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An investigation of factors affecting satisfactory student learning via on-line discussion boards

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This paper explores the factors which affect students' learning using on-line discussion boards. Following prior research into the use and acceptance of information technology in general, and of educational technologies in particular, we established our conceptual framework upon a number of dimensions: (1) learner, (2) instructor, (3) content, (4) social, and (5) design. The study employed an empirical approach using statistical and qualitative data analysis to examine the impact of on-line discussion boards on e-learner satisfaction, looking at various factors within these five dimensions. The discussion of findings includes such aspects as the instructor's role, the learner's attitude and anxiety, the sense of on-line social presence within a blended learning environment, the perceived usefulness and ease-of-use of the technology, and the effectiveness of on-line discussion boards as tools to promote reflective thinking.

Keywords learner satisfaction; learning effectiveness; discussion boards; e-learning; blended learning

1. Introduction

The arrival of multimedia and Internet technologies in the mid-1990's was greeted with much speculative fanfare as a "revolutionary paradigm", but the initial hype was short-lived as it soon became clear that the technology was not quite ready for mass consumption. Significant advancements in recent years, such as the growth of social networking and Web 2.0 technologies, the proliferation of Web- and multimedia-enabled mobile devices, the expansion of broadband Internet access, the ongoing trend towards digital "media convergence", and the imperative to develop more inclusive and accessible programmes, means that the use of ICT as a teaching and learning tool within higher education is now becoming more the norm than the exception.

This paper investigates the factors which affected students' satisfaction with their learning experiences using an on-line discussion board in a blended learning environment. As used within this paper, a "discussion board" (also commonly referred to as "discussion group", "discussion forum", "message board", or "on-line forum") is defined as an on-line communication tool that allows members of a particular community to exchange questions, comments and responses for discussion. The platform that we used in our study was the Blackboard™ e-Learning System. According to Kay [1], relatively little is known about students' attitudes towards the use of on-line discussion boards as educational tools. Previous studies in this area have revealed mixed experiences [2]. In view of this gap in the literature, the objective of this study was therefore to explore the combination of factors that affect students' satisfaction of learning using on-line discussion boards.

2. Background literature

We derived our conceptual framework by reference to theories in the fields of teaching and learning, media richness, software usability, computer-supported collaborative work, and technology adoption/effectiveness, drawing in particular upon Piccoli et al's [3] framework of virtual learning environment (VLE) effectiveness, Wang's [4] e-learner satisfaction model, and Sun et al's [5] investigation of critical factors affecting e-learner satisfaction. The various factors that individually and collectively contribute to a satisfactory e-learning experience can be classified under the following dimensions:

- **Learner dimension:** These factors are intrinsic to the learner, such as attitudes towards e-learning technology, computer anxiety, self-efficacy, motivation, confidence, learning style, previous experience to reflective / interactive pedagogical approaches, and on-line behavioural tendency (e.g. "vicarious" interaction / lurking) [3, 5-9].
- **Instructor dimension:** The main factors here relate to teaching style, the role of the instructor as facilitator/moderator, and the timeliness of feedback [2, 5, 7, 10, 11].
- **Content dimension:** This dimension takes into consideration the nature of the content and subject material, in particular how on-line discussion boards can be used to facilitate the development of

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higher-order thinking skills by encouraging students to practice reflective learning in the process of building and sharing new knowledge [12-14].

- **Social dimension:** The principal issues here are the differences between the physical classroom and virtual on-line discussions, the sense of “social isolation”, the elements of an on-line “community”, and interactions within an on-line community [15-17].
- **Design dimension:** This dimension includes such factors as media richness and appropriateness, the usability of on-line discussion boards, perceived usefulness and ease of use, interactivity, and the effectiveness of support for collaborative work [1, 18-22].

3. Research setting and method

The first author is the instructor for a postgraduate module named “Analysis, Design & Development of Web-Based Database Systems” which runs for a 12-week period in the second semester. This module is taught to three separate class groups, of which 39 were full-time students and 6 were part-time in the 2006/2007 academic year. It follows a problem-based learning approach and is assessed through team-based coursework. The on-line discussion board was set up with a view to complementing face-to-face student-instructor and student-student interactions by facilitating the exchange of knowledge e.g. “how-to” tips, bug fixes, useful resources on Apache/PHP/MySQL, etc. A portion of marks (5%) for coursework was allocated for participation within the on-line discussion board, as indicated by the number of postings and Blackboard™ access statistics. When students had completed the module, they were asked to respond to an anonymous Web-based questionnaire. This comprised 16 questions, divided into 3 sections covering basic descriptive data, connectedness of classroom community, students’ views on discussion boards, the instructor’s role in discussion boards, communication channel appropriateness, and the usefulness of discussion boards for learning. The questions were mostly attitude and opinion variables (7-point Likert scales), based on research instruments used in a number of previous related studies [4, 8, 23]. The survey was administered using best practice guidelines for Web-based questionnaires [24]. After three rounds of follow-ups, 42 responses were received (93% response rate). The survey data was analysed using step-wise regression and correlation tests. Standard reliability and validity checks were implemented (e.g. Cronbach’s alpha). Responses to the open-ended questions were analysed using qualitative data coding techniques.

