Assessment and Technology Enhanced Learning

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Abstract

Assessment practices currently employed normally focus on two critically important aspects. Student learning styles and instructor teaching methodologies. But, in reality, assessment techniques should actually analyze and examine the interaction between the two key players, namely the student and instructor. (Grasha, 1990, 1996). Many tools used in assessment of learning often document students' knowledge. However, they do not examine how classroom practices have contributed to specific learning outcomes. Traditional methods for evaluating teaching typically examine instructional practices but often ignore how those practices have actually contributed toward influencing students' intellectual development. (Brookhart, 1999). Analysis of student course portfolios approaches the problem of assessment in a different manner, and attempts to document effectiveness of teaching and evidence of learning more exhaustively, concentrating on specific issues. Yet, this method does not necessarily examine the interplay between the instructor and the learner. Assessment practices throughout the country are experiencing a state of rapid transition. (Edgerton, Hutchings, & Quinlan, 1991). Revised ideas are being implemented to develop newer assessment practices that are intended to be more useful. One of the main objectives is to document the desired competency and strengthen students’ professional development to instill a desire and motivate an ambition for lifelong learning. (McClymer & Knoles, 1992). The author outlined these ideas at the 23rd Annual Lilly Conference, Oxford, Ohio, 20-23 November 2003. These suggestions were made so that an instructor can implement necessary tools to examine and document students’ competency in a chosen area of concern. (Narayanan, 2002 a, b & c; 2003, 2004). Technology has provided the instructors with a powerful tool to expand, support and implement assessment techniques effectively and efficiently. The author has reported on twelve assessment techniques that can probably be utilized in any modern academic environment. (Narayanan, 2004). These twelve techniques, combined with the twenty principles of Total Quality Management guide the instructors with several paths that can be chosen according to their discipline.
Introduction

One can draw from the principles of Total Quality Management to successfully incorporate technology in developing assessment techniques. President Reagan awarded the National Medal of Technology to Dr. Deming in 1987. He was inducted into the Automotive Hall of Fame in 1991. During the seventies and eighties, quality became the buzzword of industry, organizations and institutions. Several awards have been instituted to promote quality. It is very well known that The Malcolm Baldrige National Quality Award is one of three global quality awards coveted by companies all over the world. The main focus here, is to document success in seven selected areas: leadership, strategic planning, customer’s market focus, information analysis, human resources, process management and business results. Following the footsteps of Dr. Deming’s teachings, the author re-visits the learning pyramid and examines Deming’s ‘14 Points for Management’ and their usefulness while discussing an engineering subject matter. Inspired by Dr. Deming’s ideas, the author developed twelve assessment techniques that have been successfully used in several departments of the School of Engineering and Applied Science at Miami University of Ohio. (Narayanan, 2003).

Twelve Assessment Techniques

1. Instructional Effectiveness: Graded Homeworks, Assignments, Lab reports, quizzes, examinations document instructional effectiveness to an extent. The process followed in the classroom and effective classroom time management can be and needs to be evaluated by the students. Angelo and Cross (1993) have discussed this in great detail in their famous book Classroom Assessment Techniques. The principle is to assess whether the course objectives have been achieved by the students. The 52 “Teaching Goals Inventory” suggested by Angelo and Cross proves to be an extremely useful assessment tool that can be successfully used by instructors in their classroom activities.

2. Portfolio Analysis: The Course Portfolio as a Tool for Continuous Improvement of Teaching and Learning has been discussed in the Journal on Excellence in College Teaching. (J.E.C.T.) by William Cerbin. This article explains how to use learning-centered course portfolios to improve teaching and learning. The article also provides rationale for using teaching portfolios that focus on individual courses. Further it also includes a discussion of portfolio of his own teaching. (Seldin, Annis & Zubizarreta, 1995; Murray, 1995). Cerbin indicates that the objective of a Course Portfolio is to:

(a) Assess more fully the substance and complexity of teaching,  
(b) Connect assessment of teaching with assessment of learning, and  
(c) Foster better teaching and learning.

3. Assessing Prior Knowledge: Dr. Thomas Angelo, of Victoria University, Wellington, New Zealand discusses techniques for assessing course-related knowledge and skills. Angelo and Cross (1993) have provided seven techniques, often called declarative learning. Several, or all of these techniques help the instructors to assess prior knowledge. The principle to emphasize on the "value-added" nature of university higher educational methodologies.

