Understanding Technology Mediated Learning in Higher Education: A Repertory Grid Approach

Completed Research Paper

Kenneth John Stevens
UNSW Australia
Sydney, Australia
k.stevens@unsw.edu.au

Zixiu Guo
UNSW Australia
Sydney, Australia
z.guo@unsw.edu.au

Yuan Li
Hebei University of Technology
Tianjin, China
Yuan.li@hebut.edu.cn

Abstract

Given the considerable opportunities that Web 2.0 technologies are seen to present for the enhancement of learning and teaching, understanding what motivates today's students to use this technology in their learning is crucial. Drawing from technology mediated learning (TML) and Uses and Gratifications (U&G) perspectives, this study investigates university students' motivations for using Web 2.0 technologies in learning. The Repertory Grid Interview technique (RGT) is used to interview 16 participants and capture their technology use motivations. A grounded approach was used to resolve eleven categories of motivations: Access and Content Control, Accessibility, Communication Efficiency, Communication Mode, Communication Quality, Course Management, Information Seeking, Interaction, Learning Capability, Managing Contents, and Self-Disclosure. The findings suggest that today's students have different motivations for using technologies when it comes to learning.

Keywords: motivations, technology mediated learning (TML), uses and gratifications (U&G), repertory grid technique (RGT), digital natives

Introduction

The introduction of Web 2.0 technologies into the university teaching environment is transforming the traditional technology-mediated learning (TML) world (O'Reilly 2006), as students move from being simply consumers of preconfigured content to participants in the creation and sharing of that content (Ebner and Walder 2007). It is, however, not well understood if students find the process of learning more compelling when they are producers as well as consumers (Anderson 2007). Although today's students are considered 'digital natives' (Prensky 2001a) and are more experienced at using blogs, Facebook and the like, than word processors (Liaw et al. 2007), there is no guarantee that they are interested in using these Web 2.0 tools in the higher education context (Bouhnik and Marcus 2006). Some evidence even suggests that students make a clear distinction between what they feel constitutes appropriate 'private living' and 'learning' technologies (Jones et al. 2010b). There are concerns that the integration of these new technologies into the education system will lose its momentum if students are not motivated to engage with their use in the education context (Anderson 2007).

There have been calls for studies to focus on students' motivations, along with technology and pedagogy, in a TML environment (Jones et al. 2010b; Liaw et al. 2007), so to inform educators on how to best deploy Web 2.0 technologies in the constantly changing educational environment and hence assist in realizing the potential that Web 2.0 appears to offer (Kim and Bonk 2006; Shih et al. 2008). In this regard, the 'Uses and Gratifications' (U&G) perspective on technology use has been found to offer insight into the reasons why people adopt an emergent technology (Ruggiero 2000). Most of these studies however fail to examine the reasons for choosing a particular technology in conjunction with other available technologies (Guo et al. 2010), thus the ways in which various technologies are actually used and the individual needs they fulfill, in view of the many functions that these technologies perform, is unclear (Flanagin and Metzger 2001). In addition, most of these studies used pre-defined mass media gratification items when studying Web 2.0 technology use motivations, rather than identifying the gratifications uniquely associated with Internet technologies used in the specific contexts under examination (Guo et al. 2011). In order to keep up with the change in technologies and our students' perceptions and use of that technology, we need to update our research regularly. If, as some researchers contend, today's students are growing up in a very different environment, surrounded by, and immersed, in digital media (Pedró 2009; Sánchez et al. 2011; Tapscott 2009), then it may well be the case that their motivations for using technologies in learning are also different.

It is understandable that these areas are yet to be investigated, given the newness of Web 2.0 technologies in university teaching. Therefore, this paper articulates a research agenda and research design by which these knowledge gaps can be investigated and hopefully addressed. The research design makes use of the U&G approach to understand students' general motivations for using various Web 2.0 technologies in conjunction with other available technologies. Since we sought to understand the unconstrained reasons for use of technologies by students in learning, a method that avoids the use of a priori theoretical framework was warranted (Guo et al. 2010) and accordingly the Repertory Grid Interview technique (RGT) was used. The strength of RGT is in capturing individuals' personal constructs that bring meaning and understanding to various phenomena (Stewart and Stewart 1981). RGT allowed us to develop a set of unique constructs (motivations/needs) that students wished to fulfil when using contemporary technologies in learning, but also generated deep and less-biased views of student perceptions toward technologies. Specifically, this study sought to gain insights into the following research question: *Why students use various technology mediated learning tools in their learning?*

The remainder of this paper next outlines TML tools used in learning and then the U&G approach and people's motivations for using technologies are reviewed. The research design is then articulated, followed by the results. A discussion of the implications of the findings concludes the paper.

Theoretical Background

First coined by Tim O'Reilly in 2004, Web 2.0 is seen as *"the network as platform, spanning all connected devices; Web 2.0 applications are those that make the most of the intrinsic advantages of that platform: delivering software as a continually-updated service that get better the more people use it, consuming and remixing data from multiple sources, including individual users, while providing their own data and services in a form that allows remixing by others, creating network effects through an architecture of participation."* (O'Reilly 2007). Based on O'Reilly's concepts, Anderson articulated six Web 2.0 principles: (1) Individual Production and User Generated Contents; (2) Harness the power of crowd; (3) Data on an epic scale; (4) Architecture of participation; (5) Network effects; and (6) Openness (Anderson 2007). The World Wide Web (WWW), or Web 1.0, is the first generation of the web, retrospectively named to differentiate the web technologies that preceded Web 2.0. Web 1.0 content was prepared by a small number of writers for a wide audience of relatively passive readers to navigate and access in a print-based publication model (Craig 2007; Franklin and van Harmelen 2007). There was limited interaction between the writers and readers, or contribution by the readers. If we describe Web 2.0 as a *"read-write"* web, then web 1.0 would be *"read only"* web.