4. Findings

The findings of this study touched upon a multitude of various factors, but owing to space constraints it is only possible to present a selection of points here. Under each of the aforementioned dimensions, a number of propositions were set forth and then explored through statistical and qualitative analysis of the Web survey responses.

4.1 Learner dimension

Proposition 1: A learner’s subject-matter confidence level can negatively influence his satisfaction with on-line discussion boards.

This proposition was found to be supported by the regression model ($\beta = -.21, p < .1$). Further insights were gleaned from the open-ended comments; as one student put it, *“I think that most of the input came from people who had previous experience with the technology being used. After all, it’s easy to talk about what you know. For those new to the technology, they may not even know what questions to ask, let alone provide solutions.”*

Proposition 2: A learner’s attitude towards using on-line discussion boards will positively influence his satisfaction with the e-learning experience.

This proposition was not supported by our findings, which can possibly be explained by comments which suggest that negative attitudes had more to do with apathy than dissatisfaction; for example, *“I only used it to keep up to date with new announcements, I made no contributions, I did not feel the need to”*.

Proposition 3: A learner’s anxiety towards using on-line discussion boards will negatively influence his satisfaction with the e-learning experience.

This proposition was statistically supported by our regression model ($\beta = -.38, p < .01$). As we had expected, it was also found that learner’s anxiety towards on-line discussion was negatively correlated with subject-matter confidence level ($r = -.47, p < .01$). Related open-ended comments included *“It’s easier to talk to someone in person, some people might be too embarrassed to post a question and look stupid”*, and *“I never felt comfortable enough to ask for help on a particular problem, I would ask classmates [in person] but was*

reluctant to let everyone know [via the discussion board], I felt a little shy". (In this study, anonymous postings were not permitted to the on-line discussion board.)

4.2 Instructor dimension

Proposition 4: The timeliness of the instructor's responses within on-line discussion boards will positively influence an e-learner's satisfaction.

As was also the case in Sun et al's previous study [5], we found no apparent association between the timeliness of the instructor's feedback and the students' perceived satisfaction level. Although this may seem surprising, a plausible explanation is that the data was heavily skewed, with the result that there was insufficient variance to reveal a statistically significant effect.

Proposition 5: The nature of the instructor's intervention (facilitator/moderator as opposed to lecturer) within on-line discussion boards will positively influence an e-learner's satisfaction.

Again, this proposition was not supported. This may be because there was substantial off-line interaction between the students and the instructor – there were 49 student postings in the on-line discussion board, as opposed to 165 email messages sent to the instructor and 155 personal visits to the instructor's office. Although the instructor acted in the role of a facilitator for the on-line discussion board, many students preferred to lean upon him as a face-to-face tutor, perhaps because the technical content of the module was challenging. 54% of respondents concurred with the statement that *"I still need to physically visit the instructor's office to obtain some of the course materials and information"*.

4.3 Content dimension

Proposition 6: The effectiveness of an on-line discussion board as a tool for problem resolution will positively influence an e-learner's satisfaction in a blended learning environment.

Because the module followed a problem-based learning (PBL) pedagogy, students were encouraged to attempt to solve problems (e.g. by looking for answers in Web search engines) rather than come knocking on the door of the instructor at every obstacle. A percentage of course marks was allocated for participation in the discussion board, whereby students were encouraged to help each other with similar problems and share useful tips and resources that they came to know of. Notwithstanding the fact that the most helpful and informative postings were submitted by a small cohort of the overall class, students were generally pleased with the effectiveness of the on-line discussion board as a mechanism for problem resolution. Positive comments included:

"The discussion board was extremely useful. The ideas, links and comments posted were vital for my coursework."

"I was looking for instructions on how to download Apache/PHP/MySQL, there was some useful site information in the discussions. When I was having problems with the Apache server, I put up tips to help others not to have the same problems."

"I found useful links to tutorials that other students had posted, I would not have known about them without utilisation of the discussion board."

Proposition 7: The effectiveness of an on-line discussion board as a tool for reflective thinking will influence an e-learner's satisfaction in a blended learning environment.

The evidence in favour of this proposition is that 81% of survey respondents agreed that the use of the on-line discussion board encouraged reflective thinking and learning. However, the lack of experience of both the students and the instructor in using discussion boards meant that this reflective aspect was not as successful as it might otherwise have been; as one respondent commented, *"With discussion boards others can share their knowledge; I think I would use it better next time"*. The instructor was disproportionately active in the discussion forums, with substantially more impetus coming from him than from the students. In retrospect, this may have been a mistake because this close hands-on approach almost certainly resulted in some students engaging in wait-and-see "lurking" behaviour.

4.4 Social dimension

Proposition 8: The strength of classroom community connectedness of class members will positively influence perceived a learner's satisfaction when participating in on-line discussion boards.

The rationale for this proposition is that the strength of the personal bonds between students, developed through off-line face-to-face interaction with one another, will impact the sense of collegiality and hence will lead to students being more willing to help each other within the on-line discussion board. However, the survey

data did not support this proposition, with no statistically significant correlations found between classroom connectedness and satisfaction with the on-line discussion board.

