The Problems With State Educational Standards

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Abstract

Although prescribed standards for science education are the basis for educational reform in virtually all states in the United States, these standards are often problematic. Indeed, an emphasis on prescribed standards often (1) frustrates and inhibits good teachers, (2) marginalizes many at-risk students, (3) produces curricula that ignore fundamental ideas in science (e.g., many states' standards do not mention the word *evolution*), and (4) do not enhance teaching and learning. It is teachers, not prescribed standards, who are the most important ingredient of science education.

The standards-based reform of education began in the early 1990s in response to failures of previous reforms (see discussion in Falk, 2002). The publication in 1993 of *Benchmarks for Science Literacy* (American Association for the Advancement of Science, 1993) described some of the science education standards, and was followed in 1996 by the more comprehensive *National Science Education Standards* (*NSES*) (National Research Council, 1996). Both these documents recommended inquiry, the in-depth coverage of fewer concepts, and an emphasis on the process of science as effective ways of teaching and learning science. The standards-based reform movement has been based on the assumption that large-scale prescribed interventions can produce large-scale improvements in education and leverage through standards-based assessments (Lynch, 2001).

Advocates of state-prescribed educational standards claim that the standards-based reform of education offers a variety of potential benefits. For example, prescribed educational standards 1) specify the desired outcomes that drive classroom activities, assessment tests, lesson plans, and curricular designs, 2) provide a basis for comparing states' expectations of what students should learn, 3) tell parents what students should learn and how teachers should help students learn, and 4) promote educational uniformity within a state, thereby easing the transitions for students who change schools. Although state standards are not always related to what teachers teach (Blank, Porter, & Smithson, 2001; Hoff, 2001; Moore, 2001), they are supposed to be the foundation of what students learn, and are supposed to produce the states' desired educational outcomes.

The NSES and State Standards

The *NSES* prompted virtually all of the states in the United States to develop their own standards for science education. Today, the ongoing reforms of K-12 education in the United States are based on the design and presumed implementation of these state-prescribed educational standards. Indeed, state-mandated standards--the first significant statehouse-led effort to change classrooms (Cohen & Steinberg, 2002)--are the order of the day in all states except Iowa, which continues to prefer local control to state-prescribed mandates (Lerner, 2000).

Although states such as New York and North Carolina modeled their state standards after *NSES*, others such as California began with *NSES*-like standards but, following a backlash, "developed very traditional science standards" (p. 37) that emphasized lectures, worksheets, and reading (Leonard, Penick, & Douglas, 2002). As noted by Leonard, Penick, and Douglas, there is little or no research that

supports the effectiveness of these traditional methods that are emphasized in many states' standards. Although these state-prescribed standards are very influential, they also raise concerns. For example, states' educational standards are inevitably accompanied by standards-based assessments (e.g., standardized tests, assessment tests) that are often used as a basis for establishing schools' budgets and teachers' salaries, as in Arizona (Jorgenson & Vanosdall, 2002). This makes standards-based assessments and standards-based curricula high-stakes ventures. For example,

1. In Chicago, principals and teachers can be reassigned if a school doesn't do well on assessment tests (Falk, 2002).
2. New York state has a "takeover" policy that allows poor-performing schools to be closed. In these schools, teachers and administrators lose their jobs (White & Johnston, 1999).
3. In several states, performances on assessment tests are used to allocate resources to schools (Darling-Hammond, 2003; Falk, 2002; Jones & Whitford, 1997). These policies have often produced competition and, in some cases, resentment.

Given the importance of state-prescribed standards and their accompanying assessments to schools and teachers, it's not surprising that growing numbers of teachers "teach to the test" (Jorgenson & Vanosdall, 2002). For example, in Kentucky, test-related sanctions and rewards have caused teachers to "focus on whatever is thought to raise test scores rather than on instruction aimed at addressing individual student needs" (Jones & Whitford, 1997, p. 277). The emphasis on standards-based assessments has also had some unforeseen, and especially unfortunate, consequences (Darling-Hammond, 2003). For example, some schools have manipulated scores by keeping certain students out of the testing pool (Falk, 2002 and references therein), and others have tampered with the scores that they have reported (Hoff, 1999). Some teachers have even committed crimes to ensure that their students performed well on the tests (e.g., Richard, 2002).

Lost in the debate about prescribed educational standards and assessments are four simple but important questions:

1. Are science education standards always in the best interests of students?
2. Does an emphasis on prescribed standards further marginalize at-risk students?
3. Should science teachers always tailor their courses and teaching to match science education standards?
4. And, most importantly, do prescribed standards enhance teaching and learning about science?

