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Students' Motivations For Using Contemporary Technologies In Learning: A Structural Approach.

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STUDENTS' MOTIVATIONS FOR USING CONTEMPORARY TECHNOLOGIES IN LEARNING: A STRUCTURAL APPROACH

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Abstract:

This study investigates university students' motivations for using contemporary information technologies in learning from a Uses and Gratifications (U&G) perspective. The Repertory Grid Interview technique (RGT) is used to interview 16 participants and capture their technology use motivations and the relationship between motivations, with grounded theory used to determine categories. Interpretive Structural Modelling (ISM) technique is used to identify a structural hierarchical framework of motivations. Eleven categories are found: Access and Content Control, Accessibility, Communication Efficiency, Communication Mode, Communication Quality, Course Management, Information Seeking, Interaction, Learning Capability, Managing Contents, and Self-Disclosure. ISM developed in this study reveals that Access and Content Control, Communication Mode, and Course Management are the most important influencing motivations. In contrast, Communication Efficiency, Communication Quality, and Learning Capability are the three most important influenced motivations. This study has made significant contributions to both IS research, university policy makers, and educators by developing a student-specific motivation scale, and a hierarchical motivation framework.

Keywords: motivation, e-learning, human-computer interaction, ICT adoption

I. INTRODUCTION

Given the considerable opportunities that contemporary information technologies are seen to present for the enhancement of learning and teaching, understanding what motivates students to use information technologies in their learning becomes crucial [Jones et al. 2010b; Liaw et al. 2007], however there is a lack of research that systemically examines the personal and social motivations that drive this use [Guo et al. 2010; Tao 2008].

Furthermore, since students are likely to have multiple reasons for using technologies in their learning, it is important to understand how these motivations are related [Rubin 1983] as the relationship identifies the "strength" of a motivation and thereby aids in understanding the influence of the motivations on each other [Hasan et al. 2007]. This understanding is important since it will allow policy-makers and educators to assess the relative importance of the influencing motivation and develop policies and teaching approaches accordingly. Despite the importance of this issue, there is no structured framework to map and understand the causal relationships between the various motivations. This study seeks to fill that gap.

Specifically, this study employs a Uses and Gratifications (U&G) approach to understand university students' motivations for using contemporary technologies in learning. A Repertory Grid Interview Technique (RGT) was used to elicit university students' motivations for using

technologies in learning. A grounded theory approach was used to classify the motivations into 11 categories and to identify relationships between pairs of motivation categories. Interpretive Structural Modeling (ISM) technique was applied to develop a hierarchical framework of the motivations. We aim to understand not only students' motivations for using contemporary technologies but also the inter-relationships among these motivations in learning.

The following section defines contemporary technologies and discusses their adoption in the education sector. Second, the U&G approach and people's motivations for using technologies are reviewed. Third, research methodology for collecting data to identify students' motivations and develop underlying relations among these motivations is presented. Next, we present the results of a multi-stage investigation that serves to answer our research questions. Finally, the paper concludes with a discussion of the importance and implications of the findings in terms of the new technology environment in the university contexts.

II. CONTEMPORARY TECHNOLOGY CHARACTERISTICS

Contemporary technologies refer to Internet-based information and communication technologies that enable individuals to communicate, create, disseminate, store, and manage information and can be classified as Web 1.0 or Web 2.0 [Cormode and Krishnamurthy 2008].

Web 1.0-based Learning Tools

Initial use of the Internet in teaching involved teachers using conventional websites to disseminate learning resources such as lecture notes and assignment specifications, and where primarily seen as a means of reducing the administrative burden on teachers [McMullin 2005]. Later, Learning Management Systems (LMS), web-based systems allowing instructors and students to share instructional materials, make class announcements, submit and return course assignments, and communicate with each other online, are now the major tools adopted by higher education [Lonn and Teasley 2009]. However, these traditional LMSs, such as Blackboard or WebCT, have largely focused on what Schulmeister calls "administered learning", which is based on the knowledge-transfer approach of behaviorist learning [Ullrich et al. 2008]. In this environment, students are passive content consumers that cannot contribute and social interactions are restricted to a few communication tools, such as email and discussion forums [Ebner 2007; Ullrich et al. 2008]. 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 realized [Ebner 2007].

Web 2.0-based Learning Tools

Web 2.0 applications are seen as different from Web 1.0 applications in a number of ways: 1) they allow for individual production and user generated contents; 2) they harness the power of crowd; 3) they can use data on a large scale; 4) they involve an architecture of participation; 5) they create network effects; and 6) they encourage openness [Anderson 2007, p.14]. Of these benefits, it is the individual creativity and social dimension captured by the "harnessing of the power of the crowds" that is seen as the most important because within Web 2.0, a group of students can socialize, collaborate, and work with each other within the classroom or around the world and this shared nature of Web 2.0 encourages students to actively participate and contribute to their own learning [Franklin and van Harmelen 2007].

Of the current crop of Web 2.0 applications, wikis and blogs are two of the most important and popular ones for educational application [Bryant 2006; Jones et al. 2010b]. These tools allow students to mix, amend, and recombine content, invite revision and commentary beyond the classroom, and provide new ways for students to collaborate and communicate with their peers, instructors or even people around the world [Bryant 2006; McLoughlin and Lee 2008]. Both wikis

and blogs are found to enhance students' learning experience [e.g., Bryant 2006 ; Elgort et al. 2008; Trentin 2009].

What Motivate Today's Students for Using Technologies in Learning?

Although technology embedded learning systems can lead to an interactive learning environment, there appears no guarantee that the quality of education will be enhanced [Liaw et al. 2007; Pituch and Lee 2006] as human factors and pedagogical skills are also required to ensure high quality learning [Du et al. 2010; Ebner 2007]. Liaw [2007] also indicates that understanding the targeted population's beliefs, attitudes, needs, and motivations toward the use of technologies in learning is essential to make technology-mediated learning more effective, efficient, and appealing. Given the significance and high demand of technology mediated learning, researchers have called for a greater focus on students' needs in developing technology mediated learning environments [Bouhnik and Marcus 2006; Kim and Bonk 2006], and hence suggesting that understanding what motivates students to use technologies in learning is important.