Proposition 9: The sense of on-line social presence will positively influence perceived a learner's satisfaction when participating in on-line discussion boards.

80% of students agreed that “there is a spirit of community” within the class, 73% responded that “I feel confident that others will support me”, and 68% indicated that “I do not feel isolated in this course”. Given this strong sense of collegiality, we were surprised that no correlation was found between on-line social presence in discussion boards and community connectedness within the classroom environment. Although this might seem anomalous, Picciano [16] explains that it is possible for a student to interact with discussion boards while not necessarily feeling that he/she is part of a group or class. Conversely, as was the case in our study, a strong sense of off-line connectedness coupled with close physical proximity (the class mostly worked on their projects within a dedicated laboratory) can mean that students have less recourse to the on-line discussion board than if they were geographically distributed. Another explanation might be the limitations of the Blackboard™ platform because it does not facilitate social networking in the modern conventional sense (e.g. Bebo, LinkedIn, Facebook, Twitter, YouTube, del.icio.us, Flickr); this was evidenced by the finding that 42% of the class did not think that Blackboard™ “makes it easy to feel connected to others”. Regardless of the reason for the relatively low sense of on-line presence, our proposition was supported by statistical evidence ($\beta = .39, p < .05, t\text{-value} = 4.549$). This suggests that learners would have been more satisfied with the on-line discussion board if it were better at encouraging and facilitating socialisation activities.

4.5 Design dimension

Proposition 10: A learner's perceived usefulness of an on-line discussion board will positively influence his satisfaction with his e-learning experience.

This proposition, and the next, are both based on Davis' [19] well-known technology adoption model (TAM). Our statistical regression revealed that perceived usefulness was found to be the strongest factor which impact satisfaction with the on-line discussion board ($\beta = 0.69, p < .001, t\text{-value} = 4.549$). Further light is cast on this finding by an analysis of positive and negative student comments:

“I think we could have been encouraged to use it more, an email to alert the user to a topic it would encourage more use. I can see the benefits of the discussion boards, but is not being used to its full potential.”

“The discussion board is certainly a useful tool and I did find some helpful information within the various threads.”

“It was useful to a point, but provided help with more general problems rather than specifics.”

“It was useful because it allowed student and staff members to provide technical support for project work.”

Proposition 11: A learner's perceived ease of use of an on-line discussion board will positively influence his satisfaction with his e-learning experience.

89% of respondents indicated that they considered the Blackboard™ discussion board “easy to use” and 84% agreed that Blackboard™ “makes it easy for you to find the content you need”. However, no statistical evidence was found to support the proposition that ease-of-use affected learner satisfaction, which is contrary to the findings of most previous studies based on the TAM model (this may simply be because the sample was small). That said, some of the qualitative data suggests that ease-of-use is a contributory factor to learner satisfaction:

“I found that if you didn't read the comments every few days, they would build up and take a while to get through.”

“It's easy to use but participation is what gets the ball rolling on these things.”

“Blackboard is excellent because you can access it anywhere in the world and keep up to date with lectures announcements.”

Proposition 12: The appropriateness of communication media will have a negative influence on a learner's satisfaction with on-line discussion boards.

The rationale for this proposition is that the on-line discussion board, although it has the advantage of being a medium independent of time and place, also has the disadvantage of being “media poor” (i.e. heavy on plain-text), meaning that it is of limited use for communicating difficult and abstract technical concepts. Students were presented with a number of communication options and asked to rank the effectiveness of each. Their preferred channels were, in order of highest to lowest preference: (1) face-to-face, (2) email, (3) discussion

board, (4) telephone, (5) SMS. Thus we conclude that the on-line discussion board is considered by the students to be a useful channel, but with definite limitations, as evidenced by the following open-ended comments:

"The discussion board lent itself to being far more efficient in delivering information than a blanket email sent to all students."

"With the discussion board you had up-to-date online help without having to nag at fellow students or lecturers."

"The discussion board was useful to a point, but for help with specifics I needed to call in to my lecturer."

5. Conclusions

This paper discussed the findings of a Web-based survey of a class of 42 postgraduate students which explored the factors that affect a satisfactory learning experience using on-line discussion boards. On the whole, the students found the discussion board to be very useful and complementary to their traditional learning methods. While e-learning technologies are currently being used beneficially in higher education, predominantly in the form of VLE platforms such as Blackboard™, we feel that there is substantial potential to make further use of advanced interactive features such as on-line discussion boards, blogs and WIKIs as mechanisms to help students develop higher-order thinking skills and encourage reflective learning within class groups. However, as our experiences reveal, it is not simply a case of "build it and they will come". For these collaborative learning technologies to be effective, instructors must develop effective e-moderating skills, students must perceive that the technology is useful and easy to use, there needs to be a mechanism to grow and build a sense of on-line identity and presence, and the technology needs to be complemented by richer media (e.g. video recordings, desktop conferencing, interactive digital whiteboards/sketchpads) where appropriate.

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