Adaptation with Four Dimensional Personalization Criteria Based on Felder Silverman Model

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ABSTRACT

In the past decades, various systems have been proposed to provide students with a better learning environment by taking personal factors into account. Learning styles have been one of the widely adopted factors in the previous studies as a reference for adapting learning content or organizing the content. However, very few researchers give an idea of matching e-media with appropriate teaching and learning styles and very few studies give an idea of which appropriate combinations of electronic media and learning styles are more effective than other. In this paper, the authors aim to prototype an AFDPC-FS system (Adaptation with Four Dimensional Personalization Criteria based on Felder Silverman model). Their system presents a general framework for combining and adapting teaching strategies, learning styles and electronic media according to Felder-Silverman’s learning style model. An experiment was designed to explore the effect of adaptation to different learning styles when learning materials were matched with learning styles. In particular it was set up to see whether there are significant differences in learning achievement and cognitive load between two groups, an experimental group who studied with learning style-fit version and a control group who studied with non-fit version of the system without adaptation to learning styles. The experimental results showed that the proposed system could improve the learning achievements of the students. Moreover, it was found that the students’ cognitive load was significantly decreased.

KEYWORDS
Cognitive Load, Learning Achievement, Learning Strategies, Learning Style, Personalized Learning

INTRODUCTION

The rapid advancement of computer and network technologies has attracted researchers to develop tools and strategies for conducting computer-assisted learning activities (Hwang, Wu, & Chen, 2012; Tsai, 2004). With these new technologies, learning content becomes rich and diverse owing to the use of hypermedia and multimedia presentations (Yang, Hwang & Yang, 2013).

Web-based adaptive e-learning hypermedia systems are suitable for providing personalized learning supports or guidance by identifying the personal characteristics of students and adapting the presentation styles or learning paths accordingly (Tseng, Chu, Hwang, & Tsai, 2008).

In the past decade, various personalization techniques have been proposed for developing adaptive e-learning hypermedia systems, and have revealed the benefit of such an approach (Mampadi, Chen, Ghinea, & Chen, 2011; Nielsen, Heffernan, Lin, & Yu, 2010; Wells & McCrory, 2011). In this respect, according to (Al-Azawei & Lundqvist, 2015; Hwang, Sung, Hung, & Huang, 2013) many personalized

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or adaptive learning systems have been developed based on a range of students’ personal information, such as their profiles (e.g., gender, age, knowledge level, and background data), learning portfolios, and preferences (Chen, 2008; Wang & Liao, 2011; Wang & Wu, 2011). Recently, researchers have largely focused on learning styles due to several reasons. According to literature, learning styles have widely been used to avoid a ‘one-size-fits-all’ teaching approach (Akbulut & Cardak, 2012; Al-Azawei & Badii, 2014; Dorça, Lima, Fernandes, & Lopes, 2013; Felder& Brent, 2005). Learning style is a student characteristic indicating how a student learns and likes to learn (Keeffe, 1991). For example, some learners prefer graphical representations and remember best what they see, others prefer audio materials and remember best what they hear, while others prefer text and remember best what they read. There are students who like to be presented first with the definitions followed by examples, while others prefer abstract concepts to be first illustrated by a concrete, practical example. (Popescu, 2010).

There are many studies on the effectiveness of combining multimedia and hypermedia with learning styles in educational systems (Najjar, 1996) (Liao, 1999). They attempt to associate specific e-media characteristics to different categories of learners and propose instruments and methods for assessing learning style (Riding & Rayner, 1998). Most of these studies based on Felder-Silverman learning style model (FSLSM) (Felder and Silverman, 1988). Examples of such systems include CS383 (Carver et al., 1999), TANGOW (Paredes and Rodriguez, 2004) and PHP Programming Course (Hong & Kinshuk 2004).

On the other hand, Learning strategies are the strategies used to remember, learn and use information. Consequently, Teaching strategies (TS) are the elements given to the students by the teachers to facilitate a deeper understanding of the information. The emphasis relies on the design, programming, elaboration and accomplishment of the learning content. Teaching strategies must be designed in a way that students are encouraged to observe, analyze, express an opinion, create a hypothesis, look for a solution and discover knowledge by themselves (Franzoni & Assar, 2009). In this regard, some of the previous studies worth mentioning are for example those of Dunn (1988), who insists on the importance of teaching the students by using methods that adapt to their conceptual preferences. Or Cabrero (2006), who also points out how the applied teaching strategies will take effect on the teaching quality, not only from an individual point of view, but also on the collaboration of the group as a whole.

However, very few researchers give an idea of matching e-media with appropriate teaching and learning styles and very few studies give an idea of which appropriate combinations of electronic media and learning styles are more effective than other (Franzoni & Assar, 2009). To cope with this problem, in this paper, we aim to prototype an AFDPC-FS system (Adaptation with Four Dimensional Personalization Criteria based on Felder Silverman model). Our system presents a general framework for combining and adapting teaching strategies, learning styles and electronic media According to Felder-Silverman’s learning style model. More specifically, this paper focuses on the proposal for an adaptive taxonomy that will be used to release the fourth levels of adaptation: content level adaptation, link level adaptation, presentation level adaptation and collaboration level adaptation of an educational hypermedia, while based on the four dimensions of Felder-Silverman’s learning style model.

LITERATURE REVIEW

Learning Style-Based Adaptive Educational Systems

Learning style-based adaptive educational systems (LS-AES) are a special case of adaptive educational systems which focus on students’ learning preferences as the adaptation criterion. There are several different learning style models including Honey and Mumford (1982), Kolb (1984), and Felder and Silverman (1988). Among those learning style models, the Felder–Silverman learning style (FSLSM) has been widely adopted and has been validated by various studies (Mampadi, Chen, Ghinea, & Chen, 2011; Ackbulut, 2012; Hwang, Sung, Hung, & Huang, 2013).
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