A Knowledge-Based User Interface to Optimize Curriculum Utility in an E-Learning System

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ABSTRACT

The Internet and the World Wide Web in particular provide a unique platform to connect learners with educational resources. Educational material in hypermedia formed in a Web-based educational system makes learning a task-driven process, motivating learners to explore alternative navigational paths through the domain knowledge and from different resources around the globe. Many researchers have focused on developing e-learning systems with personalized learning mechanisms to assist on-line Web-based learning and to adaptively provide learning paths. Although most personalized systems consider learner preferences, interests and browsing behaviors when providing personalized curriculum sequencing services, these systems usually neglect to consider whether learner ability and the difficulty level of the recommended curriculums are matched to each other. Therefore, the authors proposed approach is based on an integer program (IP) to optimize user curriculum accompanying with fuzzy logic approach which analyze the effective criteria by linguistic variables in a knowledge based system. The effectiveness of the proposed framework is shown by numerical illustrations which are inferenced from the designed user interface.

Keywords: Electronic Learning System, Fuzzy Logic, Integer Programming (IP), User Curriculum, Web-Based Learning

1. INTRODUCTION

E-learning system is an internet based service like the application system or the internet based virtual course study service (this paper argues this service to be a part of the e-Learning system). This system is able to be interpreted in various ways such as “computer based, education delivery system which is provided through the Internet,” or “an educational method that

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is able to provide opportunities for the needed people, at the right place, with the right contents, and the right time” (Song, 2000). The e-Learning system is one of many methods of the education (the teaching and learning procedure) that allows flexible learner-centered education (Piccoli et al., 2001). It is an information system based on the World Wide Web. E-Learning provides an inter-disciplinary approach to information technology and educational engineering, and an assessment of e-Learning effectiveness could also be achieved (Wang, 2003). As of
For comparing the e-learning system and traditional learning system, two comprehensive studies are illustrated. Mahdavi et al. (2008) compared traditional system with virtual educational system statistically in Iran. In this way, by the means of economical equations and statistical analysis they illustrated an in depth survey. Finally, by the means of hypothesis testing, they illustrated the best option for educational system is the combination of both systems. Fazlollahtabar and Sharma (2008) compared traditional engineering educational system with the e-learning engineering educational system on the economic dimension using hypothesis testing approach in Iran. The comparison involved trend analysis and prediction based on costs and benefits of the two systems. Interestingly, the analysis revealed that the traditional system had greater advantage on the economic dimension. Several factors support the e-learning system despite the associated economic disadvantage. The final analysis provided results in favor of a blended system which takes advantage of the traditional and e-learning systems.

Different studies have been worked out on cost optimization within e-learning environment. Mahdavi et al. (2008) identified varied cost elements in e-learning educational system and optimized them by the means of mathematical programming. Then they proposed an effective method to estimate the learning cost between any two skills of learner using the grey relational analysis. Mahdavi et al. (2008) developed their previous study combining the grey relational analysis and a radial basis function network to estimate the learning cost between any two skills after identification of varied cost elements in e-learning educational system and optimization by the means of mathematical programming. Fazlollahtabar and Yousefpour (2009) applied the cost elements in the e-learning educational systems and proposed a combination of grey relational analysis and a radial basis function network to estimate the learning cost between any two skills. An integer programming method was employed to demonstrate that it is possible to facilitate the acquisition of single skills by considering a set of useful compound skills.

Finding the optimal (shortest) learning path for user or tutor has been studied in different researches. Fazlollahtabar (2008) applied a dynamic programming to find the shortest path for users in the e-learning environment. Since the learning parameters are qualitative, he used an analytical hierarchy process approach (AHP) to turn the qualitative parameters into quantitative ones. Fazlollahtabar and Mahdavi (2009) proposed a neuro-fuzzy approach based on an evolutionary technique to obtain an optimal learning path for both instructor and learner. The neuro-fuzzy implementation helps to encode both structured and non-structured knowledge for the instructor. On the other hand, for learners, the neural network approach has been applied to make personalized curriculum profile based on individual learner requirements in a fuzzy environment.

Also Tajdin et al. (2008) designed an assessment method based on real-time simulators. These simulators were able to facilitate education and play the role of virtual intelligent teacher referring to student capabilities by following the feedback mechanisms. This system, which was constructed by the means of network and expert system, was contained a real-time simulator core that has an inference engine based on a hypothesis testing.

For analyzing user satisfaction in e-learning system, Mahdavi et al. (2008) designed a heuristic methodology for multi-criteria evaluation of web-based e-learning systems based on the theory of multi-criteria decision making and the research results concerning user satisfaction in the fields of human-computer interaction and information systems.

An advanced e-learning system has to comply with the following requirements:
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