The Effects of Flow on Learning Outcomes in an Online Information Management Course

Don Rossin
Young K. Ro
Barbara D. Klein
Yi Maggie Guo
Management Studies
University of Michigan-Dearborn
Dearborn, MI 48126, USA

ABSTRACT

As online courses and programs expand in business schools, it becomes increasingly important to understand the link between students' experiences in these courses and learning outcomes. The study reported here investigates the relationship between students' experiences of flow, a psychological state generally associated with improved task performance, and learning outcomes in an online information management course taught in an MBA program. Four learning outcomes (objective learning performance, perceived learning of the subject matter, perceived skill development, and student satisfaction) are predicted to be affected by an overall flow score, four dimensions of flow, and three characteristics of flow activities. Support is found for a relationship between flow and students' perceived learning of the subject matter, students' perceived skill development, and student satisfaction. The findings of the study have implications for the design and instruction of online courses offered in business schools.

Keywords: Online Education, Flow, Learning Outcomes, Information Management

1. INTRODUCTION

Web-based courses are being offered by colleges and universities as a means of delivering education to students facing location and time constraints (Carr, 2000; Honan, 1997). For example, web-based classes are becoming popular in business schools as alternatives or supplements to traditional on-campus courses (Alavi, Yoo, and Vogel, 1997; Arbaugh, 2000). Although researchers have shown that the traditional classroom learning environment still offers some advantages (Zhang et al., 2004), student interest in and demand for online courses are increasing over time (McFarlane and Hamilton, 2005/2006; Lundgren and Nantz, 2003).

The present study seeks to increase our understanding of the underlying psychological experiences of students participating in an online course in business schools. Specifically, the study examines the effects of flow, a psychological state associated with improvements in task performance, on learning outcomes in an online graduate-level course in information management. We examine the effects of flow on several types of learning outcomes including objective measures of learning, student perceptions of learning, and student satisfaction. The effects of flow on learning outcomes are examined through a field study in which data were collected during the course of an online information management course offered through an MBA program in a public university.

The remaining sections of the paper discuss (1) the literature on flow and learning outcomes, (2) the theoretical framework underlying the study, (3) the research question and hypotheses examined in the study, (4) the methodology of the study, (5) the findings of the study, and (6) the implications of the results.

2. LITERATURE REVIEW

We begin by discussing the motivation for improving our understanding of learning outcomes in online courses offered in business schools. Next, a review of the literature on flow and learning outcomes is presented.

2.1 Learning Outcomes in Online Business School Courses

Much of the literature on online courses has focused on the question of whether online courses or campus-based courses are more effective in terms of student learning. This literature suggests that there is not a significant difference between the two mediums. For example, Borthick and Jones (2000) found no significant difference when comparing student test scores from an online class with the on-campus version of the class taught the previous semester. Piccoli, Ahmad, and Ives (2001) also discovered no significant difference in the exam scores of students when comparing online and on-campus courses. Harrington (1999) compared on-campus and online social work graduate students and concluded that students, by and large, could perform equally well in both learning environments. Also, Thirunarayanan and Perez-Prad (2001) reported in their comparison of education students in both an online and on-campus group that there was no significant statistical difference on the class post-test between the two groups.

Although several studies have found no significant difference in student performance between the online and on-campus class environments, it may be too hasty to conclude that equivalent learning outcomes are guaranteed in online learning environments. A deeper understanding of learning outcomes in online course environments may be gained by examining how underlying psychological phenomenon associated with learning affect students taking online courses. Such an understanding may help students learn more effectively while taking online courses, help instructors teach more effectively in the online environment, and provide guidance for more effective design of online courses. To date, there has been little research that examines psychological phenomenon associated with student learning in online courses offered in business schools. With faculty and institutions of higher learning facing concerns involving financial, workload, and curriculum limitations regarding providing online educational programs (Arnone, 2002a, 2002b; Gehring, 2002), finding an effective role for online courses in the curriculum can be aided if scholarly research can shed light on how various factors such as flow are involved in the learning process.

