A COMPREHENSIVE EVALUATION AND ASSESSMENT STRATEGY FOR A COMPETENCY BASED CURRICULUM

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Abstract

Although not mutually exclusive, there are substantial conceptual differences between a traditional discipline-based and a competency-based education, especially in professional courses. Competencies describe the understanding, skills and professional values required of a student that are essential for employability. Performance measurements have been largely dependent on evaluation of students' performance in Toto via tests, quizzes and assignment submissions. Assessment plays a significant role in influencing a student's academic and career opportunities. A competency based teaching paradigm calls for an individual evaluation of each course learning outcome as specified in the structure or outline of the course curriculum. The learning outcomes of a specific competency need to be assessed using methods that include a series of formative and summative assessments. These measurements can be used as a guide for classifying students' learning abilities and for future improvement of both, the teaching method and the learning process. This paper proposes an individualized assessment scorecard which can be applied to a competency based curriculum design.

Keywords: Education, assessment, competencies, performance scorecard.

1   INTRODUCTION

Students in most traditional discipline-based instructional content courses largely learn what teachers choose to teach them in an order formulated by an author of a prescribed textbook. This results in producing students with prescribed packages of knowledge, some of which will be retained upon graduation. However, a competency-based curriculum identifies what is essential for practice, and then provides a sequence of defined learning experiences so that the student may graduate as a qualified beginner. In [Baloh, Damij and Vrecar, 2006], a relevant study brings out the issue of applicability of knowledge that students receive when a course is done in a traditional manner. Fretwell et al [Fretwell, Lewis and Deij, 2001] make a mention that quality curriculum can only be created by linking curriculum design and assessments to the needs of the workplace. More recent research papers illustrate a similar outlook [McDaniel, Roth and Miller, 2005], [Pinto, 2008], [Mishra and Yazici, 2011].

The primary purpose of any professional education is to inculcate knowledge and professional and personal skills to its participants. To achieve this, besides the basic concepts of a discipline, effective learning methodologies characteristic to that discipline need to be incorporated in the knowledge delivery. Thus, education should also include within its curriculum design; processes, methods and models [Hansen and Ratzer, 2002]. The goal of an effective academic program should primarily be industry relevance, adaptability and flexibility. A professionally designed curriculum would require inculcating the two main types of competencies - the Professional and the Personal Competencies. Curriculum design would thus require the identification of the core competencies that a student would require for his job profile and subsequently design the syllabi, the assessment and evaluation strategies to achieve these competencies. Assessments should also focus on providing instant feedback to students and teachers and should be used as a tool to aid the learning process. [Pinto, 2010]. With competency levels and assessments at each level, we can compare at what level of mastery the student is at for a given subject area, resulting in combining the CRT and NRT assessment pedagogies.

The ACM/IEEE joint task force on computing curricula [ACM 2013] has laid out several high level themes as a guide for holistic curriculum development to promote successful professional practice in a variety of career paths.

Students desiring entrance to most professional fields face a prolonged period of training. Many educational programs rely on transmitting a body of formal, abstract knowledge related to the profession, and producing well informed beginners. [Evers, Rush and Berdrow, 1988] comment that

students are exposed to a large body of disciplinary knowledge in their professional preparation programs, but may not develop sufficient skills needed for practice of their chosen profession. Competence, the set of knowledge, skills, capabilities, judgment, attitudes, and values that entry-level practitioners are expected to possess and demonstrate, is the result of integrative learning experiences in which knowledge, skills, and abilities are applied to practice problems [Banta, 2001].

Employers are becoming increasingly concerned about the employees competencies and capabilities required for employability in the domain. Given the increasing importance attached to assessing a wider range of competencies (i.e. knowledge, skills, understanding and wider attributes), traditional assessment methods may no longer be regarded as an appropriate and effective means of assessment. The major purpose of assessment should thus be able to investigate the extent to which students have gained in technical and generic skills from the instructional delivery methods. This necessitates a paradigm shift from assessing a set of examinations to an assessment that focuses on learning outcomes.

