2006-158: INTERACTIVE SYLLABUS AND BLOOM'S TAXONOMY

Mysore Narayanan, Miami University

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Abstract

The author is of the opinion that an effective assessment rubric based on the principles of Bloom's Taxonomy can help the learning process by generating a constructive dialogue between the instructor and the learner. The author also favors the development of a set of course material content that includes an *interactive syllabus,* as opposed to a *traditional syllabus.* Such a system has been suggested by Clifford O. Young Sr. & Laura Howzell Young of California State University, San Bernardino. Saxe also comments that traditional teaching methods *evoke learning passivity and resentment.* (Saxe, 1990). With the traditional delivery methods, a course syllabus is considered to be an official contract between the instructor and the learner. Both are expected to abide by the requirements of the course and to adhere to the time constraints required for the class. On the contrary, in an interactive method of teaching, the instructor is more flexible to permit the students to revise the contents of the syllabus. It is thereby transformed into a *learning contract* between the instructor and the learner. It is possible to design a *learning contract syllabus* in such a way so that it still follows the general guidelines of the instructor. However, this time, it is more precisely matched to the learning needs of the students. A properly generated assessment rubric can easily identify that course curriculum goals and objectives have been successfully attained.

Introduction

Over the past couple of decades, the computer classroom has slowly evolved and emerged as a standard matrix for interdisciplinary dialogue. Further, it is of notable importance that this dialogue is not just between the instructor and the learner, but it is also between the learners themselves. Another interesting observation is that the learners are spread across disciplines and across continents. Interactive multimedia technology initially made its impact as a simple information storage-and-retrieval medium. Over the past thirty years this technology has revolutionized the workplace as well as the classroom. In this paper, the author describes how multimedia applications have effectively influenced and transformed present day educational methodologies.

Successful accreditation of any program requires proper documentation in two important areas. Assessment of Basic Components (ABC) and Primary Trait Analysis (PTA). Dr. Barbara E. Walvoord is Fellow of the Institute for Educational Initiatives and concurrent professor of English at the University of Notre Dame. She has been the founding director of four faculty development programs and consultant to more than 250 institutions. She is the author of the widely acclaimed book: *Assessment Clear and Simple* published by Jossey-Bass of San Francisco. Walvoord begins by

outlining the three steps of assessment: First is to articulate one's goals for student learning. Second, to gather evidence about how well students are meeting the goals, using direct as well as indirect measures. Third, to use the information collected for continuous improvement.

Learning Paradigm

Clifford O. Young, Sr., & Laura Howzell Young of California State University, San Bernardino argue that a new paradigm for assessment, a learning paradigm, must be constructed to measure the success of new kinds of educational practices. They first review the literature that explores possible ways of gauging the effectiveness of skill based courses and then present a case study of public administration graduate students in a public policy analysis course. (Young and Young 1999).

Based on the recommendations of Young and Young, the author is in the process of developing a detailed questionnaire to identify the principles and primary traits pertaining to interactive teaching methods. Principles of Bloom's Taxonomy and Socratic questioning techniques are utilized in the classroom to motivate students towards a learning paradigm. The main objective is to identify the strengths and weaknesses of Instructor-led teaching methodology and Learner-oriented educational environment. In the latter case the instructor is viewed as a facilitator of an effective and efficient learning group of students.

In a paper he presented at the 2004 ASME Heat Transfer/Fluids Engineering Summer Conference at Westin Charlotte & Convention Center**,** Charlotte, North Carolina **(**July 11-15, 2004) the author raised five questions :

1. What should be counted as appropriate goals in an undergraduate engineering course that has a significant laboratory component ?

2. Are the teaching practices utilized by the instructor in this course providing reasonably acceptable paths toward accomplishing the specified learning goals ?

3. What do students actually accomplish in the course and the laboratory exercises and how does the instructor's teaching methodologies contribute to students' intellectual development and progress ?

4. How does the instructor respond to students' learning difficulties ? Does the teacher revise the teaching strategies to address such problems ?

5. What impact does this type of teaching have on students' life-long learning attitudes ? Are they able to "learn, how to learn."

A Ten-step Process

Over the past several years, the Senior Design Project Course has evolved into a very powerful and productive component in the Engineering Technology Curriculum at Miami University. Experience over these years have resulted in several modifications and ultimately has resulted in streamlining the design project process to follow a smooth flow in a systematic manner. This has resulted in formulation of the following ten steps during the administration of a senior design / service-learning course.

