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Automated Generation of Course Improvement Plans Using Expert System

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ABSTRACT

To satisfy ABET's continuous improvement criterion, an instructor, teaching a course suggests, at the end of the course, an improvement plan to be implemented when the same course is taught next time. Preparation of such a course improvement plan may be mandatory if a pre-specified target level of students' learning is not attained. Since, manual preparation of a course improvement plan is difficult, an idea of generating it using an expert system is presented. The objective is to make the task of improvement plan preparation easier and enjoyable. The proposed expert system has a set of remedies and a set of rules in a data base. A web-based interface queries the instructor about teaching and assessment tools used in the course. The inference engine selects the most appropriate remedy based on instructor's preferences. A cloud implementation of the expert system has been used to test it for a course.

KEYWORDS

ABET, Accreditation, Continuous Improvement, Course Learning Outcome, CQI, Educational Quality Control, Expert System, Student Outcome

INTRODUCTION

Continuous improvement of students' learning in each course has always been an important objective of all academic programs. Its importance becomes more obvious from the fact that for ABET accreditation (ABET, 2015) of an academic program, one of the general criteria is "Continuous Improvement" (ABET, 2016). This criterion requires that the student learning be monitored through assessments to ensure that a target satisfaction criterion pre-specified by the department offering the program is attained or progress is made towards attaining it. In this paper, this satisfaction criterion will be referred to as "Program Satisfaction Criterion" or PSC as described in (Smart-Accredit, 2016a). For example, an academic program may specify a PSC to be "75% students score 70% or higher". This PSC is applicable to the learning outcomes of all courses in the program. If the satisfaction level for a given outcome in a course is found lower than the specified PSC it will trigger the alarm for

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improvement measures i.e. reasons must be found out and a plan must be suggested by the instructor to improve students' learning. Some of the measures may have to be done by the administration of the program and may not be in the control of the instructor. On the other hand, there are measures that can be implemented by the instructor to improve students' learning. It is the instructor's responsibility to suggest and document these measures at the end of the course. Such a document will be referred to as Instructor's Course Improvement Plan (ICIP). The ICIP will be implemented when the course is taught next time. The ICIP for a course will ensure the learning outcome satisfaction is improved and pushed closer to the level of the target PSC. However, writing an ICIP is usually a difficult task requiring lot of experience of teaching the course and most instructors avoid it. The instructor, in writing an ICIP must think of several aspects of the course and do the thinking about what measures are possible. It will be described in the next section on Typical Manual ICIP.

This paper presents an idea of an expert system (ES) to help the instructors in preparing an ICIP and make this task easier and enjoyable. The task will become easier and enjoyable because the instructor will have to only answer the questions asked by the ES just by clicking the mouse pointer to select from a set of possible answers. It may be noted here that ES has been used in engineering education and other disciplines (Nakamura et al., 2014, Garcia et al., 2010, Tucho et al., 2003, El-Khouly et al., 2000, Elnajjar and Naser, 2017, Hilles and Naser, 2017), but the issue of writing an ICIP with the help of an ES has never been presented in the published literature.

In the next section, a typical ICIP prepared manually is described. This is followed by a description of the proposed ES. Course topic tagging is described next. Then examples of ES interaction with the instructor are presented. In the following section, a list of possible remedies is presented. The working of the inference engine and examples of rules are described next. Finally, the conclusion of the paper is presented.

TYPICAL MANUAL ICIP

To understand what the proposed ES will do, the way an instructor writes an ICIP is described here. For writing an ICIP, the instructor identifies the weak outcome and then comes up with changes in the teaching plan. The instructor treats the weakness in a particular outcome by suggesting changes in the teaching plan to be implemented next time the course is taught. In doing so, the instructor has to answer the question: "I taught the students the topic, explained to them the methods and concepts involved, gave them the homework, quizzes and other types of assessments. With all this, why the PSC was not attained i.e. why the percentage of students obtaining the required score was lower than the specified target score. For example, if the PSC for a program is 75% students get 70% or higher scores then why only 65% students attained the 70% scores?" The question is thought provoking and will generate the following types of questions:

1. Was the explanation not enough or not clear?
2. Was the topic covered beyond the student's background?
3. Can I lower the lever of complication involved with this topic while keeping the same level of Bloom's Taxonomy as required for the related outcome?
4. Were the questions not so much focused on the outcome being assessed?
5. Will a better of explanation of the nature of the assessment to the students help them achieve better score?
6. Will more quizzes on the outcome help?
7. Do I need to explain the students more on what type of answer they must provide in home work or exams?
8. Do I need to tell them what are the qualities of good answers are?