2.2 Flow and Learning Outcomes

The theory of flow has the potential to increase our understanding of learning outcomes in online business school courses. Broadly speaking, the theory of flow argues that individuals tend to engage in tasks and enter into a state of flow when tasks are challenging and interesting (Csikzentmihalyi, 1990). The attentiveness and concentration that individuals bring to tasks when they are in a state of flow (Csikzentmihalyi, 1990) have the potential to improve learning outcomes in online courses.

Picturing the following scenario will help one understand the idea of flow. Imagine that you have decided to take an online course. While working on the course in your home office one evening, you find yourself focusing very intensely. You do not notice that you are working very hard, and you are not aware that the rock band that practices next door is playing even louder than usual. Eventually you glance at a clock and are surprised to see that you have been working online for several hours. The time has flown by quickly. You have been in a state of flow.

Some researchers have claimed that there exists a link between the flow experience and learning outcomes (Czikszentmihalyi and LeFevre, 1989; Webster, Trevino, and Ryan, 1993; Hoffman and Novak, 1996). Previous studies have found that the flow experience has aided learning and development in teenagers and young adults (Rathunde, 2003) as well as high school students (Shernoff et al. 2003). Studies of flow have been conducted in the context of learning in higher education (Ghani, 1995; Kiili, 2005), foreign language studies (Egbert, 2003), music education (Custodero, 2002), education for the gifted (Rea, 2000), and instructional design using hypermedia (Chan and Ahern, 1999; Konradt, Filip, and Hoffman, 2003).

With regards to the occurrence of flow in online learning specifically, studies have shown that students experience flow in various computer-based educational settings. For example, Choi, Kim, and Kim (2007) found that students in an ERP web-based training program experienced flow and that it had both direct and indirect impacts on learning outcomes.

Although much work has been done to study the effects of flow on student learning performance in various educational settings, little work has been done regarding the effects of flow in business education (Guo et al., 2007; Guo and Ro, 2008). With all the research on flow being linked to learning in non-business educational environments, the study and application of flow theory in business education could yield similar beneficial insights into improving business education.

3. THEORETICAL FRAMEWORK

Csikszentmihalyi argues that there is a state of flow in which humans concentrate intensely and feel a change in their perception of control when performing an activity (Csikszentmihalyi, 1975). Additional properties of flow are said to be a merging of conscious awareness and the activity being performed, a shift in one's perception of time, and a feeling of loss of self (Csikszentmihalyi, 1975). In addition to describing the sensation of being in flow, Csikszentmihalyi describes characteristics of tasks that are likely to lead to the sensation of flow and a set of dimensions of flow that can be used to determine whether a person is experiencing flow (Csikszentmihalyi, 1975).

3.1 Characteristics of Flow Activities

Csikszentmihalyi (1975) suggests that tasks that are likely to lead to a state of flow share three characteristics: (1) goal clarity, (2) feedback, and (3) a perceived balance of challenge and skill. Activities with these characteristics are called flow activities (Csikszentmihalyi, 1975).

3.2 Dimensions of Flow

The theory of flow also provides a means for assessing whether a person is in a flow state. A set of dimensions of flow are used to assess whether a person is in flow while engaged in the performance of a task (Csikszentmihalyi, 1988). The dimensions of flow are (1) focused concentration, (2) merging of activity and awareness, (3) perceived control, (4) transformation of time, (5) transcendence of self, and (6) autotelic experience. The sixth dimension, autotelic experience, refers to the idea that there is an intrinsic reward or autotelic aspect associated with tasks performed while in a flow state. We focus on four of the dimensions of flow in this study because two of the dimensions (merging of activity and awareness and transcendence of self) are associated with physical tasks such as playing golf. The task used in this study is a purely intellectual task. The four dimensions of flow associated with intellectual tasks are defined in Table 1. The expression of the above-mentioned dimensions of flow can be seen in different learning experiences. For example, it has been reported that the

