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STUDENT E-LEARNING INTRINSIC MOTIVATION: A QUALITATIVE ANALYSIS

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ABSTRACT

In the age of life-long learning and increased competition for time, motivation becomes a salient issue. Students need to be more intrinsically motivated in the absence of more formal structure. This is especially true in online learning environments where direct instructor influence is mitigated. Online learning environments typically embrace many choices in ways in which learning material is presented and interaction with students is supported in both individual and collaborative contexts. As such, it is imperative that we better understand the implications of various learning activities and associated technologies on aspects of intrinsic motivation in e-learning. In this paper we examine these effects through qualitative analysis of semi-structured interviews with students in an online MBA program. Results encourage use of a pedagogically driven portfolio of learning activities supported by well-selected and integrated audio, video, and data technologies. Extension to use of mobile devices in ubiquitous e-learning contexts is explored.

Keywords: intrinsic motivation, e-learning, pedagogy, mobile, ubiquitous

I. INTRODUCTION

In an age of increased use of technology delivered education and with an emphasis on life-long learning, intrinsic motivation on the part of students becomes ever more important. There are fewer education institution formalisms and more distractions and demands on time. As such, students wishing to stay engaged (and institutions providing education) need to increasingly rely upon intrinsic motivation on the part of the students. Intrinsic motivation can be described as proclivity to engage in a behavior simply for the inherent reward of the task [Rieber 1991]. Considerable research has revealed intrinsic motivation to be significantly related to students' ability to achieve academically [Gottfried 1985]. Deci and Ryan [1980], noted that increased conceptual learning, creativity, flexibility, positive emotional health, and higher self-esteem have all been associated with intrinsically motivated activity. As we create information systems to support programs and curricula, it becomes imperative that we take into consideration the impact

of e-learning activities and associated technologies on aspects of intrinsic motivation [Keller and Suzuki 2004]. Rieber [1991], concludes that individuals tend to persist at activities that are intrinsically motivating.

Unfortunately, little is known of the impact of different e-learning activities and technologies on student intrinsic motivation even though we have sought to create programs with that in mind [Hodges 2004]. For example, the City University of Hong Kong (CityU) Interactive Master of Business Administration (*i*MBA) allows course participants the flexibility to study at any time, any place and at the pace that best fits their schedules and learning needs. Technology-supported individual learning activities include: (1) video lectures available in self-selected segments; and (2) other interactive learning materials (e.g. slides, interactive short questions/answers, references or hot links to other Web sites). Technology-supported collaborative learning activities include: (1) online tutorials to support the interaction of a tutor and up to ten participants who can see (video) and talk (audio) to each other or type in text-based messages; and (2) a Web-based discussion forum (via WebBoard), which is an asynchronous learning process whereby instructors, tutors, and participants can contribute ideas and provide comments/advice to each other anytime from anywhere.

In this study, we pose "How do learning activities and technologies affect intrinsic motivation in an online learning environment?" as a research question. The purpose of this paper is to examine how students' intrinsic motivation is affected by constructs of challenge, control, curiosity, and engagement in the context of iMBA learning activities in seeking answers to our research question addressing the problem area. Six in-depth interviews held with iMBA students are analyzed and results reported. Conclusions are drawn and extension to use of mobile devices for ubiquitous e-learning is explored.

II. INTRINSIC MOTIVATION LITERATURE

The concept of intrinsic motivation originated with William James [James 1950] who used the terms "interest and instincts of constructiveness" to explain different types of human behavior. "Interest" and "instincts of constructiveness" reflect the concepts of self-determination and competence, which today define intrinsic motivation [Reeve et al. 2004]. The need for self-determination, a component of intrinsic motivation theory [Deci and Ryan 1985; Deci and Vansteenkiste 2004], was derived from [DeCharms 1968] theory of personal causation which theorizes that individuals are motivated to be the causal agent of their behavior. The theory of self-determination postulates that the three innate psychological needs include the need for competence, relatedness, and autonomy [Reis et al. 2000; Ryan 1994; Ryan and Deci 2004]. According to Deci et al. [1991], competence "involves understanding how to attain various external and internal outcomes and being efficacious in performing the requisite actions" and that the need for relatedness involves "developing secure and satisfying connections with others in one's social milieu" (p. 327). Deci and Ryan [1985] propose that controlling strategies cause a student to feel less independent or autonomous which produces an extrinsic motivational orientation and conclude that an approach that promotes autonomy and student independence induces a more intrinsic orientation [Ryan and Deci 2004]. In this sense, perceived personal control, on the part of the participant, is an important factor that influences intrinsic motivation [Cordova and Lepper 1996; Lepper and Chabay 1985].

Other authors have extended beyond aspects of self-determination and control in the study of intrinsic motivation. For example, Lepper [1988], concluded that challenge and curiosity as well as control are components of a task that positively influence intrinsic motivation. Hutchins [1995], included engagement as a basic element of effective education in intrinsically motivating settings. Challenge, curiosity, engagement, and control consistently emerge as salient considerations in examining the intrinsic motivating effect of e-learning activities and supporting technology [Martens et al. 2004; Rosenberg 2000].