III. THE U&G PERSPECTIVE FOR UNDERSTANDING TECHNOLOGY USE MOTIVATIONS

The Uses and Gratification (U&G) is a well accepted theoretical framework in the study of media adoption and use [Lin 1996]. One basic assumption of this approach is that media users are goal-directed in their behavior, and the personal use of media is an active choice made to satisfy needs [Katz et al. 1974]. The second assumption of this approach is that media users are aware of their needs and select the appropriate media to gratify their needs. This approach attempts to recognize the important role the individual brings to the use of the media by asking what people do with the media, rather than what media do for people [Katz 1959]. This communication research paradigm has been very successfully applied in prior research on examining audience's motivations or reasons behind using a particular communication medium whenever it becomes available [Elliott and Orosenberg 1987; Lin 1996; Ruggiero 2000].

The characteristics of active choice of technologies and user-centered nature make the U&G approach particularly useful for understanding motivations for using the Internet-based technologies [Kuehn 1994; Ruggiero 2000]. A range of studies employing the U&G approach have studied the motivations for using Internet technologies [Yoo and Robbins 2008], although studies incorporating the students' learning contexts are still somewhat scarce [Guo et al. 2010]. For instance, Papacharissi and Rubin [2000] developed a scale of Internet usage motivations that consisted of five primary dimensions: interpersonal utility, pass time, information seeking, convenience, and entertainment. Ebersole [2000] found that students used the web for the needs of research and learning, easy access to entertainment, communication and social interaction, something to do when bored, access to material otherwise unavailable, product information and technical support, games and sexually explicit sites, and consumer transactions. Parker and Plank [2000] identified students' five motivations for using the Internet: interpersonal utility, pass time, information seeking, convenience and entertainment. In examining blog users uses and gratifications, Kaye [2005] found that blog users were motivated to use blogs for information seeking/media checking, personal fulfillment, political surveillance, social surveillance, and expression and affiliation. Recently, relationship maintenance, pass time, virtual community, entertainment, coolness, and companionship were identified as students' motivations for using Facebook [Sheldon 2008]. Guo et al. [2010] found that students used computer-mediated communication media to fulfill the needs of information seeking, convenience, connectivity, problem solving, content management, social presence; and social context cues in their learning contexts.

Emerging from these taxonomic efforts is a diverse range of motivations. In addition, results also vary across different types of participants, such as general public [Stafford et al. 2004] or

students [Papacharissi and Rubin 2000], or different contexts, such as general use [Ebersole 2000] or in learning [Guo et al. 2010], or different technologies, such as blog [Kaye 2005] or Facebook [Sheldon 2008]. Such diversity is not surprising given the wide variation in empirical approaches and research contexts of the studies. Given the fact that people's needs to be fulfilled vary across technologies and contexts [Fulk and Gould 2009], researchers have called for context specific U&G studies [Guo et al. 2010; Kang and Atkin 1999]. Within the educational context this suggests that identifying student motivations for using contemporary technologies in their learning is an essential element in understanding how these technologies can be used to enhance their learning outcomes.

In addition, the above-mentioned studies on the uses and gratifications of media use produce categories of audience motivations. However, some mass media investigations indicate that media use motivations are not isolated, static traits, but interrelated structures [Rubin 1983; Rubin and Rubin 1985]. Though considering motivations as a set of interactive needs and expectations is a more meaningful and accurate explanation of media uses and gratifications, it has not looked at possible underlying hierarchical relationships among motivations. Such relationships aid in understanding the relative position and influences of the motivations to each other. The need for developing a hierarchy is pressing as it helps in the classification and categorization of the motivations, and thereby formulates their respective strategies while providing clarity of thought [Hasan et al. 2007]. This study is designed to further the understanding of students' technology use motivations by generating a hierarchical framework to map and understand the causal relationships between the various motivations.

IV. RESEARCH METHOD

Interview Participants

The interviews were performed using the RGT [Tan and Hunter 2002]. RGT is "a structured technique for eliciting both the conceptual content embodied in an individual's mental model and the relationships which exist among these concepts" [Latta and Swigger 1992, p.116] which has gained considerable acceptance as a useful technique in information Systems (IS) research [Curtis et al. 2008; Siau et al. 2010; Tan and Hunter 2002]. In this study, RGT was used to collect raw statements of reasons for using contemporary technologies in learning.

RGT involves the presentation to the participants with a sequence of elements for comparison. In this research the elements are the technologies used and the researchers supplied a list of five most commonly used technologies identified in the literature (conventional websites, LMS, discussion forums, wikis and blogs), plus face-to-face teaching (for comparison purpose). The interviews involved construct elicitation, a process to identify the constructs when the research participant interprets the elements [Siau et al. 2010]. Constructs are the qualities that people attribute to the elements. They describe how some elements are alike and yet different from others [Tan and Hunter 2002]. Two interviewing methods, "triading" and "laddering", are employed to elicit constructs. The elicitation process was repeated to identify more constructs until either no new constructs can be elicited from a triad or the participant became noticeably tired [Tan and Hunter 2002].

A total of 16 university students (13 males, 3 females) were interviewed, in interviews ranging from 50 – 110 minutes long. The participant's age ranged from 20-26 years and all had been at university for at least two and a half years (average of 3 years). All were studying in the Business School, with majors in IS, IS Management, Business, or Software Engineering at an undergraduate (14) or masters (2) coursework level. All participants reported using the Internet for at least 7 years, had experience using popular Web 2.0 technologies (such as wikis, blogs, and Facebook) and considered themselves highly computer literate.

Content Analysis

Content analysis was used to analyze the data generated in the interviews. Content analysis was used as it allowed for the creation of thematic categories from the constructs described in the interview [Neuendorf 2002]. The purpose of this data analysis process is two-fold: (1) to identify motivation categories, and (2) to establish contextual relationships between each pair of motivation categories.

