Challenges in Developing Adaptive Educational Hypermedia Systems

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INTRODUCTION

Traditional educational hypermedia systems afford learners the "one size fits all" approach to learning (Brusilovsky, 2003, 2004; Chatti, Jarke, & Specht, 2010; Hsieh, Lee, & Su, 2013). In the "one size fits all" approach to learning each student in every cohort of students is given access to the same learning objects in the same way as every other student who is studying the same course. The learning objects or learning content stays static regardless of the learning requirements of different students.

The objective of Adaptive Educational Hypermedia Systems (AEHS) is to afford learners the opportunity to engage with learning content which has been specifically designed to meet the learning requirements of each individual learner by adapting the content and the user interface to suit the needs of a specific user. AEHS could be used in the education of learners at all stages of their education from junior school to post graduate level. AEHS could also be used in organisations for continuous professional development or training for compliance purposes, for example, first aid or manual handling. Software engineering for AEHS commences with a thorough study of the requirements of the proposed system. AEHS, as proposed systems, are very complex systems to design as the software engineer has to design a system to enable non-technical and technical educator authors to design adaptive learning courses for use by students. Therefore, the design and development of AEHS are very complicated, time

consuming, and expensive. This article reviews a few of the challenges encountered in the design and development of these complex systems and some of the challenges encountered by educators who propose to use AEHS with their students.

The background section of this article provides the reader with brief definitions and discussions on the concept of AEHS and positions AEHS in the larger research area of E-Learning or Technology Enhanced Learning. The main body of the paper outlines some of the challenges encountered in the development and use of AEHS including: the classification of different categories of learners; the sourcing of suitable educational materials or learning resources; gauging the impact that AEHS have on the learning experience of end users; and student access to open and editable user models/profiles. Followed by sections on the following: solutions and recommendations; future research directions and the conclusion.

BACKGROUND

"Adaptive hypermedia systems build a model of the goals, preferences and knowledge of each individual user, and use this model throughout the interaction with the user, in order to adapt to the needs of that user" (Brusilovsky, 2001, p. 87). AEHS build a model of each individual student, and use the information from this model to determine the adaptive learning experiences to be created for each student.

The following sections provide more information on AEHS and include definitions of the terms Adaptive Education (AE), Adaptive Educational Hypermedia (AEH) and Adaptive Educational Hypermedia Systems (AEHS). E-learning and Technology Enhanced Learning (TEL) pertain to various forms of teaching and learning through the use of technology (O'Donnell & O'Donnell, 2015) and access to the Internet. TEL in the context of this article can be used synonymously with E-Learning. AEHS is a form of E-Learning which goes beyond the "one size fits all" approach to E-Learning by adapting the content to suit the learning requirements of individual learners.

Adaptive Education (AE)

Adaptive Education (AE) can be defined as an educational experience that adapts to suit the learning requirements of each individual learner. The purpose of AE is to provide learners with learning resources which have been specially selected to suit their specific learning needs.

Adaptive Educational Hypermedia (AEH)

AEH is electronic content which can be used in the provision of adaptive education. Software developers and educational providers are continuously

exploring how technology can be used to enhance the learning experience of students.

In a study of AEH authoring tools, Gaffney, Staikopoulos, O'Keeffe, Conlan, and Wade (2014) suggest that "AEH authoring tools have however not been as successfully adopted as was initially expected" (p. 416). Further research is required to explore why AEH authoring tools have not been as successfully adopted as initially expected.

Adaptive Educational Hypermedia Systems (AEHS)

Adaptive Educational Hypermedia Systems (AEHS) are designed and developed to deliver adaptive educational experiences to students. Some examples of AEHS include: GRAPPLE (De Bra et al., 2012; Glahn et al., 2011); AHA! (De Bra, Stash, Smits, Romero, & Ventura, 2007; Knutov, De Bra, & Pechenizkiy, 2009); and ELM-ART (Weber & Brusilovsky, 2001). AEHS use many different mediums of electronic content. Hypertext is a section of online text or an online paragraph of information that has been embedded with links to other content. Hypermedia is electronic content which includes links to many different mediums of content as shown in Figure 1, such as: text; images; tables; figures; graphics; audio; video; animations; simulations; or games.

Figure 1. Hypermedia can be linked to many different mediums of content
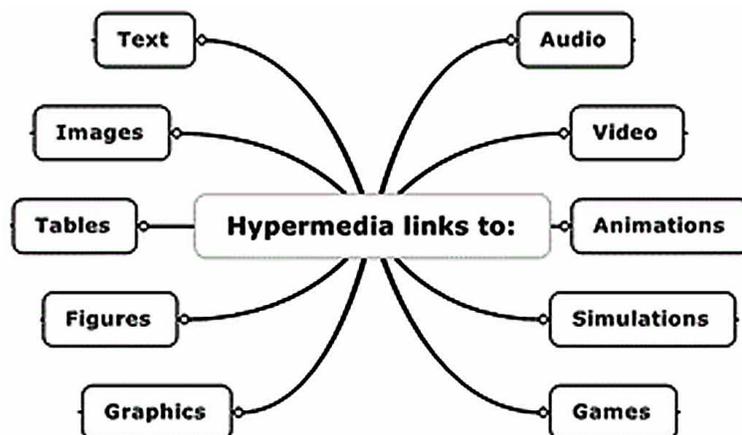
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