A New Verification Process for Assessing Intended Learning Outcomes

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ABSTRACT

Continuance and accurate quality assessment of any academic program is the primary indicator of its progress and success. Quality assessment processes are mainly conducted to improve students' learning outcomes. Successful quality assessment processes should demonstrate clearly how an educational program had achieved its intended learning objectives. To validate the accomplishment of these intended objectives by a course instructor, students' assessments are usually used to demonstrate that the instructor had covered all relevant contents and material within his lectures.

The main drawback of this approach is that it cannot prove that students had really attained the required knowledge and skills for each intended learning objective. In this paper we are proposing a general model and a tool that supports the evaluation of each intended learning objective within a course based on the actual students' performance on that objective. It measures the accomplishment of an objective not only based on instructor's opinion but also on the actual students' assessments results related to that specific objective.

For abstraction, the model is consisted of a several layered architecture and a main assessment process. A specialized tool which follows this proposed model has been also developed. It supports a course reviewer to accurately evaluate the accomplishment of each and every indented learning objective within a course. The reviewer's evaluation will be basically based on the averaged students' scores and the instructor's own rating. In addition, this tool will provide the reviewer with the ability to back-track that averaged score to its original assessment objects' scores.

Key words: Quality Assurance, Quality Assurance Model, Intended Learning Outcomes, Programming Learning Outcomes, ABET

1. INTRODUCTION

Many teaching institutes and universities worldwide are seeking the accreditation and recognition of international or national accreditation bodies, such as ABET (Accreditation Board for Engineering and Technology) [1], NCAAA (Saudi National Commission for Academic Accreditation & Assessment) [2], etc. The main objective of many accreditation processes and regulations are to insure that a course learning outcomes had met its intended learning objectives. Improving the academic program outcomes depends highly on the information obtained from these quality assessment processes [3]. The departmental management and faculty members may decide to update a specific course syllabus, textbook, or content based on these obtained information.

The primary objective of many quality assessments is mapping the intended learning objectives and students' learning outcomes [4]. Intended learning objectives, ILOs, should communicate clearly what a student must know after finishing a certain course. Assessing student's knowledge is a challenging task. The word "assessment" has many meanings within the educational field. It can refer to a process used to grade student's exams, assignments, or any other activities. It is designed to collect information regarding the fulfillment of expected leaning outcomes [5]. Usually grades and marks are used as indicators of knowledge being assessed. There are many types of educational assessments that are widely used in the teaching environment, such as exams, home works, assignments, projects, etc. In order to validate the accomplishment of ILOs within a course, students' assessments should relate clearly to their intended learning objectives.

ABET PLO's - General Criteria for software engineering program

Program Learning Outcomes describe what students are expected to know and be able to do by the time of graduation. These relate to the knowledge, skills, and behaviors that students acquire as they progress through the program. A graduate of the computer science program will demonstrate:

1. Analyze a complex computing problem and to apply principles of computing and other relevant disciplines to identify solutions.

2. Design, implement, and evaluate a computing-based solution to meet a given set of computing requirements in the context of the program's discipline.

3. Communicate effectively in a variety of professional contexts.

4. Recognize professional responsibilities and make informed judgments in computing practice based on legal and ethical principles.

5. Function effectively as a member or leader of a team engaged in activities appropriate to the program's discipline.

6. Applying the principles methodologies, tools, and best practices in software engineering for building and developing high quality and effective solutions that meet requirements.

2. THE CURRENT QUALITY ASSESSMENTS PROCESS

Quality assessments processes are typically based on reviewing the course report file [6]. Crouse report file usually contains a collection of course documents and artefacts that have been used and delivered by an instructor. It might contain for instance, course syllabus, PPT slides, intending learning objectives report, samples of assignments responses, student scores sheet, etc. For instance, each instructor within our department, the information system department at Taibah university, is required to submit a course report file for each course that he taught at the end of the teaching semester. The main component of this file are the intended learning objectives and assessments.