This study was undertaken in a TML environment, where technologies are used to support course delivery and to manage teaching and the learning activities, such as large and small classroom teaching, workshop, tutorials, group assignments, interactions among peers, and between students and instructors (Santhanam et al. 2008). In this blended learning environment, students learn with computers, but course content is not necessarily delivered via computers (Santhanam et al. 2008). The technologies we

examined in this study included both Web 1.0 and 2.0 technologies, namely conventional websites, Learning Management Systems (LMS), discussion forums, wikis, and blogs. These technologies were examined because they were considered the most popular technologies used by students in learning (Jones et al. 2010b; Waycott et al. 2010) with each technology having unique characteristics that fulfil students' various learning needs (Guo et al. 2010). For comparison purposes, traditional face-to-face interaction was included as a channel for learning and teaching.

The first generation of TML systems were conventional websites that were used to streamline and reduce the administrative burden on teachers (McMullin 2005). These early TML systems were often the personal websites of teachers which were used for disseminating learning resources to students (Craig 2007). They were primarily unidirectional and allowed a large number of students to view content generated by instructors. Over the last decade we have seen the integration of emerging Internet technologies into the teaching and learning process (Kim and Bonk 2006). Of these, LMS's are now widely adopted across higher education (Kim and Bonk 2006; Lonn and Teasley 2009; McLoughlin and Lee 2008). LMSs are, however, largely focus on 'administered learning', a knowledge-transfer approach of behaviourist learning (Ebner 2007; Kim and Bonk 2006; Ullrich et al. 2008), which sees students as passive consumers of content with limited opportunity to contribute and where social interaction is restricted to a few rudimentary communication tools, such as email, whiteboards, and discussion forums (Ebner 2007; Ullrich et al. 2008). LMS developers have attempted to provide a range of tools for interaction that are preferred by today's students (e.g. chat room and journals), however these tools have not been utilised effectively or efficiently (Chen et al. 2010). Students are still "situated in a 'walled garden' within the 'safe' confines of the institution's systems and networks" (McLoughlin and Lee 2008, p.668) with constrained access to content designed for a particular course and interact solely with participants in that course, which may "consequently promote a culture of dependency rather than autonomy for our students" (Chen et al. 2010, p.2). As a result, the real shift from "the transmission of information towards the management and facilitation of student learning" (Coaldrake and Stedman 1999, p.7) has not been realised (Ebner 2007).

Among the many benefits of Web 2.0 applications, it is the individual creativity and social dimension captured by "harnessing of the power of the crowds" (Anderson 2007, p.15) that is the most relevant to pedagogical research. In particular, it is the 'read/write/share' nature of Web 2.0 which allows users to use the web as a platform, rather than an application, to generate, re-purpose, and consume shared contents (Downes 2005; Franklin and van Harmelen 2007) that is seen to encourage students to actively participate and contribute to their own learning, thereby adding value to the learning process and its results. With Web 2.0, a group of students can socialise, collaborate, and work with each other within the classroom or around the world (Franklin and van Harmelen 2007).

Of the Web 2.0 applications, wikis and blogs are two of the most important and popular ones in education (Bryant 2006; Franklin and van Harmelen 2007; Jones et al. 2010b). These tools allow students to mix, amend, and recombine 'microcontents' and invite revision and commentary (Bryant 2006; McLoughlin and Lee 2008). Originally developed by Cunningham and further defined by Leuf and Cunningham, wiki is a *"freely expandable collection of interlinked Web pages, a hypertext system for storing and modifying information—a database where each page is easily editable by any user with a forms-capable Web browser client"* (Leuf and Cunningham 2001, p14). In general, wikis follow simple, syntax-based rules, and require no special HTML or markup skills to manipulate contents. They also allow previous versions to be examined and restored. Wiki technology has been found to be useful in teaching, especially where collaboration and knowledge sharing are important (Raman et al. 2005). Wiki's have been used to support activities such as project management (Xu 2007), developing and maintaining software projects (Malani and Dwyer 2005), supporting writing instructions (Lamb 2004), information and knowledge sharing (Elgort et al. 2008), online teaching and assessment (Bruns and Humphreys 2005), online collaboration in the e-learning environment (Raitman et al. 2005), and evaluating student contribution to collaborative group projects (Trentin 2009).

A blog is a form of online journal or diary. A basic blog provides a simple and intuitive structure to allow a single person to publish personal journals/articles, arranged chronologically with the most recent first (Anderson 2007) to which other readers can read and add commentary. Similar to wikis, blogs present very low barriers to entry, and can be instantly created by the average user on any one of the numerous blog platform providers, such as Google Blogger (McMullin 2005). The text-based and asynchronous

nature of blogs has made them very attractive in education (Weller 2007). Student use of blogs typically revolves around the creation of journals to express opinions on topics brought up in class and is seen to provide an opportunity for students to reflect on their experiences and interactions (Bryant 2006; Windham 2007), to comment on their classmates entries, and to interact with their teachers (Rollett et al. 2007). They are also seen to give a 'voice' to shy students, and provide student with an opportunity to practice writing skills (Ullrich et al. 2008). Blogs also allow instructors to make announcements and provide feedback to students. Existing blogs can be used in the orientation of new students (Bryant 2006; Franklin and van Harmelen 2007).

Various theoretical perspectives have been advanced to explain the linkage between the use of these technologies and improved learning outcomes (Alavi and Leidner 2001; Jonassen et al. 2000). Of these perspectives, the constructivist approach to teaching and learning provides a promising and useful means by which we can understand why these technologies enhance teaching and learning. The constructivist approach is the dominant paradigm in learning and its implications for how instructors teach and learn to teach are seen as considerable (Jonassen et al. 2000).