The interview transcripts were imported into Nvivo 8 and open coding was used to code the data. Whenever an 'entity' appeared, it was coded as a construct. If a statement about relationships between constructs appeared, a relationship "from" construct "A" and the "to" construct "B" was created. The Relationship Type was defined as "influences" and shown as a one-way arrow, indicating that attaining motivation "A" influences achieving motivation "B". Since there was considerable overlap between constructs across all participants, a data reduction process was conducted to consolidate similar constructs and remove insignificant constructs (less than 3 occurrences) [Guo et al. 2010; Siau et al. 2010].

The 16 interviewees produced a total of 646 raw constructs and 504 unique relationship nodes. Consolidation of raw constructs yielded 77 unique constructs and 328 relationship nodes. A content analysis was then performed on the 77 constructs to categorize them using an 'adjusted core-categorization procedure' as outlined by Jankowicz [2004]. Based upon semantic similarities, the 77 unique constructs were collapsed into 11 large categories, as shown in Table 1. A detailed description of each is presented in the results section.

Table 1: Summary of Motivation Categories

Motivation Category	Unique Constructs Identified
S1: Access and Content Control	Access control (12); Content control (15); Data security (9); and Multiple-user editing (16); Privilege (13)
S2: Accessibility	Cost (3); Easy access (12); Ease of use (14); Familiarity (5); Place independence (10); Quick access (10); and Time independence (14)
S3: Communication Efficiency	Convenience (7); Ease (6); Frequency (4); and Speed (12)
S4: Communication Mode	Audibility (7); Multimedia (7); and Visibility (12)
S5: Communication Quality	Clarity (14); Depth (4); Effectiveness (8); Specificity (5); and Topic focusing (6)
S6: Course Management	Assessment function (3); Compulsion (6); Control for assignments submission (3); Grading (4); Integrative systems (14); Subscription(4); and virtual class (5)
S7: Information Seeking	Accuracy (10); Amount of information (9); Currency (7); Granularity (5); Trustworthiness (12); and Various sources (7)
S8: Interaction	Communication direction (16); Communication flow (8); Communication format (9); Guarantee response (5); Intensity (13); Participation (16); Pattern (11); Range (5); Seniority (9); Sharability (11); Speed (12); and Synchronicity (12)
S9: Learning Capability	Collaborative learning (15); Critical thinking (3); Group work efficiency (12); Independent thinking (3); Internalization (3); Learning at your own pace (4); Learning from others (10); Learning guidance (7); Reflection (5); Suitable learning style (5); Taking initiative (7); and Teaching effect examination (4)

S10: Managing Contents	Add files (9); Electronic trail (5); Information index (13); Keep notes (10); Put citations/references/page links (7); Reprocessibility (16); Storage (3); Traceability (5); and Versioning capability (8)
S11: Self-Disclosure	Anonymity (6); Belonging (7); Courtesy (10); Formality (3); Homophily (3); Self-expression (13); and Social cues (7)

Note: number in () is the number of participants who mentioned that construct

ISM

ISM is an interactive learning process whereby a set of different interrelated variables affecting the system under consideration is structured into a comprehensive systemic model [Sage 1977; Warfield 1974]. The principle of ISM is based on discrete mathematics, graph theory, social science and collective planning [Sage 1977; Warfield 1976; Warfield 1973]. The objective of this methodology is "to expedite the process of creating a digraph, which can be converted to a structural model, and then inspected and revised to capture the user's best perceptions of the situation" [Malone 1975, p.399].

ISM has been extensively applied by a number of researchers to develop a better understanding of the complex systems under consideration such as higher education program planning [Hawthorne and Sage 1975], vendor selection criteria [Mandal and Deshmukh 1994], evaluating IS effectiveness [Kanungo et al. 1999], and IT enablers and barriers for KM [Anantatmua 2008; Bhattacharyya and Momaya 2009]. Building an ISM involves a number of steps, which are well documented in the literature [e.g., Farris and Sage 1975; Janes 1988]. Due to space constraint, only procedures used to develop ISM model are presented here.

Step 1: Defining a set of variables affecting the system
Step 2: Establishing a contextual relationship between variables
Step 3: Developing a Reachability Matrix, and checking the matrix for transitivity
Step 4: Partitioning the Reachability Matrix into different levels
Step 5: Forming a conical form of matrix
Step 6: Drawing a directed graph (DIGRAPH) and removing the transitive links
Step 7: Converting the resultant digraph into an ISM by replacing variable nodes with statements

The set of variables considered for ISM development were the 11 motivation categories identified earlier, denoted Si, in sequence, where i = 1,2,3,4,5,6,7,8,9,10,11. Since the relationships identified in Nvivo represented the relation between any two unique constructs from any two categories for any participant, it allowed the researchers to determine the relationship for each pair, resulting in a total of 65 relationships. The weak relations (those mentioned by less than three participants) were then removed. Table 2 provides the final relationships between each pair of motivation categories, in which cells were populated by 0s and 1s, in which "1" indicating the relationship and "0" indicating otherwise. This binary matrix, which describes whether there is a direct relation between the row and column variables, is called Adjacency Matrix used for ISM analysis.

Table 2: Adjacency Matrix

A	**S1**	**S2**	**S3**	**S4**	**S5**	**S6**	**S7**	**S8**	**S9**	**S10**	**S11**
S1	0	1	1	1	0	1	0	1	1	1	1
S2	0	0	1	1	0	0	0	0	1	1	0
S3	0	0	0	0	0	0	0	0	0	0	0
S4	0	0	0	0	0	0	0	0	0	0	0
S5	0	0	1	1	0	0	0	0	1	0	1

S6	0	0	1	0	0	0	0	1	1	1	0
S7	0	1	0	0	0	0	0	0	1	1	0
S8	0	0	0	1	0	0	0	0	0	0	0
S9	0	0	1	1	0	0	0	1	0	1	0
S10	0	0	0	0	0	0	0	0	0	0	0
S11	0	0	0	1	0	0	0	1	1	0	0

V. RESULTS

Motivation Categories for Using Technologies in Learning

The following table describes and discusses each of the motivation categories identified in the study:

Table 3: Motivation Categories

Motivation Category	Description and Discussion
Access and Content Control	All participants presented a construct in this category. Almost all participants indicated that they liked the system which allowed multiple users to work on the same documents, such as reading or making comments. However, 13 participants indicated that functions should be integrated with different privilege levels.
Accessibility	Accessibility refers to the physical access to and subsequent use of the technology [Culnan 1984]. This category consists of seven items. All participants gave constructs in this category. Interestingly only three participants indicated the importance of cost and five participants indicated that they would like to use the technology if they were familiar with it. Ease of use is an important construct to motivate them to use the technology.
Communication Efficiency	Communication Efficiency refers to the extent to which communication can be done conveniently, easily, frequently, and quickly. 13 participants declared constructs in this category. Several participants stated that ease of use and convenience of communication was important.
Communication Mode	Issues pertaining to Communication Mode were presented by 14 participants. At least near half the participants appreciated the multimedia feature of the technology. Participants in this study also indicated the importance of having face-to-face interactions in their learning due to the availability of audio and visual features.
Communication Quality	All participants gave constructs that fall within Communication Quality category, which refers to the extent to which communication is clear, in depth, effective, specific, and focused. How good the technology is used for clarifying the issues seems to be the most important one, declared by 14 participants. Half the participants highlighted the importance of effectiveness of communication and only four participants indicated the importance of depth of communication. Students did emphasize that in general face-to-face was better than technology mediated learning, and speaking was better than writing, in terms of clarification and effectiveness.

Course Management	This category refers to the administrative role of the technologies in their learning. It consists of seven items. As an integrated learning management system, LMS at least achieved that goal as 14 participants viewed the integrative nature of current LMS to be beneficial in terms of managing their courses, compared with wikis or blogs.
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 was also elicited from all participants. It consisted of seven items. Several participants appeared to consider a variety of sources as their motive for information seeking. Finally, students did elicit constructs related to quantity of information as their motive for using technologies to seek information. However, it seems they concerned more about information accuracy, currency, and truthfulness rather than quantity when it comes to Internet search.
Interaction	Interaction refers to the exchangeability of sources and receivers [Rice 1987]. It was not surprising that most participants presented a construct in this category since interaction is one of the most important characteristics of Internet technologies [Ruggiero 2000], and one of the most important principles of constructivism approach. For all participants, static one-way communication or dynamic two-way communication was of importance. They felt that a static LMS was mainly used for information dissemination and did not encourage participation in class discussion.
Learning Capability	Technologies with Learning Capability have the ability to create a learning environment to develop students' critical thinking skills, to be independent, active and reflective, to collaborate and cooperate, and to be constructive [Miers 2004]. All participants provided constructs relating to this category. The popularity of group collaboration construct (15 out of 16 participant elicited this construct) indicates that technologies, indeed, can be used to enhance group collaboration, as found in previous studies [Kitsantas and Chow 2007]. Even though not every participant provided constructs relating to independent learning, constructive and reflective learning, and active and manipulative learning, it indicates a shift among students from teacher-focused learning to a student-centred and self-paced learning style. The participatory nature of Web 2.0 makes it possible for students to take the initiative in learning by starting their own questions or discussion, rather than just reading or commenting on others.
Managing Contents	All participants provided constructs relating to Managing Contents category. Ten participants indicated that a shared virtual space offered by wikis or forums allowed them to have their group meeting discussion notes posted online. This was especially useful for groups for whom face-to-face meetings were difficult. In addition, ten participants liked to use online technologies to take notes. More often students used wikis for note-taking while in class.

Self-Disclosure	Self-Disclosure refers to the extent to which any message about the self a person communicates to another [Wheeless and Grotz 1976]. Six participants liked the anonymity of technologies. Ten participants stated that they wanted to be respected when communicating with other students and would avoid being embarrassed. Self-expression was one construct elicited by most participants in this category. The lack of nonverbal and social context cues of computer mediated technologies [Rice 1993], actually becomes an advantage for those students with higher degree of self-disclosure since they become less shy or feel less pressure when communicating via CMC, and are more likely to share their emotions with others and use less formal way to communicate. Ledbetter [2009] also identified self-disclosure as one important motivation for people who communicated online and he further found that self-disclosure was related to Facebook use [Ledbetter et al. 2011].

Model Development

Based on Adjacency matrix (Table 2), Tables 4, 5, and 6 show final reachability matrix, level partitions, and conical matrix. Figure 1 shows ISM model.

Table 4: Reachability Matrix

M	**S1**	**S2**	**S3**	**S4**	**S5**	**S6**	**S7**	**S8**	**S9**	**S10**	**S11**
S1	1	1	1	0	1	0	1	1	1	1	1
S2	0	1	1	0	1	0	1	1	1	0	0
S3	0	0	1	0	0	0	0	0	0	0	0
S4	0	0	1	1	1	0	1	1	1	0	1
S5	0	0	0	0	1	0	0	0	0	0	0
S6	0	1	1	0	1	1	1	1	1	0	0
S7	0	0	0	0	1	0	1	0	0	0	0
S8	0	0	1	0	1	0	1	1	1	0	0
S9	0	0	0	0	0	0	0	0	1	0	0
S10	0	0	1	0	1	0	1	1	1	1	0
S11	0	0	1	0	1	0	1	1	1	0	1

Table 5: Level Partitions

Level	**S_i**	**R（S_i）**	**A（S_i）**	**R∩A**
V	1	1, 2, 3, 5, 7, 8, 9, 10, 11	1	1
IV	2	2, 3, 5, 7, 8, 9	1, 2, 6	2
I	3	3	1, 2, 3, 4, 6, 8, 10, 11	3
V	4	3, 4, 5, 7, 8, 9, 11	4	4
I	5	5	1, 2, 4, 5, 6, 7, 8, 10, 11	5
V	6	2, 3, 5, 6, 7, 8, 9	6	6
II	7	5, 7	1, 2, 4, 6, 7, 8, 10, 11	7
III	8	3, 5, 7, 8, 9	1, 2, 4, 6, 8, 10, 11	8
I	9	9	1, 2, 4, 6, 8, 9, 10, 11	9
IV	10	3, 5, 7, 8, 9, 10	1, 10	10
IV	11	3, 5, 7, 8, 9, 11	1, 4, 11	11

