

SPRING 2007

VOL. 9, NO. 2

# peerReview

Emerging trends and key debates in undergraduate education

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## Assessing Student Learning

Interpret  
Findings



A publication of the Association of American Colleges and Universities





Published by the  
 Association of American Colleges  
 and Universities © 2007  
 1818 R Street, NW · Washington, DC 20009  
 Tel. 202.387.3760 · www.aacu.org

ISSN: 1541-1389

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This issue of *Peer Review* is supported by the Teagle Foundation.

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**As this issue of *Peer Review* goes to press,** national events—from the breakdown of negotiations over new rules governing accreditation to the spirited resistance to Secretary Spellings’s efforts to federalize judgments about educational quality—remind us all that the larger context for our work is changing rapidly and dramatically.

Colleges and universities are under a spotlight with far more scrutiny than has been typical in recent years. The good news is that this heightened scrutiny is a result of higher education’s increasing importance in our society. Once just an option for the fortunate, higher education is now seen as essential for America’s future. The bad news is that many who are scrutinizing us have brought an accounting rather than an educational vision to the task. Determined to produce quantitative metrics that allow comparisons across institutions, the current Department of Education and policy leaders in many states are focusing relentlessly on things that can be counted, such as graduation rates, job placement rates, and pass rates on standardized tests. The obvious danger to anyone who cares about education is that we will end up narrowing and trivializing higher learning in order to measure it.

Yet employers, ironically, are urgently demanding that students master the *higher-level* outcomes associated with liberal education: analytical and communication skills, rich knowledge of science and global interdependence, and the ability to apply knowledge to unscripted problems where the “right answer” remains an unknown (see results of AAC&U’s employer survey and recent LEAP report online at [www.aacu.org/leap](http://www.aacu.org/leap)). But federal officials seem focused instead on what is best described as the meager minimum.

The higher education community is mobilizing to stop the misguided efforts launched by the Department of Education. But blocking is not enough. We must band together to champion a vision of educational quality and authentic assessment practices that will do more than measure basic skills. Assessment can and should be designed to deepen and strengthen student learning, not just to document it. And assessments surely must aim at the

highest levels of student learning—at the integration of knowledge, analysis, and action—not at the most rudimentary levels.

With strong endorsement from educators and employers, AAC&U’s LEAP report, *College Learning for the New Global Century*, affirms that “the framework for accountability should be students’ demonstrated ability to apply their learning to complex problems.” By definition, this standard calls for a strong emphasis on students’ performance in authentic integrative assignments and projects.

With this as our standard, we have focused in this issue of *Peer Review* on assessment approaches that serve the needs of external accountability, but also help us raise students’ levels of achievement. We explore in particular the use of the culminating course or project as a context both for integrating students’ learning and for assessing it.

As the examples in this issue show, capstones also can be designed and assessed to reveal student learning on broad outcomes, such as critical thinking or civic engagement, as well as on competencies particular to a field of study. Some institutions, including community colleges, also are incorporating capstone assignments in student portfolios that include first-year and milestone work. By systematic sampling and review, an institution can use these work samples to show student growth over time, as well as the actual level of student accomplishment.

Our challenge now is to make more visible to policy leaders and the public these authentic assessment practices and explain clearly why they are the right standard for accountability. To do this, we will need educational leadership at two levels: nationally, to promote the concept of assessments worthy of our mission, and on campus, to establish high standards for the design and implementation of authentic, learning-intensive assessments. The stakes in this debate are very high. AAC&U’s goal for assessment and accountability is to “aim high” and make authentic learning the standard. Working with you, we will do everything we can to make this the American standard as well.

—CAROL GEARY SCHNEIDER



## “Going Naked”

**By Richard H. Hersh**, codirector of the Collegiate Learning Assessment project and former president of William and Hobart Colleges and Trinity College (Hartford, Connecticut)

Education—from preschool through college—is the primary means of improving human capital and is therefore understood to be the single most important factor in the ability of America to compete in the global economy. But there is a growing unease about what now passes for higher education—a vocal concern led not by angry students, as in the sixties, but by parents and business, political, and academic leaders who sense a dangerous hollowing of an increasingly precarious ivory tower.

Virtually every study within and outside the academy acknowledges that that we need to significantly improve our undergraduate colleges, not only to compete globally, but also to enrich an active democracy here at home, a public life marked by liberty, dissent, and robust civic engagement. The critics, in essence, have declared, “The academy has no clothes!”

### **The Spellings Commission**

Joining the critics and jumping into the vacuum created by higher education leaders perceived to be unwilling to take on the necessary reform agenda to substantially improve quality, Secretary Spellings’s Commission on the Future of Higher Education identified accountability as *the* fundamental issue—an issue that can only be resolved through the assessment of value-added learning. The commission’s logic is as follows: (1) undergraduate educational quality is inadequate, given the challenges we face in the twenty-first century; (2) quality improvement requires a more *transparent* accountability; (3) assessment, especially value-added learning assessment, is fundamental to the improvement of quality and accountability. The commission’s report states that

We believe that improved accountability is vital to ensuring the success of all the other reforms we propose. Colleges and universities must become more transparent about cost, price, and student success outcomes, and must willingly share this information with students and families. Student achievement, which is inextricably connected to institutional success, must be measured by institutions on a “value-added” basis that takes into account students’ academic baseline when assessing their results. (U.S. Department of Education 2006, 4)

### **Assessment as a Force for Accountability and Excellence**

The Spellings Commission got it right—quality needs to improve, accountability must become far more transparent, and assessing learning is crucial to both. This is not to say, however, that one single test must be imposed on all institutions or that we know how to measure all that is worth learning. But it is to say that transparent, systematic learning assessment can be a powerful force for improvement and that such assessment is necessary for regaining public trust in the *public* good served by higher education.

There is, of course, the apparent conflict between assessment for improvement and assessment for accountability. I say “apparent” because I do not think this is an either/or situation; assessment for improvement and accountability are inextricably related. The public has every right to expect that it is higher education’s educational and professional duty to systematically assess its

impact on student learning as an essential condition for improvement *and* transparent accountability.

From an improvement perspective, student learning is higher education's *raison d'être*, and we know that appropriate and timely feedback to students and faculty increases student learning and informs institutional change. From an accountability perspective, rigorous, specialized professional training and the status it confers obligates the academy to be transparent in its endeavors, something expected of all professions. Moreover, colleges and universities are subsidized by the public, directly through tax revenues and/or through tax exemptions, and thus do have responsibility for rigorous student and institutional assessment and public accountability. The challenge is to make sure *appropriate* assessments are being used for each function and that the "stakes" attached to each are fair.

In light of the commission's recommendations, the academy is rightly worried about the imposition of federal and state mandates and the resultant loss of institutional autonomy. In terms of learning outcomes, we do not have—and it is not possible to have—one measure that does sufficient justice to the outcomes promised by colleges and universities. And certainly we know better than to defend *U.S. News and World Report* criteria as being worthy of anything other than our contempt as measures of quality—their variables of reputa-

tion, retention and graduation rates, and alumni giving, for example, are predicted mostly by admissions selectivity and endowment per student.

So how might the conversation about learning assessment and institutional accountability be reconciled in the name of institutional and student learning improvement without becoming politicized, as happened in the K–12 sector? The best answer from my perspective is for higher education,



both institutionally and via its accreditation agencies, to take the professional lead on issues of learning assessment and public accountability.

### **"Going Naked"**

There is a useful analog in medicine, summarized in the December 12, 2004, *New Yorker* article "The Bell Curve" by Atul Gawande, which centers on the treatment of cystic fibrosis. The outcomes of various

treatments across the very best hospitals, Gawande notes, are distributed on a bell curve. For example, in 1997, patients at an average center lived to be just over thirty years old; similarly situated patients at the most effective center typically lived to be forty-six. Clearly this is a difference that matters! But what causes that difference? As it turns out, perceived reputation and rankings of hospitals and clinics do not predict excellence in this case. What matters is a caring and demanding institutional culture that also requires rigorous and transparent measurement of outcomes. Shared assessment data in the best clinics informs prescriptive compliance by patients and aids doctors constantly trying to improve treatment.

Making data about their outcomes public leaves centers with no alternative but to do everything possible to help patients survive. Significantly, the ability to *compare* results across similarly situated institutions lays bare (pun intended) the advantage of being candid and the opportunity to be challenged; there is no place to hide. And with it comes the ability to benchmark excellence and establish a culture of continuous improvement. As one doctor said, this is like "going naked."

### **The Collegiate Learning Assessment Project**

The academy is populated with "doctors," and while we are not literally brain surgeons, the quality of life of the mind and



heart is very much in our hands. Assessing outcomes to inform improvement should be just as important to colleges and universities as it is to the medical profession. Yet higher education has neither developed adequate metrics nor demonstrated a willingness to make such results public; instead, it is content to rely on, even while condemning, college guides and reputation rankings. And it is not uncommon to hear faculty and administrators across the country protest that most of what we teach is too complex and cannot be measured, that the diversity of college and university missions precludes one-size-

fits-all assessment, and that the marketplace is the only required arbiter of quality. This implicit “trust us” attitude is now confronted by stakeholders who are questioning quality and no longer willing to accept higher education’s sense of “faith-based” entitlement.

Seven years before the Spellings Commission, the Collegiate Learning Assessment project (CLA) began as an approach to assessing core outcomes espoused by all of higher education—critical thinking, analytical reasoning, problem solving, and writing. (Fig. 1 provides a small sample of questions used in developing our

scoring rubrics.) These outcomes cannot be taught sufficiently in any one course or major but rather are the *collective and cumulative* result of what takes place or does not place over the four to six years of undergraduate education in and out of the classroom.