- An activity is intrinsically motivating if it provides a challenge to the participant. Lepper [1988], contends that learning to master information that is at least of intermediate difficulty is challenging and may quite possibly bring about feelings of self-efficacy and enhanced levels of intrinsic motivation [Deng et al. 2004].
- An activity is also intrinsically motivating if it stimulates curiosity. Rieber [1991], believes that curiosity can be stimulated with activities that are new or of moderate complexity. It seems that activities that are new and moderately complex also tend to be challenging, which would reinforce an increase in intrinsic motivation [Kashdan and Fincham 2004].
- Engagement research has addressed how learning activities can be structured to promote student motivation (challenge, choice, and efficacy). Giving students choices about what tasks to engage in enhances intrinsic motivation among the students [Reeve et al. 2003; Zuckerman et al. 1978]. Additionally, students need to learn by engaging in learning activities that are interesting and meaningful to them. When students engage in activities that require a high degree of intellectual engagement, they not only increase their chances (expectancy) of achieving this goal, but they also recognize the value of achieving this goal.
- Finally, when individuals are given perceived personal control over their fate and environment, intrinsic motivation and self-determination are likely to increase [Lepper and Chabay 1985]. Therefore, when individuals are given the opportunity to choose or manipulate their environment, they are more likely to continue to engage in the educational program. Also, when they are permitted to work at their own pace, intrinsic motivation will probably increase [Whitehall and McDonald 1993].

Research has been conducted on the constructs of challenge, control, curiosity, and fantasy within the context of Web-based learning environments [Wang and Reeves 2006]. Results indicate that instructional design that includes these factors can improve student motivation. Much of the analysis of this area includes problem-based learning (PBL), which has also been adopted as a mindset in the design of the course being investigated in this study.

In conclusion, it has been shown that students who report possessing higher levels of intrinsic motivation have significantly higher academic achievement and more favorable perceptions of their academic competence, regardless of their academic ability [Gottfried 1985; Gottfried 1990]. Students with higher levels of academic motivation have lower levels of anxiety and more favorable perceptions of their competence. According to Deci and Ryan [1980], increased conceptual learning, creativity, flexibility, positive emotional health, and higher self-esteem have all been associated with intrinsically motivated activity. When intrinsically motivated, students tend to employ strategies that demand more effort and that enables them to process information more deeply [Lepper and Malone 1987]. Condry and Chambers [1978] found that when students were confronted with complex intellectual tasks, those with intrinsic orientation used more logical information-gathering and decision-making strategies than did students who were extrinsically oriented. All said, there is considerable encouragement for developers of information systems supporting e-learning to actively address aspects of intrinsic motivation [Martens et al. 2004].

III. IMBA BACKGROUND

Teaching institutions are making increasing use of online or collaborative technologies. In fact, institutions also make use of real-time online classrooms and easily accessible forums to provide for increasing demands upon students and educators alike [Ocker and Yaverbaum 2002]). It is important that an appropriate pedagogy should be adopted and applied to the technologies in order to create meaningful learning [Liedner and Jarvenpaa 1995]. However, there is a danger that traditional pedagogies will be applied inappropriately to modern technologies [Teo et al. 2006]. Understanding how students are motivated during online courses will enable an understanding of how to make better use of the technological support.

City University's Interactive Master of Business Administration (iMBA), offered in partnership with Pacific Century CyberWorks (PCCW), was the first academic program in Hong Kong being delivered via the broadband Internet and is now in its twelfth intake. This information-rich, interactive delivery medium allows participants the flexibility to study at a time and place that best fits their schedules and learning needs. Students of the iMBA program in the Faculty of Business at City University of Hong Kong are aware that the emphasis of this program is on interactive learning, not to be confused with distance learning since it offers much more interaction than a text-based program. The part-time students are experienced in the use of online support technology and, by nature of the program, have considerable latitude in learning choice and timing. They are all employed and have to balance busy working lives with their studies.

Details of the iMBA mission statement, goals of the program, courses offered and general description are available at http://www.imba.cityu.edu.hk/. ISV5003 is a course on Global Information Systems in which there are six prescribed learning activities: watching video lectures on the internet, attending online tutorials, attending on-campus tutorials, participating in Web board discussions, submitting an individual project, and taking a final examination. An initial face-to-face orientation gives participants a brief "'hands on" introduction to the technologies to be used. They are also introduced to the general operation of the program: the lectures are segmented and accessed via broadband streaming video. Most tutorials are "virtual" and led by a tutor (not the instructor giving the lecture) using voice and Web "chat" facilities. All of the course material is online with video accompanied by PowerPoint slides. The assessment consists of participation and a project plus the exam. The marking scheme consists of: 50 percent exam, 15 percent participation (Virtual Tutorial and asynchronous WebBoard) and 35 percent assignments.

The selection of this course was based on the following criteria: First, this course provided a rich opportunity for applying technology support to the learning environment. Second, the learning activities as prescribed previously were structured into the design and organization of the course. Third, these technology-supported learning activities could be utilized for understanding the affects it has on intrinsic motivation.

IV. RESEARCH APPROACH

A qualitative interview-based approach was taken in this research to assist in answering our research question, i.e., how learning activities and technologies affect intrinsic motivation in an online learning environment. Based on a review of intrinsic motivation literature, a case study protocol was designed. This case study protocol was developed from a combined literature review and research question. The interview protocol minimized bias by providing a basis for a consistent sequence and approach to interviews. This was done by adopting consistent wording for the applicable questions and by asking each question in the same way to each participant to minimize bias.

A theoretical interpretive model was applied and the findings of the literature review were mapped to the respective constructs according to case study research methods [Yin 1994]. The student reflections that were measured using this research method serve as an important element of the assessment process, since they penetrate into dynamic issues surrounding the interaction process in the technology-supported learning environment. An embedded units design as illustrated in Table 1 was employed to enable comparison within and between cohorts to seek to examine both individual and group effects.

Two cohorts from an iMBA required course (Global Information Systems) taught by the same instructor and tutor were chosen for the study. Trimester 1 had 10 students and trimester 2 had 11 students. Students of the iMBA program in the Faculty of Business at City University of Hong Kong program constituted a large pool of available interviewees that fit well within the context and purpose of this study. Interviewing a student sample from the ISV5003 course helped cast a wider net in the data collection stage, helped to cross-check data and served, "as a strategy that added rigor, breadth and depth to [the] investigation" [Denzin and Lincoln 1994]. For this study,

six students (three from each cohort) were interviewed over a two-week period. A number of six interviews appeared to be reasonable, both with respect to the goals of this study and the feasibility involved.

