complexity. If the teacher wants to evaluate students' depth of learning relative to the curriculum goal, the task must be open enough that students have flexibility in their responses. She can provide feedback to students who provided surface responses and guide them to deeper levels of learning. In this way, SOLO is used as an instructional and an evaluative tool. Table 1 provides characteristics of possible responses for each level of the SOLO taxonomy.

Our study provides evidence that although deep learning can happen, most often, it does not. Promising steps along the way to helping students achieve deep learning include (*a*) supporting teachers as they engage in dialogue about surface and deep learning, (*b*) examining teaching practices and the resultant student learning, and (*c*) rethinking classroom assessment with deep learning approaches in mind. Abigail Adams stated, "learning is not attained by chance; it must be sought for with ardor and attended to with diligence" (Howe 2003). Our research has shown that teachers' efforts to foster deep learning outcomes do make a difference. As educators, we must devote ourselves to intentional rather than happenstance efforts to teach for deep student learning.

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TABLE 1. Characteristics of Possible Student Responses Corresponding to Structure of the Observed Learning Outcome (SOLO) Levels

	SOLO level	Characteristics of possible student response	Rationale for SOLO rating
Surface	Prestructural	The student response indicates that there were many causes and effects of conflicts in the twentieth century.	The student misses the point and generates a response that merely repeats the question.
	Unistructural	The student response provides one cause and effect pair related to World War II.	The response focuses on only one aspect of the task. The student has defined the task in a limited way, focusing only on one specific twentieth-century conflict.
	Mulistructural	The student response provides multiple cause and effect pairs related to World War II.	The student has provided multiple relevant details but has not discussed the relationship among those details. The teacher knows that the student used a recall strategy to generate the response because all cause and effect pairs had been discussed in class.
Deep	Relational	The student response provides multiple cause and effect pairs related to multiple twentieth-century conflicts. Additionally, the student discusses the relationships between the causes and effects and uses examples from various conflicts as support.	The student has identified multiple relevant details and has discussed the relationship between these details.
	Extended abstract	The student response provides multiple cause and effect pairs related to multiple twentieth-century conflicts. Additionally, the student discusses the relationships between the causes and effects and uses examples from various conflicts as support. Finally, the student hypothesizes how similar cause and effect pairs might play out in specific current conflicts (or in conflicts in regions of the world not previously discussed).	The student has identified multiple relevant details, discussed the relationships among these details, and has constructed principles about conflict that he or she has used to develop hypotheses about global conflicts that might not have been explicitly studied in the twentieth-century conflicts unit.

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