The CLA is an institutional measure of value-added rather than an assessment of an individual student or course. It has now been used by more than two-hundred institutions and over 80,000 students in cross-sectional and longitudinal studies to signal where an institution stands with regard to its own standards *and to other similar institutions*:

One of the most important features of the CLA program is its policy of reporting results in terms of whether an institution’s students are doing better, worse or about the same as would be expected given the level of their entering competencies. . . . [It] also examines whether the improvement in average student performance between entry and graduation at a school is in line with the gains of comparable students at other colleges. The program is therefore able to inform schools about whether the progress their students are making is consistent with the gains at other institutions. Thus, the CLA program adheres to the principle that post-secondary assessment programs should focus on measuring and contributing to improvement in student learning. (Klein et al. forthcoming)

**Figure 1. Sample questions used in developing CLA scoring rubrics.**

The CLA measures critical thinking, analytic reasoning, problem solving, and writing skills. These skills include the ability to evaluate and analyze source information, draw conclusions, and present an argument based upon that analysis. Below are some of the many factors that may be included in a task’s scoring guide.

*How well does the student*

- determine what information is or is not pertinent;
- distinguish between rational claims and emotional ones;
- separate fact from opinion;
- recognize the ways in which evidence might be limited or compromised;
- spot deception and holes in the arguments of others;
- present his/her own analysis of the data or information;
- recognize logical flaws in arguments;
- draw connections between discrete sources of data and information;
- attend to contradictory, inadequate, or ambiguous information;
- construct cogent arguments rooted in data rather than opinion;
- select the strongest set of supporting data;
- avoid overstated conclusions;
- identify holes in the evidence and suggest additional information to collect;
- recognize that a problem may have no clear answer or single solution;
- propose other options and weigh them in the decision;
- consider all stakeholders or affected parties in suggesting a course of action;
- articulate the argument and the context for that argument;
- correctly and precisely use evidence to defend the argument;
- logically and cohesively organize the argument;
- avoid extraneous elements in an argument’s development;
- present evidence in an order that contributes to a persuasive argument?



The purpose of comparison is to stimulate benchmarking and standard-setting discussions that can inform changes in institutional culture, pedagogy, and curriculum to improve student learning. And, as in the medical example above, CLA institutional comparisons result in a bell curve and bear no correlation with rankings such as those reported in *U.S. News and World Report*.

### **Does It Matter Where One Goes to College?**

While the CLA's institutional comparison feature is important, measuring value-added is a necessary but not sufficient condition for improvement; defining standards of excellence must also be part of the improvement process that comparable learning assessment data afford. For example, over the past five years we have found that simply going to college makes a difference—no matter where they go to college, students do show statistically significant gains in the learning of critical thinking, analytical reasoning, problem solving, and writing. Yet virtually all colleges and universities claim that “coming here” versus going elsewhere makes a difference.

Does it matter, then, where one goes to college? In our sample of colleges and universities, we have found that twenty percent of colleges and universities provide substantially greater value-added than other similarly situated schools. We are currently looking at these one-in-five schools to begin to identify what in their cultures, curricula, and pedagogy might explain such significantly better learning gains.

### **Questioning the CLA**

As the CLA has captured greater public attention, a number of fundamental issues have been raised. Trudy Banta, for example, has raised questions about the appropriateness of the value-added approach to learning assessment:

ment focused on the individual student level and did not effectively control for student entry characteristics. This problem is remedied by the CLA, which aggregates student-level data to the institutional level. And while Banta asserts that higher education's mission and student diversity makes valid

Over the past five years we have found that simply going to college makes a difference—no matter where they go to college, students do show statistically significant gains in the learning of critical thinking, analytical reasoning, problem solving, and writing.

For nearly 50 years measurement scholars have warned against pursuing the blind alley of value added assessment. . . . Moreover, we see no virtue in attempting to compare institutions, since by design they are pursuing diverse missions and thus attracting students with different interests, abilities, levels of motivation, and career aspirations. (Banta 2007)

Steve Klein and his colleagues rebut that conclusion by pointing out that prior to the CLA, attempts at value-added assess-

comparisons across institutions difficult, it is precisely for this reason that the CLA assesses core outcomes transcending diverse missions and is designed to permit comparisons between similarly situated students and institutions.

George Kuh has been critical of aggregating individual student scores up to the institution level. Specifically, he suggests that when this is done, “the amount of error in student scores compounds and introduces additional error into the results, which makes meaningful interpretation difficult” (NSSE 2006, 9). Actually, measure-

ment theory predicts just the opposite—results should become much more rather than less reliable when results are aggregated to the school level, especially if there is reasonable variability in scores among campuses, as there is in the CLA. Our further analysis confirms this prediction.

Some believe comparing campuses is invalid because the amount of measurable value-added would be especially limited in

so little in four years that the value-added would be negligible. What she is suggesting, however, is that measures like the CLA cannot detect such learning gains at highly selective schools. Yet no such “ceiling effect” has been found in the CLA national data sample, which includes schools as selective as Penn.

A major concern also has been raised about the potentially brutish purposes for which the CLA or any single assessment might be used. The CLA is not meant to be used as a new ranking tool or as a tool for state or federal agencies to use when deciding how to distribute funding, and this is why CLA data are not made public. If useful learning assessment is the goal, multiple kinds of assessment are required, such as portfolios, comprehensive exams covering both general education and majors, thesis requirements (with and without oral examinations), and capstone courses, although in combination they are rarely utilized in a comprehensive, coherent, or cumulative way within any single institution.

### Conclusion

The CLA's purpose is improvement of teaching and learning. The assessment measures core outcomes shared by all institutions and complements more local and

specific assessment techniques with important comparative and value-added data. It communicates that specific higher-order learning is valued, enables institutional improvement by utilizing institutional comparisons to benchmark quality, and emphasizes that such outcomes are accomplished collectively across the entire curriculum.

Higher education has been reticent to measure and share what students are learning, although institutions using the CLA and working in consortia are more willing to take on this transparent task of comparison knowing that others are engaging in the same self-critical analysis. Improvement requires far more substantial and transparent learning assessment, a process that requires going institutionally naked. ■

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highly selective institutions. President Amy Gutmann, for example, said that if such tests were implemented at the University of Pennsylvania, “students would do superbly when they came in, and superbly when they left, and it would be no measure of what they learned at Penn” (Lifshin 2006). Surely President Gutmann does not mean to suggest that Penn’s students learn

# Can Assessment for Accountability Complement Assessment for Improvement?

By **Trudy W. Banta**, professor of higher education and senior adviser to the chancellor for academic planning and evaluation, Indiana University–Purdue University Indianapolis

*All of this focus, of the media, of quality assurance and of institutions, is on assessment as measurement. . . . We should design assessment, first, to support worthwhile learning. . . . Standards will be raised by improving student learning rather than by better measurement of limited learning.*

—Graham Gibbs, Oxford University, UK;  
and Claire Simpson, Open University, UK

These are times of great uncertainty and challenge for those of us who have devoted our energies to encouraging faculty and student affairs colleagues to assess student learning outcomes for the purposes of improving academic progress and student services. We know the academy has been slow to realize the need for assessment to guide improvement, but now some faculty in virtually every institution are at least trying it out. Certainly the regional and disciplinary associations have been emphasizing outcomes assessment, and this is making a difference at most institutions today. Creative work on new tools to assess critical thinking, reflective judgment, and deep learning are being developed by faculty, some individually and some in consortia such as the one Wabash College is leading ([www.liberalarts.wabash.edu/nationalstudy](http://www.liberalarts.wabash.edu/nationalstudy)). At last, colleagues across the country are becoming aware of the potential for positive change offered by the kind of assessment we have championed for all these years.

Unfortunately, if we listen more carefully, we learn that the kind of assessment we believe is beginning to guide improvements in student learning is not what is being discussed by higher education policy makers. It is assessment for accountability, not improvement, that stakeholders outside the academy are proposing.

So those of us in the assessment community are asking each other, “Can assessment for accountability and assessment for improvement coexist? Can the current accountability focus actually strengthen assessment for improvement? Or will an accountability tidal wave roll across the fields, crushing the fragile green sprouts of assessment for improvement that have begun to appear?” In this essay I suggest how assessment for accountability may begin to complement, and even strengthen, assessment for improvement.

## Lessons from Grades K–12

On my campus, I regularly convene a combined group of public school representatives and educators from multiple disciplines who are involved in preparing future teachers. From these colleagues I have heard the following comments: “Some of the most experienced teachers in my school have left the classroom because they feel the public has branded an F on their foreheads that only higher standardized test scores can erase.” “Many who remain in the profession feel pressure to spend much of their time drilling students on the material that will be on the state’s accountability

tests. They say their classrooms have become boring places for both students and teachers as creativity is no longer valued.” “In some schools, the curriculum has been narrowed to focus on the English and math to be tested, so less time is spent on science and social studies, and physical education, art, and music are no longer offered.” “Some students who know they are poor test-takers have given up, exhibit negative behaviors in class, and look forward to dropping out of school at the earliest possible date.”

These educators know the literature and what is needed to create more effective schools—places that delight teachers and students alike, where learning is fun and student achievement is on the rise (Allington 1994). They know that for many students the school day and the school year should be longer, with ninety minutes each for reading, writing, math, and science—interspersed between periods for physical education, art, and music—every day. Personalized instruction should be based on diagnosed needs and learning styles and staff should receive abundant opportunities for professional development that helps them provide such instruction. The tests K–12 teachers value are not the high-stakes state exams, but those that match their teaching objectives and tell them immediately where learning is effective and which students need to improve which skills. But all these improvements cost money, and where will the dollars come from to implement them? To our chagrin, some stakeholders in our community seem more eager to call for spending millions on a second

administration of the statewide tests each year—spring as well as fall testing—than to advocate and find the money for the school improvements we know will enhance student learning. In the meantime, performance of U.S. students on international tests continues a downward spiral.

### **The Press to Make Higher Education More Accountable**

Now we are on the brink of making the press to assess with a test a part of the higher education environment. In September 2006, the Commission on the



Future of Higher Education made a number of recommendations, including the suggestion that “the collection of data from public institutions allowing meaningful interstate comparison of student learning should be encouraged and implemented in all states” (U.S. Department of Education 2006, 24).

Just as we know what works to improve learning in grades K–12, we also have good evidence of what it takes to improve student growth and development in college. Decades of research have demonstrated

that students learn more if they engage actively in learning, spend more time studying, interact frequently with faculty and with student peers concerning intellectual matters, experience high expectations for their persistence and achievement, and encounter and interact with diverse people and ideas (Pascarella and Terenzini 2005). Many students need academic support programs and lots of time with peer and faculty mentors. Most current faculty are not trained as teachers, so extensive faculty development is needed to raise awareness of good practice in enhancing learning.