1. Conduct an extensive research and document the expertise and experience of the previous student group that was involved in the project. If this has been the pioneering project, try to gather data from similar projects conducted elsewhere by other institutions. Were their flaws in their approach ? Can the flaws be removed ? Did they have a list of suggestions for improvement ? What conclusions can we draw from their project ? Was it a total success ? Could it have been done better ? Has the project been dated ? Are we capable of utilizing modern technology to improve our success rate ?

2. Take an inventory of the talent-at-hand. Are the skills and expertise adequate to handle the project successfully ? Do we need to acquire additional human expertise ? Are our sister departments willing to offer us with their expertise ? (Nursing, Paper Science, Computer Science for example -- in the School of Engineering and Applied Science). Will such an inter-disciplinary approach be beneficial to the success of the project ? Do we need different equipment or instrumentation facilities ? Do we need experts from Industry or commercial establishments ?

3. Conduct an extensive background search that focuses on salient features of the main project and address the key issues that may arise as the project unfolds. Always have a "PLAN B". Be prepared to handle contingencies. You may be very diligent in your design, planning and implementation. Regardless, things may go wrong. (Example : Bridge Building Service Learning Project ---- Heavy Rains ! Students just could not work ! They could not pour mixed cement concrete !)

4. Develop a *Decision Analysis Matrix* that can justify the actions taken during the development of the project. You should provide four or five methods for solving the problem. In each case you should evaluate it with chosen engineering methodologies, such as safety, cost, reliability, maintenance, performance, ergonomics, cleanliness & Hygiene, etc.

5. Create a *Gantt chart* that clearly defines the time-line of the project. This *Project Planning Tool* helps the students to represent the timing of

tasks required to complete a given project. They are very simple to understand because each task takes up one row. As the project progresses, the students are required to update the chart by filling in the bars with different colors to a length proportional to the fraction of work that has been successfully accomplished on any given task. Member of the student group, who is responsible for the task normally writes his or her name on a chosen column on the chart. Several software packages are available that offer help in constructing a Gantt chart with great ease.

6. Generate a *Fish-Bone Diagram* that helps the members obtain a graphical picture of the project development and keep track of its progress. These are *Cause-and-Effect* diagrams that are used to systematically organize and list the variety of different causes that can be assigned or attributed to given problem or an effect. This diagram is extremely useful as a visual document however, its usefulness is invaluable when a designed process goes out of control. It is extremely easy to identify *what is causing the problem* with the help of a fishbone diagram.

7. Highlight the important issues surrounding the project and the milestones that need to be achieved and attained. These issues are result of good feasibility study, power of logic, creative thinking and sound reasoning. The issues may not be limited to engineering design or economic viability or justification of cost analysis. Students necessarily need to address various other aspects such as Ethical, Environmental or Ergonomics.

8. Design, develop and generate an instrument to assess your progress and success of your project. Questionnaires, surveys, one-minute papers, and other self-assessment tools such as the ones described in Angelo & Cross's famous book : *Classroom Assessment Techniques* must be utilized to assess the progress of the project at suitable intervals.

9. Aspire at accomplishing T.Q.M. (Total Quality Management) TQM is the brainchild of Dr. W. Edwards Deming who is also known as the father of the Japanese post-war industrial revival. He is regarded by many as the leading quality guru in the United States. Deming's business philosophy is summarized in his famous "14 Points" that have inspired significant changes among a number of leading US companies striving to compete in the world's increasingly competitive environment.

10. Invite external reviewers and judges to evaluate and criticize your project. Evaluation of the service by the recipient is extremely important. It must be recognized that *Civic Education* is an integral part of the service learning project exercise. It is very important that this aspect of the

project is assessed clearly. The project should be designed so that the students are able to see and appreciate the value of their technical background and expertise in solving some of the problems encountered by the citizens of the local community.

Innovative Technology

In *Review of Educational Research,* published by the National Institute for Science Education of Madison, Wisconsin, Springer, Stanne & Donovan report on a meta-analysis conducted during 1998-1999. In their paper entitled *Effects of small-group learning on undergraduates in science, mathematics, engineering and technology,* they conclude that small-group learning promotes greater student achievement, increases retention in courses, and promotes favorable attitudes toward the course material. (Springer, Stanne, & Donovan, 1999). Sharan & Sharan also stress the importance of cooperative learning methods incorporated into the traditional classroom and recommends group investigation. (Sharan & Sharan,1994). Traditional methods of instruction may not be very resourceful in service learning courses pertaining to engineering disciplines. Student learning styles are completely different and instructors have to accommodate new and different learning strategies. (Schmeck, 1988). The instructor responsible for service-learning course is charged with the responsibility of creating an active learning environment. The instructor may have to utilize some innovative modern technology to design develop and present interactive lecture demonstrations. (Sokoloff & Thornton, 1997). Herein the instructors should utilize Silberman's guide. He offers several suggestions in his famous book : *Active learning : 101 strategies to teach any subject.* (Silberman, 1996).