4. Self Assessment: Sally Brown, Phil Race & Brenda Smith provide several techniques for implementation of Self-Assessment. (Brown, Race and Smith, 1996). The students should be provided with an opportunity to express their "satisfaction-rating" of courses, laboratory experiences and the educational experience as a whole. This serves as a very useful tool and provides valuable assessment data upon which the department can take appropriate action to stay at the "edge of technological advancements."

5. Group Assessment: Alumni and their cumulative experience in 'real-world' situations will provide invaluable data to the faculty and administrators. (Young & Young, 1999). Mary Huba and Jann Freed have emphasized several aspects of group assessment and have suggested rubrics and provided interesting examples. (Huba & Freed, 2000). It is a common practice in a university atmosphere to conduct Alumni Surveys, Employer Surveys, Co-op and Internship Employment Surveys, Senior Exit Interviews, etc. Assimilation and consolidation of these data often prove to be very valuable to ensure continuous quality improvement.

6. Peer Assessment: Dr. Craig E. Nelson has been recognized as the "U.S. Professor of the Year" among research universities by the Carnegie Foundation for the Advancement of Teaching in 2000. The author has referred to many of his publications and presentations. Peer Assessment must be a part of the Teaching Evaluations Plan and should be practiced by almost all the faculty in any given department. Peer assessment procedures are a mandatory requirement in Senior Design Projects. (Muchinsky, 1995, Nelson, 1991, Brown, Race and Smith, 1996).
7. **Program Reviews**: University’s internal program review by itself should provide valuable assessment data to the department. The objective of the review should be to judge the quality of the program as well as its centrality to the University. (Slater, 2000). It is of course very well known that nationally recognized external agencies are always capable of helping the departments in establishing and attaining specific goals and objectives. Regional accreditation agencies also provide valuable feedback. It is important to note that the curriculum content can be developed utilizing specific techniques and meet the demands depending upon anticipated growth.

8. **Established Performance**: The author has referenced several of Dr. Barbara Cambridge’s research publications and has observed that it is very valuable to create a track record that effectively documents student learning and establish performance levels and criteria. (Norman, 1980). Cambridge, Williams and Norman have indicated a variety of actions that can be taken to document performance levels of graduates. These methods suggested by eminent scholars in the area of Cognitive Science can effectively document the level, and establish the standard for student learning accomplishments.

9. **Student Feedback**: James O. Nichols and Karen W. Nichols have published an extremely useful guide that provides help in this important area. In their book: *The Nichols Guides to Institutional Effectiveness and Student Outcomes Assessment*, Nichols and Nichols have stressed the importance of assessing student outcomes. (Nichols & Nichols, 2001). Students should always be encouraged to voice their opinion, discuss their ideas and provide constructive feedback to the faculty and the department as a whole. The department should consider this to be a very valuable tool that would be helpful to the faculty as well as students.

10. **Industry Feedback**: Peter Schwartz and Graham Webb have examined several case studies and scenarios while reporting on the importance of assessment in their book: *Assessment: Case Studies, Experience and Practice from Higher Education*. (Schwartz & Webb, 2002). Twice a year, the department of engineering technology meets with an Industrial Advisory Council to obtain valuable insight in to a variety of topics. The council consists of several experts from a wide variety of industries who have volunteered to donate their time and expertise to benefit the faculty, staff and student body of Miami University. The Industrial Advisory Council has helped the department in a number of ways and the council continues to take an active role and helps the department procure valuable assessment data.

11. **Employer Feedback:** Saxe has stressed the importance of closing the loop and suggests several methods to implement such an assessment tool effectively. Employers who encourage co-op or summer internships can help the department in a number of ways. It is possible to obtain significant feedback data from employers who can assess and comment about students’ technical knowledge as well as on–the–job performance capabilities. (Saxe, 1990 June, Bennett & O'Brien, 1994, June, Perry, 1970, 1981, 1984).

12. **Departmental Activities:** Novak and Gowin have stressed the importance of learner interactions in their book *Learning How to Learn.* (Novak & Govin, 1984). Norman also talks about the learner’s mental preparedness in the article *What goes on in the mind of the learner.* (Norman, 1980). Importance of co-operative learning, student’s study habits, laboratory activities, field trips, service learning, cognition and college teaching must be discussed in departmental meetings and appropriate actions must be put in place. (Novak & Govin, 1984, Norman, 1980, Ausubel, 1968).