This paper is sectioned as follows: Section 2 discusses the issues involved in evaluation and assessment while section 3 proposes a comprehensive assessment strategy for a competency based curriculum.

2   ISSUES IN EVALUATION AND ASSESSMENT

The understanding of the differences between tests, assessments, evaluation and measurements is fundamental to the knowledge base of professional teachers and effective teaching. Applicable definitions [Overton, 2008] are Test: A method to determine a student's ability to complete certain tasks or demonstrate mastery of a skill or knowledge of content. While it is commonly used interchangeably with assessment, or even evaluation, it can be distinguished by the fact that a test is one form of an assessment. Assessment: The process of gathering information to monitor progress and make educational decisions if necessary. Evaluation: Procedures used to determine whether the student has met preset criteria. This procedure could involve a series of assessments to make a determination of qualification in accordance with a predetermined set of criteria. Measurement refers to the set of procedures and the principles for how to use the procedures in educational tests and assessments.   Some of the basic principles of measurement in educational evaluations are raw scores, percentile ranks, derived scores, standard scores, etc.

Assessment is thus a process by which information (knowledge or skills) needs to be acquired with respect to some known objective. Evaluation, being an indication of quality based on predetermined criteria is more complex and ascertains the appropriateness or worthiness of the assessment. Assessment, Evaluation, Measurement and Feedback are an integral part of the learning processes. Assessment thus requires a standardized, systematic, and objective method for evaluating an individuals' performance in a specific area. In its application, it centers on job performance that can be scored objectively and demonstrates a level of knowledge or skill an individual has in a given area. The value of assessment is in measuring and validating knowledge and experience in order to award credit. In the personnel arena, it can help identify who should be promoted and/or who will succeed in a special assignment. In the training arena, it can help validate skills and experiences and/or evaluate training needs and effectiveness. Good assessments lead to good decisions. [Walvoord and Anderson, 1998] advise that establishing clear criteria for grading can help make the process consistent and fair, assist faculty members to grade more consistently, explain expectations to students, and encourage students to participate in their own learning process because they are able to envision performance goals more explicitly.

In competency-based education, statements of competence or attainment define the standards expected and consequently, what learners are expected to be able to do.   When the outcomes of learning are clearly specified, assessments and evaluation must logically be based directly on these outcomes and must confirm to what degree the required learning has been achieved. Such assessments tend to be continuous and comprehensive, rather than end-of-course examinations, with more emphasis being placed on assessing performance and demonstrations and transfer of skill or competence, rather than simply a knowledge acquisition. Certain instructional objectives may help students more quickly to acquire the mental processes for learning [Nitko, 1996] [Mundrake, 2000].

Assessment efforts should not only determine whether students are acquiring the specified competencies, but should enable students to visualize the desired level of performance and provide detailed feedback on their performance [Palomba and Banta, 2001]. Competency based curriculum

delivery necessitates a continuous growth; and becoming a professional means going through a sequence of qualitatively different patterns of knowledge, skills and values. The system should also provide an opportunity for individualized and collaborative learning to allow learners in making this transition.

The differences between a discipline-based and a competency-based education must be taken into account when planning and developing curricula that are intended to provide an IT professional sustainable employability. An integrated approach whereby competency is achieved by defining the essential knowledge that is required, and by assessing the required skills and attitudes of students, is a way forward in the development of traditional courses [Pinto, 2008]. An increased demand for accountability for professional education programs has focused attention on the concept of professional competence. Competencies based models target crucial skills and practices that directly contribute to an organizations goals. Once the skills and knowledge that form a competency model have been developed, the amount of the skill or knowledge required to succeed must be determined by the organization and relevant stakeholders. This translates to a subsequent shift in both, short and long term strategies of assessment and evaluation. Kaplan and Norton introduces of the Balance Scorecard, defines the same as, [Kaplan and Norton, 1996], "the Balanced Scorecard translates an organizations' mission and strategy into a comprehensive set of performance measures that provides a framework for a strategic measurement and management system". The balance scorecard framework enables the execution of the following four strategic processes:

- Clarify and translate vision and strategy.
- Communicate and link strategic objectives and measures.
- Plan, set targets, and align strategic initiatives.
- Enhance strategic feedback and learning

The NACTE's perspective [Rutayuga and Kondo, 2006] further states "The establishment of the competence/outcomes-based education and training requires change of assessment approach and methodology from the acquisition of knowledge to the acquisition of skills, knowledge, understanding and wider attributes. The implementation of the approach and use of a range of assessment methods and techniques require that learners be assessed against outcomes by using appropriate assessment methods. Such a paradigm shift involves, amongst other things, the development of competence-based curricula. The curricula should comprise statements on what someone with a particular qualification should be able to do in the world of work and typical context that a person who successfully followed the developed curricula could work in more efficiently"

3 A COMPREHENSIVE ASSESSMENT STRATEGY FOR COMPETENCY BASED CURRICULUM

Assessment is important because it drives students' learning [Brissenden and Slater,2002]. Observably, and whether we like it or not, most students tend to focus their energies on the most expeditious way to pass their 'tests.' Knowing this, we should use assessment strategies to stimulate the kind of learning that takes place. Assessment strategies that focus predominantly on information recall will likely promote superficial learning. On the other hand, if we choose assessment strategies that promote critical thinking, we can potentially achieve a higher level of student achievement. Good assessment can help students become more effective self-directed learners [Angelo and Cross, 1993].

Incentives are at the core of an individuals' learning and non-graded passes appear to remove a key source of incentive for learners. Hence, it is recommended that some form of graded assessment that measures the skills required for students to be adaptable and flexible be introduced to provide important incentives for learners [Microsoft Researcher]. In summarizing the comments of more recent researchers [Shepard 2000; Wiliam 2000] we can conclude that "assessment of learning" is not the same thing as the "testing of learning". What is preferable, they maintain, is an assessment culture which is integrated into a learning culture.

While evaluating a competency, an absolute marking system of percentage marks is insufficient as it does not provide a measure of the level of a learner's ability for the specified competency. Competency Based Assessment measurements of 'Competent'/'Not yet competent' or Pass/Fail are also insufficient to determine the strengths and weaknesses of a learner. Although this removes the fear of failure for lower achievers it ignores the efforts of higher achievers. The competency evaluation process must be an indirect measure of performance, and used to provide indicators of students'

perceptions of their own competency and performance and improvement. Grading scales provide teachers and potential employers with a more appropriate mechanism to measure and motivate employees/learners.

Evaluation is a process that attempts to determine as systematically and objectively as possible, the relevance, effectiveness and sustainability of a program. Assessment is an ongoing process aimed at measuring the learning and the dispositional characteristics of a student. Besides defining criteria and standards of quality, assessment involves gathering, analyzing and interpreting evidence and using these results to improve performance. There is a large body of research on the various forms of assessments, specifically on the need of formative assessments to enhance student learning when compared to the summative assessment. The paper [Kennedy et al, 2006] discusses this debate in great depth. They state the following:

A more inclusive model of assessment needs to have the following characteristics:

1   All assessment needs to be conceptualized as "assessment for learning";

2   Feedback needs to be seen as a key function for all forms of assessment;

3   Teachers need to be seen as playing an important role not only in relation to formative assessment but in all forms of summative assessment as well – both internal and external;

4   Decisions about assessment need to be viewed in a social context since in the end they need to be acceptable to the community.

