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Adapting for visual and verbal learning styles in AEH

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Abstract

This paper describes how visual and verbal learning styles have been successfully integrated into an adaptive educational environment. User trials of this system were carried out, to determine the effect of the adaptation, and although these user trials do not indicate any statistically significant differences, the qualitative information gleaned from the study indicated that students preferred using this environment over other traditional revision methods, and that they perceived personalized tuition to be better than a 'one size fits all' approach.

1. Introduction

The way in which user profiling for AEH (Adaptive Education Hypermedia) [1] is carried out is currently the subject of much discussion. Traditional user profiling for adaptive systems have been via prior knowledge [2], as shown in applications such as AHA! [2], MOT [3] and WHURLE-HM [4]. There has been little work done so far on the ways in which individuals process information in these environments. 'Learning styles' (LS), address the way in which information is processed and organized in the brain. It is not well known if these styles are static or dynamic, nor if they are contextual or independent of the subject being studied.

This paper examines an AEH system designed to cater for students with a preference for a visual or verbal LS. The study involved both matched and mismatched learners using visual, neutral and verbal representations of content. User logs were collected and analysed along with qualitative data from post-trial user evaluations and one-to-one interviews.

2. The WHURLE system

WHURLE (Web-based Hierarchical Universal Reactive Learning Environment) is an XML-based AEH for the web. It uses 'pluggable' user models [5], in that such models are not hard-wired into the system and can be swapped easily. WHURLE-HM is the version of WHURLE that uses a hybrid user model (a hybrid of the overlay & stereotype models) and bases adaptation on a user's prior knowledge. It is a dynamic system and is updated continuously. Pedagogically, this user model is simplistic, as it does not cater for the differences in how individuals process information.

WHURLE uses conceptually discrete units of information stored as *chunks*. Chunks only describe their own content; a lesson structure is overlaid to give a lesson plan. A *Lesson Plan* (LP) describes the default narrative for a lesson and includes all chunks required to describe a lesson. Adaptation occurs when the chunks of this default LP are filtered using information from the user's profile.

2.1. Learning styles in WHURLE

In an attempt to improve the pedagogical value of WHURLE, a user model was created that incorporated learning styles. For the purposes of the study, we assumed that learning styles were fixed and non-contextual. There are many different measurements of learning style, and since multimedia is used extensively in WHURLE, it was decided to use the visual-verbal continuum of LS. To determine the students' learning style, the Felder-Solomon Inventory of Learning Styles (ILS) was used; this is a 44-item questionnaire that assesses a person's preferences for:

- Visual-verbal learning
- Active-reflective learning
- Sensing-intuitive learning
- Sequential-global learning.

Since only visual-verbal preferences were modelled in WHURLE, only 11 items from the questionnaire were required.

3. Case study: WHURLE revision guide

A digital revision guide was created for use by 221 undergraduate and taught postgraduate students at the University of Nottingham for an assessed taught module.

Using the system for the first time, a student's visual-verbal LS was assessed and they were then randomly assigned to either a matched, neutral or mismatched group.

Matched students were presented with content that was matched to their LS, whilst mismatched students were presented information in a representation that was contrary to their preferred style. Those students in the neutral group were given content that had no bias.

The guide was available to students for a 2-week period, and students could access the system wherever they liked. Log files and assessment data about each student was collected during these 2-weeks along with their academic performance for the course as a whole.

4. Quantitative findings of the case study

Once data had been analysed, a number of findings were made from the study. The most important was that there did not seem to be a statistically significant difference in academic performance between matched, neutral or mismatched students. It might be expected that if a student was given matched content, they may learn more effectively and perform better academically. The fact that the data gathered from the case study does not support this hypothesis is very interesting and may have implications for how learning styles are integrated into other learning environments. These findings build upon those discussed in Brown *et al* [6].

5. Qualitative findings of the case study

Some of the data collected from the case study comprised feedback from students, in the form of questionnaires and one-to-one interviews. Whilst this information is not quantitative, it is nonetheless important to record the perceptions and opinions of the students.

The questionnaire data indicated that the students enjoyed revising using the system more than other, more traditional methods of revising. All the students interviewed said they would like to have used such a system in other modules, and would recommend it to their friends and fellow students. Interestingly enough, none of the students seemed to see much difference between what they saw on their own screens, and what their friends saw. When asked about who should control the adaptation, most said that they wanted to have ultimate control over what they saw. Only a few students were happy to have a computer take complete control of their content. However, all students thought that using an adaptive, personalised system was preferable to a 'one size fits all' approach.

6. Conclusions

There are many possible reasons why these negative results were obtained from this study, and the fact that they were negative does not necessarily show that visual-verbal learning styles are not important (or even that learning styles themselves are not important *per se*).

The qualitative results however indicate that the students prefer this kind of revision aid over other, more traditional means of revision, and they also like to have their individual needs recognised and catered for. It is this kind of information that is not often highlighted by empirical studies, yet it is an essential part of any system evaluation.

This study provided a clear example of how learning styles can be integrated into an adaptive hypermedia system, and showed promising results in terms of student motivation, even though academic performance was not in itself affected.

7. Acknowledgements

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