**Scholarship**

Ernest L. Boyer, in his 1990 book, “Scholarship Reconsidered: Priorities of the Professorate” suggests that there has been an attempt to redefine the university teacher-scholar’s role in the academic environment. In his 1990 book, published by the Carnegie Foundation for the Advancement of Teaching, Boyer cites some ground breaking studies and offers a new paradigm that identifies the need to recognize the growing conversation about teaching, scholarship and research in the universities. Boyer’s research on redefining scholarly work to include teaching has had a profound impact on the way teaching is viewed at universities and colleges (Boyer, 1990). Universities, colleges and educational institutions do not adapt to change easily. Their traditional infrastructures call for ideas that are much more likely to foster stability rather than change. (Laurillard, 1993). In spite of this, one should recognize that things are changing for the better, in many cases.(Perry, 1970, 1981 & 1984). Now-a-days universities are showing greater interest in the teaching activities of its faculty members, and ‘Lilly Conference on College Teaching’ is a classic example. Opportunities are being provided for teachers to learn more about the ‘scholarship of teaching’. Foundations, endowments and grants have been supporting initiatives aimed at improving classroom teaching. (Narayanan, 2003 & 2004).
Regardless, the relationship between scholarship of teaching and scholarship of discovery research is neither simple nor can easily be documented. Several studies have indicated that outstanding research faculty need not necessarily be good classroom teachers. Further, teachers who excel in the classroom need not necessarily be good at research. (Norman, 1980). However, it is clear that it is possible to improve teaching, through better effort. Everyone agrees that both activities are important in universities. Traditionally, outstanding research has always been rewarded better than outstanding teaching, because of the perception that research is a high-stakes activity in the academic environment. (Narayanan, 2002 : a, b & c)

Ramsden (1999) suggested that a cooperative approach of carrying out the task-on-hand that relies both on talents and on the capabilities of the teaching professor both research and teaching to continually improve quality and productivity using teams. Furthermore, instructors and administrators should work jointly to explore and look for different methods and new pathways to verify teaching improvements (Glassick, Huber, & Maeroff, 1997). Changes are very much needed and these changes that are occurring will eventually cycle back into the planning phase for shaping the future. The development of electronic communication technologies also has been an important stimulus in encouraging the rethinking of university teaching. These developments have broadened the range of teaching media available and allowed for new and different student/faculty interactions. (Arnold,1999).

Academic institutions are increasingly employing these sophisticated technologies both in campus-based settings and for distance education. Implementing the use of such media requires major changes within pedagogy and the institutional infrastructure. Even well-informed teachers are being challenged by these developments. Further, Fullan (1993) proposes that "Productive educational change roams somewhere between overcontrol and chaos" (p. 190). Smith (1999) uses the ACORN (Action, Communication, Ownership, Reflection, Nurture) model of Hawkins and Winter (1997) to link these operational and strategic change processes. He summarizes the model's important factors and the author reported this aspect in a paper he presented at the 2003 American Society for Engineering Education Annual Conference (Narayanan, 2003). The ACORN Model of Hawkins and Winter is an extremely effective tool and can be creatively used jointly by the faculty and administrators to bring about progressive changes in an academic environment. The main focus should be to successfully utilize modern technology for achieving course objectives and document program outcomes. (Hawkins & Winter, 1997).
The ‘ACORN’ Model of Hawkins and Winter

The use of ‘ACORN’ model suggested by Hawkins and Winter to conquer and mastering change, may offer some helpful hints for the novice professor. It must again be emphasized that successful implementation of the ACORN model depends on the joint co-operation of faculty, staff, students and administrators.

*Action*: It is possible to effectively change things only when a teaching professor actually tries out a new idea.

*Communication*: Changes are successful only when the new ideas effectively communicated and implemented.

*Ownership*: Support for change is extremely important and is critical. Only strong commitment for accepting changes demonstrates genuine leadership.

*Reflection*: Feedback helps towards thoughtful evaluation of the changes implemented. Only reflection can provide a tool for continuous improvement.