Just as weighing a pig will not make it fatter, spending millions to test college students is not likely to help them learn more. Equally important, faculty who are just beginning to use assessment aimed at improvement may ask why they should continue to do so if the quality of their institution is going to be judged on the basis of standardized test scores achieved by a small sample of students.

Without question, we will see more emphasis on assessment of learning in college using standardized tests of general intellectual abilities. The commercially available tests of these abilities that I have studied recently are surprisingly lacking in vital information about their reliability and validity—the very characteristics that we expect to give standardized tests the edge over ones faculty develop to test what they are teaching. Moreover, we in colleges and universities have not yet conducted the studies that are needed to test the validity of these exams in our own contexts. We don’t even know how students’ scores on these tests



compare with those of students who have matured over the same four to six years, but who have not gone to college. The impact of what goes on in the classroom—only 15 percent of a student's time—and elsewhere on campus is very hard to tease out of change that is the result of simple maturation, as well as learning that occurs on the job, in the family setting, in the community, and in interactions with peers outside the campus setting. Before we commit millions of dollars to a national testing program, we need to see the results of such validation studies.

The fact that so much is left undone in developing the standardized measures of general intellectual abilities available to us today suggests that there is yet time to develop more meaningful measures of student learning in college. And the impetus provided by the current accountability wave could give such efforts a boost.

### So What Can We Do?

In some states, the mandate to administer one or more standardized tests has already been issued. Elsewhere we have the opportunity to try out some of the instruments being suggested. If scores are going to be used to compare institutions, we have an obligation to learn all we can about these tests. An excellent guide for conducting this investigation is *Standards for Educational and Psychological Testing* (AERA, APA, and NCME 1999). We can ask faculty groups to study the instruments and answer the following questions, among others.

- Do the tests have scales that match our goals for student learning? That is, if we aim to develop good writers

and critical thinkers, do the tests give us scores for these skills?

- Do students in the norm group come from institutions like ours?
- Have valid techniques been used to draw samples of test-takers on these campuses?

- Are convincing studies available that demonstrate test–retest reliability, construct, and content validity?
- Have items been studied to see if they function differently for different groups?
- Are we ready to undertake studies to demonstrate the validity of the tests in our own contexts?
- Will faculty embrace the tests and encourage their students to take them seriously?
- Can students be persuaded to do their best work on the tests?

All of these questions must be answered affirmatively if institutional reputations are to be judged on the basis of scores on standardized tests.

Other options offer advantages over standardized tests for addressing the press for accountability. One possibility is a report card that uses research-based indicators of good practice in higher education. Good

practice in promoting student learning, for instance, can be measured using the National Survey of Student Engagement. We can develop standardized methods for reporting retention and graduation statistics; the portion of financial aid that is need-based; aspects of alumni satisfaction; job

**Most current faculty are not trained  
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of good practice in enhancing learning.**

placement rates by field; and proportions of students engaged in undergraduate research, service learning, study abroad, and other engaging pedagogies.

Just as some standardized test providers have developed rubrics for scoring students' written work, faculty are capable of developing rubrics that can be applied to virtually every behavior that can be observed. Rubrics make seemingly immeasurable things measurable, and therefore comparable. We can share rubrics across campuses and conduct blind scoring of senior projects, capstone papers, and products of undergraduate research. Students can use rubrics to self-assess their performance in an internship or service-learning setting and compare their perceptions with those of faculty and field supervisors using the same rubrics.

I have argued elsewhere that standardized testing in major fields will pay far richer dividends than standardized tests of

general intellectual abilities (Banta 2007a, 2007b). Many professional fields already have such tests, and disciplinary associations in other fields can develop their own if we must test and compare.

The most authentic assessment will be achieved through electronic portfolios for which students themselves develop the content. On my campus, as at many others, we have developed expected learning outcomes in general education and the major field. Students select graded written, spoken, and artistic works from courses throughout their college careers, as well as photographs and videotapes of speeches, work-related events, and other leadership experiences on and off campus to illustrate their achievement of the expected outcomes. They write reflective essays to demonstrate the connection between portfolio artifacts and the expected outcomes. Again faculty use rubrics to grade students' achievement of each outcome. Just as with written work on standardized tests, faculty can use the same rubric to grade student work on multiple campuses if we must compare institutions.

Finally, we can use the "assessment for accountability is coming!" warning to mobilize colleagues to do their own pioneering work in developing measures of critical thinking, reflective judgment, and deep learning. Instead of throwing in the towel, let's roll up our sleeves and show our critics how creative we can be in developing our own instruments to assess and report on the knowledge, skills, and dispositions our mission statements say we value. And let's argue for the use of multiple measures—questionnaires, interviews, and focus groups as well

as various direct measures of learning—since no single measure is perfectly reliable or valid.

### Conclusion

Should we prepare ourselves to imagine a time when our students' scores on a standardized test become an important component of judging our own effectiveness for promotion, tenure, and raises? Will the college curriculum then be narrowed, as it has been in grades K–12, to focus students' attention on attaining the knowledge and skills defined by the content of these tests? Instead of reading the Great Books, will students have workbooks that help them drill on the concepts on which they will be tested? If so, the United States will fall ever farther behind in the global economy. It is knowledge creation, not knowledge reproduction, that creates competitive advantage. The strength of American higher education has been in the diversity of opportunities we provide for students and faculty with diverse interests and talents. Will standardized testing across all institutions make higher education more homogeneous? And if assessment becomes synonymous with standardized testing, what will happen to assessment undertaken for the purpose of guiding improvement in instruction, curricula, and student services?

As suggested in the examples above, we must work together with our stakeholders to make assessment for improvement and assessment for accountability complement, even strengthen, one another. Ralph Wolff, executive director of the Senior College Commission of the Western Association of

Schools and Colleges, noted recently that accreditors ask each institution "to define its learning outcomes, and to assess the achievement of those outcomes . . . to determine whether improvement is needed. We believe we should keep that locus of responsibility at the institutional level" (quoted in Lederman 2007). If the recommendations of the Commission on the Future of Higher Education and subsequent actions of the U.S. Department of Education related to accountability can provide the impetus for more of the activity Wolff describes, assessment undertaken to guide improvement will be broadened and strengthened. ■

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# Assessing General Education Capstone Courses: An In-Depth Look at a Nationally Recognized Capstone Assessment Model

By **Seanna Kerrigan**, capstone program director, University Studies, and **Sukhwant Jhaj**, interim director, University Studies, both of Portland State University

**P**ortland State University (PSU) has been recognized by the Corporation for National Service, the Pew Charitable Trust, the Atlantic Foundation, the Kellogg Foundation, and *U.S. News and World Report* for implementing an exemplary capstone program. The purpose of this article is to share PSU's model of capstone courses, describe the goals of this program, and provide detailed information on how PSU assesses the senior capstone courses and how the data are used to improve the quality of future courses.

The Portland State capstone was developed in 1994 as a result of an entire redesign of the general education program. In the early 1990s, the administration at PSU asked a working group of faculty to examine the university's general education curriculum from a scholarly perspective. The working group was charged with exploring current learning theory, student affairs literature, and best practices in teaching and learning, and it examined national trends, data, and scholarship on teaching and learning as it sought to revise PSU's general education model. As a result of that research, the faculty senate at PSU approved the adoption of a four-year general education program called University Studies. The new program was based on a constructivist philosophy of education, an approach that encourages high student-to-student interaction, low faculty-to-student ratios to promote increased faculty and student interaction, active learning pedagogies, inquiry-based coursework, and learning with relevance (real-world learning).

Service learning was promoted throughout the curriculum and mandated in a required senior-level capstone because, as pedagogy, it showed promise of addressing the four goals of the University Studies program: communication, critical thinking, ethical/social responsibility, and appreciation of the diversity of the human experience. To improve students' communication skills, courses address oral communication, visual communication, quantitative literacy, and current communication technologies. Courses tackle the critical thinking goal by requiring students to evaluate differing theories and numerical information and to analyze personal and societal assumptions. Ethical/social responsibility is framed in terms of understanding the impact of life choices on self, society, and environment, as well as exploring the ethical dimensions within these arenas. Finally, the diversity goal aims to enhance students' awareness and appreciation of diversity at the local, regional, national, and global levels. One of the foundational beliefs of University Studies is that education should be relevant to students. Capstone courses require students to apply





their learning in these four general education goal areas while addressing real issues in the greater community.

All 3,000 senior-level PSU students are required to take one of the 230 capstone courses offered annually. In the capstone course, students address the four University

quantitative course evaluation that measures how well their course addressed the University Studies goals, the congruence between community service and course content, and the quality of the instruction. Finally, a qualitative section of the end-of-term evaluation asks students to state their

feedback affecting most or all the class.

The questions that students respond to are (1) What about this course is helping you to learn the course material and engage in your community work? (2) What could be changed to improve the course? (3) What specific suggestions do you have to bring about those changes?

After the assessment session, the facilitator summarizes the students' feedback and contacts the faculty member. The faculty member and the facilitator have a follow-up conversation to review the data, clarify any feedback statements that are unclear, get ideas for concrete changes the faculty member may choose to make to the course, and consider how the assessment results will be discussed with the students. The transcribed assessment data is also shared with the capstone program director and the faculty development coordinator to determine any themes that are relevant across the capstones in order to facilitate programmatic improvement.

**Analysis of mid-quarter feedback.** In order to use this data for programmatic improvement, an analysis of the data is conducted to see what themes are present across capstone courses. Three readers analyze these data using Creswell's qualitative approach to data analysis (1994). This process requires the researchers to read through all of the session transcriptions carefully to get a sense of the whole and to note initial ideas about the data. The researchers then review the data one course at a time and answer the question, "What is the underlying meaning of this transcription?"

## In the capstone course, students address the four University Studies goals while connecting their academic course content to a real issue in the community through the completion of a comprehensive, group-based final project.

Studies goals while connecting their academic course content to a real issue in the community through the completion of a comprehensive, group-based final project. Among the most popular capstones are Grantwriting, Immigrant and Refugee Resettlement, Small Business Consulting, Engineering Design, and Public Relations.

