Essential Science Curriculum Project

Julie Gaubatz
Hinsdale South High School

The Essential Science Curriculum project is a grass-roots, teacher-led effort designed to improve high school student achievement in the sciences. This professional learning community (PLC), which began in the Fall of 2007 with the help of the DuPage Regional Office of Education, consists of science educators in the Chicagoland area and Northeastern Illinois who work together to identify Essential Curriculum objectives for biology, chemistry, physics and Earth science courses, and create common assessments to measure student achievement on these objectives. The goal of this project is for teachers to use data from the Essential Curriculum assessments to inform professional development conversations about science, curriculum, education, teaching, and learning. Essential Curriculum objectives and corresponding assessments have been developed for biology, chemistry, and physics, and this year the Earth science work group has begun work on their objectives and assessments as well. Since the project's inception, over 16,700 students from multiple districts in DuPage, Lake, Grundy, and Cook Counties have submitted Essential Curriculum assessment data, and over one hundred teachers from around Illinois have participated in project work groups, data collection, and curriculum-development conversations.

PLCs and Common Assessments
The Essential Curriculum project is based on two powerful educational tools: 1) professional learning communities and 2) common assessments. Professional learning communities and common assessments have become more prevalent in educational systems due to their impact on teaching, professional development, and student learning (DuFour 1998; Mindish, 2008; Vescio, 2008).

One of the foundations of PLCs is the affirmation of teachers' roles as agents of their own, and their colleagues', professional growth. A tool that is often used to fuel PLC discussions is data derived from common student assessments. PLC discussions based on common assessments occur in diffuse scenarios throughout the U.S. in which teachers (and sometime administrators) use the results of state and local testing to spark curriculum adjustments designed to help their students perform better the following year. Similar discussions also take place in more focused PLCs in which teams of teachers within a single school or district create common assessments by objective, unit, or quarter, and actively adjust their curriculum based on the data received from these assessments (e.g., DeLong, 2008; Zeppiere, 2008).

Project Origins
Motivation for this project stemmed partly from literature citing the power of PLCs and common assessments; another stimulus stemmed from teachers' general dissatisfaction with the approach Illinois currently takes toward secondary school science assessment - the Prairie State Achievement Examination (PSAE).

Throughout the U.S., a considerable amount of variation exists between states and their roles in science education and assessments (for example, Timms, 2007; Porter, 2009). State science standards and exams continue to be in flux due to new philosophies and new social constructions; these changes in thinking have resulted in initiatives such as STEM (science, technology, engineering and math) and College and Work Readiness (for example, Sawchuk, 2009). To determine student achievement in science at the secondary school level, some states,
Table 1: Steering committee members

<table>
<thead>
<tr>
<th>Name</th>
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<tbody>
<tr>
<td>John Adamsoki</td>
<td>Fenton High School</td>
</tr>
<tr>
<td>Bruce Basek</td>
<td>Glenbard West High School</td>
</tr>
<tr>
<td>Marjorie Cave</td>
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<td>Jim Carter</td>
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<tr>
<td>Michele Chapman</td>
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<tr>
<td>Eric Day</td>
<td>Glenbard North High School</td>
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<tr>
<td>Jim Effinger</td>
<td>Benedictine University</td>
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<tr>
<td>Lisa Fernandez</td>
<td>Hinsdale Central High School</td>
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<tr>
<td>Julie Gaubatz</td>
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<tr>
<td>Bill Grosser</td>
<td>Oak Park River Forest High School</td>
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<tr>
<td>Andy McWhirter</td>
<td>Naperville North High School</td>
</tr>
<tr>
<td>John Rhodes</td>
<td>West Chicago High School</td>
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</tbody>
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including Illinois, collect a single snapshot of student learning through a testing series that consists, in part, of college entrance exams (such as the ACT or SAT). Other states use single administration of state-created exams, while still others (fourteen states planned by 2015) use multiple, content-specific exams to assess students’ learning throughout their high school career (Center for Educational Policy, 2008). Most states use data from these exams to provide feedback to schools on their curriculum, while twenty-three states additionally hold students accountable for their achievement by requiring them to pass a portion of these exams before graduating (Center for Educational Policy, 2008).

Based on feedback during exploratory Essential Curriculum project sessions, specific dissatisfaction with Illinois’ current science assessment approach includes the facts that:
- Students are required to take a large exam over multiple content areas within a two-day time span;
- Students are required to remember content and skills learned during their freshman through junior year;
- The exam covers four science content areas (physics, chemistry, Earth science, and biology), yet students take this exam their third year in high school, by which point most will have completed only three courses corresponding to PSAE domains;
- Minimal feedback is provided to teachers/districts about the standards on which students did well or poorly, which precludes teachers from making curricular improvements;
- Students are not held accountable for their achievement on the state’s assessment.

Based on best educational practices and assessment models used by other states, the originating group of Essential Curriculum educators decided that a PLC focused on using common assessments might be able to address some of these concerns. The West Suburban Science Supervisors Association took the initiative to organize a steering committee (Table 1) for a teacher-led project to develop common subject-area assessments and began working with the DuPage Regional Office of Education to provide this PLC opportunity to area teachers. From the inception of this project, the steering committee was keenly aware that if teachers were not guiding its development and seeing its potential, then the project would not succeed. For any reform effort to be successful, teachers must be full and willing participants, but the implementation of reform efforts nationwide often overlook this crucial factor (Darling-Hammond, 1997).