Are States' Science Education Standards Always in the Best Interests of Students?

Although most sets of state science-education standards acknowledge that science is a process, the standards and their accompanying assessments typically emphasize scripted, pre-packaged content (e.g., definitions, facts) rather than process (see discussion in Arey, 2002). As a result, there are many valuable experiences that don't match any particular standard. Consider, for example, a field trip to a pond or lake. Since such local science activities do not match any specific standard, is the field trip a "wasted day"? Similarly, is a walk through woods to see mushrooms and bryophytes in their natural environment (rather than as pickled specimens in jars or as drawings on a wall chart) a wasted day? Although these and other highly-scripted activities often don't match any standard, they can nevertheless be invaluable and memorable learning experiences for science students and teachers.

However, these activities are often avoided to ensure that teachers can cover all of the topics that are prescribed by the state standards and tested for by assessment tests. This "cover everything" approach dictated by prescribed standards has often prompted schools and teachers 1) to push low-scorers into special education, or encourage them to drop out (Allington & McGill-Franzen, 1992; Darling-Hammond, 1991, 1992; Koretz, 1988; Shephard & Smith, 1988), 2) to reduce or eliminate their students' exposure to important experiences and techniques, such as term papers, computers, and science-related technology (Dividing Lines, 2001; Fitzhugh, 2002), and 3) to often eliminate pedagogical approaches that have been based on successful practice and validated by gains in achievement, including inquiry-based instruction (see discussion in Jorgenson & Vanosdall, 2002). Science assessment tests often still focus not on the process of science, but rather on students' abilities to retain massive amounts of facts (Falk, 2002).

The dilemma that occurs when experiences that enhance learning about science do not conform to any particular educational standard is why many of the best science teachers--that is, those who are dedicated to experiential inquiry and constructivism--are often frustrated (and even inhibited) by prescribed science education standards (e.g., Gerking, 2001). These teachers know that it is in students' best interests to *experience* and *do* science. They also know that such experiences may not necessarily improve students' scores on standards-based assessment tests that emphasize facts and definitions. However, these teachers--and there are many of them (Arey, 2002)--often feel that their hands are tied. If they stray from the scripted standards, they are often reprimanded by administrators for not following the prescribed plan. So these teachers follow the plan, despite knowing that the plan may bore students and be counterproductive to learning (Arey, 2002).

Teachers who emphasize the "cover-it-all" approach encouraged by standards-based reform are seldom bothered by content-laden standards, for such standards help these teachers justify their content-based courses. Rather than organize educational activities that may not match a particular standard, content-based teachers teach to the test by giving students more fact-filled lectures that will help them on assessment tests. This approach, which is much easier than hands-on constructivist teaching, is often justified with the claim that something is not worth teaching if it cannot be measured or directly correlated with a specific standard. However, the teaching-to-the-test approach that usually accompanies an emphasis on prescribed standards is often based merely on drilling and repetitive examples, which can alienate many students from learning science (Haberman, 1991). This emphasis on testing rather than learning has important consequences:

1. State-mandated testing consumes large amounts of time. For example, in some Arizona school systems, the testing required by the state and districts consumes one fifth of students' and teachers' class time (Jorgenson & Vanosdall, 2002).
2. The costs of state-mandated tests divert money from instruction. Indeed, the administration of only one test can cost more than many teachers get to buy instructional supplies for the classes during an entire year (Falk, 2002). As one teacher noted, "if this money were given to me to buy more books and materials for my students or to sponsor professional development opportunities for me and my colleagues, I could do a far better job of preparing my students for the upcoming tests than more test practice will ever do" (p. 614).

The standards-based recipe for teaching, learning, and testing in many states has little to do with how students learn best, and nothing to do with how teachers teach best. In some instances, the emphasis on

standards-based teaching has even forced many teachers and school districts to abandon inquiry-based instruction (see above) and to replace hands-on experiences (e.g., field trips) and other similar activities with "practice testing" (see quote above), and has reduced teachers to technicians who prepare practice tests and follow highly-prescribed "cookbook" curricula (Falk, 2002). In many districts, these curricula are extremely restrictive. For example, in 1999 the Chicago Public Schools adopted a standards-based curriculum that specifies what students learn every day, what questions teachers should ask every day, what pages of the textbook teachers should cover every day, and which parts of assessment tests are addressed every day. In these curricula, administrators prescribe what topics are addressed in every discipline in every grade on every day. This emphasis on prescribed standards forces teachers to ignore their professional judgements and students' needs regarding the proper pace and method of coverage to ensure that they cover everything and meet the state's prescribed standards. As one teacher noted, standards have shackled teachers' jobs in a "straightjacket of outcomes" as administrators have used state standards to "teacher-proof" instruction (Arey, 2002). Instead of strengthening teachers' professional abilities and knowledge, administrators use standards to make teachers compliant robots who must follow state-prescribed rules to produce results (Falk, 2002). In these and other instances, following prescribed science-education standards often impedes science education and is not in students' best interests.