The constructivist perspective of learning considers knowledge, as well as meanings, as constructed rather than given (Jonassen 1999). In this paradigm, learning is seen as an active process of integrating information with pre-existing knowledge, rather than a passive process of being taught by someone (Du et al. 2010), with the students, rather than the teachers, having control over the learning process (McLoughlin and Lee 2008). This perspective emphasises the importance of communication, dialogues and shared activity, and encourages active participation with others, including peers, instructors, experts and the broader community (McLoughlin and Lee 2008). In this self-oriented learning process, the teacher is the one who encourages self-directed learning by making time for students to interact and to discuss the problems they encounter, provoking debate and raising questions, and allowing opportunity to question students' ideas and develop a 'conversation' with students in lectures (Trigwell et al. 1999).

In the constructivist approach, learning technologies are tools to support the process of both cognitive and collaborative knowledge construction by facilitating active participation and interaction (Fabrigar et al. 1999). As Jonassen (1997) noted "technologies should be used to keep students active, constructive, collaborative, intentional, complex, contextual, conversational, and reflective". Hence within this perspective, those technologies that provide better support for these knowledge construction processes and are able to keep the students engaged in the manner outlined by Jonassen will be the technologies that are better at enhancing teaching and learning.

Challenges in Using TML Tools to Enhance Students' Learning

While the constructivist approach can assist in understanding how the technologies should be used so that learning outcomes are enhanced, it does not assist in understanding how that use can be promoted among students, although it does imply that where technology use leads to a more active and participatory environment, then the students should want to use them. In particular, what drives the use of technologies by students is an issue of considerable concern since it directly affects the way they learn (Clark 2006). This concern has become more apparent with Web 2.0 technologies as there has been an implicit assumption that deploying Web 2.0 will automatically lead to greater use and hence enhanced quality of learning (Bouhnik and Marcus 2006; Liaw et al.; Pituch and Lee 2006). It would appear that technology has become a necessary condition for today's education, but on its own is not sufficient to enhance learning. Ebner (2007) indicated that a third 'human factor' component is necessary, in conjunction with technology and pedagogical skills, to ensure high quality learning. Support for this view is found in Liaw, who indicates that understanding the target population's beliefs, attitudes, needs, and motivations toward the use of technologies in learning is essential to make the TML more efficient, effective and appealing (Liaw et al. 2007). In TML environments, McLoughin and Lee (2008) have argued that it is in fact the learner's needs, rather than technology, that drive the learning process. Given the current interest of mediated learning in the tertiary sector, researchers have called for a greater focus on students' needs, along with technology and pedagogy in the developing TML environment (Bouhnik and Marcus 2006; Kim and Bonk 2006). Although today's students may have different perceptions about technology and its role in their education (McMillan and Morrison 2006; Pedró 2009), empirical evidence is required to find out what needs these students want to fulfil when using technologies in learning (Pedró 2009; Spires et al. 2008). This information is crucial in today's TML environment since it will help

instructors understand what motivates students to learn, what obstacles stand in their way and what constitutes good practice to overcome those obstacles (Clark 2006, p.10)

The U&G Perspective for Understanding Technology Use in Learning

The U&G approach is one of the most widely accepted theoretical frameworks to study media adoption and use (Lin 1996) as it *"has always provided a cutting-edge theoretical approach in the initial stages of each new mass communications medium: newspapers, radio, television, and now the Internet"* (Ruggiero 2000, p.27). One basic assumption of this approach is that media users are goal-directed in their behavior, and their personal use of media is an active choice made to satisfy their needs (Katz et al. 1974). Another key assumption is that media users are aware of their needs and select the appropriate media to gratify those needs (Katz et al. 1973).

The characteristics of active choice of technologies and its user-centered nature make the U&G approach very useful for understanding motivations for using contemporary technologies (Kuehn 1994; Ruggiero 2000). A number of U&G based studies have investigated students' motivations for using contemporary technologies. For example, Vincent and Basil's (1997) study of why university students read news online found that the students wanted to fulfill their needs of surveillance, escape, boredom, and entertainment. Kaye (1998) established 6 motivation factors for the undergraduate student web use: entertainment, escape, information, pass time, social interaction, and web site preference. Stafford (2005) identified 4 key underlying dimensions of distance student technology use motivations: content gratifications, search process, social gratifications, and surf process. By employing exploratory and confirmatory factor analysis, Guo et al. (2010) found that university students used various media to fulfill different needs, such as connectivity, content management, convenience, information seeking, problem solving, social context cues, and social presence. Guo et al (2011) further found that Chinese university students used technologies in learning for the purposes of accessibility, communication goals, communication mode, content management, information seeking, interaction, problem solving, and self-disclosure. These studies show a wide range of types of motivations and highlight the lack of consistency across the studies. Such diversity is not surprising given the wide variety of empirical approaches and research contexts used in these studies and the fact that people's needs may vary across technologies and contexts (Fulk and Gould 2009). This diversity does however suggest that further research is required to establish the context specific gratifications for Web 2.0 technologies in technology mediated learning environment (Guo et al. 2010).

Some researchers consider that today's students not only think different things from their parents, but also think differently (Prensky 2001b). If such is the case then their motivations for using technologies in learning may also differ. Although Web 2.0 applications are seen to hold considerable potential for addressing the needs of today's diverse students, enhancing their learning experiences through customization, personalization, and rich opportunities for networking and collaboration (Bryant 2006), little is known what actually motivates today's students for using technologies to fulfil their various needs in learning. This study is designed to fill in this gap. Specifically, this study aims to understand what motivates digital natives to use contemporary technologies in learning.

Research Method

Repertory Grid Technique

RGT is the methodological extension of Kelly's (1955) Personal Construct Theory. RGT is a structured interview process, involving the generation of a list of concepts (elements) about things and/or events to be studied and the forming of attributes (constructs) based on the list of concepts (Zhang and Chignell 2001). In IS research, this technique has been used in developing expert systems (Phythian and King 1992), eliciting the qualities of excellent system analysts (Hunter 1997), exploring the cognitive thinking of business and IS executives (Tan and Gallupe 2006), examining the skills of successful IT project managers (Napier et al. 2009), and understanding website usability (Tung et al. 2009). More recently, RGT has been used in identifying students' motivations for using computer mediated communication technologies in learning (Guo et al. 2011; Guo et al. 2010).

