Al-Azhar University,
Faculty of Science (Girls),
Department of Mathematics.

Automated Test Evaluation Techniques for E-learning

A thesis submitted for

A Master Degree

in

Computer Science

by

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Research title in English language:

"Automated Test Evaluation Techniques for E-learning"

Research title in Arabic language:

" تقييم الاختبارات الالكترونيه فى التعليم عن بعد"

The plan of the research in English language:

1. Collect the evaluation techniques in e-learning tests.
2. Evaluate their advantage and disadvantages.
3. Compare between evaluation techniques in soft copy and hard copy tests.
4. Display the algorithm of using AI techniques to ameliorate e-learning tests.
5. Implement the proposed solution in real system.

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Shimaa Muhammad Tawfik

Notes:

According to this thesis, the following papers have been published in:

1) **"Automatic evaluation technique for certain types of open questions in Semantic learning systems". Human-centric Computing and Information Sciences (HCIS) a Springer Open Journal Oct. 2013.**
Available at: http://www.hcis-journal.com/content/3/1/19.

2) **"Automatic Evaluation of mathematical open questions" International Conference on Mathematics Trends and Development (ICMTD12) The Egyptian Mathematical Society 27 – 29 DEC. 2012. Cairo, Egypt 2012 www.ETMS-EG.org.**

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Abstract

In the last few years, new and quick advancements in knowledge evaluation techniques have entered the field of e-learning, focused on automated evaluation exam items.

Students usually have various academic knowledge and teachers have to provide them with material and achievement tests of appropriate levels. No one can deny that, the constructed answers for each student represent his/her own way of thinking, knowledge, and cognitive ability in solving problems. A crucial issue in the teaching/learning process is the evaluation of the student abilities. Indeed, the perceived knowledge and skills of the learner to solve problems remain a fundamental aspect of any educational system, permitting the learner and his or her human tutor to perceive the strengths and weaknesses of the learner. Many new technological and electronic tools have been developed paving the way to develop several kinds of e-learning evaluation techniques.

The purpose of this thesis is to enhance evaluation techniques of different types of open questions in hybrid exams. This is for empowering the automatic evaluation tools. The study focuses on a methodology to enhance the evaluation tools in semantic e-learning systems. The proposed methodology have been applied to the case study of a mathematical multi operations question, the mathematical proof question on a logic course and closed questions in a hybrid exam. This thesis shows that the proposed technique in the first type MOQ (Multi Operations Question) uses the matrix concept for fuzzy score, which proposes a fuzzy automatic evaluation web method. This proposed method uses the fuzzy concept in open questions mathematical evaluation in e-learning. The question type has a variable number of mathematical operations, where the solution steps are not unique. So the proposed method uses the combination of sets and vectors to generate a one multiple dimensional matrix.

In addition, a POQ (Proof Open Question) is more complicated so we use a direct connection set between learning objects and POQ's solutions. That is by using the domain knowledge representation (Ontology based method). Also, we take into consideration the dependence among learning material concepts so we merge the universal ontology with a W-matrix (weight matrix). The last closed questions type uses the traditional evaluation methods.

The proposed method empowers tutors and students to preview the evaluated answers ensuring the strengths and weaknesses for each solution item.

The thesis also shows that the emerged different open and closed questions' types in general, have been successfully evaluated in the hybrid exam. This material is oriented to the problematic of practical task evaluation.

The results of this research indicate that the mathematical multi operations question, the proof question on a logic course and the closed questions solved in a hybrid exam successfully have been automatically evaluated.

However, the exam's items evaluation processes which measure individual knowledge abilities automatically are require more improvements in integrating the different systems techniques and applications, and need more involvement by the administrators, developers and tutors, within the context of e-learning, so as to maximize the effectiveness of evaluation strategies and e-learning approach.

Key words: Ontology based Systems, W- matrix, E-learning, Evaluation tools, Hybrid exam, fuzzy evaluation, open question, predictive, e-learning, Inferences.

CHAPTER 1

Introduction

1.1 Background:

Recently, using computers and information technology are making revolution in education systems and that offers new challenges and opportunities in distance education and e-Learning. Many of the ineffective evaluative educational systems provide little immediate feedback to students, require teachers to spend hours grading routine assignments and they are not very proactive about showing students how to improve comprehension, and fail to take advantage of new developed resources that can improve the learning process. On the other hand, the effective e-learning evolution environment proposes a good number of tools; it provides powerful tools supporting students during the knowledge acquisition process.

1.2 Problem Statement:

Nowadays, online exams are widely used. Online exams are more convenient and flexible relative to traditional exams. They have many advantages as low cost and ubiquity. They reduce the overall expenses of processing exams especially in saving papers, storage, and materials' costs.

For many areas of education, the testing by using closed questions based on variant answers is un-useful, and do not represent the knowledge of current student. However, grading closed questions is straightforward and does not require any Artificial Intelligence (AI) or Natural Language Processing (NLP) techniques or algorithms [37].

However, closed questions can limit the skills of students in writing and expressing knowledge. On the other hand, open questions are the most appropriate question type, because they are the most natural and they produce a better degree of thought. They help to evaluate the understanding of ideas, the student's abilities to organize material and develop reasoning, and to evaluate the originality of the proper thoughts. Many educators prefer to have open questions to grade students' skills. However, they are much more difficult to evaluate than more restricted tests such as multiple choice tests. When a student calculates some mathematical formula; not