Designing an effective course syllabus starts with clear statements about what the course is trying to accomplish. A clear statement of a learning objective serves as the foundation of the course syllabus. In order to be able to measure specific learning outcomes, assessments should be constructed according to these intended learning objectives. There are several types of assessment that are being used at our department such as:

- Midterm Examinations
- Final Examination
- Quizzes
- Written Examinations
- Oral Examinations
- Homework/Assignments
- Case Study Reports
- Written Research Papers
- Individual Projects
- Teamwork Projects
- Illustrative Presentations
- Participation in Lectures
- Practice in the Labs

In each course report file, instructors are asked to evaluate the accomplishment of the intended learning objectives based on the assessments that they have given. For each given assessment, they need to tick the proper rating according to their judgment:

- E – Excellent: The assessment fully accomplished the quality of the intended objective.
- G – Good: The assessment mostly accomplished the quality of the intended objective.
- M – Minimal: The assessment minimally accomplished the quality of the intended objective.

As also shown at table 1, for each assessment instructors need to provide a brief description of how the assessment have accomplished the quality of the intended learning objective and to provide a summary analysis of assessment results of that objective.

Table 1: Instructor's assessment table for all ILOs within a course

ILO #	Intended Learning Objective	List methods of assessment for LO	Instructor Rating			Assessment's Comments
			E	G	M	

For each completed course, five assigned reviewers will be asked separately to rate each intended Learning objective based on a list of used assessments. They will fill up a rating section similar to that shown at table 2.

Table 2: Reviewer's ILOs assessment table according to related assessments

ILO #	Intended Learning Objective	List methods of assessment for that ILO	Reviewer Rating		
			E	G	M

The primary task of each course report reviewer is to check whether the assessments had covered all intended learning objectives [7]. This could to some extend proves that the instructor had covered the content related to these ILOs within his course lectures. The objective is to develop an evidence to support that a given ILO has been met to a certain level.

The main weakness of this quality process is that it cannot prove clearly that students in a course had really attained the required knowledge and skills for that specific ILO. It is based on the assumption that as long the assignment is related to the ILO that means the students had attained the acquired knowledge. What if students are doing poor in a specific ILO's related assignments but they are doing well in that course as a whole. If a reviewer looked at the general students scoring performance, he would assume that students are doing generally well in all ILOs of that course. This could be a misleading finding. In the other hand, it would be very challenging and time consuming for each instructor to track down students' performance of all assignment objects, such as exam questions, a project specification element, etc. that are related to a specific ILO.
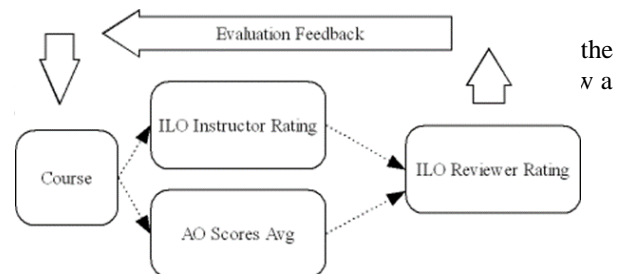
3. ADVANCED QUALITY ASSESSMENT MODEL

The proposed model is based on evaluating each ILO based on the actual students' performance at the related assignment objects. As shown in Figure1, the model is consists of three layers. The bottom layer consists of program courses that need to be reviewed and evaluated. The second layer consists of predefined lists of courses' ILOs.   When designing a course, the instructional designer usually starts by defining all courses' ILOs within the course syllabus. These ILOs need to be aligned with the overall program learning outcomes as well. The Third Layer consists of a list of assessment objects AOs. The assessment object could have different levels of granularity. It could be as small as a single exam question or as large as a final course project. It is up to the course instructor to define these assessment objects and to relate them to specific ILOs.
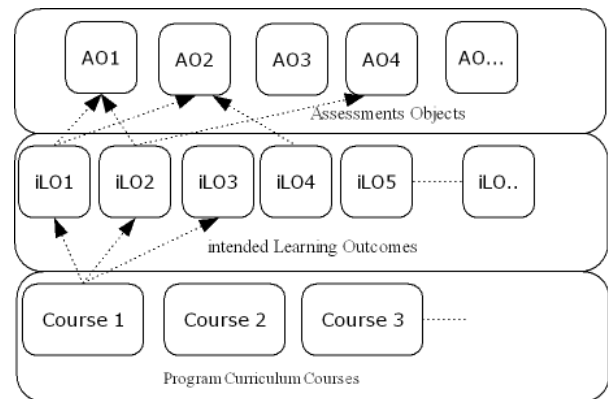
Figure 1:   The Advanced Quality Assessment Layered Model