RGT was used in this study as it allowed the researchers to elicit specific motivations for each of the technologies being studied in an efficient and effective manner while avoiding the use of a priori theoretical framework, and hence take a less biased approach to the research question (Stewart and Stewart 1981). In RGT, the interviewers simply guide the interviewees through the interview process, letting the participants provide constructs to randomly selected triads of elements and to respond in their own words. This last aspect is important as it avoids the bias that other techniques (such as surveys or traditional interviews) could bring. Finally, the data obtained from RGT is sufficiently rich to enable a thorough examination of content elicited by each individual's construct system (Hunter and Beck 2000).

Research Participants

Given the intensive and comprehensive nature of the RGT, sample sizes of 15-25 participants are typically considered more than adequate (Tan and Hunter 2002). Sixteen university students (13 males, 3 females), enrolled in two advanced IS courses, were interviewed. The age of participants ranged from 20 to 26, and all had been at university for at least 2.5 years (average of 3 years). The majority of students were studying IS or Software Engineering (15 out of 16) at either undergraduate (14) or coursework master's (2) level. All participants reported having used the Internet for at least 7 years. In terms of each of the 5 technologies involved in this study, all participants had used LMS for their entire time at university, primarily for accessing course materials, preparing for lectures, completing tutorials, lodging assignments, and managing their courses. Discussion Forums had been used by all participants for class online discussions. As both courses made extensive use of wikis, all participants had used this tool in group assignments, personal journals and other class communications. Twelve participants also had used wikis for outside of the classroom. Blogs were a mandatory component of one of the courses, providing 11 students with exposure to this tool. The other 5 participants also reported using blogs for more than 2 years at university. All students indicated that they had used blogs and Facebook in their private life.

Interview Procedure

The interviews ranged from 50 to 110 minutes and followed a conventional RGT interview process. The major steps involved in the interview are outlined below.

Supplying elements is the first step and aims to identify subjects within the domain of the investigation. Elements are objects within the domain of the investigation. The relevant elements for this study are the technologies used by the students. Elements can be either supplied by the researchers or identified by the participants, depending on the nature of research. In this study the researchers supplied five most commonly used technologies identified from the literature, (conventional website, LMS, discussion forums, wikis and blogs), plus traditional face-to-face interaction for comparison purposes, so that the participants elicited constructs based on the same set of elements (Siau et al. 2010). As discussed above, these 5 technologies, plus face-to-face interaction, are commonly used by students to achieve various learning goals since each of these tools can be used to fulfil different needs in their learning. All participants had experience with each of the technologies. The names of each of the 6 elements were then written on individual index cards that were used in the next step.

Once the elements are determined the constructs can be elicited. Constructs are the qualities that people attribute to the elements. Constructs are bipolar in nature and they describe how elements are alike and yet different from each other (Tan and Hunter 2002). Two interviewing methods, 'triading' and 'laddering' are employed to elicit constructs. 'Triading' involves the participant randomly selecting three elements. The constructs are elicited by asking the participant to identify, 'in what way are two of these technologies similar to each other and different from the third in terms of your motivations for using them in learning?' Participants were advised that learning referred to any activity related to their university study, including lectures and tutorials, face to face groups or online discussions, individual or group assignments, communication with lecturers/tutors or peers, managing their learning materials, or checking their grades. Participants were encouraged to provide a brief label that best described the motivation and its contrast. In the laddering process, the researcher probed the participants with a series of 'how' and 'why' questions to clarify the meaning and uncover underlying assumptions. The participant then placed the cards back in the stack, shuffled them and selected another three cards. The exercise was repeated until no new constructs could be elicited from a triad or the participant tired (Tan and Hunter 2002).

Theoretical Saturation

Interviews were conducted until the point of theoretical saturation was reached, i.e. until further interviews no longer provided new constructs. Following the same techniques used in previous RGT studies (Guo et al. 2010), this study analysed the data after completing each block of five interviews to determine if any new constructs had emerged. The theoretical saturation can be said to have occurred when subsequent interviews failed to produce new constructs (see Figure 1). In this study, theoretical saturation occurred after twelve interviews, despite continuing to interview 16 participants overall. This sample number was consistent with Tan and Hunter's (Tan and Hunter 2002) recommended range of 15 to 25 interviews.

Figure 1: Theoretical Saturation
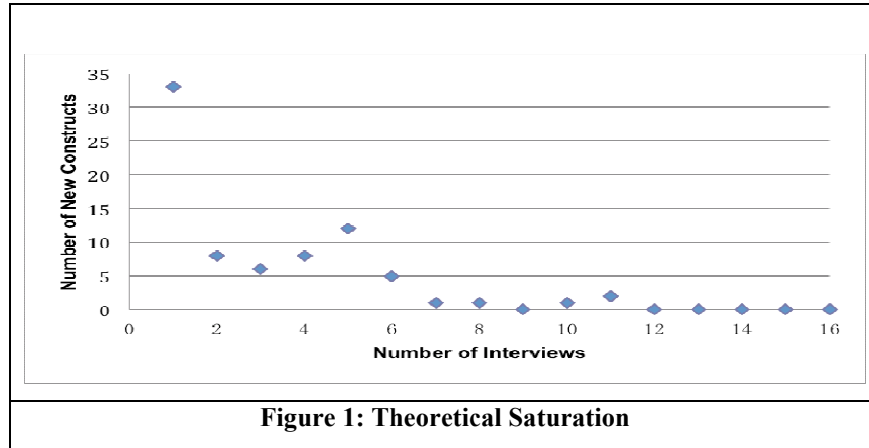
Data Analysis Technique

Content analysis was used to analyze the interview data. By design, the RGT process allows participants to freely voice their opinions and can achieve good construct elicitation. In this study, the 16 participants produced a total of 646 raw constructs. The initial coding was undertaken by one researcher. A second researcher coded 2 of the transcripts for which an acceptable cross-coder reliability of 81.1% was reached (Krippendorff 1980), suggesting that the coding schema was valid. A data reduction process was conducted to consolidate the constructs with the same underlying idea and to remove insignificant constructs (those which appeared less than 3 times) (Siau et al. 2010). The reduction process resulted in 77 unique constructs.

