Requirements Framework for Personalized Real-Time Feedback in Interactive Agent-Based E-Learning Systems

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Abstract. E-learning systems at the market do not adequately support learning in a constructivist way because they do not adapt to the special needs and personal attributes of individual learners. Eliciting complete and correct requirements is a major challenge in personalized learning. Literature review and Interviews conducted with twenty lecturers helped in the design of questionnaires administered to three hundred second and third year students of Bachelor of Science Education and IT related courses from two universities in Uganda. Respondents were allowed to interact with two types of systems A that gave feedback at the end of each task and B at every stage during a learning process. The nine attributes used in the design of the questionnaire got the lowest response being 55.8% (feedback) and the highest 74.2% (Personalizing learning). These were used to design the basic requirements framework needed for personalized learning with real-time feedback in e-learning system.

Keywords: Agent-Based Approach, E-Learning Systems, Framework, Interactive and Real-Time Feedback.

1 Introduction

In order to align with the rapid change of the new knowledge intensive era, a new vision for learning is required [1]. There is need to broaden what students learn, when they learn, where they learn, how they learn, and the rate at which they progress in achieving learning outcomes [2]. Thus a fundamental shift is needed towards a more personalized, social, open, dynamic, emergent and knowledge–pull model for learning as opposed to the one-size-fits-all, centralized, static, top-down, and knowledge–push models of traditional learning solution [3]. The need has arisen for the consideration of individual differences, to include their learning styles, learning orientations, preferences and needs in learning to allow learners engage and be responsible for their own learning, retain information longer, apply the knowledge more effectively, have positive attitudes towards the subject, have more interest in learning materials, have higher scores and high intrinsic motivation level [4]. E-learning systems currently at

S.K.S. Cheung et al. (Eds.): ICHL 2013, LNCS 8038, pp. 290–300, 2013.

the market do not adequately support the learning in a constructivist way because they do not adapt to the special needs and personal attributes of individual learners [5]. Based on the review of previous research, online personalized learning environment is the best learning medium for individual difference approach, in that it has impact on students' achievements and satisfaction in learning [4].

Several interactive platforms have been proposed for sharing learners' ideas, integrating mutual knowledge or providing feedback. These approaches still lack the consideration of cognitive differences among the learners resulting in very limited success [6]. Other researchers also point out that, although design education is already taking full advantage of the just in time and economy of online information, the online teaching materials suffer from scanty content, poor interactivity, and sense of insufficient participation [7]. Due to poor interactivity and sense of insufficient participation, learners can easily loose track and motivation during learning in an e-learning environment hence drop out. A major challenge facing providers of e-learning is provision of meaningful interactive courseware that is responsive to learners, allowing them to actively participate in the learning process [8]. Considering the popularity of the Internet, an automatic interactive feedback system for e-learning websites is becoming increasingly desirable [9]. More work needs to be done on the introduction of e-learning technology in a Ugandan education system especially in the use of agent technology for personalized real-time feedback generation to address the cultural diversity of the learners and their varying learner needs [10].

In an online learning environment, there is need to create a more effective interaction between the e-learning content and the learners [11]. New kinds of support systems are needed for effective interaction and to provide RF during learning process in e-learning. Agent systems can provide better support here as they can provide greater flexibility in the way learners utilize services provided by learning management systems (LMS) [12]. In this LMS, the feedback is generated by consolidating the predefined information after the learner has been assessed [13]. However, there is no mechanism in place for the feedback to reflect the learning objectives set for the overall learning content and achievements at different learning stages [14]. Furthermore, the feedback mechanisms that are used by the learners have changed with advances and growth of web-based learning systems [13]. To match with the changing learner needs, feedback mechanisms and the growth of web-based learning systems, there is need for an interactive agent –based approach to real-time feedback (IAARF) mechanism that will help the learners in their learning path [15]. To provide this kind of feedback would satisfy a degree of success for individual questions, but it is difficult to customize feedback according to individual learner performance and to support continuous improvements during the learning process [14]. However, eliciting complete and correct requirements is a major challenge in personalized learning and incorrect requirements are a constant source of defects. The purpose of this study focuses on the requirements framework for personalized real-time feedback in e-learning systems during a learning process. It also examines the link between feedbacks, and learning process, discusses in details the various factors necessary for real-time feedback generation in e-learning.