The NACTE's Perspective [Rutayuga and Kondo,2006] states that Conventional systems of assessment tend to present all or some of the following characteristics:

1   Assessment is associated with a course or program;

2   Parts of a program are included in the final examination;

3   Approbation based on scales of points;

4   The questions are unknown;

5   Assessment is carried out in a defined amount of time;

6   Assessment uses statistical comparisons.

On the other hand, assessment in competence-based education and training has the following characteristics:

1   It is centered on results of labor performance;

2   Not determined by time;

3   It is individualized;

4   Not associated with a course or study program;

5   Does not compare different individuals;

6   Its result is either competent or not yet competent.

From the guidelines provided in the Guide to Measures of Student Learning [Guide to Measures of Student Learning for Administrators and Teachers] Student Learning Objectives should represent the most important learning during an interval of instruction and may be based on progress, mastery or a combination of the two. Objectives based on progress require students to make a certain amount of progress from a baseline measure toward a clear benchmark of performance. Objectives based on mastery require students to demonstrate a particular level of skill and knowledge in that specific course content, regardless of any baseline measures. In order for an evaluator to approve a Student Learning Objective, it must be rated as acceptable on three criteria:

1   Priority of Content: is the objective focused on content that is aligned to important curriculum targets that capture majority of the instructional period?

2   Rigor of Target: Does the numerical target represent an appropriate amount of student learning for the specified interval of instruction?

3   Quality of Evidence: Will the evidence source(s) allow for clear, accurate measurement of student learning?

Indicator systems have emerged in the context of increased awareness of the importance of analyzing performance. Using indicators for analysis can help to improve information systems, in terms of both the volume and the reliability of the information generated. A higher education indicator system cannot be developed without two prerequisites being fulfilled. The first is possession of a functioning information system that contains basic information reliable enough to develop the indicators. This is not always the case as there are many dysfunctional information systems that are not very accurate and are unable to produce information in the time required. The second prerequisite is a policy or plan that is sufficiently explicit and clear, providing a foundation upon which an informative indicator system can be constructed. [Martin and Sauvageot, 2011]

Assessment of occupational standards must include both knowledge and performance assessment. The competencies assessed will vary, depending on the nature of the occupational standard and the setting in which training has been delivered. Assessment may, in addition to evaluating technical skills related directly to the occupation, assess other skills often referred to as core skills: basic skills, including literacy and numeracy; life skills, including social and citizenship skills; general employability skills such as communication and decision making; and depending on the occupation, possibly entrepreneurial and management skills [Fretwel, Lewis and Deij,2001]

Educational or learning outcomes or competencies need to be developed from the activities defined in occupational standards. They need to include learning objectives to ensure that the necessary skills and knowledge are developed by a person to enable him or her to function at an agreed level in an occupation [Pinto, 2010]. Most traditional report or score cards do not fairly reflect the content level of the course and the assessment activities. An employer should be able to have an easy access to this information as it aids in gauging the skill level of a potential employee which may be crucial in placing a candidate in an appropriate position in the company. A score card should be a means of communication between the stakeholders and thus needs to contain useful information to aid decision making and

High academic achievement students tend to be motivated by a report card while low achiever seems to be anxious with it. The quest for an informative design of a report card is necessary so as to provide useful information for both students and parents to facilitate learning [Chang, 2009]

To be able to effectively assess a competency, an assessment rubric needs to be developed that can be used by all stakeholders – the learner, peers, teachers and employers. Instead of focusing on individual performance measures within a definitive subject area, strategies that benefit the entire program and optimize the overall effectiveness of the teaching and learning process are required to be adopted. Assessments need to take into consideration technical and generic skills. This paper seeks to provide one such strategy.