After the data reduction, further content analysis was undertaken by two researchers to categorize the elicited constructs. For the categorization of constructs, an adjusted core-categorization procedure as outlined by Jankowicz (2004) was used. Using semantic similarities, the 77 unique constructs were collapsed into 11 broad categories, some of which were further divided into sub-categories. Table 1 sets out the 11 categories with sub-categories. The interpretations and labels assigned to each category were informed by literature on technology use motivations (Guo et al. 2011; Guo et al. 2010). The categorization process was examined independently by two researchers and over 80% agreement was initially achieved with all remaining discrepancies being resolved via consensus between the researchers.

Table 1: Students' motivations for using TML tools in learning		
Construct	**Definition**	**N^**
Access and Content Control		16
Access security		14(12.5)
Access control	Technology has access control (technology is open to	12

	public)	
Privilege	Users can only perform tasks they are authorized (users have full authority)	13
Content security		16 (13.3)
Content control	Someone monitors the content (no one monitors content)	15
Data security	How the data are modified is recorded (no record to indicate who changed the data)	9
Multiple-user editing	Multiple users can work on the same document (only author can revise the document)	16
Accessibility		*16*
Access		16 (9.8)
Cost	Cheap to use (expensive to use)	3
Easy access	Ease of access to technology (difficult to access)	12
Place independence	Use technology anywhere (restricted places to use technology)	10
Quick access	Quick access to technology (slow access to technology)	10
Time independence	Use technology at anytime (restricted time to use technology)	14
Use		14 (9.5)
Ease of use	Ease of use (difficult to use)	14
Familiarity	Familiar with technology (unfamiliar with it)	5
Communication Efficiency		*13 (7.25)*
Convenience of communication	Communication is convenient (inconvenient)	7
Easy for communication	Communication is easier (difficult)	6
Frequency of communication	Communication is frequent (less frequent)	4
Speed of communication	Communication is fast (slow)	12
Communication Mode		*14*
Multimedia		7 (7)
Multimedia	Technology has various features (single feature)	7
Communication cues		13 (9.5)
Audibility	Use verbal (text only)	7
Visibility	See body language (no visual image)	12
Communication Quality		*16 (7.4)*
Clarity of communication	Communication is clear (confused)	14
Depth of communication	Communication is in detail (shallow)	4
Effectiveness of communication	Communication is effective (ineffective)	8
Specificity	Communication is specific (general)	5
Topic focusing	Communication is focused (out of track)	6
Course Management		*14*
Course administration		10 (4)

Assessment function	Can do various assessments (cannot)	3
Compulsion	Have to use (not compulsory)	6
Control for assignments submission	Can submit assignment (cannot)	3
Grading	Can check your marks (cannot)	4
Subscription	Can subscribe news (cannot)	4
Blended system		14 (9.5)
Integrative system	Have all features required (only one feature)	14
Virtual class	Can do course online (offline)	5
Information Seeking		*16*
Quality		16 (8.5)
Accuracy	Information provided by the technology is accurate (inaccurate)	10
Currency	Information provided by the technology is current (out of dated)	7
Credibility		12 (9.5)
Trustworthiness	Information provided by the technology is trustworthy (not)	12
Various sources	Information can be obtained from various sources (only one)	7
Quantity		13(7)
Granularity	Posts through the medium are lengthy (or not).	5
Amount of information	The medium allows you to obtain large (or small) quantity of information.	9
Interaction		*16*
Nature of interaction		16 (10.25)
Interaction intensity	Interaction can be more (less)	13
Interaction pattern	Interaction can be back-forth (less)	11
Interaction range	Interaction can happen among more people (few)	5
Interaction speed	Interaction can have quick feedback (slow)	12
Benefit of interaction		16 (10.75)
Guarantee responses	Can guarantee responses (no guarantee for reply)	5
Communication direction	One way communication (two way communication)	16
Communication flow	One to one communication (one to many or many to many)	8
Communication format	Communication has a fixed format (non-fixed)	9
Participation	Can participant (only receive)	16
Seniority	Can talk to senior person (only good for peers)	9
Sharability	Can share knowledge (not easy)	11
Synchronicity	Real time communication (not real time)	12
Learning Capability		*16*
Active and manipulative		10 (4.33)

Internalization	Can internalize what has been learnt and creating your own understanding (only receive information without soaking)	3
Independent thinking	Create your own ideas (only receive from lecturers)	3
Taking initiative	Can create your own thought (just follow others)	7
Constructive and reflective		9 (4.75)
Critical thinking	Good for cultivating your critical thinking (or somebody brain dump on you)	3
Learning guidance	Learning can be guided by the lectures (no feedback)	7
Reflection	Allow you to reflect deeply (not)	5
Teaching effect examination	The medium allows students to show their understanding and lectures to examine if his teaching is proper (or lectures will be like not knowing students' exact problems)	4
Collaborative, cooperate, and conversational		16 (12.33)
Group work efficiency	Group work is more efficient (not)	12
Learning from others	Learn from other people (not easier)	10
Collaborative learning	Allow group collaboration (on your own)	15
Autonomous		8 (4.5)
Learning at your own pace	Learn on your own pace (not flexible)	4
Suitable learning style	Choose your own learning style (fixed style)	5
Managing Contents		*16*
File management		15(7.5)
Can add files	Can attach files (not)	9
Electronic trail	Can retrieve records and information (not)	5
Information index	Contents are well structured (not)	13
Storage	Can be used to store files (not)	3
Document modification		12 (8.5)
Can keep notes	Can write notes (not)	10
Can put citations, references or page links on	Can link to external resources (not)	7
Document management		16 (9.7)
Reprocessibility	Can review again (not)	16
Traceability	Can keep track changes (not)	5
Versioning capability	Can keep different versions (not)	8
Self-Disclosure		*15*
Mode of self-disclosure		12 (6.33)
Anonymity	Can publish anonymously (not)	6
Courtesy	Can avoid pressure or embarrassment (not)	10
Formality	Have a formal communication (informal)	3
Benefit of self-disclosure		14 (7.5)
Belonging	Have a sense of being engaged with other people (not)	7
Homophily	Can talk to people with similar interest (not)	3

| Self-expression | Can self-express yourself (not) | 13 |
| Social cues | Can know others' reactions (not) | 7 |