Table 1. Embedded Units Design

Trimester 1			**Trimester 2**		
Cohort Trimester Characteristics			Cohort Trimester Characteristics		
(1A)	(1B)	(1C)	(2A)	(2B)	(2C)
Individual Characteristics	Individual Characteristics	Individual Characteristics	Individual Characteristics	Individual Characteristics	Individual Characteristics

The procedures used for conducting the interviews were performed as follows: Participants were scheduled for a 60-minute session in a private room. They were then asked to read and sign the informed consent form and asked if they had any pertinent questions for the researcher. The description of the research was read, which allowed for the participant to ask any questions to clarify the nature of the study and his or her expectations for participation. Following the project description, participants were asked a series of open-ended questions in a semi-structured format from the interview guide. If a question did not apply in the context of a particular participant, we skipped to the applicable question. Participants were encouraged to describe situations in significant detail and were asked follow-up questions to draw emerging meanings [Rubin and Rubin 1995].

V. CASE STUDY MEASURES

The research question in focus is "How do learning activities and technologies affect intrinsic motivation in an online learning environment?" We believe that the interactive nature of the learning activities coupled with technological support may affect intrinsically motivated behavior of an individual. A semi-structured interview outline was developed to examine how students' intrinsic motivation is affected by the constructs of challenge, control, curiosity, and engagement, chosen from the literature previously described. Measures were developed for each of the following constructs covered in the interviews:

1. **Challenge:** Questions relating to individual perceived challenge were asked, such as the extent to which the learning activities raised levels of difficulties and whether the structure of the activities provided "conquerable" challenges or not. The following four measures are factors affecting the level of challenge among the related activities based on the literature [e.g., Lepper 1988]. Challenge is measured by the extent to which these factors are present or not.

Goal Attainment	List of requirements to be met when addressing challenging tasks or activities.
Competence	Competence is the ability to find, evaluate, use and communicate information. The integration of literacy, critical thinking and communication skills may foster and maintain students' intrinsic motivation.
Capability	The potential ability of students that enables them to see perspectives and to construct knowledge. Capability may activate and maintain students' intrinsic motivation and

	mastery goal orientation.
Difficulty	The organization of materials or activity on an increasing level of difficulty; that is, structure the learning material or activity to provide a "conquerable" challenge.

2. **Curiosity:** Questions relating to individual perceived curiosity were asked, such as the extent to which the related activities promoted the ability of an individual to investigate, study, or analyze, look into or explore, etc. The five measures following are designated as factors affecting the level of curiosity among the related activities based on literature [Rieber 1991]. Curiosity is measured by the extent to which these factors are present or not.

Interesting	Tasks or activities that are demanding to the extent that they engage the attention or arouse the curiosity of the student.
Attractive	The degree of influence the student has in evoking pleasure and stressing the appeal of the online task or activity.
Exploratory	The potential ability of students to investigate, study, or analyze**:** look into and explore the relationship between the task and their learning ability.
Motivating	Tasks or activities that invite or impel a student to perform to his or her full capacity.
Encouraging	Suggests the raising of one's confidence sufficient enough to overcome the timidity or reluctance towards a task or activity. (i.e., the use of WebBoard).

3. **Engagement:** Questions relating to individual perceived engagement were asked, such as the extent to which the related activities provided an individual with the extent to which he or she shared his or her knowledge, the ability to participate and degree to which he or she participated in the activity. The four measures following are designated as factors affecting the level of engagement among the related activities based on literature [e.g., Zuckerman et al. 1978]. Engagement is measured by the extent to which these factors are present or not.

Participation	The ability of students to take part in an undertaking, activity or discussion and/or experience something along with others.
Involvement	The degree to which the student engages as a participant or commits him/herself to a task or activity.
Collaboration	The ability of students to work jointly with others or together in an intellectual endeavor in their respective task or activity.
Sharing	The extent to which one experiences with others or distributes (shares) his/her knowledge, expertise or skills with other participants in a task or activity.

4. **Control:** Questions relating to individual perceived control were asked, such as the extent to which the online discussions provided an individual with choices in terms of selection, efficiency, effectiveness, and preference. The four measures following are recognized as especially relevant factors affecting the level of control among the related activities [e.g., Deci and Ryan 1985; Whitehall and McDonald 1993; Cordoba and Lepper 1996]. Control is measured by the extent to which these factors are present or not.

Selection	The opportunity or privilege of students to choose freely which may require an exercise of judgment in their respective task or activity.
Efficiency	The degree to which the student is productive or produces a desired effect in a task or activity.
Effectiveness	The degree to which a student produces a decided, decisive, or desired effect or result.
Preference	The extent to which a student brings forward for consideration or gives favorable priority or opportunity of choosing.

The interview questions were generated using the constructs in the literature review. Individual students with acceptable English skills were selected to be interviewed from the ISV5003 course. The objective was to interview them with a motive to explore the influence of the online discussions relative to each intrinsic motivation construct. Semi-structured interviews were used with leading open-ended questions, so that participants were able to reflect on the meaning of their experiences during the interviews and thus engage themselves in a deeper exploration of the ascribed meaning of their motivational behaviors.

VI. DATA ANALYSIS PROCEDURES

In our data analysis, information was represented in the form of matrices that displayed information (tabular information showing relationships among categories of information) in a spatial format, thereby presenting that information systematically to the reader [Miles and Huberman 1984] and enabling the identification of the coding procedures to be used in order to reduce information to themes/categories [Tesch 1990]. The stages of the coding process (Figure 1) are shown as follows.