### Using Multiple Approaches to Assess Capstones

The capstone program uses three formal assessment strategies to provide feedback on the quality of capstone courses. First, mid-term qualitative assessments are completed each term in 20 percent of capstones to gather formative data for capstone faculty and the capstone office. Second, students complete an end-of-term

most important learning and their ideas for improving the course.

**Mid-quarter feedback.** Each year at mid-quarter, Portland State conducts qualitative feedback sessions in all capstone courses. In each of these assessments, a trained facilitator (who is also a capstone instructor) observes the flow of teaching in a course for about fifteen minutes. Then the faculty member leaves the class and the facilitator seeks anonymous student feedback. The students are organized into small groups, and each group provides a written response to the assessment questions. The facilitator instructs the students to report only those comments upon which there is group consensus, which not only provides for anonymity in small capstone courses, but also provides faculty with



Next, the researchers make a list of the core underlying topics and cluster similar ones into topical themes (identifying, coding, and categorizing the primary patterns in the data). The researchers then test these themes by looking at the data to see if it could be organized according to these themes (a process of content analysis in which topics are defined and labeled). After organizing the data, the researchers categorize the data and look for relationships between the themes in

order to make final decisions about the themes and their coding.

Each reader conducts an individual thematic analysis according to the same set of data analysis instructions. The researchers compare and contrast their thematic findings and confirm the results. An example of results of their collaborative conclusions follows (see table 1).

***Analysis of qualitative comments from end-of-term course evaluations.***

The end-of-term course evaluation asks

students to answer two questions: (1) What stands out as your most important learning in this capstone? (2) What would you change about this course? The capstone course evaluation typically yields over 1,500 student comments, which are transcribed and given back to the faculty for the purpose of course improvement. The data are also shared with the capstone program director and a faculty development coordinator so that 1:1 faculty support is given to any faculty member with a

**Table 1. Themes emerging from mid-quarter feedback**

What is helping you learn?		What changes would you suggest to improve the capstone process?	
<b>Effective instructors</b>	<ul style="list-style-type: none"> <li>• Approachable/responsive</li> <li>• Enthusiastic</li> <li>• Engaging</li> <li>• Knowledgeable</li> <li>• Experienced—great resource</li> <li>• Strong facilitators</li> </ul>	<b>Clearer structure in the capstone</b>	<ul style="list-style-type: none"> <li>• Better organized (logistics at community partner site)</li> <li>• More examples of capstone final product</li> <li>• Clearer grading criteria</li> </ul>
<b>Engaging class discussions</b>	<ul style="list-style-type: none"> <li>• Created safe learning community</li> <li>• Happen frequently/ongoing</li> <li>• Interesting</li> <li>• Connect reading and service</li> <li>• Questions got answered</li> <li>• Well facilitated</li> <li>• Enhanced by small class sizes</li> <li>• Web ct reported as effective tool</li> </ul>	<b>More training on specific duties at community partner site</b>	<ul style="list-style-type: none"> <li>• Tutoring</li> <li>• Working with population</li> <li>• More orientation</li> </ul>
<b>Informative readings</b>	<ul style="list-style-type: none"> <li>• Helpful</li> <li>• Thought provoking</li> <li>• Informed students work</li> <li>• Linked and enhanced learning from the community and the lectures</li> </ul>	<b>Suggestions regarding course structure</b>	<ul style="list-style-type: none"> <li>• Pacing of project so that students can work towards the final project earlier in the term</li> <li>• More time in groups</li> <li>• More time to complete the project</li> </ul>
<b>Depth of connection with community</b>	<ul style="list-style-type: none"> <li>• Meaningful volunteering</li> <li>• Connection with population was a powerful tool for learning</li> <li>• Tours in the community enhanced learning</li> <li>• Community added depth to course content</li> <li>• Connection with the community made powerful and emotional impression on students</li> </ul>	<b>Logistical challenges</b>	<ul style="list-style-type: none"> <li>• Transportation issues</li> <li>• Sites closer to PSU</li> </ul>



In addition to its annual meeting, AAC&U offers a series of working conferences and institutes each year. Additional information about the upcoming meetings listed below is available online at [www.aacu.org/meetings](http://www.aacu.org/meetings).

### Summer Institutes

**June 20–24, 2007**

#### **The Greater Expectations Institute**

Burlington, Vermont

#### **Network for Academic Renewal Meetings**

**October 18–20, 2007**

#### **Civic Learning at the Intersections: U.S. Diversity, Global Education, and Democracy's Unfinished Work**

Denver, Colorado

**November 1–3, 2007**

#### **Shared Responsibility for Essential Learning Outcomes: New Partnerships Across Departments, Academic Affairs, and Student Affairs**

Savannah, Georgia

### AAC&U Annual Meeting

**January 23–26, 2008**

#### **Intentional Learning, Unscripted Challenges: Knowledge and Imagination for an Interdependent World**

Washington, DC

struggling capstone course. In addition to this individual analysis, a random sample of 250 student responses to each of the questions are selected for analysis. These comments are analyzed by two independent readers who consider the data separately, create themes suggested by the data, and categorize the comments by the identified themes.

### Improving the Quality of the Program through Faculty Development

Course evaluation data is broadly shared with capstone faculty through the capstone e-mail listserv, through meetings with capstone faculty, and at capstone faculty retreats. Program assessment documents the common strengths and challenges in capstone courses and encourages dialogue and the exchange of ideas among faculty. The data demonstrate the importance of working with newer faculty on developing, organizing, and integrating the community partnership experience and course structure. Creating a clear and well-organized course is a common challenge throughout the university, of course, but for capstone faculty this needs to be addressed within the context of community service learning, since the nature of the community partnership necessarily influences the structure and organization of the course. Faculty development efforts target both instructors with extensive teaching experience but less experience structuring community collaborations and those with extensive community knowledge but less experience in designing a course.

By using multiple strategies—the continuous generation of course assessment data through mid-term qualitative assessments and end-of-term course evaluations, the reporting out of this data in an ongoing basis in a variety of faculty development settings, and the developing and sharing of best practices in both group and one-on-one settings—the program intentionally and systematically addresses the concerns expressed by students and furthers the quality of teaching and learning in capstones.

### Future Directions

The capstone program's current assessment plan includes assessment of capstone students' work samples. A faculty group hopes to study the final products created in the capstone courses and is undertaking a separate project to assess the students' written reflections. Our project to assess student written reflection shows early signs of being fruitful. An initial qualitative study has allowed us to deepen our understanding of how our students are enhancing their communication skills, critical thinking ability, sense of social responsibility, and appreciation of diversity. ■

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# The Senior Assignment: Applying Learning to Complex Problems

By **David Sill**, associate provost for academic affairs, Southern Illinois University Edwardsville

Southern Illinois University Edwardsville (SIUE) provides educational opportunities for the region it serves and supports that region's health care through its nursing, dental medicine, and pharmacy programs. It also provides economic development through the schools of engineering and business and supports the public and private schools in the region through the school of education. With an enrollment of 13,500 students, SIUE is a public comprehensive regional master's university in southwestern Illinois, located about twenty miles from St. Louis, Missouri. Its first priority is undergraduate education, although SIUE also offers selected graduate programs that address regional needs.

The senior assignment, which was fully implemented as a graduation requirement in 1992, is a central part of the SIUE assessment plan. That plan was approved by the faculty senate, accepted by the president, and adopted in 1989. According to the assessment plan, "every student shall be required to complete a senior assignment that permits an assessment of the extent to which the student can exhibit a general education perspective while demonstrating proficiency in the major."

As a first step in implementing the senior assignment, SIUE faculty drafted a Statement of Objectives for General Education and the Baccalaureate Degree, which was completed in 1991. Guided by that statement, every undergraduate program created assignments, projects, or activities that make learning visible for seniors for the full range of baccalaureate objectives. In practice, the senior assignment engages each student in an integrative project under the supervision of a professor or

professors so that student learning, assessment, and faculty involvement intermingle. At its best, the senior assignment encourages integrative learning for the students and the faculty.

The SIUE senior assignment has received national recognition because it provides a model for assessment of student learning embedded within an integrated senior capstone experience. Recently the senior assignment was highlighted as a "Principle in Practice" in the Association of American Colleges and Universities' Liberal Education and America's Promise (LEAP) report, *College Learning for the New Global Century* (2007). That report called for embedded assessments that connect with essential learning outcomes, such as knowledge of human cultures and the physical and natural world, intellectual and practical skills, personal and social responsibility, and integrative learning.

Assessing integrative learning is one of the most challenging tasks in higher education, in large part because we are not always clear about what we mean by integration. We can consider theory and practice within the disciplines, or integration between knowing and doing. Or we can look at collaboration between individuals, or the integration involved in partnering and teamwork, or integration that connects the individual with social and civic responsibilities. In purely intellectual terms, we can consider integrative thinking—or the scholarship or practice of integration across domains, time, courses, and disciplines, the kind of integration that is often called interdisciplinary studies. Finally, we can look at integration in transference, applying what is learned in



one area to another—for example, transferring what has been learned in a statistics class to what is being studied in a sociology class. Each of these types of integration requires different measures, and none of them are measured well by tests.

At SIUE, the senior assignment provides students the opportunity to experience and demonstrate the integration of the entire baccalaureate experience through collaboration, integrative thinking, and transference. The integrative experience is effective partly because the senior assignment is the second of two common experiences for all SIUE graduates: all students, including all transfer students, must also complete a junior-level interdisciplinary studies course.

### What We Have Learned

With each year, SIUE program administrators have modified and refined their senior assignment standards to make them both better assessment vehicles and more valuable experiences for students. In the beginning, for example, SIUE's Department of Psychology required a standard senior thesis for their senior assignment. After being disappointed with the results, the department replaced the simple research paper project with a model for integration that connects throughout the psychology curriculum, ending in the culminating psychology senior experience. One of the challenges for assessing skills such as writing and critical thinking is that those skills are defined differently within each discipline. Good writing in English literature may be viewed as bad writing in psychology and vice versa. Good critical thinking in studio art may be thought

of as undisciplined and too subjective for psychology, while good critical thinking in psychology may be considered too rigid and objective for studio art.