*Nurture*: Implemented changes deliver results only when nurtured and promoted with necessary support systems, documentation and infrastructures.

The T.Q.M. Principles of Dr. Edwards Deming

Inspired by the ACORN model, the author experimented on implementing certain principles of ‘Total Quality Management’ in the classroom. (Narayanan, 2001 & 2002). The author believes that the following twenty principles (derived from Deming’s ideas) help the teaching professor in a variety of ways to excel in his or her field. Each of the twelve assessment methods, combined with the twenty principles of TQM can provide valuable data for the faculty, staff and administration, as a whole. All can be designed to have a built-in mechanism that primarily focuses on closing the loop. Modern technology can help in implementing all the above tools successfully and efficiently in a University environment.
The Twenty Principles:

1. Breakdown all barriers.
2. Create consistency of purpose with a plan.
3. Adopt the new philosophy of quality.
4. Establish high standards.
5. Establish targets/goals.
6. Reduce dependence on lectures.
7. Employ modern methods.
8. Control the process.
9. Organize to reach goals.
10. Prevention vs. correction.
11. Periodic improvements.
12. Maintain momentum.
14. Fact-based decisions.
15. Exploit opportunities.
17. Drive out fear.
18. Recognition/keep score.
19. Identify accomplishments.
20. Customer focus/results.

Quality is defined as conformance to requirements, not “goodness.” The instructor can be instrumental in enforcing this philosophy of quality in all respects. Quality work should be expected in students’ written laboratory reports, examinations, tests, quizzes, take-home assignments, homeworks, creative drawings, technical topic presentations, research reports, etc. This can be effectively accomplished by providing the students with a model report. The model or the format can be instructor-generated or one that is standard and already available in the system. Even a very diversified student body will be able follow a standardized model, whether it be for a publication or be it for an assignment. (Narayanan, 2003).

Furthermore, several leading authors (Buzzel & Gale, 1987; Jablonski, 1994; Poirier & Tokarz, 1996; Ross, 1993) have outlined that:
1) Quality is in the eyes of the customer. Quality must begin with customer needs and end with customer perceptions. In other words, the fundamental aim of today’s quality movement is to provide “total customer satisfaction.”

2) Quality must be reflected not just in the company’s products, but also in every company activity. Quality must be reflected in market research, quality of the product produced, service, product literature, scheduled delivery, and after-sales support.

3) Quality requires total employee commitment. Removing the barriers between departments help employees work to satisfy their internal customers as well as external customers.

4) Quality requires high-quality partners. Quality can be delivered only by companies whose marketing-system partners also deliver quality. Therefore, a quality-driven company must find and align itself with high-quality suppliers and distributors.

5) Quality program alone cannot save a poor product. A quality drive cannot compensate for product deficiencies.

6) Quality can always be improved. The best companies believe in “continuous improvement of everything by everyone.” The best way to improve quality is to benchmark the company’s performance against the “best-of-class” competitors or the best performers in other industries, striving to equal or surpass.

7) Quality improvement sometimes requires quantum leaps. Although the company should strive for continuous improvement, it must at times seek a quantum quality improvement. Companies sometimes can obtain small improvements by working harder. But large improvements call for working smarter.

8) Quality does not cost more. Managers once argued that achieving more quality would cost more and slow down production. Quality is not inspected in; it must be designed in. Doing things right the first time reduced costs of salvage, repair, and redesign, not to mention losses in customer goodwill.

9) Quality is necessary but may not be sufficient. Improving a company’s quality is absolutely necessary to meet the needs of increasing demanding buyers. At the same time higher quality may not ensure a winning advantage, especially as all competitors increase their quality to more or less the same extent.

Conclusions

The reason that technology should play a vital role in today’s educational environment is quite obvious. Technology can help the instructor as well as the student in multiple ways. Simulation exercises, videotaped demonstrations, CD ROM based instructional modules and other modes of instruction all help reinforce the fundamental concepts of engineering science and engineering design methodologies. Universities are facing challenging problems not only on the technological front but also on the socio-economic front. Universities may face budget constraint not only on capital investment, but also on faculty development skills. Modern technology can offer solution to an extent. It is therefore necessary to assess and document the way in which technology has been changing the educational environment. It is important to note that the universities are actively responding to the changes that are taking place in the global consumer marketplace.

References


