

Exploring Patterns of Student Learning Technology Use in their Relationship to Self-Regulation and Perceptions of Learning Community

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Abstract

This paper reports the results of a multi-method research project aimed at evaluating learner experiences of e-learning at Oxford Brookes University and supported by the Higher Education Academy in the UK. The focus of the study was on the interrelationships between patterns in student online technology use, self-regulatory activities and perceptions of learning community. A 47-item self-completion questionnaire partly based on previous instruments on experiences of technology-enhanced learning and perceptions of study in higher education was administered to the representative sample of full-time undergraduate students. The analysis of descriptive statistics showed that students varied in their use of online media and factor analysis helped to identify five key dimensions in learning technology use. Second-order factor analysis suggested a clear divide between the use of Web-based tools for study and for entertainment. Correlation analysis pointed to associations between some of the self-regulatory activities and online media usage. The paper concludes with the discussion of the implications of the study for learning technology research and practice.

Keywords

Technology-enhanced learning, learner experiences, e-learning

Introduction

Learning technologies play an increasingly important part in higher education worldwide. In a previous review of the literature we noted that the majority of research has been carried out from the practitioner's perspective and rarely had the learner's own expressions of their experience as their focus (Sharpe, Benfield, et. al, 2005). Two projects funded by the UK Joint Information Systems Committee (JISC) in response to this review discovered an underworld of learning technology use which is integral to student lives (Conole et al, 2006, Creanor et al, 2006). They showed that some learners are making sophisticated use of an increasing range of educational media and are capable of customising and personalising the learning technologies provided to them by their institutions to suit their needs. It was found that learners use the Internet as their primary source of information and the widespread use of Wikipedia by students has been confirmed in survey research (White, 2007). As well as using technology to access information, it was noted that effective e-learners are adept in using learning technology for interpersonal interaction and social networking. The data on Internet use in the UK supports these findings showing that students are more likely than other occupational groups to undertake communication activities online (Dutton & Helsper, 2007). Evidence from research in the United States (The Digital Future Report, 2004; Salaway et al, 2007) and Germany (JIM-Studie, 2006) suggest that similar trends are common to other contexts internationally.

Although these projects have started to reveal the types of online activities today's learners are likely to be engaged in, there is still little empirical evidence regarding learner directed activities and patterns of learning technology use. In a large scale qualitative study observing and interviewing young people Green and Hannon (2007) identified four patterns of use. They describe four groups of young people:

digital pioneers, creative producers, everyday communicators and information gatherers. These terms were offered in an attempt to characterise and make visible the ways in which young people are using technology, but it raises the question of whether groups of learners are using technologies in distinct ways.

According to both recent studies on e-learning experiences in UK (JISC, 2007) and research on 'the Net generation' (Oblinger & Oblinger, 2005), today's learners actively construct their learning process, regulate and adapt both their behaviour and the study context to the demands of their studies. This is an agreement with the self-regulated learning tradition of research on learning, which assumes that learners can monitor, control and regulate their cognition, motivation or behaviour and their self-regulatory activities mediate the impact of personal and contextual characteristics on performance (Pintrich, 2004). Although attempts have been made to take account of the influence of learning technology on learner conceptions of learning (e.g. Ginns and Ellis, 2007), much of previous research on learner uses of technology was descriptive and failed to relate its findings to literature on approaches and conceptions of learning, including research on self-regulation.

The current study addresses the dearth of research in the area and explores patterns of learning technology use and their interrelationships with perceptions of learning (Sharpe, Benfield, et. al, 2006). The study was part of a larger multi-method research project aimed to evaluate learner experience of e-learning at Oxford Brookes University and supported by the Higher Education Academy in the UK. The qualitative stage of the study was intended to evaluate student experience of the use of social software, e-portfolios, personal learning environments and virtual environments for reflective learning and personal development planning. The quantitative part of the project aimed to investigate patterns in online technology use in their relationship to self-regulation, learner perceptions of learning community and choice in learning and some of its results are reported in this article.

Method

A 47-item self-report questionnaire comprising of Likert-like statements was designed to address the key goals of the study. The questionnaire consisted of four sections:

- Section A: demographic information
- Section B: preferences in terms of online access and methods of contact
- Section C: learner use of online media.
- Section D: learner self-regulatory activities, help-seeking and peer learning,

Section C included 27 items concerned with learner use of media. Some of the items were used in the JISC LXP student experience study (Conole, de Laat et. al, 2006) and others were developed by the project team from an initial item pool that was partly based on the results of qualitative evaluation. The participants were asked to indicate how often they performed various online activities using a five-point scale from 'virtually never' to 'very often'.