Coding was guided by a coding scheme that was derived from constructs and ideas found in the relevant literature (a so-called start-list of codes). Data refinement included selecting and thus simplifying the data that appeared in the transcriptions. The objective was to code the categories and group and organize these categories, so that conclusions could be reasonably drawn and verified. Data were displayed in matrices and charts (see Table 2 for example), thereby illustrating the patterns and findings from the data.

Analysis and coding of the data transcript, presented in matrices and displays, were used to visualize and represent the data, thus enabling further discovery of patterns in the issues raised by the participants. Finally, the comprehensive findings resulting from the analysis were summarized. This included developing initial thoughts about patterns and explanations from the findings, verifying them constantly by checking the data and forming a new matrix. It is through this process that the validity of the data were established and the meanings of our findings emerged [Miles and Huberman 1984]. Our analysis strategy was to analyze each embedded unit (e.g., a particular student from a cohort) followed by a look across all units in one cohort. We then compared across cohorts to examine higher-level group characteristics to explain differences between cohorts.

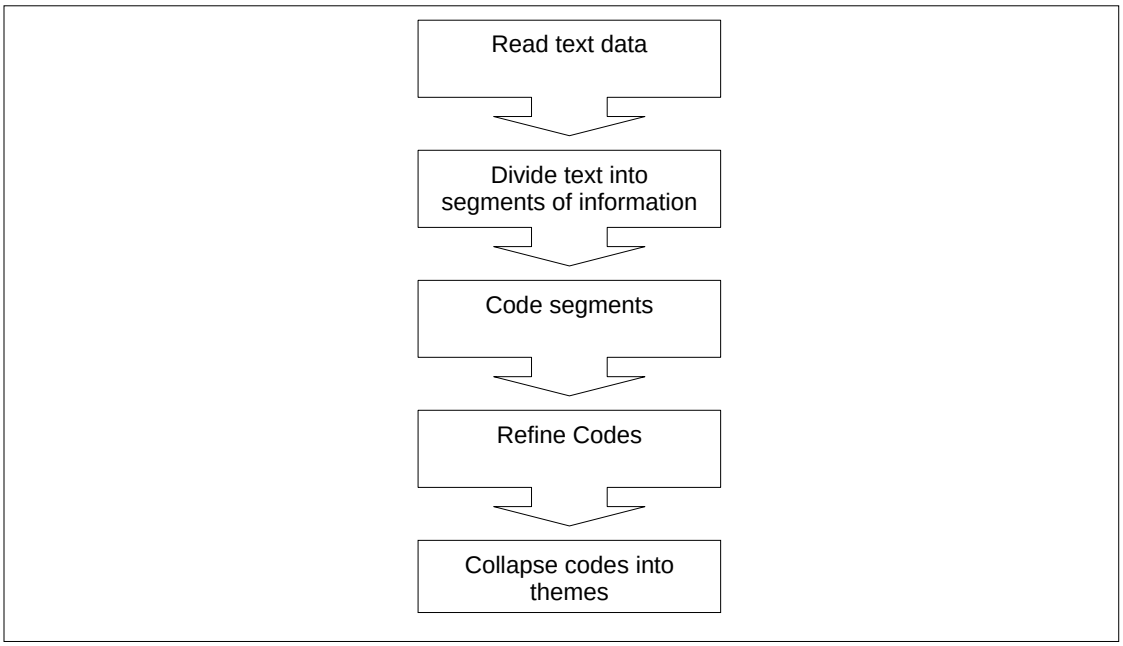

Figure 1. Coding Process

Table 2. Classification for Coding of Interview Responses

Construct/Concept	**Code**	**Measure**	**Sub-Code**
1. Challenge	CH	Goal Attainment	CH-GOA-XX
		Competence	CH-COM-XX
		Capability	CH-CAP-XX
		Difficulty	CH-IMP-XX
2. Curiosity	CU	Interesting	CU-INT-XX
		Attractive	CU-ATR-XX
		Exploratory	CU-EXP-XX
		Motivating	CU-MOT-XX
		Encouraging	CU-ENC-XX
3. Engagement	EN	Participation	EN-PAR-XX
		Involvement	EN-INV-XX
		Collaboration	EN-COL-XX
		Sharing	EN-SHA-XX

4. Control	CO	Selection	CO-SEL-XX
		Efficiency	CO-EFY-XX
		Effectiveness	CO-EFF-XX
		Preference	CO-PRE-XX

XX=Related Activities (Face-to-face tutorials, online tutorials, video lectures, WebBoard discussion, individual project and examination)

VII. RESULTS

Our results are summarized in Table 3 aligned with the embedded units design with "+" and "-" indicating positive and negative comments respectively based on the coding scheme illustrated in Table 2. For example, "+CH" under "(2A)" indicates a positively related comment from interviewee "A" in cohort "2" with respect to the "challenge (CH)" construct with regard to the "video lectures" learning activity. Similarly, "-CH" under (1B) indicates that interviewee B from cohort 1 made a negative comment with respect to "challenge (CH)" with regard to the video lectures. Note that both positive and negative comments can occur on the same issue e.g., +CU / -. An example is quoted as follows, relating to a comment from an interviewee about her feeling of curiosity in the online tutorial:

> *I think sometimes . . . for example I've taken four classes and now I'm taking two . . . so basically six, right? Half of the classes I think have been quite interesting because of the classmates and the tutor . . . and some others I don't think so because the classmates don't react and the tutor seems boring. I really like the classmates if they have lots of experience from which I can learn from them and also I can contribute. If I feel I can't contribute I just feel bored.*

Based on this comment, it can be seen that the interviewee thinks the online tutorial is interesting sometimes but may also be boring at other times. Therefore, in our coding result, both positive and negative attitudes were recorded.