The author extends this philosophy to students taking service-learning courses in the discipline of engineering in general. Feedback from students indicates a sense of satisfaction, fulfillment and accomplishment. The school of engineering and applied science uses several written survey instruments to obtain and analyze student responses to classroom teaching and instructor interaction. (Narayanan, 2004 b) The author strongly believes that students should be provided with an opportunity to state their own views and express their opinion freely. Nevertheless, it should be remembered that, they are essentially required to listen to their peers and instructors in order to appreciate their viewpoint as well. Since ENT 497/498 is a Miami University Capstone Course, the student groups are required to submit a detailed written report about the experience. In addition, the groups are required to present their findings to the faculty, peers, external reviewers and fellow-student groups in a *Show-and-Tell* oral presentation. Finally, it is extremely important that the achievement and accomplishments of these student teams needs to be assessed and evaluated. Slavin has provided us with some very useful guidelines regarding cooperative learning and achievement. (Slavin, 1994 & 1996).

Service learning has branched off to support education with more outreach programs. For example, the Wharton School of the University of Pennsylvania has embarked on a mission to educate students with a broader perspective. They are encouraging students to become more open-minded and well articulated. Their objective is to generate a new generation of effective leaders that can make a dent in the global marketplace. The undergraduate division of the school offers a course on leadership and communication that operates in groups is in reality collaboration between students and academic affairs. It aims at developing and refining leadership skills not only inside but also outside the classroom. Over a course of four years, the students experience a variety of skill-building workshops, leadership development program retreats, mentoring activities, etc.

Interactive Syllabus

The author recommends the use of Thomas Angelo's (1993) *Fourteen Principles for Improving Higher Learning* while creating an interactive syllabus.

1. Students' performance excel when they are encouraged to engage more actively in their academic work. (rather than passively attending lectures and taking notes.) This is accomplished by motivating students to explain to fellow learners creative ideas and practical implications as viewed in different contexts.

2. Students are asked to focus their attention by being made aware of the basic structure of what is to be learned. Here, the priorities of content are stressed while the subject matter is discussed.

3. Students are asked to write down specific learning goals and compare them with their peers and also the instructor. Students are encouraged to set and maintain realistic goals that can be accomplished in a given time frame.

4. Students are asked to meaningfully connect new information to knowledge acquired previously in relevant courses. Students are required to provide multiple examples, analogies and metaphors.

5. Students are asked to successfully identify and unlearn erroneous previous knowledge if any.

6. Students are encouraged to organize subject matter and content in meaningful ways that are personally and academically appropriate. Accommodate different styles of learning. Students should be able to generate concept *maps and mental models.*

7. Students should receive specific feedback. Encourage them to incorporate constructive feedback in their portfolios and journals.

8. Students are provided in detail, and in advance, the rubrics that are used in assessment and evaluation. Model exams and study guides help to a large extent.

9. Student must be encouraged to invest adequate time in addition to high quality focused effort. Allow them to understand the real-world constraints while achieving mastery of the content.

10. Students find real-world applications in many contexts to transfer what they are learning. Encourage students to generate their own applications based on the concepts discussed.

11. Students should perceive and adopt high expectations of achievement. Compare students' expectations with instructors' expectations. Allow them to review what their peers have accomplished during previous years.

12. Students experience a balance of intellectual challenge and academic support. Realize that novices may need more support.

13. Students clearly perceive the value in what is to be learned. It is very important that the instructor communicates with the student that content is held to be very valuable. Make sure that the student understands that mastery of the content will ultimately lead to other important goals.

14. Students interact frequently with other learners and instructors. Engage the students in a dialogue and challenge the students with assignments that groups perform better than individuals.

Conclusions

The author agrees with the findings of Young and Young those interactive teaching methods positively and definitely demonstrate increased benefits for the students and the facilitator / instructor. Interactive teaching methods provide skills necessary for the future workforce. Effective group work, interpersonal communication skills, creativity, job-ready competencies is some of the benefits gained by a learner oriented syllabus. The author strongly recommends the use of Thomas Angelo's *Fourteen Principles for Improving Higher Learning* while creating an interactive syllabus.

