Development of an Information Quality Framework for Mechanical Engineering Modules with Enhanced Treatment for Pedagogical Content

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ABSTRACT

The technology based learning systems have capability to comply with diverse requirements of all the stakeholders in the modern education system. In technology based modules, such as those taught in Mechanical Engineering courses, the psychomotor content takes precedence over other domains of teaching and learning. Effective integration of pedagogical content within the Mechanical Engineering modules is of utmost importance for effectiveness in teaching and learning processes in these modules. Published literature is limited in this regard, and hence, the present study focuses on developing a novel an information quality framework for Mechanical Engineering modules, through which an enhanced treatment has been provided to the pedagogical content, in order to meet the educational goals and the industrial requirements worldwide. The novel information quality framework developed in the present study can be used as a guideline for measuring the effectiveness of Mechanical Engineering modules.

KEYWORDS

Bloom's Taxonomy, Information Quality Framework, Mechanical Engineering Modules, Pedagogical Content, Technical and Vocational Education

INTRODUCTION

Technical and Vocational Education (TVE) systems are common throughout the world as they deliver specialised skills required by the modern industry. The primary focus of these systems is on practise based teaching and learning, and generally very limited importance is given to the pedagogical content. This leads to limited transfer of analysis, evaluation and creating skills within the teaching and learning process. Consequently, the newly trained engineers become restrict the fundamental conceptual and product development in modern industries. Alseddiqi et al (2010) has also pointed out the same issues in context of Engineering Education courses. It has been reported that Technical and Vocational Education systems are facing a number of challenges regarding the delivery of appropriate courses and skills required in the industry. It has been further observed that both the industry and the academia are suffering from lack of pedagogical content in engineering courses. An information

quality framework has been proposed by Alseddiqi et al (2010) that takes into account some basics of pedagogical domain contents from Bloom's Taxonomy. However, the proposed framework lacks in addressing the essential skills required in a professional engineer, which have been identified above as analytical, evaluation and creation.

Alseddiqi (2012) extended the information quality framework in order to evaluate the content of e-learning packages in engineering education courses with respect to two aspects, pedagogical and technological. This framework incorporates specific pedagogical and technological aspects as per modern industrial requirements. The e-learning system content from the technological aspect considers the following quality factors: intrinsic information quality, contextual information quality, and accessibility information quality. These factors are combined from existing information quality frameworks. The pedagogical aspects in the e-learning system content are represented as information quality factors, incorporated from the literature (interpretability, ease of understanding, representational consistency, and concise representation) as well as modern industrial needs (depth of knowledge, personal attributes, motivation, and integration of skills). Furthermore, one pedagogical quality element (interactivity) was added to accessibility information quality.

From the literature survey presented here, it has been identified that the pedagogical content in the existing information quality frameworks is severely limited, which restricts the fulfilment of the goals set by these models. In the present study, Alseddiqi's (2012) extended model has been modified by increasing the quality dimensions, and providing an enhanced treatment to the pedagogical content for Mechanical Engineering modules. This next section presents educational and industrial requirements that must be satisfied by a suitably designed teaching and learning system.

Modern Industrial Requirements from TVE Systems

Industrial requirements need to be fulfilled in order to increase the employability of the engineers in industry. It has been observed that engineers graduating from TVEs seem to lack in higher level cognitive skills such as analytical, evaluating and creating skills. Brown (2002) has reported that engineers should understand the fundamentals of employability skills required in the industry. Students attain knowledge skills in the classroom environment and practise specific skills in practical workshops. It was worth mentioning that teachers have become master practitioners to help students in the learning process and adapt their teaching style according to students' needs.

The Economic Development Board (EDB) and the TVE system conducted a benchmark study of the existing educational systems (TVE, 2006). The study pointed out that substantial demand exists for vocational skills in the industrial market, which should be integrated effectively in the learning process. The study compared three educational systems in order to propose the most suitable TVE system, as shown in Figure 1.

Even though the existing educational system has its advantages and drawbacks, the study highlights the important issues to be considered in a TVE system. Table 1 summarises the modern industrial requirements from existing TVE system, and what the new system may offer to improve the standard of employability skills required by the industry to be integrated into educational courses. Quality Assurance Authority for Education and Trainings' report points out the areas of main strengths and the areas for development in the existing TVE system (Quality Assurance, 2011). The main strengths are:

- Technical skills learned (psychomotor skills);
- Health and safety procedures.

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