Table 6: Conical Matrix

M	S3	S5	S9	S7	S8	S2	S10	S11	S1	S4	S6
S3	1	0	0	0	0	0	0	0	0	0	0
S5	0	1	0	0	0	0	0	0	0	0	0
S9	0	0	1	0	0	0	0	0	0	0	0
S7	0	1	0	1	0	0	0	0	0	0	0
S8	1	1	1	1	1	0	0	0	0	0	0
S2	1	1	1	1	1	1	0	0	0	0	0
S10	1	1	1	1	1	0	1	0	0	0	0
S11	1	1	1	1	1	0	0	1	0	0	0
S1	1	1	1	1	1	1	1	1	1	0	0
S4	1	1	1	1	1	0	0	1	0	1	0
S6	1	1	1	1	1	1	0	0	0	0	1

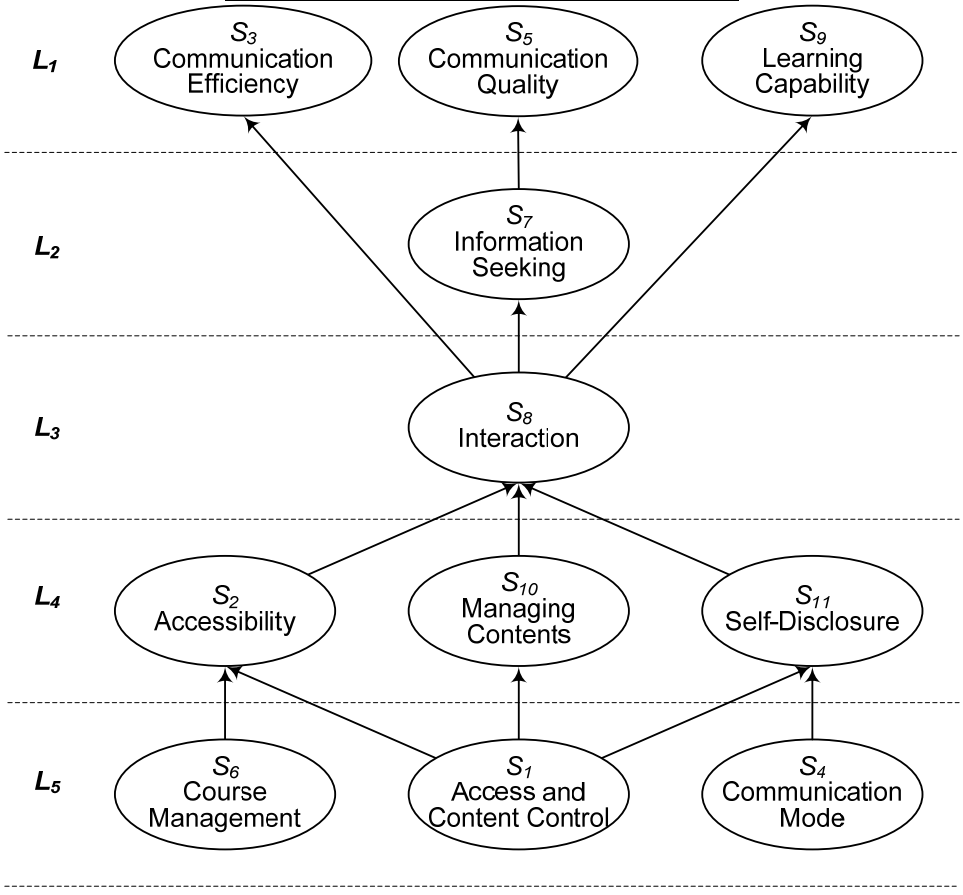

Figure 1: ISM Model of Students' Motivations

Figure 1 shows that Access and Content Control is the key for Accessibility, Content Management, and Self-Disclosure, while Course Management has impacts on Accessibility and Communication Mode affects Self-Disclosure. Interaction, which has impacts on Communication Efficiency, Information Seeking, and Learning Capability, is influenced by Accessibility, Managing Contents, and Self-Disclosure. The model shows that Information Seeking behaviors promote more high quality communication.

VI. DISCUSSION

Students' Motivations for Using Technologies in Learning

Of the 11 student-specific motivation categories reported above, Access and Content Control, Course Management, and Learning Capability had not been previous identified. This finding supports the contention that university students have different motivations for using technologies in learning, when compared to other contexts.

Consistent with previous studies [e.g., Guo et al. 2010; Waycott et al. 2010], this study also found that students tended to choose a technology that had no time or place constraints. Ease and speed of access are important since the less the effort required to access the technology, the more attractive it is, which leads to greater use.

The findings support those of previous studies where face-to-face interaction is the preferred medium when tasks are equivocal and required intensive interactions [Guo et al. 2008; King and Xia 1997]. It appears that students still appreciate the value that face-to-face interaction brings to the classroom.

Previous research has found that young people often evaluated information's relevance to a topic based on its newness, interestingness, convenience [Hirsh 1999], or quantity [Metzger et al. 2003; Shenton and Dixon 2004], rather than quality. The students of this study however showed more interest in information accuracy, currency, and reliability. Although further research is needed to better understand student's awareness of quality of information within the Web 2.0 context, this study does appear to indicate a change in students' perceptions and behaviors of information seeking.

A key finding of this study is that Web 2.0 technologies enhanced the learning experience by promoting independent learning for employability, which agrees with Jones et al [2010b]. Given that most instructors still see learning as knowledge transmission rather than a process incorporating peer feedback and online mentoring [Kim and Bonk 2006], there appears to be a mismatch between what students want and what instructors deliver in terms of learning. It should be noted however that instructors do anticipate that more student-centered techniques should be used in the technology mediated learning environment in the future. They also note that this additional use is conditional on sufficient pedagogical skill training being provided by their institutions [Kim and Bonk 2006]. Thus, armed with Web 2.0 technologies, along with pedagogically competent instructors, students will have more opportunities for self-directed learning [Liaw et al. 2007].