Psychology has built a curriculum that integrates the objectives for a baccalaureate education into the student experience starting with the first psychology courses. At the beginning of the students' major curriculum, the department teaches students what it means to write, think, make judgments, and put things into context from a psychology



perspective. That perspective runs throughout the curriculum and culminates in the senior assignment, where teams of students conduct rigorous research, analyze and write up the results, and present and defend their results at a poster session. Students are expected to put their work into perspective beyond the field of psychology and to discuss the ethical issues involved in research. The psychology senior assignment has been recognized as exemplary practice by the Council for Higher Education Accreditation.

Several departments, including the Department of Art and Design, have found

that their senior assignment for one specialization or group of students was much stronger than that for others. These programs have reworked the experience for all students. In 1995, the Department of Art and Design implemented the Mexica Project, a program that began with a three-week summer experience in Mexico. The students worked with Mixtec potters and weavers to learn the local crafts while experiencing the local culture. During the following fall semester, the students created artworks that communicated to an Illinois public the essential nature of the students' experience in rural Mexico. The students formed into three teams: one team organized an exhibit of student work from the Mexica Project; another was responsible for publicity and organizing the opening reception; a third team created a catalog to record the project. Even though only fourteen students and two faculty members participated in the first Mexica Project, it was clear that Mexica fit all of the expectations for a senior assignment. While a self-selected sample of students participated, the information available from the students' work was extremely valuable. What the Department of Art and Design realized, though, was that the rich, integrative experience of students in the Mexica project was not shared by the students who did not participate in Mexica. The department reworked the senior assignment for the studio students so that all students had an integrative culminating experience.

A number of senior assignments are structured around real-world projects and change year to year. For example, civil engineering students, working as teams, were



able to write a grant proposal for the campus to implement a study of trash. The study, which was externally funded and was completed after the students had graduated, provided the basis for the SIUE's current recycling program. In a later year, civil engineering students analyzed water runoff from the campus and demonstrated that the flooding problems were caused by development upstream of the campus. The student teams recommended catch basins, which were constructed, to slow the runoff through campus and reduce downstream flooding.

### For the Future

SIUE participates in the Academic Quality Improvement Program (AQIP), which is an alternative accreditation process of the Higher Learning Commission of the North Central Association based on continuous quality improvement principles. In AQIP, institutions engage in several different processes that provide peer review, benchmarking, and supportive feedback for improvement. Four years after admission to AQIP, an institution prepares a *systems portfolio* that reports on the institution's context, processes, results, and improvements in nine different categories, including helping students learn, understanding students' and other stakeholders' needs, and planning continuous improvement. A team of external reviewers analyzes the systems portfolio and writes a *systems appraisal*, which identifies strengths and opportunities for improvement. SIUE's systems appraisal identified the senior assignment as an opportunity for improvement not because it was a weakness, but because it could be stronger than it

was—stronger both as an assessment instrument and as a student learning experience.

A recent visit to SIUE by a team from the American Association of State Colleges and Universities' Graduation Rate Outcomes Project (GRO) has recommended that the senior assignment, as a destination goal, become more visible from the time when students first enroll on campus. In the most recent National Survey of Student Engagement (NSSE) results (2006), 82 percent of seniors at SIUE reported that they have had or plan to have a culminating senior experience. Because it is a graduation requirement, 100 percent of graduates will have completed a senior assignment. The other 18 percent of seniors either did not recognize that their senior assignment was a "culminating senior experience" or their senior assignment was not a culminating experience in practice.

As part of AQIP, SIUE engages in at least three "action projects" at any given time. Responding to NSSE results and the systems appraisal, and more recently the GRO report, SIUE decided to make improving the senior assignment an action project. As part of the project, titled "Meta-Assessment Responding to the Systems Appraisal and NSSE Results," the director of assessment has met with representatives from every undergraduate program to discuss what is and is not working with the senior assignment. A review committee has examined the senior assignment both historically and in its current form. The committee found that the senior assignment brought about significant change in its early years as an assessment device, but that now that

improvements have been made, the primary benefit of the senior assignment is as a culminating experience for the students.

### Conclusion

While the senior assignment is an institutional strength, SIUE realizes that it can improve. The review committee has found that it is a universally valuable experience for students as a senior capstone, but it does not connect with the rest of the curriculum in all the programs as it does in the psychology department's curriculum. Also, while the senior assignment provides a minimal level of assessment information for all programs, the information that it provides for programs is not always as rich and meaningful as it is for the Department of Art and Design or the Department of Civil Engineering. In response to the Graduation Rate Outcomes study, SIUE is looking at how recruiting materials, new student advisement, communications from departments to new and current majors, and catalog descriptions can make the senior assignment more visible and intentional. The challenge for SIUE now is to take a strength and make it stronger. That is not a bad challenge to have. ■

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# Multiple Drafts of a College's Narrative

By **Paul Sotherland**, professor of biology and chair of the faculty assessment committee; **Anne Dueweke**, director of faculty grants and institutional research; **Kiran Cunningham**, professor of anthropology; and **Bob Grossman**, professor of psychology—all of Kalamazoo College

Writing a story about how well a college helps its students become better educated is an endless helix of “counting and recounting” (Shulman 2007), yielding a series of narratives that track a college’s educational trajectory. When discussed openly, both within and among institutions, these iterative accounts gleaned from measures of student learning can improve undergraduate education by making it more transparent (Bok 2006). In this spirit, we offer part of Kalamazoo College’s draft narrative as a case study, based on explorations of information from the Collegiate Learning Assessment (CLA) and the National Survey of Student Engagement (NSSE), and invite colleagues at other institutions to share insights from their own investigations.

Results from the CLA and NSSE can be enlightening, challenging, and affirming. Trying to understand our students’ CLA performance has led us to examine features of our curriculum that might bring about changes we see in students between matriculation and graduation. In so doing, we are addressing questions, expressed by Hersh (2006), about how we might learn from the CLA. A similar approach to interrogating NSSE results revealed patterns that corroborated our hunches about variation in CLA data. Through these analyses we are finding that at least some of our students’ experiences seem to have a “value-added” effect, and we are beginning to discern how this effect might be expanded to reach more students.

## **Performance of Kalamazoo College Students on the CLA**

Through a grant from the Teagle Foundation, and as part of an assessment collaboration with Colorado College and

Earlham College, we administered the CLA to first-year students and seniors during the 2005–6 academic year. First-years had a mean performance at the 80th percentile (at the lower end of the “at expected” range) of the CLA, even though their mean SAT scores were at the 92nd percentile compared with first-years who took the CLA in 2005–6. Seniors had a mean performance at the 99th percentile (at the upper end of the “above expected” range) of the CLA, whereas their mean SAT scores were at the 92nd percentile compared with other seniors who took the CLA. The “value-added” (mean senior CLA score minus mean first-year CLA score) of a Kalamazoo College education was “well above expected.”

While examining these CLA results, two questions guided our inquiry: (1) What attributes of a Kalamazoo education might account for this overall performance? (2) What variations in students’ educational pathways might account for differences in CLA performance at Kalamazoo? To explore these questions we employed several approaches, including comparing “typical” indicators of students’ academic abilities (i.e., GPA and SAT) to CLA performance, disaggregating CLA scores among academic divisions, performing similar analyses of NSSE data, and interviewing students about their college experiences.

## **Indicators of Academic Ability and CLA Scores**

We began with the easiest comparisons by looking for correlations between CLA performance and SAT scores and cumulative GPAs. CLA scores of both first-years and seniors were positively, but weakly, correlated ( $r = 0.37$  and  $0.24$ , respectively) with SAT scores (fig. 1). Similarly,

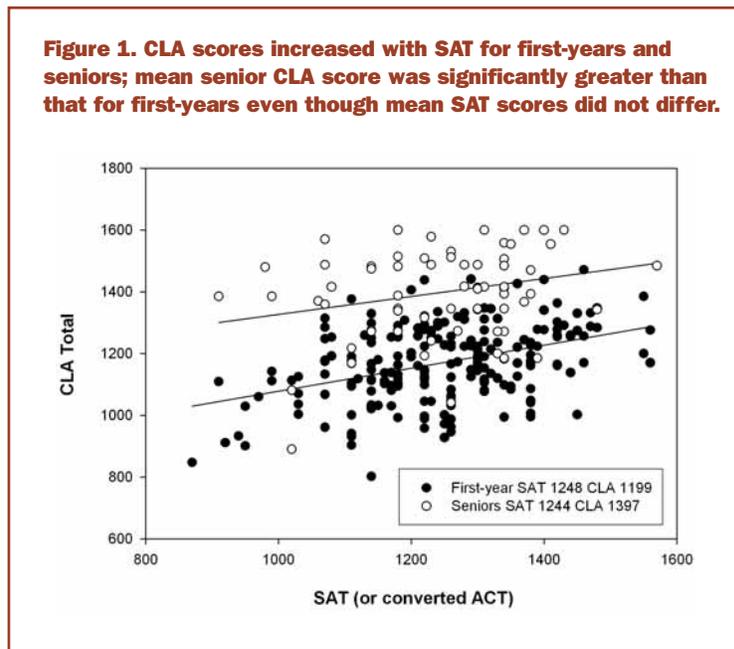
cumulative GPAs of our seniors showed a weakly positive correlation with CLA score. Thus, students over a range of “abilities” performed well (and not as well) on the CLA, suggesting that students selected for admission to an institution perhaps should be those most likely to thrive in the college’s environment and not just those with the (presumably) highest academic ability. However, to find out why some students seemed to thrive more than others, as measured by the CLA, we had to dig deeper.

### A Disaggregated View of Kalamazoo’s CLA Performance

In post-CLA surveys and interviews, our seniors described educational experiences that they believed contributed to their CLA performance, but our attempts to identify predictors of CLA performance through analyses of academic transcripts and comparisons of scores by academic division revealed little about what might cause some students to perform well and others to perform less well. While acknowledging that these analyses probably suffer from our small sample size, and acknowledging that the CLA was designed to yield one aggregated score for each institution, we were disappointed with our lack of insight.