The quality assessment process, as shown in figure 2, starts when a course instructor rates the course's ILO, as shown in table 1. For each course ILO, the instructor is asked to list all used assessments (homework assignments, quizzes, exams, etc.) that are related to it. Course reviewers need to look at the following: Firstly, all ILOs within to that course. Secondly, all assessment objects, AOs, that are related to these ILOs. Thirdly, the assessments' actual student average scores percentage. Finally, the instructor's original ratings and comments. Based on the above information, the reviewer is asked to rate these ILOs according to his judgment. These evaluation results could be

Figure 2: The Advance Quality Assessment Process

Table 3: ILOs assessments and students results for the Mobile Business Systems course

	List course learning outcomes	List methods of assessment for LO	Instructor Rating			Ass. Scoring Average
			E	G	M	
ILO #1	**Apply mobile software development techniques.**	Exam 1- Q5	X			60%
		Exam 3- Q3		X		45%
		Exam 3- Q7		X		62%
		HomeWork2		X		62%
		Final Project			X	45%

Table 4: Reviewer's assessments result of ILO # 1

List course learning outcomes		List methods of assessment for LO	Reviewer Rating		
			B	G	M
LO #1	**Apply mobile software development techniques.**	Exam 1- Q5	✓		
		Exam 3- Q3			✓
		Exam 3- Q7			✓
		HomeWork2			✓
		Final Project			✓

In order to support instructors and evaluators based on this proposed quality assessment model, a prototype tool was build. This tool has the capability to manage online exams. It allows instructors to compose various types of online assignments, such as, multiple choice questions, assay questions, etc. It also supports the grading process according to predefined answers and instructor's input.

Unlike other Learning Management tools, this tool will manages and evaluates the intended learning objectives. It explicitly asks instructors to map all assessment objects, such as exam question, to the related ILOs. In addition, it will ask them to rate these assessment objects based on their relation strength with that ILO.

To support the reviewing process, the tool presents to reviewers all the related assessments objects related to the investigated ILO, student actual results average on these objects, and instructor's original rating. The tool then accumulates all other reviewers' assessments related to that ILO and then presents the final rating result in a bar chart layout. These charts can be used as an evidence that students had/or had not acquired the required level of knowledge related to that ILO. For instance, table 3 presents an ILO for a course titled: Mobile Business Systems that has been taught in our department during the last term. Even though students had done well in this course in general, the actual student scores in that ILO show that students did not do well in that ILO.

Based on the results obtained in the previous table, the reviewer's assessment rating of ILO1 was lower than the instructor's rating, as shown in table 4. This was due to basically students' poor performance. In addition, according to the averaged scores obtained from all other reviewers regarding this ILO, the intended learning outcome of this ILO has not been accomplished

and was less than expected. The feedback regarding this finding was submitted to the course designer for future improvements.

4.CONCLUSION

Eeffective quality assessment process should be able to assess students' proficiency of intended learning objectives. Intended learning objectives are what students are expected to know, understand or be able to do at the end of a course. Many quality assessment processes rely on students' assignment to validate the coverage of ILOs. The main drawback of these processes is that it cannot prove that students had actually attained the required knowledge and skills for a specific ILO. Even when reviewing students' results within a course, they cannot be used to assess students' attainment of every and each ILO. It would be very difficult for instructors and reviewers to breakdown the assignment according to a specific ILO and to track-down students' results according to these breakdowns.

In this paper we have proposed an advanced quality assessment model and a prototype tool to support an authentic course evaluation of students' learning outcomes. The proposed tool supports course reviewers to perform their evaluation of ILOs based on various criteria. Firstly, it presents all assignment objects that are related to the examined ILO. Secondly, it presents the original instructor's ratings on the ILO fulfillment. Thirdly, it presents the students' scores in all these assignments objects. The course reviewers' overall results could be used back by a course designer to improve the course design.

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