^ Number of participants who mentioned the item, () Average number of participants who mentioned sub-category

Results and Discussion

Access and Content Control

The Access and Content Control category is concerned with the security aspects of accessing the technology and the content. Five constructs made up this category, represented in two sub-categories: access security and content security respectively. The participants indicated that they preferred applications and systems that allowed simultaneous work on the same document, but indicated that control over access to the application itself and the level of privileges (such as reading, editing and deleting) given to individual users was important, so as to stop "changing the data maliciously and making the data inaccurate." (Sam, Triad 1). Students liked the freedom they had in managing their content however they also appreciated the centralized monitoring and control over the contents, especially when it comes to learning discussion, particularly the "specific knowledge which only the teacher would have, you would need them to actually step in and say this is the way it is" (Andrew, Triad 1).

Accessing a system without authority or changing someone else's data maliciously is considered academic dishonesty, a serious issue within academic settings (Akbulut et al. 2008). The advance of the Internet is seen to have exacerbated this aspect of academic dishonesty. The literature suggests that most students are not aware that these behaviors are unethical and they don't appreciate the negative impacts of such behaviors on their learning and to the society at large (Karim et al. 2009). However, the results of this study do suggest that this awareness does, to some extent, already exist and that students appreciate systems attributes that control for unethical behavior by their classmates.

Accessibility

Accessibility refers to both the physical access to the technology and the subsequent use of the technology (Culnan 1984). Seven constructs made up this category. Five of these constructs were concerned with access to the application (grouped as 'Access'), and the 2 remaining constructs related to using the application (grouped as 'Use'). Respondents expressed some concerns about the difficulty in accessing the LMS, as they said "generally to even access Blackboard, you need to be a user of the system, you have to be either a student or a staff member" (Sam, Triad 3). This is consistent with previous studies (e.g., McCreadiea and Rice 1999) and supports the findings of Waycott et al. (2010) where ease and speed of access to technologies used in learning are considered important as the less effort required to access the technology, the more attractive the technology becomes, and hence the more the systems will be used.

The notion of familiarity is usually associated with ease of use and studies have indicated that familiarity with the technology is important as it encourages use (Guo et al. 2008). In this study however, only 5 participants indicated that they would not use the technology if they were not familiar with it, suggesting that the nexus between familiarity and use may not be as strong as in the past (Guo and Stevens 2011). It could be that many of the students are experienced users of technology and are comfortable adopting and using new technologies as they arise (Pedró 2009; Waycott et al. 2010).

The students' views on accessibility to the technology can be seen as typical of a digital native way of learning: liking flexibility and instantaneity of the Internet, but with low tolerance for lectures and 'passive' forms of learning (Waycott et al. 2010).

Communication Efficiency

Communication Efficiency refers to the extent to which communication can be done conveniently, easily, frequently, and quickly. It measures the outcome of communication from efficiency perspective. Thirteen participants identified constructs regarding this theme. Communication is one of the most important students learning activities, with 12 participants emphasizing the importance of quickness at which communication can be done. This result supports those of Lonn and Teasley (2009) who found that

communication efficiency (saves my time) was the most popular feature and that the speediness of the communication was the valuable benefit for using technologies in their courses. This study also found that, even though students like the efficiency that technologies can bring, they do appreciate the value of face-to-face conversation, as *"your five minute conversation in the non-technology space will take me about an hour or even more in forum and blog…..It's quite time consuming to click each thread and then try to expand each one and see what's happening"* (Amy, Triad 1).

Communication Mode

Communication Mode refers to the number of ways in which information can be communicated (Dennis and Valacich 1999). Three constructs made up this category. One of these constructs related to the multimedia nature of the application and was identified as important by almost half the participants. The remaining 2 constructs related to the mode of communication (grouped as 'Communication Cues') and were identified as important by 13 participants. When compared with face-to-face interactions, interactions mediated by computer have typically been considered as impersonal, with lower quality interaction due to reduced social context cues (Judee et al. 2002; Straus and McGrath 1994). Some recent research has, however, suggested that the lower social cues may in fact provide some benefits, such as allowing students to have sufficient time to reflect on, and structure their ideas (Kim 2008) and improving students consciousness of grammatical accuracy (Yamada 2009). Other positive results of reduced social context cues include allowing students to clearly and openly express their opinions without fear (Kim 2008; Kitsantas and Chow 2007) or having equal participation opportunities (Hiltz et al. 2006). That said, the participants in this study indicated that face-to-face interaction was a very important aspect of their learning. It seems they still believed that face-to-face interaction is the only way for them to have full access to all the nonverbal cues: sharing the same physical location, seeing and hearing one another (tones, gestures, feeling, etc.), and experiencing the immediacy of interacting.

Communication Quality

Similar to Communication Efficiency, Communication Quality is also a measure to evaluate the outcome of communication, but from quality perspective. All participants gave constructs in the communication quality category. The clarity of the communication afforded by the use of the technology was identified as most important by 14 participants. Eight participants highlighted the importance of effectiveness of communication, however only 4 participants identified the importance of depth of communication. Students did emphasise that, in general, face-to-face interaction was better in terms of clarification and effectiveness, since *"you can express yourself better generally in non-tech because you don't have to keep waiting for somebody else to say, what does this mean? You can change the way you express it depending on the person that you're talking with"* (James, Triad 7). This further supports previous results where face-to-face interaction is always the preferred medium when tasks are equivocal and require intensive interactions (Guo et al. 2008).