Because CLA scores tend to increase with higher SAT scores (as illustrated in fig. 1 and in the CLA Institutional Report; see

**Figure 1. CLA scores increased with SAT for first-years and seniors; mean senior CLA score was significantly greater than that for first-years even though mean SAT scores did not differ.**



www.kzoo.edu/ir), we needed to account for variation in SAT scores when interpreting the CLA performance of our students. So, instead of using actual CLA scores (i.e., scores earned by students), we computed “adjusted” CLA scores (AdjCLA) by calculating each student’s “expected” CLA score using the equation from the interinstitutional regression of CLA score on SAT score ( $CLA = 0.69(SAT) + 448$ ), and then subtracting it from that student’s actual score ( $AdjCLA = Actual\ CLA - Expected\ CLA$ ). Thus, a student with a positive AdjCLA had a CLA score above the interinstitutional regression line and a student with a negative AdjCLA had a CLA score below the interinstitutional regression line. Adjusting CLA data in this way presumably attenuates variation in CLA scores attributable to variation in SAT scores and thereby exposes other potential sources of variation in CLA scores, such as educational experiences. This method of identifying students who “over-performed” and

“under-performed” on the CLA revealed interesting patterns.

We created three categories similar to those used in the institutional report for grouping institutional scores—“below expected” (AdjCLA more than one standard error below “expected” CLA), “at expected” (within one standard error below or above “expected”), and “above expected” (more than one standard error above “expected”)—and sorted student CLA performance into these groups. (We used data

from the interinstitutional regression for these analyses because the “nationally normed individual regression” data were unavailable to us, so this was the best available and most consistent way to explore variations in students’ CLA performance.) The mean SAT score of students in the “below expected” group was about 5 percent greater than the mean SAT score of students in the “above expected” group, but we found no statistically significant differences among SAT scores of the students in the three groups. However, “above expected” students had CLA scores that were 24 percent greater than those of “below expected” students, and CLA scores varied significantly among all three groups. And we were pleasantly surprised to discover seemingly “less capable” students (i.e., those with SATs and GPAs below the college mean) among those in the “above expected” group with high

actual CLA scores. Thus, something more than intellectual ability, as measured by the SAT, seems to have led to high CLA performance for some students. With this new way of looking at students' performance, we set out once again to look for patterns. This time, we had more success.

At Kalamazoo College, CLA performance seems to vary with the academic division in which students majored. Adjusted CLA scores differed significantly among divisions, even though actual CLA scores did not, with students in natural sciences having the lowest AdjCLA. This observation is corroborated by the distribution of students among the three performance categories. The natural sciences showed a bimodal distribution (fig. 2), with eight “below expected,” three “at expected,” and eleven “above expected” scores, whereas all other divisions showed uni-modal distributions, with the vast majority of scores in the “at expected” and “above expected” ranges. The bimodal distribution in natural sciences led to hypotheses about causes for the “below expected” performance of some science majors and prompted us to examine NSSE results more closely.

### Interdivisional Differences in NSSE Performance

We hypothesized that student engagement in “programs and activities that institutions provide for their learning and personal development” ([nsse.iub.edu/html/quick\\_facts.cfm](http://nsse.iub.edu/html/quick_facts.cfm)) would correlate positively with CLA scores. However, data from seniors who completed both the NSSE and the CLA (n = 48) revealed no significant

correlations between any measures of engagement (benchmarks or individual questions) and performance on the CLA. In retrospect, these results are not surprising given that NSSE data are self-reported whereas CLA data are direct measures of abilities. And our analyses again probably suffer from the small sample size and a relatively homogeneous group of students. (Homogeneity, in this case, is in terms of experiences—for example, all Kalamazoo students complete a language requirement, take comprehensive examinations, and complete a senior project, and over 80 percent study abroad.) However, our success with comparing adjusted CLA scores among academic divisions led us to perform similar analyses of NSSE data from a larger sample of seniors.

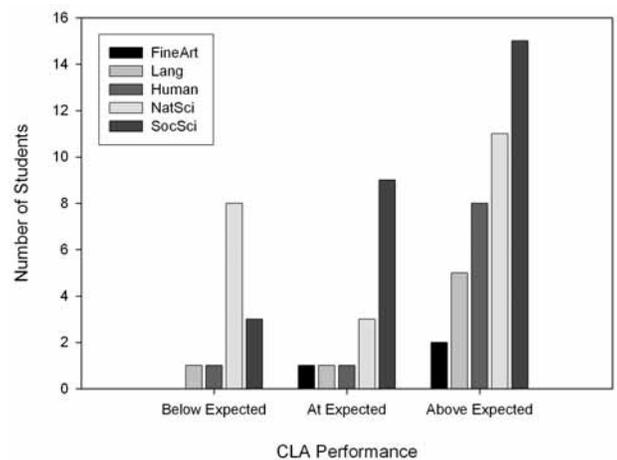
We reexamined data from *all* seniors who took the NSSE in 2005–6 (the response rate was 76 percent) by comparing responses from students majoring in each of the five academic divisions. We found that the “Level of Academic Challenge” (LAC) benchmark differed significantly among divisions. The LAC “score” for natural sciences was significantly lower than scores for humanities and for social sciences, prompting us to examine responses to each question comprising this benchmark. Students in humanities

and social sciences scored significantly higher than students in natural sciences in three areas: (1) number of written papers between five and nineteen pages; (2) number of assigned textbooks; and (3) making judgments about the value of information. If these responses truly highlight different experiences of students in these disciplines, then we might be seeing reasons for interdivisional differences in CLA performance and possibilities for improving our curriculum. Students who write well and who have had more experience making judgments about the value of information would theoretically perform better on the CLA.

### Insights from Student Interviews

Interviews of Kalamazoo seniors provide additional information about effects of various educational experiences. Students in a qualitative research methods course

**Figure 2. Distribution of students among three CLA performance categories differed among academic divisions in which students majored. Students in natural sciences performed both “below” and “above” expected; students in other divisions performed mostly “at” and “above” expected.**



administered, transcribed, and analyzed interviews of thirty-one seniors who took the CLA. Examining the interview transcripts from students with high CLA scores and students with low CLA scores revealed intriguing intergroup differences that corroborate insights gained from examining disaggregated CLA and NSSE scores. The following “patterns” emerged: foreign language proficiency seemed to correlate positively with CLA scores; students who used phrases like “personal initiative” generally did better on the CLA; and some science majors seemed to get “lost” in their major, but those who did explore other disciplines tended to do well on the CLA.

The interviews also caused us to wonder about transformational learning at Kalamazoo. We are intrigued by Kiely’s (2006) finding that transformational learning may be catalyzed by experiences of “high-intensity dissonance” that essentially force students to change the parameters of their thinking. We wonder if Kalamazoo’s distinctive focus on integrated, experiential learning might provide students not only with many opportunities to encounter high-intensity dissonance, but also with critically important structures for processing these experiences so that transformational learning is captured. In the interviews we found evidence of transformational learning occurring through, for example, challenging courses, service learning, and long-term, immersive study abroad programs. Moreover, the interviews suggest that students who perform well on the CLA might be those with the confidence, initiative, and (with regard to study

abroad) language ability to place themselves in situations where they not only experience high-intensity dissonance, but experience it in such a way that they develop habits of mind that help them perform well in situations like those encountered on the CLA.

### Preliminary Inferences

Clearly, a college education enhances critical thinking, analytical reasoning, and effective writing, and the trajectories students take through that education seem to affect the degree to which those abilities develop. Although small sample sizes preclude our reaching definitive conclusions about factors affecting CLA performance, at this point in our explorations we surmise the following: a high “value-added” education emphasizes *all skills* measured by the CLA and creates opportunities for students to experience, reflect on, and learn from “high-intensity dissonance.” Analytical reasoning and critical thinking are essential for performing well on the CLA, but without effective writing students cannot fully demonstrate those skills.

Several questions remain. What causes some “high-ability” students to underperform on the CLA, and what experiences help students with “weaker” academic records perform above expected? Could it be that some natural science students do not get as much practice with writing as students in other divisions (as noted in Bok 2006), and are therefore unable to demonstrate their abilities to think and reason on the CLA? If encounters with “high-intensity dissonance” bring about developmental

leaps, how do we ensure that all students benefit from those experiences? Moreover, what are the conditions under which encounters with high-intensity dissonance actually lead to transformational learning? And how can we best use lessons learned from investigations like those described here to inform curricular decisions?

Data and stories from assessment of student learning provide “ground truth” that allows our heads to believe what our hearts tell us. We in the academic realm live, at some level, in the cerebral sphere of influence that makes us skeptical of hunches born outside of our heads. And yet, we “know” in our hearts—from noticing changes in demeanor, new twinkles in eyes, and more conviction in voices—that we effect significant growth in our students. Assessment of student learning helps cause the spheres of the head and heart to fuse into a powerfully convincing whole. Through that fusion, we find affirmation of the learning that takes place during college and develop the impetus for writing the next draft of our institution’s narrative. ■

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# The Culminating Experience Decision

**By Verna Teasdale**, senior academic administrator, Office of Academic Affairs, Prince George's Community College

"I have asked for a vote by secret ballot," the new vice president for academic affairs announced at the meeting of the department chairs. "The question," he continued, "is whether or not to require a culminating experience in both the college's transfer and career degree programs, or only in career degree programs."

"I will abide by the chairs' decision," he concluded, and



sat down as the ballots on half-sheets of paper were distributed to the twenty-three department chairs at Prince George's Community College.

The vice president for academic affairs first had proposed that a culminating experience should be included in each of the college's degree programs. He defined a culminating experience as one that enables students to contextually apply the knowledge they have gained from the education received at the college. He explained that a culminating experience included in a degree program could be a capstone course and/or work-based learning which could consist of an internship, clinical experience, field experience, or a cooperative education experience.

The vice president understood that adding a culminating experience of any kind to an existing program

of study would require reworking each program's curriculum. He knew that, in some cases, adding a culminating experience to a program would increase the number of credits that a student needed to graduate, and that the culminating experience might not transfer. Recognizing the importance of the department chairs in facilitating change, especially change of this magnitude, the vice president for academic affairs let the chairs decide whether to require a culminating experience in all degree programs or only in the career degree programs.