**Essential Curriculum**
The success of this voluntary project required the PLC to have an achievable and meaningful focus. The steering committee suggested that teachers concentrate only on the essential content of each course, and to

Figure 1: This project focuses on the Essential Curricula for each core science content area: biology, chemistry, physics, and Earth science.
leave valuable, though non-essential topics (categorized as enrichment or extension topics – see Figure 1) to individual teachers or school teams to develop. It was also decided that scientific skills assessments would be developed through individual school’s laboratory assessments and our state test. Essential topics in this project’s vocabulary meant that teachers agreed that if a student had a core science listed on their transcript, she or he should be able to show mastery of these objectives. With these guidelines, teachers created the Essential Curriculum objectives during the first few sessions of the PLC workshops, then designed a multiple choice assessment linked to these objectives during the remaining sessions. Teachers debated together and grappled with philosophical approaches and content to create these objectives and assessments, which now serve as the foundation of the Essential Curriculum in each subject area.

The Process

Year 1 (2007-2008) of this project focused on creating the Essential Curriculum for biology; different content areas have been added each subsequent year. This year (2010-2011), the project has added its fourth and final content area: Earth science. The DuPage ROE contracted with Golden Apple Award winner Jim Effinger (see Figure 2) to moderate all content area workshop sessions, and teachers from across the state were invited to join this endeavor. Early meetings also had a content expert co-moderator (Kristin Ciesemier for biology, Bob Lewis for chemistry, and Scott Iliff for physics). The agenda of these early meetings consisted of setting norms of behavior, followed by philosophical discussions to determine which objectives were essential to each content area.

At the end of each content area’s first year, a pilot assessment was administered to students of participating teachers, and assessment data was collected using Survey Monkey online software. For pilot and normal administration of the Essential Curriculum assessment, individual teacher/school data was viewed by only one person; this person compiles and disaggregates the data, then shares the compiled and anonymous data, with participating teachers (that is, those who submitted data for analysis) (see Figure 3). This data is then used the following year to refine Essential Curriculum objectives and assessment items, and to prompt teacher discussion about curriculum, lessons, labs, and units that appear to have a positive impact on student learning.

The PLC process used by this project is recursive and cyclical in nature, starting from creation of the Essential Curriculum, and leading to the refinement of objectives and assessments, and teacher professional development (see Figure 4). As the project progresses for each content area, less time is spent on objectives and assessment refinement and a greater emphasis naturally falls upon teachers’ roles in sharing and discussing teaching ideas designed to increase student achievement in science (see Figures 5 and 6). During these sharing sessions, teachers also emphasize how particular labs and lessons not only support the Essential Curriculum, but also how they support College Readiness Standards and scientific skill building.

<table>
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<tr>
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Figure 3: An example of compiled, disaggregated, and anonymous data collected from and shared with teachers.
Issues and Concerns
Although the Essential Curriculum process has been smoothly running for the past four years, the steering committee recently has become concerned that the cost per teacher may become a barrier to attendance. Cost-cutting explorations are continuing, and partnerships with Fermilab (physics group) and the DuPage Forest Preserves (biology group) are helping the project by donating workspace for meetings, while also providing additional access to professional development opportunities.

An additional concern is test security. Teachers involved in this process are provided with the Essential Curriculum assessments with the expectation that they will submit their student data by mid-June. Because of the hours and the effort that teachers have contributed to this process, one concern held by many teachers is that these exams may fall into unintended use as test review sheets, worksheets, or internet-posted study material. Although there is no perfect way to prevent these uses of the assessments, the importance of test security is emphasized with each teacher work group at every PLC session.

Project Results and Future Considerations
To date, over one hundred teachers from multiple Illinois counties have participated in the Essential Curriculum workshops, and teachers have submitted Essential Curriculum assessment results for:
* 9,000+ biology students representing eight districts from multiple counties over a three-year period.
* 5,600+ chemistry students representing seven districts from multiple counties over a two-year period.
* 2,100+ physics students representing seven districts from multiple counties in year one of the project.

This year, the fourth year of the Essential Curriculum project, these numbers are expected to continue to increase as more teachers and schools learn about

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Figure 5: Eva Cone sharing biology lessons and labs.
the progress of this endeavor. In addition, 2010-11 will be the first year that Earth science teachers will have the opportunity to submit assessment data. This assessment data will again be used to drive Essential Curriculum PLC discussions that result in refined objectives and assessments, and teacher-driven professional development, all of which is predicted to result in increased student achievement in science.

Through this project, it is hoped that teachers will refine their thinking and philosophy about how they teach their subjects, share and promote the professional development of their colleagues, receive meaningful and specific feedback about student learning and curricula, and find support to explore and grow in their profession. This PLC cycle of professional development and curriculum refinement based on common assessment data should result in enhanced learning experiences for students, thereby increasing student content knowledge on which scientific skills and inquiry can be based.

Essential Curriculum objectives for biology, chemistry, and physics are currently available upon request to any interested teacher. Due to security concerns, access to the Essential Curriculum assessments is based on participation in the project (a minimum of one school representative attends most sessions in a given subject area) with the expectation that teachers submit student data by mid-June for compilation and analysis purposes. This project continues to be open to any high school science teacher, and teachers may join at any time.

References

Author Information
Julie Gaubatz has been the science department chair at Hinsdale South High School for the past seven years, and is currently serving as the vice president of the Illinois Science Teachers Association. Prior to joining Hinsdale District 86, Ms. Gaubatz was a science department chair in Houston and San Antonio, Texas. Ms. Gaubatz earned her B.S. in biology from Maryville University, M.S. in cellular and integrative biology from Northwestern University, M.Ed. in curriculum and instruction from the University of Houston, and she is currently working on her Ed.D. in curriculum and instruction at Loyola University.