Interrelations among all Motives

Among a wide spectrum of motivations for using technologies in learning, some have a more direct role than others. Motivations of Access and Content Control, Accessibility, Communication Mode, Managing Contents, Course Management, and Self-Disclosure, are at the bottom of the model. These variables help students achieve their desired learning outcomes. In particular, Access and Content Control had direct impacts on three variables, indicating that safe technologies and the contents they provided on the web were identified as the key in influencing their use of technologies in learning. These features should be continuously and consciously improved since they have an overarching effect on all other variables. Accessibility, Managing Contents, and Self-Disclosure, which are next in the hierarchy, are imperative in translating technology access and content security, communication mode, and course management to effective use among students. Moving up the ISM, towards the variable of Interaction, it becomes clear that in order to help students learn with technologies in learning contexts, students need to learn how to use them well for interaction. Any shortcomings in the entire technology use process could have negative impact on fulfilling top-level technology use needs. At the top of the ISM model, there are four variables with the highest dependence. In other words, they are influenced

by lower level motivations. Any action on any other variable will have an impact on them due to the higher dependence [Hasan et al. 2007].

VII. LIMITATIONS AND FUTURE DIRECTIONS

Some limitations of the study require comment. First, all interviewee were considered computer literate. Some of studies have found that there can be a lack of homogeneity in university student population with regard to their technology experience [Jones et al. 2010a; Kennedy et al. 2008], thus caution needs to be taken when generalizing findings of this study to other settings as student's innate familiarity with Internet technologies cannot be assumed. Furthermore, even with these technologically competent students, differences in learning attitudes were still found. Future research may wish to repeat the research with theoretical sampling so to validate the findings. In addition, this study explored students' social and psychological motivations for using technologies in learning without any examination of the exact relationship between elicited motivations and supplied elements. The relationships between motivation category and technologies could be further explored in order to assess the relative contribution of each technology in satisfying each of motivation categories as well as to identify which student motivations are best fulfilled by each technology.

VIII. IMPLICATIONS AND CONCLUSION

This study has three key implications for future research. First, through the use of RGT to elicit a finite set of constructs from university students, the study developed a number of student-specific motivation categories for using technologies in learning. Instead of using gratification items developed from non-learning contexts, this student-specific technology use scale can be used to inform the development of questionnaires for student-specific studies since the scale developed here has little researcher bias as the items were generated by the students [Curtis et al. 2008].

Second, by adopting the ISM technique, linkages were developed among these motivation categories through a single, systemic framework. The hierarchical structure model identified in this study indicates that motivations are related, and influence one another. Such a hierarchy also helps in the classification and categorization of variables [Bhattacharyya and Momaya 2009], allowing researchers to better formulate their views and disseminate them to others.

Third, the combination of U&G as a theoretical lens, RGT as a data collection method, and ISM as a data analysis technique has proved to be an effective way of understanding people's motivations in areas where empirical studies are scant. Future studies can use both U&G and RGT to elicit individuals' motivations for using any emerging technology, and use ISM to identify structural framework of motivations.

This study also has practical implications for university policy makers and course instructors. First, access and content control seem to be an important concern of current students in their technology use. If the Internet is used for class discussion then the course instructors should play a moderator role to manage the quality of discussion content, otherwise students may not take such discussion seriously.

Second, instructors should be familiar with the LMS offered by the university so they can make effective use of the tools provided by the LMS in their teaching and use online activities such as online assignment writing and submission and online group discussions, as it assists students to organize their learning.

Third, face-to-face interaction is still considered very important by the students, suggesting that a blended learning environment, rather than a purely online environment may be best. Instructors may find that face-to-face consultation is still necessary for helping students learn better.

Fourth, students are now keenly aware of the importance of discerning reliable information on the internet. Universities will need to ensure that their students are aware of the resources available through university portals since most students are not aware the availability of such tools offered by the university. At the same time, instructors should promote peer and editorially reviewed resources that are available online in students' assignment requirement specifications in order for students to be able to realize and access those reliable resources.

Fifth, although some researchers questioned on the readiness of today's students for pedagogical reform [Margaryan and Littlejohn 2008], this study shows that some students' attitudes to learning appeared to be in-line with student centric, collaborate learning approaches. This result indicates that there is a diversity among students, not only on the level of technological literacy [Kennedy et al. 2008], but also on their attitudes toward learning. However, most instructors are not really ready for both technological and pedagogical changes [Ebner 2007]. In order to meet today students' learning needs, course instructors should improve both technical and pedagogical skills in order to be competent in this educational evolution. Universities should provide support on such kind of training to ensure the implementation and use of technology success [Kim and Bonk 2006].

Finally, this study has demonstrated that students have various, interrelated motivations in using technologies in learning. Although the data was collected in one university, the motivations identified in this study are quite generic. With marginal adjustments, they can be used for other universities as well. Each of the relations (arrows in the digraph) identified in this study's ISM model is viable. However, what is more important here is the logical flow of causal influence and contextual development. Instructors should pay great attention to the ones with great impacts on others.

REFERENCES

Anantatmua, V. (2008). "Role of IT and KM in Improving Project Management Performance." *Knowledge Management Systems,* 38(3), pp.357-69.

Anderson, P. (2007). "What is Web 2.0? Ideas, Technologies and Implications for Education." in *JISC Technology and Standard Watch*.

Bhattacharyya, S., and K. Momaya. (2009). "Interpretive Structural Modelling of Growth Enablers in Construction Companies." *Singapore Management Review,* 31(1), pp.73-97.

Bouhnik, D., and T. Marcus. (2006). "Interaction in Distance-Learning Courses." *Journal of the American Society for Information Science and Technology,* 57(3), pp.299-305.

Bryant, T. (2006). "Social Software in Academia." *Educause Quarterly,* 29(2), pp.61-64.

Coaldrake, P. , and L. Stedman. (1999). "Academic Work in the Twenty-First Century." Canberra, Australia: Australian Government Publishing Service.

Cormode, G., and B. Krishnamurthy. (2008). "Key Differences between Web 1.0 and Web 2.0." *First Monday* 13(6), article 1.

Culnan, M.J. (1984). "The Dimensions of Accessibility to Online Information: Implications for Implementing Office Information Systems." *ACM Trans. Inf. Syst.,* 2(2), pp.141-50.

Curtis, A.M., et al. (2008). "An Overview and Tutorial of the Repertory Grid Technique in Information Systems." *Communications of the Association for Information Systems,* 23(3), pp.37-62.