Students who complete the freshman and sophomore courses at Prince George's Community College earn one of three degrees—an associate of arts (AA), an associate of arts in teaching (AAT), or an associate of science (AS)—and transfer to four-year colleges or universities to complete their junior and senior courses and earn bachelor's degrees. Students who complete career degree programs earn associate of applied science (AAS) degrees. AAS degree programs are discipline intensive and prepare students for careers; they are not designed to transfer to four-year institutions.

## **Culminating Experiences for Career Degree Program Students**

Recently, the department chairs at Prince George's Community College approved the addition of a required culminating experience for students in career degree programs. Their approval indicated their understanding of the purpose of AAS degrees as a means to equip students for the workforce in specific disciplines. The chairs also realized that the college needed a good



method for determining how well the AAS graduates could synthesize and apply what they had learned. The culminating experience would help satisfy the need. As at most community colleges, and many senior institutions for that matter, degree programs consist of a group of discrete courses that are germane to the discipline but seldom are sequenced and rarely are interrelated. Once students satisfactorily have completed all of the required courses, they earn the degree.

Community colleges get some information about the proficiency of their transfer students when they receive feedback from the receiving four-year institutions. The same feedback is not readily available for career-degree holders. Year after year, as students proudly receive their hard-earned AAS degrees, the nagging questions remain: How well can these students apply what they have learned to the fields in which they now hold degrees? How many of them will enter the workforce in the field of their choice only to discover that it is nothing like they imagined?

Consider this example of a student who majored in accounting. He had always wanted to be an accountant, and while in college, he delighted in working out problem sets in the courses. Yet, once he received his degree and went to work in an accounting firm, he was shocked to find out that accounting in the workplace was nothing like accounting in the classroom. Nothing had prepared him for the interaction within the company that was necessary to obtain the information he needed to do his work. Another example in which

coursework and “real-world” work may look nothing alike is in business management. What exactly is a student who holds an AAS degree in business management equipped to do? Can these students concretely apply what they have been taught in the abstract?

A culminating experience provides a means for the college to determine how well students can apply what they have learned, and, depending on the nature of

strong resume builder that will impress potential employers.

A culminating experience also provides one more method to assess the efficacy of a degree program curriculum. A culminating experience is the ultimate summative evaluation.

### **Community College Capstones**

In general, four-year institutions are better known than community colleges for

**A culminating experience provides a means for the college to determine how well students can apply what they have learned, and, depending on the nature of the culminating experience, gives students the opportunity to determine whether they enjoy working in the field they have chosen.**

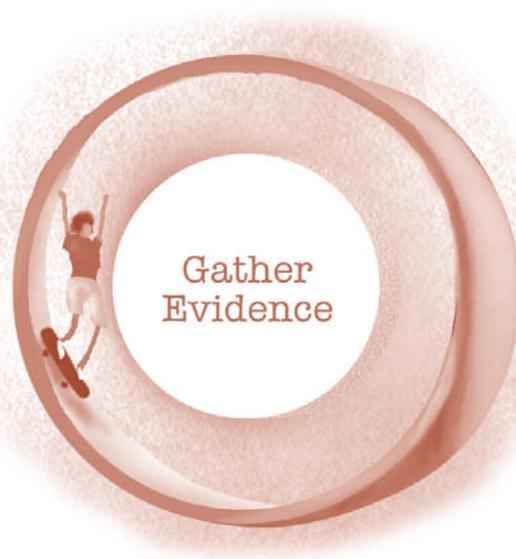
the culminating experience, gives students the opportunity to determine whether they enjoy working in the field they have chosen. Additionally, regardless of the nature of the culminating experience—whether it involves doing a major project, developing a portfolio, completing an internship, or sitting for a certifying examination—students can conclusively demonstrate their knowledge of their disciplines. Such a demonstration serves students well as a

requiring culminating experiences. But some two-year colleges, such as the Community College of Denver, LaGuardia Community College in New York, Cuyahoga Community College in Ohio, St. Louis Community College in Missouri, Wake Technical Community College in North Carolina, and Austin Community College in Texas, include capstone courses prominently in some of their programs of study.

When the concept of a culminating experience is examined, the result suggests that more community colleges require capstone courses and work-based learning experiences than is immediately obvious. At Prince George's Community College, evidence of culminating experiences abounds. Examples include the honors colloquium and programs in nursing, allied health, elementary and secondary education, art, and computer information systems. Nearly every department at Prince George's Community College offers an interdisciplinary sophomore-level honors colloquium. The nursing and allied health programs require students to have clinical experience in a variety of health-care settings. For these students, course and clinical work culminate in high-stakes licensure examinations.

To earn a two-year degree in either elementary or secondary education at Prince George's Community College requires both student teaching and passing PRAXIS I, the teacher certification test, before transferring to a four-year college or university. The art department introduces "portfolio development" in a lower-level course with the expectation that as students advance, they will continue to build their portfolio. According to the most recent version of the Prince George's Community College catalog, when the art majors graduate they are expected to have "a coherent body of work to be used as a

portfolio for transfer into other schools or for employment interviews." Several years ago, the computer information systems department began requiring a capstone course, Systems Analysis, for both its computer information systems AAS and its information science AS programs. Recently, when the computer information



systems department developed its information security AAS program, it included a capstone course. Other programs, such as mathematics, languages, and chemistry, have capstone courses by default. These focused programs require students to apply knowledge gained in lower-level courses to upper-level courses. However, the highest-level math, foreign language, and chemistry courses at the college have never been called capstone courses, even though each is a composite of all the student has learned before.

In retrospect, the department chairs'

willingness to include a culminating experience in career degree programs was not as remarkable as it first seemed because several departments already had culminating experience requirements.

However, approval for the inclusion of capstones was just the beginning. The real work will be for the faculty members in each department with programs that require the addition of a culminating experience to decide what that experience should be and when a student should undertake it. Faculty also need to agree on the expected outcomes of the culminating experience and the criteria used to evaluate it. Faculty will need to develop a rubric that determines the extent to which the criteria have been met. The department chairs and the research office need to develop a plan to gather and analyze the information collected from students' culminating experiences and to evaluate the significance of the culminating experience in terms of student retention and quality of learning that is taking place.

When the culminating experiences are fully in place in the career degree programs at Prince George's Community College, graduates will have a clearer understanding of how the knowledge they have gained applies to the careers they have chosen. Equally important, the work-based aspects of the culminating experience of the college's career degree programs can be used to verify employers' workforce development needs. ■

# Doing Less Work, Collecting Better Data: Using Capstone Courses to Assess Learning

By **Catherine White Berheide**, professor of sociology, Skidmore College

I have never met a faculty member who was excited about doing assessment, although rumor has it they exist. In fact, most have been resistant if not downright hostile to the notion. I fall in the resistant category. I have too much work to do to welcome any new task. Surprisingly, the wrong reason—minimizing the additional work—has led to the right way to do program assessment. Analyzing work students produce in the capstone is simply easier than most other assessment options. Fortunately, it also provides better measures of student learning. Since I am not the only faculty member to have come to this conclusion, capstones are becoming central components of assessment plans.

## Using Capstones to Assess Undergraduate Education

The capstone course provides a venue for “assessing how successfully the major has attained the overall goals” (Wagenaar 1993, 214). Indeed, according to Rowles et al. (2004), assessment is the primary organizing principle of some capstones. As Black and Hundley note, when students look back on their four years of college in a capstone course, they “provide invaluable information to faculty about the quality of instruction and of programs” (2004, 3). Many programs are taking advantage of this rich source of data (Berheide 2001; Brock 2004; Forest and Keith 2004). National surveys of departments reveal that in political science as well as in sociology, capstones are the most common assessment (Kelly and Klunk

2003; Spalter-Roth and Erskine 2003).

Henscheid (2000) finds that almost half of 707 regionally accredited colleges and universities use capstones as part of their institution’s assessment program. While Henscheid also finds that smaller colleges and universities are more likely to use capstones for assessment than larger ones, at the University of Washington, about 60 percent of the departments use “some kind of senior experience—including capstone courses, design courses, and senior seminars—to evaluate student’s learning in the majors” (Beyer 2001, 1). At Valdosta State University, nineteen of twenty-four academic units evaluate performance in capstone courses as a method of assessment, making it the third most frequently used method behind final exams and evaluation of course presentations (Yates 2004). Similarly, at Seton Hall, twenty-two out of thirty-three academic units use capstone courses as part of their assessment programs. Across disciplines, private institutions are more likely than public ones to use products from capstone courses to assess undergraduate education.

## Assessing Capstone Products

Currently departments use capstone products to assess their majors in a variety of ways, ranging from rudimentary to rigorous. Beginning at the most basic level, some departments require students to publicly present their work as an exhibition, performance, poster, etc. (Bachand et al. 2006, 21). These displays “provide the



most direct and most unfiltered picture of students' capabilities" (Hartmann 1992, 128).

When these presentations are judged in some way, the assessment process has moved to the next stage. For example, some institutions—including Saginaw Valley State University and Skidmore College, where I teach—submit projects for presentation at conferences or to undergraduate paper contests, providing external validation of the quality of student work. Some programs, including the engineering programs at Saginaw Valley State University, even use external evaluators to “grade” the projects.

Best practice, though, involves going a step further to analyze the projects systematically for the evidence they provide about program quality and to use that evidence to make curricular improvements. For example, the sociology department at the University of Wisconsin–Milwaukee uses five Likert scale items to assess how well the capstone papers demonstrate achievement of the department's learning goals (2006). A more elaborate approach involves applying an existing rubric, such as Primary Trait Analysis (Jervis and Hartley 2005), or a locally developed one (Cappell and Kamens 2002) to capstone products. This more systematic approach can provide useful insight into the strengths and weaknesses of the curriculum.

### A Case Study

Having dragged our feet as long as we could, my departmental colleagues and I finally were forced to conduct an assessment in spring 2003. We reluctantly agreed

to use senior seminar papers for our program assessment because all the other alternatives looked like more work. We chose the theory goal because we were already concerned about the issue. The two sociologists teaching the required theory course examined one strong, one average, and one weak paper.

This first stab at assessment led to three main conclusions:

1. All three papers, including the weakest one, demonstrated “basic facility with many of the crucial concepts in social theory.”
2. The theory goal needed to be revised.
3. The department needed to teach the connection between theory and methods not only in the theory and senior seminar courses, but also in the introductory, methods, and at least some elective courses.

