The Role of Learning Styles in the Acceptance of Web-based Learning Tools

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Abstract

Web-based learning tools have been widely adopted by tertiary educational institutions. As a consequence, much research has been devoted to examining factors that influence the level of acceptance of these tools amongst learners. Fewer studies have investigated antecedents of these factors. In this paper it is posited that learning styles are an important antecedent that will indirectly affect acceptance through factors having a direct impact. A web-based quiz tool was the specific focus of attention, as in many institutions these tools are used for assessment without understanding how individual learner attributes affect their acceptance and use.

Data was collected from a cohort of students studying a first year course in Information Systems. A key finding was that a strong relationship exists between learning styles and self-efficacy - a factor that in turn influenced the level of acceptance. The implications of this and other findings are discussed further in the paper.

Introduction

In the ever-increasing world of 'networked' computing and distributed learning, web-based learning tools have come to the fore as effective teaching mechanisms. It is imperative therefore, that educational institutions, teachers, businesses and web-tool developers become aware of the factors that affect the acceptance and success of their web-based learning tool initiatives (Eklund et al. 2003). Previous research in this area has focused on the identification of factors directly influencing the acceptance and usage of web-based learning tools (Seymour et al., 2005). However, the literature has stopped short of identifying antecedent variables that in turn influence these factors. Learning styles may be one such antecedent variable, given that compatibility of learning styles with web-based learning tools has been found to be an important factor influencing acceptance, and deserving of further exploration (Brown, 2003). The aim of this research was therefore to investigate the impact of learning styles on compatibility and other such variables, known to subsequently affect acceptance and use of web-based learning tools. The tool of interest in this case was the WebCT Quiz Tool, as previous research has shown that usage behaviour around this tool may not follow the pattern of more generic tools (e.g., discussion lists), which are not specific to the learning context (Seymour et al, 2005). In the next section the conceptual back ground to the study is outlined, which leads to the establishment of a research framework. This is followed by an outline of the research methodology before the results and findings are discussed, and the paper concluded.

Conceptual Background

Web-based Learning Tools

Web-based learning tools have been employed by institutions to help cope with the demands and information needs of today's life-long learners (Van Greunen & Wesson, 2001). It is the ability of these tools to offer the learner greater flexibility, greater accessibility, convenience and richer learning materials coupled with the ability to control the pace of the learning process that have led to the their widespread adoption (Liu et al., 2003; McDonald et al., 2004).

Many web-based learning tools and learning environments have found their way onto the commercial market. One of the most widely used of these tools is the WebCT learning management system (Beck et al., 2003). Typically, WebCT has four main tool sets that provide access to a collection of course-related materials as well as added functionality as listed below (Seymour et al, 2005):

- Course Content (e.g., Syllabus, Course Notes)
- ••Communication Tools (e.g., Chat Room, Discussion list)
- ••Evaluation Tools (e.g., Self-test, Quiz)
- ••Study Tools (e.g., Student Home Pages, Student Presentations)

Usage behaviour and acceptance of each tool set has been found to vary, thus indicating that each tool set should be investigated individually, rather than assuming that "one size fits all" (Seymour et al, 2005). The quiz tool specifically has been found to be more specific to the learning environment and so was the focus of attention.

Learning Styles and Learning Preferences

Learning styles are particularly important in the context of web-based learning because they define the way in which individuals extract, process and memorise different types of information (Felder, 1993; Price, 2004; Swisher, 1994). Learners tend to perceive, process and conceptualise information at different rates and therefore draw out information and concepts in vastly different ways. Studies have revealed that the retention of information is directly proportional to level of correlation between the learner's learning style and the presentation of the content in an appropriate manner for that particular learning style (De Bello, 1985; Giannitti, 1988; Miles, 1987). The ability to match the learner's learning style with the way in which information is presented is paramount in ensuring the success of information transfer and web-based learning tool adoption (Powell, 1999).

Learning styles are complex concepts and therefore several models exist that attempt to define and understand these complexities (Miller, 2004). Some of these models include Kolb's (1983) Experiential Learning Model, Curry's (1983) Onion Model and, Felder and Silverman's (2002) Learning Styles Model. Despite much debate, the learning

community has been unable to reach consensus on any particular learning style model. The selection of a particular model has thus far been influenced primarily by the researcher's individual focus and then secondly by the subject area of interest (Desmarais & Ritchie, 2001; Miller, 2004).