Course Management

Course Management refers to the ability of learning technologies to provide administrative support to student learning. Seven different constructs were found to relate to this category, which was further divided into two sub-categories: course administration and blended systems. Although 10 of the participants provided constructs falling in course administration group, less than half of those participants identified all of the 6 functions that the constructs represented, with most of the participants identifying 3 or 4 functions. This suggests that most of the participants were not aware of the full range of features and functions available in the integrated LMS, which mirrors previous findings. In these previous studies the lack of awareness was attributed to a lack of appropriate training of the students and instructors or lack of confidence or technical expertise of the instructor (Zhang and Bhattacharyya 2008) and suggest that appropriate training may increase this awareness and improve the both the efficiency and effectiveness of learning and teaching (Kim and Bonk 2006).

Information Seeking

Information Seeking refers to the "purposive seeking for information as a consequence of a need to satisfy some goal" (Wilson 2000, p. 49). This category consisted of 6 items which were further sub-divided into 3 sub-categories (quality, credibility, and quantity). The importance of information seeking in mass media and Internet-based technologies is well established (Courtois et al. 2009). There is little doubt that the quality of information published online varies dramatically, thus the ability to evaluate the information sourced online is important, especially in learning environments (Wang and Wang 2009). Information quality can be seen in terms of the user perspective where the information is useful, good, current, and accurate (Rieh 2002) and the need to be objective (Freeman and Spyridakis 2004). The information quality constructs identified by the participants corresponded to accuracy and currency.

The creditability of the information is another key concern in regard to information seeking. Credibility includes the key notion of information trustworthiness, which refers to its 'believability' (Metzger 2007). The students expressed considerable concern about the trustworthiness of what they read online, especially in open wikis, blogs or forums. Students also recognized the differences between open and closed websites in regard to credibility assessment (Meola 2004), and indicated that they employed different evaluation criteria when it came to different websites, as "internet forums are full of people who like to make opinions which are totally incorrect, and some people just like to put in opinions that they know are incorrect just for the fun of it, to annoy people" (Shawn, Triad 4).

It is typically seen that students often evaluate information based on relevance to the topic at hand, newness, interest, and convenience (Hirsh 1999), or quantity (Metzger et al. 2003), rather than quality. However, this study's results indicated that the participants were concerned with not only quantity, but also quality and credibility. Our findings appear to suggest that student behaviours in regard to information seeking may have expanded and students are now much more aware of the need to understand the quality of their information.

Interaction

Interaction refers to the exchangeability of sources and receivers (Rice 1987) and have been found to be a motivation in many studies. Twelve constructs relating to this factor were identified by all participants. The various constructs that made up the Interaction factor were among the most 'popular' of the study, with more than half the constructs being identified by over two thirds of the participants. Armed with technologies, students expect that their interactions with their classmates, instructors, and others would be influenced by the intensity, pattern, range and speed of that interaction.

Both static one way and dynamic two way communication was important for all participants. They felt that the LMS was mainly used for one-way information dissemination and it did not encourage participation in class discussion. The findings support previous studies such as Jones et al.'s (2010b), in which 96% of respondents considered interacting with their peers and instructors to be one of the most important reasons for them to use technologies in learning.

Learning Capability

Learning Capability is a concept from the constructivism learning paradigm, referring to the capacity students possess to develop their critical thinking skills, assist them to be independent, active and reflective, to facilitate their collaboration and cooperation, and allows them to be constructive (Miers 2004). Technologies with learning capability have the ability to create a learning environment in which these elements can thrive. Various sub-categories of this category reflected the benefits that Web 2.0 brings to the constructivism approach to learning. The identification of this theme reflects the change of digital natives' learning needs (i.e. they want control over their own learning process (Du et al. 2010)).

The popularity of the group collaboration construct indicates that technologies can be used to enhance group collaboration, as found in previous studies (Kitsantas and Chow 2007). Although not every participant provided constructs relating to independent learning, constructive and reflective learning, and active and manipulative learning, their inclusion by most participants can be seen to indicate a shift from a teacher-focused content driven learning style to a student-centric and self-paced learning style.

The identification of this category reflects a change in the learning needs of some students, where they want to use technologies to enhance control over their own learning process (Du et al. 2010), rather than simply using them for convenience and productivity (Pedró 2009). However, as Kim and Bonk (2006) found, most instructors still see learning as knowledge transmission, rather than one rich in peer feedback, online mentoring, or involving some form of cognitive apprenticeship, which suggests a potential mismatch between what some of students' need and what instructors may supply.

Managing Contents

Managing Contents refers to the ways people can do to manage their data through technologies (Guo et al. 2011). All participants identified constructs relating to managing the content held within the system. File management has been long recognized as a key reason for the use of computer mediated communication media, such as email and wikis (e.g., Guo et al. 2010), although that study did not include the document modification and document management sub-categories.

The participants appeared to be able to take advantage of 'reprocessability' of the technology to assist their learning as they noted the importance of being able to reflect on and revisit their documents before submitting them. Ten participants also liked to use online technologies to take notes. Increasingly students are using devices in the classroom for note-taking, but rather than storing these notes on the device, they are typing their notes directly into online forums, blogs, or wikis so they can access and review the notes from anywhere and are less concerned about losing the documents (and devices). As one participant said that "you can view the information at any time of day or a few days later, whereas non-technology if you don't go to a class you miss out on the information completely." (Lu, Triad 8)

Self-Disclosure

Self-Disclosure refers to the extent to which a person will communicate information about themselves (Wheeless and Grotz 1976). Seven constructs relating to this category were identified. These constructs fell into two groups, mode of self-disclosure and benefit of self-disclosure. The lack of nonverbal and social context cues of many computer-mediated technologies has been seen as problematic (Rice 1993), however it can be seen as an advantage for shyer or self-conscious students because the medium removes some of the pressure they feel when communicating. The use of these technologies increases the likelihood of these students sharing their feelings with others and thus increasing their self-disclosure. Ledbetter (2009) identified self-disclosure as an important motivation for people who communicated online. He also found that self-disclosure was related to Facebook use (Ledbetter et al. 2011).