(Brueggemann 2003)

The following year, the sociologists who teach statistics and research methods evaluated how three more papers achieve our methodological goal—concluding that “students generally succeed in achieving our methodological goals” (Fox and Karp 2004, 7). They made several recommendations “to strengthen further an already effective program,” including suggesting that the program revise its goals.

In the third year, the sociologists decided to look at how well students could articulate how the discipline contributes to understanding social life, concluding that “senior sociology majors, at all levels of ability, are applying sociological perspectives to

issues of concern to them” (Berheide and Walzer 2005, 4). The 2005 assessment identifies two general areas for improvement:

1. Encourage students to be even more explicit in linking their specific concerns with implications for sociological theory and knowledge.
2. Help students to improve their ability to move from simply cataloguing findings to writing about them in prose that reflects more synthesis. (Berheide and Walzer 2005, 4)

Overall, with relatively little effort, my department has learned a remarkable amount about what our students know and can do after majoring in sociology. First, we have learned that at least on these three goals, we are doing a good job. Second, we have learned that our theory and methods goals need some revision. Third, we have learned that we need to create greater “sequencing” within the major, especially around theory and methods. Even our minimal approach to assessment has provided vastly better data than we typically draw upon for making curricular decisions. In short, faculty do not have to spend a lot of time and effort to get very useful data.

### Other Examples

A wide range of disciplines have used capstone products to assess the majors with favorable results. Some departments, such as industrial engineering and aeronautics at the University of Washington, have capstone projects evaluated by industry experts; others, such as sociology at Bowling Green State University, have them evaluated by both department members and outside



experts. The sociology department at Bowling Green has found that the outside evaluator usually, but not always, agrees with inside evaluators (Bowling Green University 2007).

Capstones are not just used to assess majors; they can also be used to assess general education. Some institutions, such as Millikin University and Portland State University, have interdisciplinary general education capstone requirements (e.g., Brooks, Benton-Kupper, and Slayton 2004; Rhodes and Agre-Kippenhan 2004). At Southeast Missouri State University, sixty senior seminar faculty analyzed over three hundred capstone products to assess general education goals related to information, thinking, and communication skills. They concluded that student achievement on these three learning objectives ranged from performances in which students were unable to formulate a thesis, produce an edited writing sample, or cite source material accurately to artifacts that demonstrated clear mastery of the ability to locate and use relevant source material, evaluate others' arguments and construct their own, and produce polished pieces of writing. (Blattner and Frazier 2004, 5)

As a result of this assessment, faculty "have begun to redesign the writing assignments they give to students by requiring more than a single draft of papers and by specifying requirements for citation of sources and inclusion of reference lists" (Blattner and Frazier 2004, 6).

Capstone experiences in the disciplines can also be used to assess general education goals. A senior thesis assessment project at

my college revealed that at the draft stage before their thesis advisers have provided feedback, students have trouble specifying the question guiding their thesis, defining key concepts, and organizing it. Simon et al. also conclude that "students in the sciences and social sciences who have experience with research come to the senior thesis better prepared than in those disciplines that do not reinforce research skills" (2006, 1).

According to Weiss (2002), sociology department chairs rate work in the capstone course as the second most valuable assessment tool. Moriarty (2006) finds that 51 percent of criminal justice programs consider capstones a very effective assessment instrument. One reason for the effectiveness of capstone products for assessment is that they are a direct measure of student learning. Other assessment experts (e.g., Angelo and Cross 1993; Banta et al. 1996) consider direct methods of assessment the best way to measure student learning. Capstone products are also authentic embedded assessment methods, since they are created as part of normal classroom activities. Finally, capstone products are an efficient assessment method, since they take advantage of an existing source of data. In short, capstones courses provide a venue for assessing how successful a curriculum is in achieving its learning objectives.

### **Making Change**

The final step is to use the data collected about student performance to improve the major. Yates (2004) finds that, at Valdosta State University, capstone-based assessment led most frequently to the addition of new

courses and other changes in curriculum as well as changes in pedagogy or course format. For example, performance in capstone courses as well as on final exams, and pass rates of licensing exams, portfolios, and juried exhibitions, led the art department to include visual assessment, analysis, and writing projects in one of its courses.

Similarly, the University of Indianapolis Department of Communications has found the capstone to be an excellent mechanism for assessing the quality of its academic program. As is the case in my department, evaluating senior projects has raised concerns about the connections between the capstone and the rest of the student's course of study. According to Catchings, "the issues of alignment among curriculum, learning, and the capstone have prompted concerted efforts to improve the quality of both the curriculum and the capstone," including "redesign of department core curriculum courses in order to reinforce expectations in writing and oral communication" (2004, 7).

After five years of assessing the capstone, Leach and Lang report that the department of anthropology at the University of North Dakota has added methods and theory courses to the curriculum because "our students have provided relatively weak evidence of their understanding of how theory affects observation and interpretation in scientific and humanistic research." They also report "an improvement in the clarity and strength of written and oral communication, as a result of assessment recommendations" (2006, 5). As these examples demonstrate, departments that have used capstones to assess their

majors have found that it leads to improved student learning and can actually make faculty work lives easier.

Assessment, therefore, is not an end in and of itself, but rather a means to an end. The end is the improvement of student learning at the individual, program, and institutional levels. Analyzing capstone projects is an efficient and effective approach to achieving that end. ■

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# Love of Learning—and Assessment

By **Ross Miller**, director of programs, Office of Education and Quality Initiatives, Association of American Colleges and Universities

I am a musician and a music educator, and that fact drives how I think and feel about education. Practice, self-assessment, public performance, and passion shaped my teaching and my students' learning during my K–12 and college teaching careers.

I mention passion because I believe that inattention to affect underlies many of the teaching and learning challenges higher education faces. It is obvious that students must devote concentrated time and effort to their studies to have a reasonable expectation of success. What is less obvious is the level of responsibility teachers should assume in creating conditions ripe for learning. When students are motivated, when expectations and affect are positive, better learning results. Consistent regard for affect prior to, during, and after teaching should be part of our planning. It is telling that one of the widely used assessments now helping to improve higher education—the National Survey of Student Engagement—is a measure of student engagement, not cognition.

Of all the aspirations we can hold for students, perhaps the highest is “love of learning.” This dynamic integration of passion and cognition is, often, what leads faculty and administrators to their careers. Eliminate either passion or cognition from the classroom, and you compromise learning. Faculty may know all six levels of Bloom's taxonomy of the cognitive domain. Few, however, plan their teaching considering the affective domain (receiving, respond-

ing, valuing, organization, and characterization by a value). Just as we are often encouraged to plan for higher levels of cognition (i.e., synthesis, evaluation), we should strive for higher affect—at least up to valuing.

Assessment holds special promise to influence how students learn and feel about learning. Far too often, students don't know what they are doing—they cannot judge the quality of their own work because they have not been taught how to judge success. Musicians say “practice makes perfect,” but if you practice badly, you only get really good at making mistakes. We must be taught how to practice or we become discouraged and stop trying.

Assessments can provide the guidance that students need to improve the quality of their work and how they feel about learning. Teaching students to self-assess, using the same criteria an expert uses, engages students at the evaluation level of cognition. Developing the ability to judge quality and thus learn more independently is an empowering, emotional experience that increases the learner's motivation. Positive assessment leads to positive valuing.

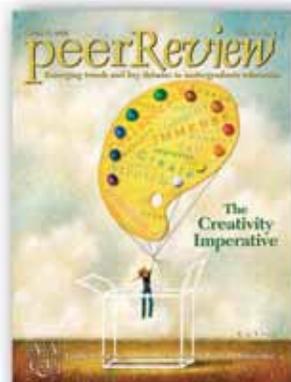
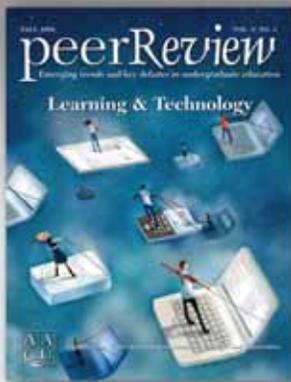
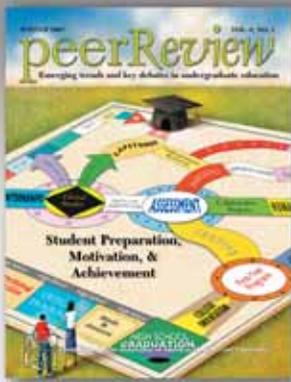
Pedagogy is another factor that we can control to improve learning. Educational practices such as learning communities, service learning, internships, and undergraduate research (among others) have been identified as effective and engaging. By requiring students to analyze and assess information while solving problems, these practices tend

to motivate students. Not all assignments or projects will be profoundly moving experiences, but faculty can increase the likelihood of exciting students about learning by making strategic pedagogical choices.

Over the last decade, questions about how well students are learning have resulted in persistent calls for assessment and accountability. Regardless of which national measures are used over the next decade, local assessment will still be needed for a variety of purposes, the most important of which is to improve student learning. Given that assessment is already a common practice among faculty (e.g., grading using specific criteria), it is not unreasonable to suggest teaching students to use those same criteria, thus transforming assessment *of* learning into assessment *for* learning.

We know enough about how people learn to do much better in planning instruction, fostering learning, and gathering evidence of achievement. If one's personal experiences with tests have been less than optimal, it may seem counterintuitive to assert that assessments can bring enjoyment to learning and keep students coming back for more. But achievement and love of learning in all disciplines emerge from the ability to work at the highest levels of cognition to address genuine problems and assess how well one is doing in solving them. After all, my trumpet lessons in college—with many rounds of teacher assessment and self-assessment—were nearly always the most enjoyable part of my week. ■

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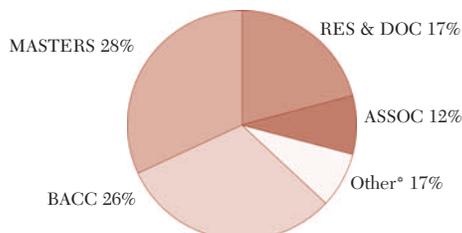
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