Section D used scales of the Motivated Strategies for Learning Questionnaire (MSLQ) (Pintrich et. al., 1991) and Course Experience Questionnaire (CEQ, Ramsden, 1991). The MSLQ is an 81-item questionnaire developed at the University of Michigan to investigate the factors that affect student performance in higher education, but was also used with secondary school students. The instrument has gone through the years of revision and rewriting and has shown adequate levels of validity and reliability (Rao and Sachs, 1999). Peer learning and help seeking scales include three and four items respectively that aim to measure the degree to which students rely on their peers or seek advice with their peers or tutors in their university studies (Pintrich, 2004).

To measure learner perceptions of choice in their studies and views on learning community, learner choice and learning community scales of the CEQ were included. The CEQ is a 25-item questionnaire which was initially developed as an indicator of quality of teaching on various degree programmes. Since 1993 the questionnaire has been used to survey all new graduates from Australian universities and is also used internationally (Lawless and Richardson, 2002). The student choice scale was part of the original instrument, but was later excluded from the instrument. The learning community scale was designed in

2000 the University of Melbourne Centre for the Study of Higher Education and consists of five items that are concerned with student social experiences of studying at a university (University of Sydney, 2008).

The questionnaire was pilot tested on a sample of respondents with characteristics similar to those of the target population. Both internal consistency coefficients and item-total correlations were at appropriate levels and so after minor modifications the instrument was deemed appropriate for the use in present research. The key data analysis techniques included the analysis of descriptive statistics, factor and correlation analysis.

Results

Paper and online versions of the instrument were administered to a representative sample of full-time undergraduate students studying in Oxford Brookes University in November 2007. The proportion of students from each of the eight schools of the University was roughly similar to the proportion of full-time undergraduate students in each school to the total number of full-time undergraduate students. The participants either completed the questionnaire online using the institutional Blackboard VLE (Virtual Learning Environment) or filled in the paper version of the survey before or after lectures.

A total of 1210 participants returned their responses to the questionnaire: 414 of them completed an online version and 796 a paper version of the instrument. The results of analysing the data from the online version of the questionnaire were available at the time of writing and are discussed below.

414 participants completed the survey online, but seven questionnaires appeared to be blank and had to be excluded from further analysis. Students from all eight academic schools responded to the online version of the survey, but the number of participants from an individual school varied from 15 to 110. The proportion of those choosing to complete the online version of the instrument also differed across the academic schools from 1.15 to 7.02 percent of the total number of full-time undergraduate students. The age of the respondents ranged from 18 to 64 years with the sample mean of 23.6 years and median of 20 years of age. 68.3 percent of the sample were 22 years of age or younger. 398 participants provided the information on their age - 145 of them were men and 253 women (or 36.4 and 63.6 percent respectively). 350 students (or 87.7 percent) appeared to be UK residents and 49 (or 12.3 percent) were permanently based in other countries. 82.7 percent of the participants named English as their first language and 17.3 were non-native speakers of English. 209 (or 52.3 percent of the sample) respondents were on their first year of University studies and 100 and 89 (or 25.1 and 22.4 percent) were on their second and third year of study respectively.

Responses to Section B showed that 79.8 percent of students chose home or student residence as their preferred choice of location to study and only 9.5 chose to study in the library. 60.3 percent of the sample used their laptops and 27.3 their desktops to get online. Respondants used a wide range of methods to get in touch with both their peers and their course tutors. However, 77.8 of them chose face-to-face or e-mail contact or their combination to contact their tutors. At the same time they were prepared to use a wider range of methods to stay in touch with their friends or other students at Brookes, e.g. 75.2 percent of them used their mobile phone and 38.2 percent of them - a social networking website to stay in touch with their friends.

Section C contained 27 items which were concerned with the frequency of student use of online media and engagement in various learning activities. Table 1 lists mean values, standard deviation and variance for each of the items in this section. The results suggest that students varied in their use of different Web-based media. For example, 74.9 percent often or very often of the students read online materials, 72.9 searched for library resources and 71.9 accessed learning resources in the past three months. The frequency of contact with other students and tutors was also fairly high (sample means of 3.25 and 2.72 respectively on a five-point scale). The reported use of some of the multimedia services was also quite high. For example, 45.8 percent of the participants often or very often listened to audio content (sample mean of 3.16), 51.8 percent watched online videos (sample mean 3.41) and 36.5 percent of the participants reported to have used instant messaging very frequently in the past few months (sample mean of 3.36), although 20.8 percent had never or virtually never done this activity.

At the same time the use of some of the popular Web 2.0 services appeared to be relatively low. For example, 81 percent of the respondents have virtually never used virtual worlds such as the Second Life and only 2.8 percent (or 11 out of a total of 394 respondents to this survey item) reportedly used this service often or very often. Despite quite an active use of Wikis on a number of course across various schools at Oxford Brookes, 93.6 percent of the respondents have virtually never or only occasionally contributed to Wikis. The use of social bookmarking services was also very low with a sample mean of 1.18, the lowest of all of the items in this section.