Particular areas of study have also focused their attention on individual learning preferences. Many of the learning style models use a combination of learning style preferences to form the basis of their theoretical frameworks. Primary learning preferences within the period of early childhood are visual and/or auditory stimuli, and tactile or kinesthetic stimuli (Bradway 2000; Lovett, 2005; McVay, 1998). With regards to the adoption and usage of web-based learning tools, studies have also highlighted and assessed the visual/auditory and tactile/kinesthetic learning style preferences (Felix, 2000). The tactile/kinesthetic learning style preference has been identified as the major learning style, with the majority of respondents preferring this approach. Conversely, the visual/auditory learning style was identified as a minor learning style with few respondents preferring a visual/auditory learning approach. The relevance of this is that the tactile/kinesthetic learning style preference has been highlighted as being conducive for working with both the web and with web-based learning tools such as WebCT (Felix, 2000, Sanchez & Gunawardena, 1998).

Factors Affecting the Acceptance of Web-based Learning Tools

Previous research has highlighted factors that affect and influence the adoption of certain technologies including the adoption of web-based learning tools (Lee et al, 2003). Much of the literature expands on the earlier work of Davis (1989) and his widely cited Technology Acceptance Model (TAM) (Lee et al., 2003). It is from these expanded models within the literature that the factors affecting web-based quiz tools were drawn.

The TAM predicts that usage, or intentions to use a technology are influenced in the main by two interrelated variables – perceived usefulness and perceived ease of use. Venkatesh (2000) posits that all other variables influence acceptance through these two variables. Many of these external variables have been identified by Lee et al. (2003). Factors found to be particularly important in the learning context are self-efficacy,

compatibility with learning styles and perceived enjoyment, respectively. Each will be discussed in turn.

Self Efficacy

Grandon et al. (2005) identified significant relationships between self-efficacy, and perceived usefulness and perceived ease of use, in the context of web-based learning environments.

Compatibility

Brown's (2003) research into factors affecting the adoption of the Internet as a learning tool highlighted the importance of web-based learning tools being compatible with learning styles. Seymour et al (2005) performed a similar study in relation to the WebCT quiz tool specifically. In this study, compatibility was highlighted as the most significant factor affecting the adoption of the Quiz Tool. Chau and Hu (2002) indicated too that compatibility was a significant factor affecting user intentions to adopt, primarily through the intermediaries of perceived usefulness and perceived of ease of use, respectively.

Perceived Enjoyment

Anandarajan et al. (2002) put forward the notion that perceived enjoyment was also an important factor affecting technology acceptance, as did Felix (2000). Venkatesh (2000) show that its effect on adoption is through perceived ease of use specifically.

Research Framework

Integrating the arguments above into a single research framework resulted in the identification of several major hypotheses, and sub-hypotheses. These are as follows:

TAM relationships

H1: The TAM variables, perceived usefulness and perceived ease of use influence student intentions to use web-based quiz tools.

- H1A: Perceived usefulness positively influences student intentions to use web-based quiz tools.
- H1B: Perceived ease of use positively influences student intentions to use web-based quiz tools.

H2: External variables (self-efficacy, compatibility, perceived enjoyment) indirectly influence student intentions to use the web-based quiz tool through the TAM variables (perceived usefulness and/or perceived ease of use).

- H2A: Self-efficacy positively influences perceived ease of use of web-based quiz tools.
- H2B: Perceived enjoyment positively influences perceived ease of use of web-based quiz tools.
- H2C: Compatibility with learning styles positively influences perceived ease of use of web-based quiz tools.
- H2D: Compatibility with learning styles positively influences perceived usefulness of web-based quiz tools.

H3: Learning style preferences influence web-based quiz tool acceptance through external variables.

- H3A: Student learning style determines the degree of compatibility of web-based quiz tools with learning style.
- H3B: Student learning style determines the level of self-efficacy with regards to web-based quiz tools.
- H3C: Student learning style determines the perceived enjoyment of web-based quiz tools.

Research Methodology

The research was positivistic, quantitative and hypothetico-deductive in approach. The use of a quantitative approach enabled researchers to effectively test the various hypotheses regarding the adoption of web-based learning tools. The research strategy employed in this study included the use of a survey. The time- frame for this survey was that of a cross-sectional time period. A questionnaire was selected as the principal means of data collection. In order to improve the questionnaire's response rate, a paper-

based questionnaire was used and administered in a scheduled class to a group of undergraduate students with experience of using web-based quiz tools.

The questionnaire was divided into three sections. The first section was made up of self-prepared demographic questions. Section two was comprised of questions to assess learning styles. The VARK (Visual, Auditory, Read/Write, Kinesthetic) questionnaire developed by Flemming (1998) was used. The VARK questionnaire consists of 13 multiple-choice questions with the majority of the questions having a maximum of four options and in some instances a maximum of three options. More than one option could be circled, which enabled the instrument to effectively isolate the respondents' learning style preference. Section three was comprised of several instruments to assess student perceptions and usage of the quiz tool. The instruments used, except one, were based on a 7-point Lickert scale ranging from strongly disagree (1) to strongly agree (7). These instruments were sourced from Brown (2003) and Seymour et al. (2005).