Interactive Syllabus and Bloom's Taxonomy

Checklist Used by the Author.

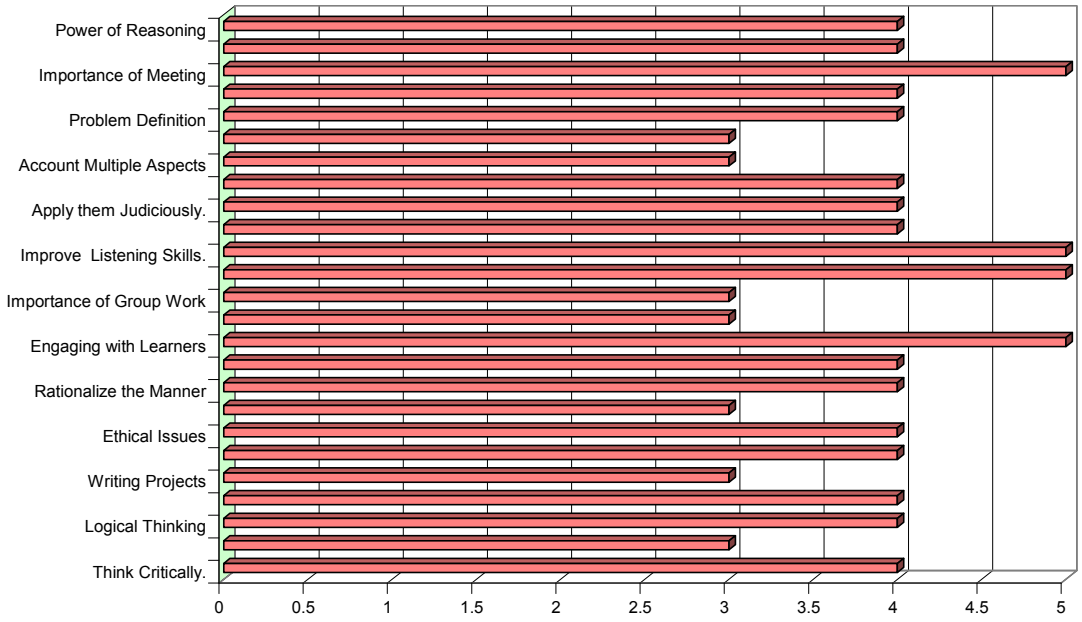
	BLOOM'S TAXONOMY LEVELS					
Assessment	Knowledge	Comprehension	Application	Analysis	Synthesis	Evaluation
In-class Examinations						
Take-home Examinations						
Laboratory Examinations						
Oral Examinations						
Short Quizzes						
Multiple-choice Tests						
Problem Solving Exercises						
Short Essay Assignments						
Extended Writing Assignments						
Oral Presentations						
Student-led Seminars						
Research Reports						
Design Project Write-up						
Computer-based Assignments						
Co-op Work Placement Reports						
Descriptive Learning Logs						
Learning Portfolios						
Poster Presentations						
Individual Projects						
Group Projects						

Reference : Student Assessment in Higher Education. A Handbook for Assessing Performance. Authors : Kevin Cox, Allen Miller and Bradford Imrie. 1998 Kogan Page.

Assessment Rubric used by the author.

	Rubrics based on Likert Scale	
5	Has demonstrated excellence. Has provided documentation. Evidence of critical thinking skills. Very good performance	Has analyzed important data precisely. Has answered key questions correctly. Has addressed problems effectively. Has evaluated material with proper insight. Has used deductive reasoning skills. Has used inductive reasoning skills. Has employed problem solving skills. Has discussed consequences of decisions. Has been consistent with inference.
3	Has demonstrated competency. Adequate documentation. Critical thinking ability exists. Acceptable performance.	Data analysis can be improved. More effort to address key questions. Need to address problems effectively. Expand on evaluating material. Improve deductive reasoning skills. Improve inductive reasoning skills. Problem solving skills need honing. Must discuss consequences of decisions. Has been vague with inference.
1	Poor, unacceptable performance. Lacks ability to think critically.	Absence of analytical skills. Answers questions incorrectly. Addresses problems superficially. Lacks documentation. Inability to evaluate material. Shows no deductive reasoning power. Inductive reasoning power non existent. Poor problem solving skills Unaware of consequences of decisions. Unable to draw conclusions.

An example of what an assessment bar-chart may look like.



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