In order to identify patterns in student learning technology use all of the 27 items in Section C were subjected to factor analysis using a principal component analysis (PCA). After the initial factor solution was obtained the dataset was submitted to oblique rotation by a varimax method. Varimax rotation is an orthogonal rotation method which is commonly used to differentiate the original variables by the extracted factor (Garson, 2008). The results of Bartlett's test of sphericity were statistically significant at the .001 level ($\chi^2 = 2822.83$, d.f. = 315, $p < 0.001$), which implied that the present data could be used for further analysis. The results of data analysis identified seven factors with eigenvalues greater than 1.0. Retaining the factors with eigenvalues greater than 1.0 is one of the commonly used criteria for factor extraction (Dancey and Reidy, 2002), but it is influenced by the number of variables entered into factor analysis (Reise, Waller and Comrey, 2002). Cattell's (1966) scree plot test results suggested that only five factors should be retained for further analysis.

Table 1: Descriptive Statistics for the Question 'How often have these statements been true for you in the past three months?'

Item	Means	Standard Deviations	Variance
C1 Worked with other students	2.21	1.12	1.02
C2 Read online learning materials	4.07	1.03	1.07
C3 Did quizzes or self-assessment exercises	2.79	1.27	1.60
C4 Searched for library resources	3.96	1.15	1.33
C5 Accessed learning resources	3.99	1.01	1.02
C6 Searched for learning resources at Oxford Brookes	3.58	1.18	1.39
C7 Searched for learning resources at other universities	1.88	1.11	1.23
C8 Posted to online forums or conferences	1.91	1.41	1.30
C9 Posted comments to a blog	1.55	1.00	0.92
C10 Contributed to own blog	1.47	1.00	1.00
C11 Contributed to a website	1.93	1.27	1.60
C12 Contributed to a Wiki space	1.21	0.60	0.37
C13 Contacted other students at Brookes	3.25	1.22	1.50
C14 Contacted module tutors	2.72	1.08	1.17
C15 Uploaded video, audio or graphics online	2.49	1.32	1.74
C16 Edited audio, video or graphics online	1.57	0.97	0.93
C17 Listened to audio content	3.16	1.44	2.10
C18 Watched online videos	3.41	1.38	1.92
C19 Played online games by myself	2.04	1.25	1.57
C20 Played multiplayer games vs other players	1.60	1.09	1.18
C21 Shared files online	2.32	1.30	1.68
C22 Shared information (e.g. bookmarks, web links)	2.27	1.19	1.43
C23 Downloaded a podcast	1.62	1.03	1.06
C24 Participated in virtual communities	1.30	0.67	0.59
C25 Used social bookmarking services	1.18	0.58	0.34
C26 Used instant messaging	3.36	1.57	2.48
C27 Used chat rooms	1.46	0.94	0.88

The first factor had high loadings (i.e. 0.60 or higher) on items C9, C10 and C11 (see Table 1), all of which were related to blog or website contribution. Thus the first factor was provisionally labelled 'Web

for authoring'. The second factor had high loadings on items C15, C17 and C18 which were concerned with student use of Web multimedia and was labelled 'Web for multimedia use'. The third factor correlated with items C2, C4, C5 and C6 that dealt with student use of online libraries and learning resources and was named 'Web as a learning resource'. The fourth factor had high loadings on items C19 and C20 which explored students use of games and was labelled 'Web for games'. The fifth factor loaded highly on items C23, C24 and C25 which were related to student use of multimedia, Second Life and social bookmarking services and was labelled 'Web for social interaction'.

Based on these results, seven first-order factor-based scales were constructed by computing the participants' mean scores across the 16 items which had high loadings on one of the five factors. Analysis of Cronbach's alpha showed that internal consistency coefficients of the newly designed scales were at appropriate levels (i.e. from 0.70 to 0.74). The items which had low loadings on the five factors were excluded from further analysis.

To identify underlying dimensions within the five factor-based scales a second-order factor analysis using a principal component analysis (PCA) with varimax rotation was performed. Two factors with eigenvalues greater than 1.0 were extracted that explained 59.51 percent of total variance. The analysis of Cattell's (1966) scree plot confirmed the feasibility of a two-factor solution. The loadings of first-order factor-based scores on the two factors are listed in Table 2.

Table 2: Second-Order Factor Loadings on First-Order Factor-Based Scales*.