A pilot study was undertaken involving 5 respondents, three males and two females, who were asked to comment on the questionnaire's ease of use, comprehension and ease of completion. The time taken to complete the questionnaire was also monitored and several adjustments such as the use of more checkboxes, revised instructions and improved local context, were made to the final questionnaire.

The respondents who took part in the final survey were chosen randomly. Respondents were selected primarily based on their course registration. The course that was selected comprised of non-information systems Commerce undergraduates who were enrolled in an introductory information systems course. The majority of students enrolled in this course had at least 6 months of experience with the WebCT Quiz Tool and were presently using the WebCT Quiz Tool in another course. 171 responses out of a potential 500 or so were used in the final data analysis.

Data Analysis and Results

The respondent's demographic profile is presented in Table 1.

Table 1. Respondent's Demographic Profile

Variable		Frequency	Percent
Age	Under 20	149	86.1
	21 - 25	12	6.9
	25 - 35	5	2.9
	35 - 45	2	1.2
	> 45	1	0.6
Ethnicity	White European	17	9.8
	White African	31	17.9
	Black African	78	45.1
	Coloured African	29	16.8
	Indian African	10	5.8
	Asian African	0	0.0
	Other	3	1.7
English Language	1st Language	95	54.9
	2nd Language	72	41.6
	Other	6	3.5
Learning Style Preference	Visual	25	14.5
	Auditory	28	16.2
	Tactile	56	32.4
	Kinesthetic	62	35.8
	Not Disclosed	2	1.2

The majority of respondent's (86.1%) were under the age of 20. The ethnicity of respondent's appeared to be representative of the general student population at the university surveyed. Approximately half of the respondents (45.1%) were self-classified as Black African while White Africans and White Europeans made up less than one third of the sample (27.7%). The majority of respondents (54.9%) considered English as their first language while 41.6% regarded English as only a second language.

Learning style preference was fundamentally important with regards to this research paper. As indicated in Table 1 the majority of respondents possessed a tactile (32.4%) or kinaesthetic (35.8%) learning style preference. These two learning style preferences account for 62.8% of the responses and suggest that Felix's (2000) findings were correct in concluding that tactile and kinaesthetic learning style preferences were the major learning styles among tertiary learners. Visual and auditory learning style preferences appear to share similar percentages of 14.5% and 16.2% respectively and support

previous findings that visual and auditory learning styles are merely minor learning styles among the majority of tertiary students.

Process of Analysis

Often, it is the approach to analysis that often determines the outcome of the results with regards to the research. Due to the varying nature of the variables used within this model, a variety of tests needed to be performed on the data. Table 2 lists the hypotheses that were tested, the dependant and independent variables, and the statistical tests used.

Table 2. Summary of Variables to be Tested and Tests to be Used

Hypothesis	Independent Variable	Dependent Variable	Test to be used
H1A	Perceived Ease of Use	Intentions to Use	Multiple Regression
H1B	Perceived Usefulness	Intentions to Use	Multiple Regression
H2A	Self-Efficacy	Perceived Ease of Use	Multiple Regression
H2B	Perceived Enjoyment	Perceived Ease of Use	Multiple Regression
H2C	Compatibility	Perceived Ease of Use	Multiple Regression
H2D	Compatibility	Perceived Usefulness	Multiple Regression
H3A	Learning Style	Compatibility	ANOVA
H3B	Learning Style	Self-Efficacy	ANOVA
H3C	Learning Style	Perceived Enjoyment	ANOVA

Reliability and Validity

Before the above analyses could be conducted, reliability and validity tests needed to be completed. The reliability of the constructs used in the questionnaire were measured using Cronbach's alpha. Generally, the Cronbach's alpha value for a particular construct should be 0.7 or above in order for that construct to be deemed reliable (Nunnally, 1978). Table 3 lists the Cronbach's alpha values for the 7 variables to be used in the regression analysis.

Table 3. Cronbach's alpha values

Variable	Cronbach's Alpha
Perceived Usefulness	0.77
Perceived Ease of Use	0.77
Compatibility	0.74
Self-Efficacy	0.77
Perceived Enjoyment	0.80
Intentions to Use	0.73
Actual Usage	0.80

All the constructs to be tested using multiple linear regression achieved Cronbach's alpha values of 0.7 or higher, indicating reliability.

