

Artificial Intelligence-Based Student Learning Evaluation: A Concept Map-Based Approach for Analyzing a Student's Understanding of a Topic

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Abstract—In this paper, we describe a tool coined as artificial intelligence-based student learning evaluation tool (AISLE). The main purpose of this tool is to improve the use of artificial intelligence techniques in evaluating a student's understanding of a particular topic of study using concept maps. Here, we calculate the probability distribution of the concepts identified in the concept map developed by the student. The evaluation of a student's understanding of the topic is assessed by analyzing the curve of the graph generated by this tool. This technique makes extensive use of XML parsing to perform the required evaluation. The tool was successfully tested with students from two undergraduate courses and the results of testing are described in this paper.

Index Terms—Concept maps, evaluation, probability distributions, XML parsers

1 INTRODUCTION

CONCEPT maps, which are visual representations of a particular topic and its subcomponents, have been used in multiple settings to teach information. The power of the concept map lies in the fact that it requires the elucidation of the relationships between the subcomponents of a particular topic. The effectiveness of using concept maps for knowledge retention over other forms of summarizing information has been demonstrated in multiple studies [1] and in naturalistic settings [2]. In addition, concept maps can be used as a form of evaluation of student learning [3], [4]. When a particular topic is taught, concept maps can be utilized to determine what the student knows about a subject, rather than using more traditional forms of assessment such as multiple-choice exams.

We are in the process of developing a tool to evaluate student learning using concept maps [5], [6]. Here, a student would be given a topic to learn and build [7] a concept map based on their understanding of the topic. This tool, coined as artificial intelligence based student learning evaluation tool (AISLE), would then evaluate [8], [9] the concept map and assess if the student has captured enough concepts from the given topic. This will help the instructor in evaluating a student's understanding of the topic.

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The objective of this project is as follows:

- To develop a tool that understands student psychology in terms of the learning process [5], [6] undertaken by student using concept maps.

This project can have the following impact on the academic community:

- It will provide a better understanding of the student learning process, which will have practical curriculum and classroom applications for educational psychologists [10].
- The project will provide the school districts in north-east Texas with a new educational tool to use in their classrooms.

The research question targeted in this project is as follows: "Can we use a concept map-based approach in validating student performance?" While many concept map-based approaches have been proposed for assessing a student's knowledge of a particular topic, AISLE provides the following core contribution: "Development of a comparative analysis using probability distribution to compare concept maps developed by students." In this paper we first discuss some related work. We then present a detailed discussion on methodology involved in using AISLE and details pertaining to the processing involved with algorithms, examples and details of the analysis of the input. To conclude, we provide results of experimentation, comparison with related tools and sections describing the usefulness of this tool.

1.1 Related Work

Some of the investigators dealing with concept maps have developed assessment systems using this tool. Here we would like to note that most of these systems.

1.1.1 Intelligent Knowledge Assessment System

The knowledge assessment system presented in [39] by Lukassenko and Vilkelis provides a structured approach to assessing a student's knowledge on a particular topic. The