Overview (Both Semesters)							
	VL	FtFT	OT	WebBoard	IP	Exam	Total
CU	+3	+4	+2	+3	+5	+2	+19
EN	+3	+1	+3	+3	+3	+1	+14
CO	+6	0	+3	+1	0	+3	+13
CH	-1	0	0	0	+2	+3	+4

If we examine the issue from the four primary constructs previously discussed as illustrated in Table 3 we find that:

- **Curiosity** was relatively uniform over the six learning activities albeit with increased mention in the individual project, especially with regard to interest and somewhat less so (not surprisingly) for the examination. Attractive followed interest in mention with regard to curiosity. For example one student noted "So I think it does prod you to go in a direction you may not necessarily think of but it does help you in synthesizing a lot of that sort of information together."

  When activities heighten curiosity, then an individual is naturally involved and driven to learn because his or her intrinsic motivation is increased. If curiosity is to be stimulated,

the role of the environment is to provide an individual with activities/opportunities to explore. Thus, online tutorials can stimulate curiosity because the different dialogues and interaction patterns within the online tutorials are conducive to facilitating effective communication and learner stimulation.

The online tutorials may increase individual interest because the task of engaging in a discussion, for example, is novel and may lure the participant into action (i.e., entice or intrigue them). A variety of characteristics have also been associated with interest: (1) New, different, unusual materials, tasks or situations; (2) High activity levels of emotional content; (3) Information an individual can easily follow.

Table 3. Summarized Results

Learning Activities	***Trimester 1***			***Trimester 2***		
	Cohort Trimester Characteristics			***Cohort Trimester Characteristics***		
	(1A)	(1B)	(1C)	(2A)	(2B)	(2C)
Video Lectures	+CO +CU	+CO -CH -CU	+CO	+CH +CO +CU +EN	+CO +CU +EN -CH	+CO +CU +EN
Face to Face Tutorial	+CH +CO +EN -EN	+CU -CH -CO	+CO +CU +EN	+CH +CU -CO -EN	+CO +EN -CH	+CU -CO
Online Tutorial	-CU -EN	+CH +CO / -CO +CU / -CU +EN		+CO +CU +EN -CH	+CO +CU +EN	+CO +CU +EN
WebBoard	+CO / -CO +CU	+CO -CU +EN -CH	+EN	+CO +CU +EN	+CU -CO	+CH +CU
Individual Project	+CU +EN -CO	+CH +CU +EN -CO	+CO -CH	+CH +CO +CU +EN	+CH +CU	+CU

- **Engagement** was primarily reflected in working together (e.g., collaboration, sharing, involvement, and participation) especially in the online tutorial. Needless to say, the exam was not seen as particularly engaging in this regard. The WebBoard was also generally seen as engaging with special attributes of participation and involvement albeit with some occasional prodding from the tutor. For example, "On some of the Web board activities that we did there were a few classes where the course tutor literally demanded our participation. Literally, we were assigned to answer specific questions and other students were assigned to critique it. It was a very useful way of doing it."

  The online tutorials seemed to encourage engagement by providing an electronic medium that allowed for greater participation in the learning process and increased the contribution of information between participants. The use of online tutorials enabled subjects to respond to each other's questions more freely without the constant visual presence of an "authority figure" and therefore encouraged the construction of knowledge through discussion, analysis and collaboration, with an approach that the face-to-face tutorials found hard to achieve.

- **Control** is especially recognized in video lectures and online tutorials which makes particular sense given the ability of students to choose which video segments to view and for how long and the more passive nature of the facilitator in the online tutorials. As one student noted "You can bring up other issues that hopefully is related . . . and you don't want . . . you know . . . just all over the place . . . but there is a lot of latitude to bring that up." This was not the case in the face-to-face tutorials where the instructor was more actively directing the session and providing content and clarification as noted by the negative reflections on control in that learning activity.

  Online tutorials may increase individual choice because the interactive online nature of the tutorials increases individual volition, that is, it provides a sense of unpressured willingness to engage in the activity. For example, if an individual believes that he or she is engaged in online tutorial, because he or she chose to be involved, that individual is more likely to continue to value it. The interactive nature of online tutorials gives an individual choice in terms of how much he or she can participate in the topic of discussion or the choice of which discussions to engage in.

- **Challenge** is especially recognized in the individual project and examination and to some extent in the face-to-face tutorials and less so in the other learning activities. As noted by one student, "I found it challenging because again . . . you're up against your own organization on a day-to-day basis and as a manager . . . you know . . . it's your responsibility to try and solve these problems." Challenge as a construct of intrinsic motivation, however, was easily confused by the students and warrants considerable clarification in further studies.

  Interactions around meaningful texts challenge individual participants' views, permits multiple views to be made visible, and incites a deeper and more sustained understanding of the topic of discussion. Individual participants may find the interactive nature of the online discussions challenging as it allows them to post and reply to messages, create new online threads and customize the online discussion environment. At a more complex level, they may also find it challenging to overcome an initial reluctance in the relatively more permanent (than face-to-face tutorials) environment of an online tutorial.

  Hence, an individual may be challenged when he or she perceives the challenge(s) of the online tutorial to be balanced with his or her ability to do the task. Online tutorials may provide challenges because they facilitate individual learner stimulation and facilitate communication through interaction and collaboration. The collaborative nature of the online tutorials enables individual students to learn from each other, ensuring that they

benefit from participation by engaging in a rich dialogue that taps into their higher-order thinking levels of analysis, application, synthesis, and evaluation.