Du, Helen, et al. (2010). "Can a Lean Medium Enhance Large-Group Communication? Examining the Impact of Interactive Mobile Learning." *Journal of the American Society for Information Science and Technology,* 61(10), pp.2122-37.

Ebersole, S. (2000). "Uses and Gratifications of the Web among Students." *Journal of Computer Mediated Communication,* 6(1), pp.1-17.

Ebner, M. (2007). "E-learning 2.0 = e-learning 1.0 + Web 2.0?" Pp. 1235-39 in *The Second International Conference on Availability, Reliability and Security (ARES'07)*. Vienna, Austria

Elgort, I., A.G. Smith, and J. Toland. (2008). "Is Wiki an Effective Platform for Group Course Work?" *Australasian Journal of Educational Technology,* 24(2), pp.195-210.

Elliott, W.R., and W.L. Orosenberg. (1987). "The 1985 Philadelphia Newspaper Strike: A Uses and Gratifications Study." *Journalism Quarterly,* 64(4), pp.679-87.

Farris, D. R., and Andrew P. Sage. (1975). "On the Use of Interpretive Structural Modeling for Worth Assessment." *Computers & Electrical Engineering,* 2(2-3), pp.149-74.

Franklin, T., and M. van Harmelen. (2007). "Web 2.0 for Content for Learning and Teaching in Higher Education." Available at http://ie-repository.jisc.ac.uk/148/1/web2-content-learning-and-teaching.pdf

Fulk, Janet, and Jessica J. Gould. (2009). "Features and Contexts in Technology Research: A Modest Proposal for Research and Reporting." *Journal of Computer-Mediated Communication,* 14(3), pp.764-70.

Guo, Z., B Tan, and Kenneth Cheung. (2010). "Students' Uses and Gratifications for Using Computer-Mediated Communication Media in Learning Contexts." *Communications of the Association for Information Systems,* 27(1), article 20.

Guo, Z., et al. (2008). "An Exploratory Investigation into Instant Messaging Preferences in Two Distinct Cultures." *IEEE Transactions on Professional Communication,* 51(4), pp.396-415.

Hasan, M.A., R. Shankar, and J. Sarkis. (2007). "A Study of Barriers to Agile Manufacturing." *International Journal of Agile Systems and Management,* 2(1), pp.1-22.

Hawthorne, R.W., and A.P. Sage. (1975). "On Applications of Interpretive Structural Modeling to Higher Education Program Planning." *Social-Economic Planning Sciences,* 9(1), pp.31-43.

Hirsh, S. (1999). "Children's Relevance Criteria and Information Seeking on Slectronic Resources " *Journal of the American Society for Information Scienc,e* 50(4), pp.1253-83.

Janes, F.R. (1988). "Interpretive Structural Modelling: a Methodology for Structuring Complex Issues." *Transactions of the Institute of Measurement and Control,* 10(3), pp.145-54.

Jankowicz, D. (2004). *The Easy Guide to Repertory Grids*. Hoboken, NJ: Wiley.

Jones, C., et al. (2010a). "Net Generation or Digital Natives: Is There a Distinct New Generation." *Computers & Education,* 54(3), pp.722-32.

Jones, Norah, et al. (2010b). "Get out of MySpace!" *Computers & Education,* 54(3), pp.776-82.

Kang, M.E., and D.J. Atkin. (1999). "Exploring the Role of Media Use and Gratifications in Multimedia Cable Adoption." *Telematics and Informatics,* 16(1-2), pp.59-74.

Kanungo, R.N., S. Duda, and Y. Srinivas. (1999). "A Structural Model for Evaluating Information Systems Effectiveness." *Systems Research and Behavioral Science,* 16(6), pp.495-518.

Katz, E. (1959). "Mass Communication Research and the Study of Popular Culture: An Editorial Note on a Possible Future for This Journal." *Studies in Public Communication,* 2, pp.1-6.

Katz, E., J.G. Blumler, and M. Gurevitch. (1974). "Utilization of Mass Communication by the Individual." In Blumler, J.G. and E.Katz (eds.), *The Use of Mass Communications : Current Perspectives on Gratifications Research*. Beverly Hills: Sage. Pp. 19-32

Kaye, Barbara K. (2005). "It's a Blog, Blog, Blog World: Users and Uses of Weblogs." *Atlantic Journal of Communication,* 13(2), pp.73-95.

Kennedy, G., et al. (2008). "First Year Students' Experiences with Technology: Are They Really Digital Natives?" *Australasian Journal of Educational Technology,* 24(1), pp.108-22.

Kim, K.J., and C.J. Bonk. (2006). "A Survey Substantiates Some Ideas about Online Learning and Refutes Others." *Educause Quarterly,* 29(4), pp.22-30.

King, R. C., and W. D. Xia. (1997). "Media Appropriateness - Effects of Experience on Communication Media Choice." *Decision Sciences,* 28(4), pp.877-910.

Kitsantas, A., and A. Chow. (2007). "College Students' Perceived Threat and Preference for Seeking Help in Traditional, Distributed, and Distance Learning Environments." *Computers & Education,* 48(3), pp.383-95.

Kuehn, S.A. (1994). "Computer-Mediated Communication in Instructional Settings: A Research Agenda." *Communication Education,* 43(2), pp.171-83.

Latta, Gail F., and Keith Swigger. (1992). "Validation of the Repertory Grid for Use in Modeling Knowledge." *Journal of the American Society for Information Science and Technology,* 43(2), pp.115-29.

Ledbetter, Andrew M. (2009). "Measuring Online Communication Attitude: Instrument Development and Validation." *Communication Monographs,* 76(4), pp.463 - 86.

Ledbetter, Andrew M., et al. (2011). "Attitudes Toward Online Social Connection and Self-Disclosure as Predictors of Facebook Communication and Relational Closeness." *Communication Research,* 38(1), pp.27-53.

Liaw, Shu-Sheng, Hsiu-Mei Huang, and Gwo-Dong Chen. (2007). "Surveying Instructor and Learner Attitudes toward E-Learning." *Computers & Education,* 49(4), pp.1066-80.