First-Order Factor Scales	Web for Entertainment	Web for Studies
Web as learning resource	.02	.98
Web for authoring	.66	-.02
Web for multimedia use	.73	-.19
Web for games	.69	.07
Web for social interaction	.72	.17

*Eigenvalues larger than .06 are in bold

Based on the results of second-order analysis one might identify two dimensions within the first-order factor-based scores: 'Use of Web for entertainment' which had high loadings on 'Web for authoring', 'Web for multimedia use', 'Web for games' and 'Web for social interaction' and 'Web for studies' which had very high loadings on only one factor-based scale 'Web as learning resource' and very low or negative loadings on other scores.

While the results of factor analysis were interesting in themselves, it was important to explore how the five first-order factor-based scores were related to student views on choice in learning, perceptions of learning community, use of peers and help-seeking. A canonical correlation analysis was carried out on the mean values of the five first-order factor scores and on the student choice, learning community scales of CEQ and the use of peers and help-seeking scales of MSLQ.

The results of the analysis showed that both help seeking and peer learning had a weak positive correlation with student use of the Web for authoring ($r = 0.10$, $p = 0.04$ in both cases) and for multimedia use ($r = 0.13$, $p = 0.01$ and $r = 0.01$, $p = 0.05$). On the other hand, students who tended to use the Web as the learning resource tended to have higher scores on the learning community scale ($r = 0.14$, $p = 0.005$). The degree of learner choice in studies was not correlated with any of the first-order factor-based scores.

Discussion

The results of the project help to discern patterns of technology use among undergraduate students. The majority of students prefer to study at home on their own computer rather than on campus. The online activities that were most frequently engaged in were accessing online resources including multimedia. Most students used the Web extensively to find resources to support their University studies. Fewer students used some of the most popular Web 2.0 services such as social bookmarking and contributing to wikis and blogs.

The results of the factor analysis revealed five subscales within the 27 items about use of technology which were labelled as 'Web for authoring', 'Web for multimedia use', 'Web for games' and 'Web for social interaction' and 'Web as a learning resource'. The results of second-order factor analysis suggest that students vary in their patterns of learning technology use for entertainment and to support their university studies.

The first four factors were related to using technology for entertainment but using the 'Web as a learning resource' was related to using technology for studies. This group of activities related to using the web as a resource did not correlate with any of the learner attributes of self-regulatory activities, help-seeking and peer learning from the final section of the questionnaire.

Although Creanor et al (2006) report that the boundary between using technology for leisure and studies seems to be often blurred for today's generation of learners, we see here that the precise nature of technology use is influenced by the context of use. The independence of the group of activities related to using the web as a learning resource suggests that these behaviours are influenced by the context in which the learner finds themselves (the course, the institution) rather than their attributes. This implies a high level of institutional relevance and responsibility for shaping learner behaviours in this area. The dominance of the frequency of study activities related to searching for, accessing and reading online resources suggests that institutions should actively seek to shape learner experiences and skills in searching for and evaluating online information.

The relationship between the use of the Web for multimedia and student use of peers and help seeking in their studies shows that in the process of regulating their own behaviour and their study context student use online media. Similarly, the weak correlation between help seeking and peer learning and web authoring might suggest that there is an element of 'complementariness' in such activities, i.e. that collaborative learning designs strongly imply collaborative outputs. Further studies on the subject should explore the link between various facets of learning technology use and their approaches to self-regulation in more detail. We noted that while the MSLQ is normally used to explore learner experiences on a particular course (Pintrich, 2004) in the context of the present study the instrument was not specific to any specific course setting. It is worth exploring whether the MSLQ maintains its validity when used in this way, and until the student views on help-seeking and the use of peers in their studies should be treated with some caution.

The present study found that there was little or no relationship between student use of online media and their views on choice in their studies and perceptions of learning community. There was a weak correlation between help seeking and peer learning and certain types of online activity. Combined with the capacity for the institutional and/or course context to shape learners' online activities as suggested earlier, this might imply that learner perceptions can be influenced by activities that emphasise particular online learner interactions, such as collaborative web authoring. These conclusions should be tested with more empirical work in specific course or other institutional contexts.

The results of this study reported are based only the data collected from the online version of the questionnaire was available at the time of writing. We also have available nearly 800 responses the questionnaire in paper form. It might be possible that students who completed the printed version of the instruments might differ in the nature of their learning technology use. Both the key dimensions of using the Web and their interrelationships with learning strategies and perceptions of learning might also be different from the respondents who chose to be surveyed online. We look forward to analysing the data arising from paper questionnaires.

Conclusions

To conclude, the present study sheds more light on patterns in online technology use among higher education students at Oxford Brookes University in the UK. It helped to provide baseline information for further studies on student use of online media in its relationship with strategies of self-regulation and perceptions of choice in studies and learning community.

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