Students were also asked to comment on the technologies applied in the iMBA program. As noted in Appendix I, the questions included the problems encountered and participation assistance in discussions when using technology adopted in the program as well as the control and choice of technology students perceived in performing the iMBA learning activities. The results illustrated that students especially appreciated the convenience to attend or participate wherever they were. While most of them found no major problem and felt comfortable with using the technologies adopted in the program, some experienced problems regarding transmission quality. For example, ". . . I guess with the network speed, network bandwidth etc . . . but that does seriously detract because what tends to happen is that you get garbled communication." Although a variety of technological options were available, students did not feel a high degree of control or choice regarding technology e.g., "there's not been a lot of choice . . . A lot of that sort of technology has been defined."

An additional set of questions encouraged the students to compare and contrast the six different learning activities, half of which had high degrees of technology support (i.e., watching video lectures on the Internet, attending online tutorials, and participating in Web board discussions) and half of which had relatively low levels of technology support (i.e., attending on-campus tutorials, submitting an individual project, and taking a final examination). Our objective here (as detailed in Appendix I) was to encourage the students to identify which activities excelled (which were least effective) in supporting the intrinsic motivation constructs as previously noted (i.e., challenge, control, curiosity, and engagement). Opinions were varied among the students. For example, some students felt the online and face-to-face tutorial provided the most choice and control even though the participation time was fixed. As one of them noted "probably the online tutorial . . . in terms of . . . you know . . . some of the discussion topics that you might bring up as long as they were related. Second would be with respect to even the face-to-face tutorials. Again, you're free to bring up related topics or other things." But some other students felt the face-to-face tutorial provided the least control because they had to come back to the campus to participate. These mixed reactions occurred in part because of differences in relative importance on the constraints of timing versus the relative freedom to engage more freely in verbal less-structured contexts. Overall, the results were somewhat mixed albeit with some emergent trends:

- Watching video lectures on the Internet was consistently recognized as providing the highest degree of choice and control since students could choose which portions to watch at any time of their choosing. Similar feeling existed with respect to the individual project. Least choice and control was divided between those activities requiring the students to adhere to a fixed time (i.e., the tutorials) as well as the WebBoard, which some felt was overly structured with boring topics and, obviously, required writing.
- Most students found attending online tutorials and attending on-campus tutorials most intriguing given the rich nature of the discussions and the more personal interactions with each other and the tutor, as well as the instructor. These forms of synchronous activity were more familiar to them and gave them ample opportunity to influence the direction of the topic discussion. The face-to-face tutorials also occurred only three times during the course and remained a more novel and intriguing experience relative to activities where they engaged from different places and times.
- The students also found themselves generally more engaged in the face-to-face tutorial that gave them the highest level of bandwidth and engagement without technological interference or blockage. The WebBoard and exam were generally deemed least engaging. The WebBoard, in particular, was condemned for being not particularly user friendly and students were generally less involved accordingly. A particular problem with the WebBoard was its detachment from the other online activities, i.e., students had to enter a separate area in the learning space and log on again.
- Students noted the exam to be the most challenging activity which is not surprising given the lack of control, i.e., they had a relatively fixed amount of time and were constrained to

a fixed date and place. They also had no choice in the design of the exam and its questions, although they did have some latitude in choosing which four of five essay questions to answer. As might be expected, exams were overall the least intrinsically motivating of the six learning activities with other reflections on learning activities more a function of individual and cohort characteristics.

In general, those activities that were supported by richer multimedia technologies (i.e., watching video lectures on the Internet and attending online tutorials) fared best in terms of being intrinsically motivating. The high degree of choice and control over which video segments to watch (and when) plus choice and control over accompanying PowerPoint slides as well as the simultaneous availability and choice of verbal and/or text with live video in the online tutorial were especially appreciated. On the other hand, the more benign technology characteristics of the WebBoard (i.e., text-only threaded discussions) plus its lack of coupling and integration with other activities rendered it less motivating.

VIII. DISCUSSION

As is often the case, this research has raised more questions than it has answered. Aspects of technology and learning activities and characteristics of the cohort and development from a small group communication/collaboration perspective all interact in an online learning environment. Some of these interactions are supportive and synergistic while others are less so and, on occasion, confounding by nature. For example, technologically imposed barriers to interpersonal communication can frustrate some group development but can accentuate others. A gregarious student with good command of English can easily engage in verbal discussion and may be frustrated by technological limitations, but a shy student with poorer communication skills might find technological asynchronous support to provide openings for discussion that otherwise might not occur. Given the same instructor, tutor, and set of learning activities, each cohort tends to develop its own personality reflecting characteristics of group members as well as an emerging dynamic of enhance interpersonal communication as a result in group interaction. This cohort characteristic may, in turn, influence the degree of success with different learning activities. For example, a supportive cohort dynamic can favor synchronous learning activities while a more antagonistic cohort dynamic favors more independent and individually oriented learning activities.

The situation is indeed complex. There are, however, some data that give rise to speculation on our research question, i.e., how learning activities and technologies affect intrinsic motivation in an online learning environment. Ultimately, each learning activity carries with it support for some constructs and less for others both within and between cohorts. For example, video lectures are noted for control in terms of student ability to choose segments and duration but not particularly for challenge. Face-to-face tutorials invoked curiosity but were seen by some students as less controllable given the more dominant nature of the instructor, who was also heavily featured in the video lectures. On the other hand, online tutorials were seen as both highly controllable and engaging due, in part to the more passive facilitative nature of the tutor who ran that learning activity. The WebBoard was less prominent in the intrinsic motivation constructs but was a distinguishing characteristic between cohorts in terms of degree of engagement. The individual project was seen as challenging and invoking curiosity but less open to control as was the case with the exam.