Does an Emphasis on Prescribed Standards Further Marginalize At-Risk Students?

State-prescribed standards are often touted as an effective way of ensuring that all students graduate with a common set of academic skills that are important for success. However, this standardization of outputs (i.e., students having a common set of academic skills) inevitably depends on standardized inputs; that is, on a standardized curriculum that covers all of the material specified by the standards. To ensure that they cover everything prescribed by their state's standards, science teachers must often limit supplemental activities, students' questions, and inquiry as they rush through their classes. There is little extra time for exposure to new experiences such as technology (Dividing Lines, 2001), or for the in-depth coverage that is often necessary for understanding and thinking critically about a subject.

Many standards-based assessment tests not only emphasize facts and definitions, but also require that students show a mastery of those facts and definitions in just one way (e.g., a multiple-choice test). This narrow approach to assessment negates efforts that use multiple ways of teaching and learning to broaden the groups of students who succeed, and leaves behind students who are better able to show what they know and can do with an essay, presentation, or other project (Falk, 2002). As noted by Darling-Hammond and Falk (1997), "in the name of ambitious-sounding reforms, such standards-based initiatives are exacerbating differences between students from different backgrounds and placing constraints on education that undermine effective teaching" (p. 35).

The regimented cover-everything approach to teaching science also necessarily frames students' different learning-styles--and the different pedagogical approaches necessary to deal with those differing learning-styles--as a problem that must be contained, minimized, or ignored (Bohn & Sleeter, 2000). That is, regimented standards often make it difficult to deal with students' individual needs when they have different perspectives or stray from the prescribed, standards-based agenda. This regimentation further marginalizes many at-risk students, and is not overcome by textbooks having largely cosmetic approaches to diversity, culturally homogenous teachers who often lack substantive exposure to the work of marginalized groups, classroom discussions and textbooks that seldom

acknowledge educational inequities and different social classes, or celebrations of a few ethnic holidays (Lipman, 1998, Sleeter & Grant, 1991). This is why students having different learning styles and cultural backgrounds (e.g., ethnic minorities, students from lower socioeconomic classes) often feel unwelcome and invisible in science classrooms that emphasize covering everything rather than students' needs for learning. This marginalization often makes it impossible or undesirable for students to feel that they belong in science (Brickhouse & Potter, 2001).

Contrary to the implied assumptions of conceptual change and other traditional approaches to science education, language and culture cannot be separated from learning (Lynch, 2001). Thus, our goal of "science for all" cannot be based on the "one size fits all" approach of prescribed standards (Lee, 1999; Lynch, 2000; Lynch et al., 1966; Rodriguez, 1997). Although an emphasis on prescribed standards may work well for upper- and middle-class students, it seldom works for the 40% of US students who are culturally, linguistically, or ethnically diverse, for such standards often ignore the social, cultural, and historical contexts of teaching and learning (Darling-Hammond, 1997; Lynch, 2001). This helps explain why the academic success of minorities has continued to lag behind that of other groups, *despite* an emphasis on prescribed standards (Larabee, 1999). As Adrienne Rich (1986) has noted, "when someone with the authority of a teacher, say, describes the world and you are not in it, there is a moment of psychic disequilibrium, as if you looked into a mirror and saw nothing" (p. 9). Many teachers interpret this disequilibrium as meaning that "those students" don't try and don't want to learn (Marriott, 2001). Rather than include appropriate cultural perspectives and corresponding pedagogies to involve those students in science, these teachers often assume that the students "aren't cut out for science" and route them to non-science classes (Moore, 2002b, 2002c).