Teachers use multiple and varying parameters while generating a grade for a student. This undermines the validity of the grading method as a means of communicating the learners' content knowledge to stakeholders. A single grade for a course results in a weak interpretation of its meaning since it does not reflect the strength/weakness of the learner in a specific subject domain or competency within a course. A report card or score card must be in congruence with the purpose of assessment. A score card besides being indicative of the performance level of a learner in all of the skill areas required for a specific competency, must act as a source of reflection for both the learner and other stakeholders. The following Performance Chart attempts at designing such a scorecard

PERFORMANCE CHART

COMPETENCY: xxx   LEVEL:XX   Significance:

STUDENT: xxx yyy   Date:

CATEGORY	Importance	SCALE	POINT			Feedback
Technical Knowledge		A1	A2	A3	A4	
Domain Knowledge						
Application of DK (Practicals)						
Technological Knowledge						
Technological Skills						
Pre-requisite Knowledge						
			TK Performance Score:			
Generic Skills						
Communication Skills						
InterPersonal Skills						
Professionalism						
			GS Performance Score:			
Overall Score:						

Graphical /Comparative statistics with other competencies and with respect to class to be show

Level reflects the level of competence of the subject matter being assessed (Basic, Intermediate, Advanced)

Significance reflects the importance of that competency in the course curriculum.

Importance reflects the relevance of each dimension to the assessment of that competency.

A1, A2, … represent the assessment activity

Feedback is the corrective action a learner needs to take to improve his/her performance.

The Comparative Statistics are for the individual and group of students being evaluated for the specified competency. (This can be used for feedback mechanisms and for tuning the effective teaching strategies)

Figure 1. Performance Scorecard

The Significance factor of the competency and the Importance of each component towards the assessment of the competency differ across each competency. Further, the number and kind of activities may vary as per the teachers' teaching methodology and environment and requirements. The feedback comprises a formative individual learner feedback directed to improve the students' skills at all the Learning Levels of Blooms Taxonomy by suggesting learner centric activities for the same. The Pre-requisite knowledge needs to capture the central concept [Zendler, 2008] required for that competency as well as complementary competencies. Even from a constructivist perspective a teacher should not ignore the learner's existing knowledge [Ben-Ari, 1998], but should find out what the learner's conceptions are. The activities and Parameters for evaluation vary as per the domain.

The Overall Performance Score is computed as a weighted average of the importance of each component and the average scale obtained in all the activities comprising that component. A minimum acceptable level in all the competencies that were initially outlined in the course structure is required to be considered for a pass in the course. Further, a learner can improve his/her performance level for any of the competencies. This assessment scheme provides a flexible and adaptable system with sufficient evidence of content and coherence.

A significant question that needs to be addressed is the issue of when to assess the students' performance. An immediate evaluation of performance may result in assessing only the lower levels of learning in the Blooms taxonomy [Bloom, Hastings and Madaus 1956]. To test the persistent knowledge of a learner, the assessment needs to be performed at a later time, allowing the learner to assimilate the knowledge and analogize and propagate it. This will improve the long term performance and the versatility of the learner - a much needed personality trait for sustainable employability!

In [Pratt, 2002], Project STAR documents the use of pre- and post-test as instruments to enhances measurement results and overall program accountability. Pre- and post-tests not only document the services of a program, measure outcomes, and demonstrate success, but are useful for obtaining impact data for progress reports required by stakeholders. They act as a thermostat, providing real-

time feedback of program efforts, to help program directors decide whether or not to make changes in the implementation of activities throughout the program year.

4 CONCLUSION

The Performance Chart scorecard can be used for both the pre and post evaluation mechanisms of a competency and effectively captures the amount of learning that took place during the intermediary activities. It can also be used to filter what kind of pedagogical supporting activities benefit learner sub-categories. Employers can use this to evaluate the competency level of a potential employee and strategize the kind of job environment most suitable for the candidate.

The next step is to design and develop a tool that automatically gives constructive individual learner feedback and classify students into learner groups. This can aid teachers in designing appropriate activities suitable to the students' abilities. Further, these required resources to achieve assessment improvement within a learning environment may be better employed if shared by several courses and instructors, establishing an assessment standard for the entire program.

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