In general, simple and easy-to-use technology can help induce intrinsic motivation since students do not need to spend much time to learn it and can handle it better. The degree of control of technology settings, in fact, may not directly relate to the intrinsic motivation of students. If students have to spend too much (and perceived unnecessary) effort, technology flexibility may be distracting. On the other hand, if students are frustrated by the default settings and are further unable to change them, their acceptance and use of the technology can go down markedly. The key to success appears to be a well-thought-out easy-to-use interface with sufficient interactions with students to create generally acceptable default settings while enabling a high degree of

change for those students who are frustrated or just interested in trying different things. Further, commonly used tools (e.g., the Web) can assist in creating the “any time/any place” environment for online learning that facilitates convenience in student adoption.

Characteristics of the technology impact learning activities individually and collectively. Watching video lectures on the Internet provides degrees of freedom in place and time and choice that are otherwise unattainable through television, as an example. The video lectures were separated into segments to further enable organization and selective access. The iMBA lectures were initially offered on interactive television but the poorer performance in switching between lecture segments coupled with the more restrictive access of television relative to “any time/any place” Web access saw use of interactive television fall into disuse and eventual discontinuation. However, Web transmission quality is a great concern in online learning as it highly affects the communication between participants. Higher bandwidth provides higher video-streaming performance and lowers “jerkiness” and general distraction but also may limit access. In general, we find audio quality more important than video quality and prefer graceful degradation such that use over both broadband and modem is possible. In the extreme, decent audio with fixed screen video with only periodic updates, especially when accompanied by files of individually controlled PowerPoint slides, is very acceptable although the desirability of more full-motion audio, video and data remains high.

Online tutorials, on-campus tutorials and Web board discussions interact in an interesting fashion as a function of technological characteristics. On-campus tutorials remain a robust and well-accepted form of interaction (which should be heartening to traditional instructors). However, the success of on-campus tutorials, in part, is a result of lower frequency of occurrence as well as technological shortcomings of online tutorials and web board discussions. Online tutorial technology is in its infancy and subject to audio and video limitations as well as cumbersome control structures. The result is student and tutor frustration and stilted interaction. WebBoard discussions suffer when not linked seamlessly to video lecture segments and also have interface quirks and tend to make relatively poor use of existing screen space but do have the advantage of allowing students to more thoughtfully compose responses without the time pressure of synchronous interaction. We suggest this gap between face-to-face and online interactions will narrow in the future as technology improves and students feel less inhibited (and have more control) in its use. As such, instructors and tutors will have to make more creative (and possibly less frequent) use of face-to-face tutorials as students feel better supported and able to sustain better educational and social interaction in distributed contexts.

Although we feel that this discussion reflects the dynamics of the cohorts we evaluated, we hesitate to generalize to broader populations. By nature, the iMBA program attracts graduate students whose primary motivation (and willingness to pay higher fees) is oriented around the flexibility that the program enables. For the most part, this is a result of workplace demands. Students in the iMBA program typically travel often and require education scheduling flexibility. In our experience, the students are typically more mature and seasoned in personal time management than our normal MBA cohorts. We suspect that this generates higher levels of intrinsic motivation (especially in conjunction with those activities that exhibit high levels of flexibility) than might otherwise be experienced. Having said that, we also note that these students truly do enjoy being together and socializing, especially in the context of on-campus tutorials. We suspect as well, however, that this enthusiasm would dim if the on-campus tutorials were held every week rather than only three times during the semester.

EXTENSION TO UBIQUITOUS E-LEARNING

Ubiquitous computing connotes anytime, anywhere computing so convenient that it becomes transparent, i.e., existing and found everywhere. It provides personal convenience and has the potential to change everyday life routines through support of value-added activities as perceived by users. As previously noted, our students wanted more technological choice in e-learning. In striving to narrow the gap between face-to-face and online interactions and give students more choice and control, our recent activities have focused on providing value-added educational

activities using mobile devices, e.g., mobile PDAs and "smart" phones. In this sense we are making use of "niche" time, time that otherwise might be wasted or could be used for some purpose. For example, some look for ways to "kill" time during commuting travel while others look to make productive use of travel time. Similar situations exist around meal times as well as various times during the day in which diversion is sought from a primary activity.

We have begun to create applications to run on mobile devices to support ubiquitous e-learning that are both extensions of existing capabilities as well as exploring new opportunities e.g., in "edutainment." An example of extension of existing capabilities is using a mobile device to access audio and streaming video and stored text. To extend existing capabilities, we have developed individual as well as collaborative learning activities intended to use "niche" time and take advantage of having mobile devices continuously accessible by students [Vogel et al. 2007]. An example of use of "niche" time is a crossword puzzle that runs on a mobile device that can help students learn vocabulary and concepts associated with a particular topic e.g., group support systems. An example of a collaborative learning activity is a mobile PDA/SmartPhone-based application that encourages student sharing of experiences as they travel and interact with cultures around the world in business contexts. Students record information including on-the-spot pictures to document their experiences. Both individuals and teams are rewarded for demonstrated interest on the part of other students.

These applications were created based on our *i*MBA program findings regarding intrinsic motivation and recognized shortcomings in more stationary computing technology access. In this regard:

- **Challenge** is enhanced as students are pushed to attain goals and learn new things in non-traditional fashions. However, with a range of activities, students need not feel that the "bar" is set so high that results are unachievable which has a noted de-motivating effect.
- **Curiosity** is enhanced as students explore new ways of learning in settings outside the scope of traditional classrooms or even home or business office locals. This becomes appealing as students explore the relationship between the task and their learning ability in these various settings.
- **Engagement** is enhanced as students are able to more personally relate to learning activities especially as they are blended into other activities, e.g., business and social interactions. This is particularly salient in circumstances of rapid feedback and distributed collaboration.
- **Control** is enhanced as students can more readily choose from stationary as well as more mobile access and additionally benefit from the personalization of interfaces and wide range of choice of mobile PDAs and "smart" phones that are penetrating the market literally on a daily basis.