The emphasis on state-prescribed standards is based on the assumption that all students have an equal opportunity to learn, and therefore that all students have an equal opportunity to succeed in a standards-based curriculum. This assumption is a fantasy. There are enormous inequities regarding teachers, resources, and facilities, even in schools in the same areas (e.g., unequal percentages of under-prepared and unqualified teachers, unequal access to technology, and unequal offerings of AP courses [Reid, 2001; Viadero, 2001]). Most of these inequities are dictated by socioeconomic status. Richer (usually whiter) neighborhoods have better schools, which have better teachers, higher expectations, better facilities, and more educational opportunities. Given the current methods for funding public schools, standards-based curricula and their accompanying standards-based assessments will almost certainly widen the gap between social classes (Apple, 1996) and perpetuate the apartheid that now characterizes many sciences (Moore, 2002b, 2002c). As Ayers (2000) has noted, our school system often exists as "two parallel systems--one privileged, adequate, successful, and largely White; the other ... disabled, starving, failing, and African American" (p. 66). An emphasis on prescribed standards will exacerbate this dichotomy (Ayers).

Should Science Teachers Always Tailor their Courses and Teaching to Match Science Education Standards?

There are some instances in which responsible science teachers should ignore educational standards. For example, consider states such as Alabama, Florida, Georgia, Kentucky, Mississippi, New Hampshire, North Dakota, Ohio, Oklahoma, Tennessee, and Wyoming (to name just a few), which have science education standards that physicist L. S. Lerner (Lerner, 2000) has described as "useless" (p. 1) and, in some cases, "an embarrassing display of ignorance" (p. 1). Although there was a national

outcry by scientists, science educators, and others when Kansas deleted evolution from its state education standards in 1999 (Moore, 2002a), several states continue to base their science education programs on highly prescribed standards that do not mention evolution (Lerner, 2000; Moore, 2001). If biology teachers in these states follow their states' educational standards, they'll not include evolution in their courses, and in many cases won't even mention the word *evolution* in their classes. This would be educational malpractice (Moore, 2001). Similarly, the teaching of Biblical creationism in science classes, as is encouraged in states such as Kentucky (Moore, 2002a) is not only bigoted, but also unconstitutional (*Edwards v. Aguillard* & *McLean v. Arkansas Board of Education* in Moore, 2002a).

Do State-Prescribed Standards Enhance Teaching and Learning about Science?

In theory, prescribed standards can enhance teaching and learning. But do they? Although some science teachers claim that standards-based teaching is more useful than didactic teaching or cooperative learning (e.g., Galus, in press), others are frustrated with the regimentation that accompanies the use of prescribed standards. Effective teachers have many ways of achieving educational goals, but an emphasis on prescribed standards often shifts the focus from teaching and learning to covering everything. Moreover, the advocates of standards-based science education seldom provide any quantitative data to document that prescribed standards enhance learning. We suspect that there's a reason for this--namely, that the mere presence of prescribed standards doesn't necessarily enhance learning about science. In fact, some evidence suggests that standards-based reform may cause *more* students to drop out of school (Cohen & Steinberg, 2002).

Effective teachers have always looked for ways to make their courses interesting, integrate content, and reach students. Teachers did these things--and were effective teachers--long before they were bridled by sets of regimented standards for science education. For these teachers, standards are often little more than frustrating and unnecessary impediments to their teaching and students' learning. Conversely, content-laden standards seldom do anything to help ineffective teachers except add the illusory trappings of bureaucracy, documentation, and a false sense of accomplishment. These teachers may cover everything specified by standards, but their students often learn relatively little.

The growing emphasis on regimented standards in science education is often misplaced. Moreover, this emphasis on standards causes many teachers to experience daily attacks on their dignity, authority, and professionalism as they are told what to teach and how to teach by people far from the teachers' classrooms and struggles. Since many teachers are threatened with demotion or reassignment if they don't produce good results on assessment tests, many teachers choose the path of least resistance. Instead of looking out for the best interests of their students, teachers resign themselves to a different mindset--namely, that if their students do not do well on the assessment tests, the school can't blame the teacher, because she/he will have followed the standards (i.e., "I have done it the way they told me to" [Arey, 2002]).

Although standards are inexpensive and easy to propose (Michael Apple refers to standards-based reform as being "reform on the cheap" [Apple, 1996]), the most important part of science education continues to be effective and creative teachers, not prescribed standards. When we take away from teachers the chance to think, create, and innovate, we deny them the feeling of satisfaction when they succeed. By the same token, we relieve them of responsibility when they fail (Arey, 2002).

Standards frustrate, but seldom help, good teachers, and virtually never improve the performance of ineffective teachers. We should know by now that we can't legislate, with prescribed standards or anything else, good teaching.

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