The validation of the constructs used in the survey was conducted with the use of factor analysis. This was done to ensure that the measures used within the data collection were accurately measuring the intended attributes or characteristics. The recommended factor loading value in order for factors to be considered significant is 0.5 (Hair, Anderson, Tatham & Black, 1998). Factors were therefore analysed using a 0.5 factor loading value with varimax normalised rotation. The factor analysis of the various constructs to be used in the regression analysis indicated that the measures used were valid and could be used with confidence in the linear regression models.

Hypothesis Testing

The following section analyses the results of the various hypothesis tests used. This section is divided into three distinct subsections, each dealing with a separate type of statistical test.

Analysis of Variance Analysis (ANOVA)

ANOVA tests revealed no strong relationship between learning style preference and compatibility (H3A) and perceived enjoyment (H3C) respectively. However, there was a significant result ($p < 0.1$) with regards to learning style preference and levels of self-

efficacy (H3B). Those having a visual learning style scored significantly higher on self efficacy than those with other types of learning styles (see Figure 1).

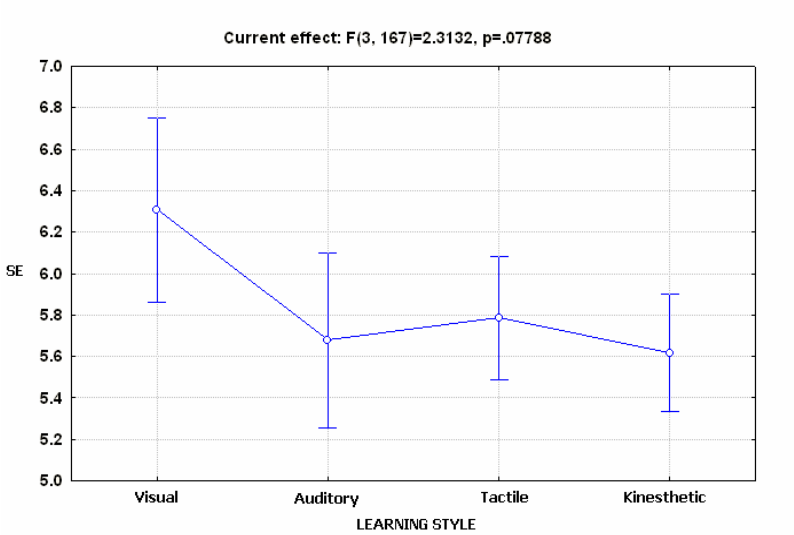

Figure 1: Learning Styles and Self-Efficacy

Regression Analysis

Multiple linear regression tests were performed for the 6 hypotheses (H1A to H1B, and H2A to H2D) in order to identify the strongest relationships between the extended TAM variables and the TAM variables as presented by Davis (1989). Hypotheses H1A and H1B were tested together in a single regression model while hypotheses H2A to H2C were tested in a separate regression model. Hypotheses H2D was also tested in a separate single variable regression. The results of the various regression tests have been collated together and presented in Table 4.

Table 4: Regression Analysis Results

Hypothesis	Variable	Beta	p-value
H1A	Perceived Usefulness	0.338138	0.000172
H1B	Perceived Ease of Use	0.458822	0.000000
H2A	Self-Efficacy	0.605330	0.000000
H2B	Perceived Enjoyment	0.044077	0.385645
H2C	Compatibility	0.018664	0.725730
H2D	Compatibility	0.462495	0.000000

Regression analysis provided support for 4 of the 6 hypotheses in Table 4. The TAM variables perceived usefulness (H1A) and perceived ease of use (H1B) influenced intentions to use. Self-efficacy (H2A) influenced perceived ease of use strongly, and compatibility (H2D) influenced perceived usefulness strongly. Perceived enjoyment (H2B), and compatibility (H2C) had no effect on perceived ease of use, however.

Conclusions

The results provide tentative evidence for the influence of learning style preference on acceptance of web-based learning tools. In particular, learning style preference was shown to be related to self-efficacy. Self-efficacy in turn was a major influence on perceived ease of use, which influenced student intentions to use the quiz tool. Surprisingly, however, no relationship was found between learning styles and compatibility, and learning styles and perceptions of enjoyment. Thus, it may be that web-based learning tools are compatible with a variety of learning styles, and may be enjoyed by students with a variety of learning styles. Where learning styles do have an impact is on self-efficacy with regards to use of the quiz tool.

Other interesting findings were the strong relationship between compatibility and perceived usefulness, but not between compatibility and perceived ease of use. Compatibility and perceived usefulness have been found in prior studies to have an especially strong relationship (Tan & Teo, 2000). The TAM relationships were as expected with both perceived usefulness and perceived ease of use influencing intentions to use the quiz tool. This provides further support for the TAM, and validates the need therefore to consider all external variables as influencing intentions to use, through perceived usefulness and/or perceived ease of use.

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