Reaction to early prototypes has been positive [Vogel et al. 2007]. Students certainly recognize the degree of control they attain through use of personal devices and further tend to stay more engaged in a variety of applications. Their curiosity and the challenge posed by these new ways of learning are plainly visible as they participate in learning activities. Toward this end, we feel that ubiquitous e-learning has an important role to play in student intrinsic motivation as they enjoy the benefits of both local touch and global reach and have anytime/anyplace access to learning resources and activities.

IX. CONCLUSION

In this paper, we have sought to examine how students' intrinsic motivation is affected by the constructs of challenge, control, curiosity, and engagement in the context of learning activities in an online MBA program. Six in-depth interviews were held with students that were subsequently analyzed using a qualitative coding-based approach. Upon reflection, we recognize that individual student characteristics and choices as well as emergent group discussion dynamics all mix

together to provide learning elements and opportunities conducive to encouraging intrinsic motivation. Ultimately, we suggest that no one form of technological support or learning activity is a panacea. Overall, it would appear at this point that a pedagogically driven portfolio of learning activities supported by well-selected and integrated audio, video, and data technologies is important in creating an environment conducive to intrinsic motivation but we can say little more. Creating an effective learning environment requires balancing the desires of the students against constraints imposed by nature of the program and delivery approach [Gulikers et al. 2005; Swan 2003]. Toward this end we seek to achieve a socio-technological fit that best meets of a broad range of stakeholders. Technology provides degrees of freedom that enable the creation of a wide range of learning activities for different learning styles. It moves us in the direction of intrinsically motivating "have it your way" learning rather than "have it our way" education albeit under an umbrella of institutional and societal expectations. Numerous opportunities exist for further research.

APPENDIX I. STUDENT INTERVIEW WORKSHEET

DEMOGRAPHICS

Personal information (introduction icebreaker)

1. Can you give me a brief overview of your occupation?
2. What general aspects of education do you find most interesting?

THE IMBA PROGRAM IN GENERAL

1. In general, why did you choose to study the iMBA program (mainly taught online) instead of the traditional MBA program taught entirely face-to-face?
2. What are your iMBA program expectations? Does this differ from that which you might expect in a traditional MBA program?
3. After you started the iMBA program, did you find these differences consistent with what you initially expected?

FACE-TO-FACE TUTORIAL (ON CAMPUS)

1. To what extent do you feel you can exercise control in the face-to-face environment of the iMBA program (i.e., making choices, directing discussion, deciding when to participate)? Could you please describe a real class situation?
2. Did you encounter any challenges in fulfilling the requirements of the on- campus tutorial (i.e., participation, discussion, etc.)?
3. What kind of things captured your interest in the face-to-face tutorial activities? Could you please provide an example?
4. Does the arrangement of activities in the face-to-face tutorial affect your desire to participate? How?

ONLINE TUTORIAL

1. To what extent did you feel that the online tutorial was challenging for you personally?
2. How effective was the online tutorial in creating interest in the subject?
3. To what extent can you choose when and what to discuss in the online tutorial?
4. What do you think your role was in the online tutorial (e.g., a passive knowledge receiver who seldom joined in the discussion or an active participant eager to lead the discussion)?
5. How did you contribute to the discussion in the online tutorial?
6. To what extent do you think the instructor and other group members provided effective feedback in the online tutorials?

VIDEO LECTURE

1. How did the video lectures affect your interest in the subject?

2. To what extend did you feel that the video lectures were challenging? How much did you feel they helped you meet course requirements?
3. How much choice did you feel you had in selecting video lectures?
4. To what extent did the video lectures keep you engaged?

WEBBOARD

1. What kind of problems did you experience with WebBoard and how were you able to overcome these problems? In what areas did you feel most comfortable or least comfortable concerning the use of WebBoard?
2. What aspects of WebBoard captured your interest? What aspects of WebBoard messages made you probe and explore? Please give examples.
3. What encouraged you to engage in WebBoard discussion and how involved did you feel when using it? To what degree did you stay involved in WebBoard discussions?
4. How well did you cooperate with group members in WebBoard recognizing there weren't physically present? What degree of choice and control did you feel you had in WebBoard discussions? Can you give examples?

INDIVIDUAL PROJECT

1. How do you feel about the degree of control and choice you had in selecting the topic of the project?
2. Did the individual project encourage you to explore a variety of issues that you might not have otherwise considered? What are some specific examples?
3. How effective was the individual project in keeping you engaged in applying learning from the course?
4. Did you find the individual project challenging? Explain.

EXAMINATION

1. Did you feel that you could exercise choice in how you answered exam questions?
2. Did you feel that the exam was challenging? Explain.
3. To what extent did the exam keep you engaged in thinking about how you could apply the course material to personally relevant situations?
4. Did the exam arouse your curiosity about the topics being addressed?

TECHNOLOGY APPLICATION IN THE IMBA PROGRAM

1. What particular problems did you encounter in using the technology in the iMBA program (includes WebBoard, online learning software and lecture video)?
2. In what ways did the technology provided in the iMBA program assist you in participating in the learning activities?
3. How much technology application control and choice did you have in performing learning activities over the duration of the course?

Comparison and contrast of different activities (i.e., face-to-face tutorial, online tutorial, video lecture, Web board discussion, individual project and exam)

1. Over which activity did you feel find you had the most choice and control? Least choice and control? Why? What about the other activities?
2. Which activity did you find most intriguing / least intriguing? Why?
3. Which activity did you find most engaging and involved? Least engaged and involved? Why?
4. Which activity did you find the most challenging? Least challenging? Why?

FINAL COMMENTS

1. Overall, how self-motivated were you during the course? Can you provide some examples?
2. Are there any other things you would like to add or comment upon?

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