A Topology and Framework to Aid the Design of Automated Assessment

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Abstract

Many computer science departments have seen an increase in class sizes. This has increased the need for efficient methods of assessment. This paper explores the possibility of automating assessment without compromising the service to the student. The selection of a particular assessment strategy needs careful consideration when designing automated assessment tools. A topology is presented that will aid the selection of assessment methods by considering ease of design and other requirements based around the desired learning paradigms. The topology is a tool that will facilitate analysis of learning environments and identify the role of agents. A sample of framework for the design of assessment is included.

1. A topology of assessment methods

The function of the topology is to map the appropriate assessment strategies against the objectives of the assessment and the expected learning paradigms that are to be encouraged. This will be of particular use when designing automated assessment. In the example topology presented here three assessment strategies are considered and related to two teaching paradigms, the traditional and the constructivist. The topology will function as a tool to map the most appropriate assessment methodology to the desired learning paradigm to be encouraged.

2. Applying the topology to designing computer science assessment

The topology (figure 1) can be used to identify the roles of actors in the assessment process and the relationships between them. This can be helpful in designing flexibility into the assessment process. It has also been used to analyse the interactions between these roles and to fully consider the part they play in fulfilling the global aims of the assessment.

The topology was used to consider the various options available to assess a level 1 undergraduate computer science course. The course had previously been assessed using essay-based assignments, problem solving tasks and examination. A five-fold increase in numbers prompted a change. The main benefit of this assessment regime was the feedback returned to students and it was desirable to maintain this if possible. The other area of concern was the need to provide course evaluation statistics accurately and in a timely manner.

To analyse the assessment options effectiveness / benefit analysis was performed to examine the roles played by the actors identified in the topology. This analysis resulted in a framework giving positive and negative aspects to be considered in the selection of an assessment method. The aim being to simplify and automate the assessment. Part of this framework is given in figure 2.

The framework indicates that fixed item test will be the best option to facilitate automatic grading. However it also indicates that this will be at the expense of feedback. Looking at the first column of the topology we observe that the quality of the feedback increases as the autonomy of the student increases. By allowing the student to include additional information it is possible to increase the quality of feedback and yet retain all the benefits of the fixed item test. The assessment was designed to ask additional questions about the confidence candidates had as they answered each question. The assessment was field tested and proved highly effective at providing both evaluation and feedback [1].

As it stands the topology causes reflection and aids analysis of the goals. The frameworks generated using this approach are beneficial in specifying the requirements. The approach allows flexibility to be designed into automated assessment systems. Adoption of this topology will facilitate activity-based design founded upon educational theory and good engineering practice.

3 Discussion and conclusion

The topology maps the assessment methods through the temporal stages. It also attempts to illustrate that although a particular route is considered appropriate by the examiner, the examinee may employ differing tactics. The topology can be used to illustrate interfaces where
meaning can be confused and autonomous decisions are made. For example an interface exists between question generation and attempting a question. The areas between these interfaces can be considered an actor’s role. If an actor can switch roles to provide a better interface the system could auto-configure to the needs of the human agents. Using the topology can reduces the restrictions sometimes introduced by automation.

References