Lin, Carolyn A. (1996). "Looking Back: The Contribution of Blumler and Katz's Uses of Mass Communication." *Journal of Broadcasting & Electronic Media,* 40(4), pp.574-81.

Lonn, Steven, and Stephanie D. Teasley. (2009). "Saving Time or Innovating Practice: Investigating Perceptions and Uses of Learning Management Systems." *Computers & Education,* 53(3), pp.686-94.

Malone, D.W. (1975). "An Introduction to the Application of Interpretive Structural Modeling." *Proceedings of the IEEE,* 63(3), pp.397-404.

Mandal, A., and S.G. Deshmukh. (1994). "Vendor Selection Using Interpretive Structural Modelling (ISM)." *International Journal of Operations & Production Management,* 14(6), pp.52-59.

Margaryan, A., and A. Littlejohn. (2008). "Are Digital Natives a Myth or Reality?: Students' Use of Technologies for Learning." in *Learning from Digital Natives: Integration of Formal and Informal Learning (LDN)*. UK: Caledonian Academy, Glasgow Caledonian University,.

McLoughlin, C., and Mark Lee, J.W. (2008). "Future Learning Ladscapes: Transforming Pedagogy throguh Social Software." *Innovate Journal of Online Education,* 4(5), pp.1-9.

McMullin, B. (2005). "Putting the Learning Back into Learning Technology." In G.O'Neill, S.Moore, and B.McMulli (eds.), *Practice of University Learning and Teaching*. Dublin: AISHE.

Metzger, M.J., A.J. Flanagin, and L. Zwarun. (2003). "College Student Web Use, Perceptions of Information Credibility, and Verification Behavior." *Computers & Education,* 41(3), pp.271-90.

Miers, J. (2004). "Belts or Braces? Is BELTS, (Basic e-Learning Tool Set) ".

Neuendorf, K.A. (2002). *The Content Analysis Guidebook*. Thousand Oaks, CA: Sage Publications.

Papacharissi, Z., and A.M. Rubin. (2000). "Predictors of Internet Use." *Journal of Broadcasting & Electronic Media,* 44(2), pp.175-96.

Parker, B.J., and R.E. Plank. (2000). "A Uses and Gratifications Perspective on the Internet as a New Information Source." *American Business Review,* 18(2), pp.43-49.

Pituch, Keenan A., and Yao-kuei Lee. (2006). "The Influence of System Characteristics on E-Learning Use." *Computers & Education,* 47(2), pp.222-44.

Rice, R. E. (1987). "Computer-Mediated Communication and Organizational Innovation." *Journal of Communication,* 37(4), pp.65-94.

Rice, R.E. (1993). "Media Appropriateness: Using Social Presence Theory to Compare Traditional and New Organizational Media." *Human Communication Research,* 19(4), pp.451-84.

Rubin, A.M. (1983). "Television Uses and Gratifications: The Interactions of Viewing Patterns and Motivations." *Journal of Broadcasting,* 27(1), pp.37-51.

Rubin, A.M., and R.B. Rubin. (1985). "Interface of Personal and Mediated Communication: A Research Agenda." *Critical Studies in Mass Communication,* 2(1), pp.36-53.

Ruggiero, T.E. (2000). "Uses and Gratifications Theory in the 21st Century." *Mass Communication & Society,* 3(1), pp.3-37.

Sage, A.P. . (1977). *Methodology for Large-Scale Systems* New York, NY: McGraw-Hill.

Sheldon, Pavica. (2008). "Student Favorite: Facebook and Motives for its Use." *Southwestern Mass Communication Journal,* 23(2), pp.39-53.

Shenton, A.K., and P. Dixon. (2004). "Issues Arising from Youngsters' Information-Seeking Behavior " *Library and Information Science Research,* 26(2), pp.177-200.

Siau, K., Xin Tan, and H. Sheng. (2010). "Important Characteristics of Software Development Team Members: An empirical investigation using Repertory Grid " *Information Systems Journal,* 20(6), pp.563-80.

Stafford, T.F., M.R. Stafford, and L.L. Schkade. (2004). "Determining Uses and Gratifications for the Internet." *Decision Sciences,* 35(2), pp.259-88.

Tan, F.B., and M.G. Hunter. (2002). "The Repertory Grid Technique: A Method for the Study of Cognition in Information Systems." *MIS Quarterly,* 26(1), pp.39-57.

Tao, Yu-Hui. (2008). "Typology of College Student Perception on Institutional E-Learning Issues--An Extension Study of a Teacher's Typology in Taiwan." *Computers & Education,* 50(4), pp.1495-508.

Trentin, G. (2009). "Using a Wiki to Evaluate Individual Contribution to a Collaborative Learning Project." *Journal of Computer Assisted Learning,* 25(1), pp.43-55.

Ullrich, C., et al. (2008). "Why Web 2.0 is Good for Learning and for Research: Principles and Prototypes." in *International World Wide Web Conference Committee (IW3C2)*. Beijing, China.

Warfield, J. N. (1974). "Toward Interpretation of Complex Structural Models." *IEEE Transactions on Systems, Man and Cybernetics* 4(5), pp.405-17.

Warfield, J. N. (1976). *Societal Systems: Planning, Policy and Complexity*. New York: John Wiley and Sons.

Warfield, J.N. (1973). "On Arranging Elements of a Hierarchy in Graphic Form " *IEEE Transactions on Systems, Man and Cybernetics,* 3(2), pp.121-32.

Waycott, Jenny, et al. (2010). "Digital Divides? Student and Staff Perceptions of Information and Communication Technologies." *Computers & Education,* 54(4), pp.1202-11.

Wheeless, L.R., and J Grotz. (1976). "Conceptulization and Measurement of Reported Self-Disclosure." *Human Communication Research,* 2(4), pp.338-46.

Wilson, T.D. (2000). "Human Information Behavior." *Informing Science,* 3(2), pp.49-56.

Yoo, E-Y, and L.S. Robbins. (2008). "Understanding Middle-Aged Women's Health Information Seeking on the Web: A Theoretical Approach." *Journal of the American Society for Information Science and Technology,* 59(4), pp.577-90.

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