Within this category, the anonymity afforded by the technology (6 participants) and the increased courtesy displayed in the medium (10 participants) were considered important by the participants. In regard to courtesy, many participants noted that the tools afforded a greater level of respect between users and also allowed them to avoid embarrassment.

Implications and Conclusion

Implications for Research

The main implication of this study is the identification of a useful set of categories of constructs that were found to be important in understanding what motivates students to use technologies in their learning. The student-specific technology use scale identified can be used to inform the development of instruments to survey the technology use of students as the scale has little researcher bias as it was generated by the students themselves (Curtis et al. 2008). Future research could use the constructs and categories identified in this study as a framework for designing survey instruments. We believe these constructs and categories to be exhaustive because of the theoretical saturation that was achieved in our data collection, however, as outlined below, some further empirical work would be useful to verify these categories holding across a broader sample base.

Another implication relates to the motivations for using learning technologies themselves. Through the use of RGT, we uncovered a number of categories of motivations that specifically related to the use of technology in learning by students. When compared to the technology use motivations identified in early

studies we find that the motivations we uncovered are somewhat different from those previously identified. This finding may imply a number of things. On one hand it may suggest that people's needs are different when they use technologies in different contexts, as has been suggested in the literature (Shao 2009). Alternatively it might suggest that what motivates technology use in learning has changed over times, as has been discussed by Guo et al (2011). It may also suggest both. Again, further research is needed to establish the impact of context and time on the motivations to use technology in learning.

Finally, RGT has been shown to be a valid and reliable methodological approach for the effective, relatively unbiased, and practical articulation of personal constructs of individual technology users. The combination of U&G as a theoretical lens and RGT as a data collection method has proved to be an effective way of understanding people's use of technologies in this under-studied area. Future studies may wish to consider similar use to elicit individuals' motivations for using any emerging technology.

Implications for Practice

The first implication for practice of this study relates to the finding that some, but not all, students' attitudes toward technology mediated learning appeared to be in line with the constructivist paradigm, indicating that there is a diversity among today's students, not only on the level of technological literacy (Kennedy et al. 2008), but also in their attitudes toward learning (Pedró 2009). This suggests that instructors need to be aware of this diversity and that a uniform approach to technology use in teaching may not be as successful as one that accommodates these differences. More broadly, the future role of technology in teaching may lie on a path somewhere between those who believe that we need a paradigm shift in the use of technology in teaching (Helsper and Eynon 2010; Selwyn 2009) and those who prefer to continue with the current approach of incremental efficiency gains (Jones et al. 2010a) needs to be found. The form of 'middle path' could be addressed in future research.

Secondly, the study identified a general lack of awareness by the students about the range of features of the LMS. This lack of awareness was seen to be due to either insufficient training or a reluctance to use. The implication for practice is not to increase training or try to convince students that the LMS is useful, but not to assume that because the students are 'net generation' that every student will be able to easily 'pick up' the systems (Raman et al. 2005). It seems important therefore that instructors understand individual's technological skills and develop training plans for those students that need them. This fits in well with the student-centric learning approach and the student's desire to take charge of their learning.

Thirdly, the study found that some students were very concerned and upset by the unethical behaviour of other students in regard to 'unauthorised' and 'unwanted' modification of shared content, which led the concerned students to secure the shared content. Students have been found to be generally unaware of the unethicality of this behaviour in regard to shared content (Karim et al. 2009), but our findings suggest that this may be changing, but is not uniform across students. It is therefore important that any shared content systems (i.e., wikis, forums and blogs) have adequate security controls and moderation and that instructors are cognisant that different levels of awareness of what is ethical and what is not in regard to shared content is likely among their students.

Lastly, this study found that face-to-face interaction between instructors and students is still considered very valuable by the students because of its efficiency in discussing difficult and complex concepts and problems and suggests that it is worthwhile including such interaction in courses.

Limitations and Future Directions

The conclusions and implications of this study should be considered in light of the following limitations and assumptions. Firstly we used a 'convenience' sample that assumed that all our participants were sufficiently proficient in the learning technologies covered to meaningfully participate in the study. This assumption was based on their self-reported proficiency, ad-hoc observations of their use of the tools in the classroom, and the fact that all were studying an Information Systems or Computer Science. While we believe that this assumption is sound and nothing arose in study to suggest otherwise, it is possible that the participants were atypical and hence caution is needed in applying these findings to other contexts.

The sample size was also small and while this was not considered a problem given the exploratory nature of the study and the modest sample sizes required for RGT (Tan and Hunter 2002), it may reduce the

applicability of the findings to contexts beyond those of the study. To validate the motivation dimension measures identified in this study, a future survey with a large sample size may be required in order to create a student specific motivational scale for technology mediated learning. In addition, we have explored students' social and psychological reasons for using technologies in learning without any examination of the exact relationship between elicited reasons and supplied elements. The relationships between technology use category and technologies need to be further explored in order to assess the relative contribution of each technology in satisfying each of these categories, as well as to identify which student technology use reasons are best fulfilled by each technology. Given the popularity of new technology mediated teaching modes, such as MOOCs or flipped classrooms, expanding this study to a larger sample size and other TML contexts is important. We expect to conduct a large scale survey to incorporate technology use categories identified in this study, plus other emerging technologies, to not only validate the scale but also assess the specific needs to be fulfilled by each technology.

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