Dimension of Flow	Definition
Focused concentration	"A centering of attention on a limited stimulus field" (Csikszentmihalyi, 1975, p. 40)
Perceived control	"There is the sense that the outcomes of the activity are, in principle, under the person's own control." (Csikszentmihalyi, 1988, p. 33)
Transformation of time	"Time no longer seems to pass the way it ordinarily does" (Csikszentmihalyi, 1990, p. 66)
Autotelic experience	"The key element of an optimal experience is that it is an end in itself." (Csikszentmihalyi, 1990, p. 67)

Table 1. Dimensions of flow

dimensions of flow involving focused concentration and perceived control are among the most dominant indicators of flow in tasks involving language acquisition (Egbert, 2003). When engaging in educational games and when using computer software, subjects have described their experiential state as including dimensions such as focused concentration, perceived control, transformation of time, and autotelic experience (Ghani, 1995; Kiili, 2005).

3.3 Learning Outcomes

Improved learning outcomes have been associated with a flow state in prior studies (Csikszentmihalyi, Rathunde, and Whalen, 1997). In this study we conceptualize learning outcomes in four ways. First, since learning in business courses is often assessed through exams and quizzes, we use objective measures of performance on quizzes to assess learning. Next, we view both students' perceived learning of the subject matter and students' perceived skill development as important aspects of learning outcomes since a cognitive perspective on learning outcomes views learning taking place through changes in mental models and knowledge representations (Alavi, Marakas, and Yoo, 2002; Shuell, 1986). Finally, we conceptualize student satisfaction as a learning outcome since we expect student satisfaction to be improved if students experience flow while learning.

4. THE RESEARCH MODEL, QUESTION, AND HYPOTHESES

Guo and Ro (2008) proposed a general model of flow in the context of learning based on Egbert (2003). In the Guo and Ro (2008) model, contextual variables and learner characteristics are hypothesized to impact learners' flow experience, which in turn is hypothesized to affect learning outcomes. The Guo and Ro (2008) model provides a systematic way to study the effect of flow on learning outcomes.

In this study, we test part of the Guo and Ro (2008) model by testing the relationships between the flow experience and learning outcomes. In this study, we do not theorize about or measure the contextual variables and learner characteristics included in the Guo and Ro (2008) model. The research model used in this study is presented in Figure 1.

The research question examined in this study is whether there is a relationship between flow and learning outcomes in an online information management course. A series of research hypotheses are tested to answer this research question.

H1: There is a relationship between flow and learning performance.

H2: There is a relationship between flow and students' perceived learning of the subject matter.

H3: There is a relationship between flow and students' perceived skill development.

H4: There is a relationship between flow and student satisfaction.

The independent variables in the study give us three ways of conceptualizing and measuring flow: (1) an overall flow score reported by the subjects, (2) scores for the four dimensions of flow, and (3) scores for the three characteristics of flow activities. The dependent variables used in the study are all measures of learning outcomes. Four measures of learning outcomes are used: (1) objective performance on multiple-choice quizzes, (2) student perceptions of perceived learning of the subject matter, (3) student perceptions of skill development, and (4) student satisfaction.

Three different regression models are used to test each of the four research hypotheses. In the first regression model, the independent variable is the overall flow score. In the second regression model, the independent variables are the four dimensions of flow (focused concentration, perceived control, transformation of time, and autotelic experience). In the third regression model, the independent variables are the three characteristics of flow activities (goal clarity, feedback, and balance of challenge and skill).

5. METHODOLOGY

A field study was conducted in an online, graduate-level information management course to test the hypotheses. MBA students in a public, Midwestern American university were recruited as subjects in the study.

The study was conducted using two course modules in the information management course. Each module lasted two weeks. The first module covered logical database design, and the second module covered physical database design. Each module consisted of a statement of objectives outlining the knowledge and skills to be acquired through the module, a textbook reading assignment, online material supplementing and clarifying the material in the textbook, and an online discussion. The online material asked students to solve problems that required them to apply the material in the course module. Students had access to the solutions to these problems so that they received feedback on their problem-solving efforts.

Subjects completed questionnaires at three points during the course. First, a pre-learning quiz was completed to measure students' existing knowledge of logical and physical database design before these modules were covered in the course. The online pretest quiz contained a total of twenty multiple-choice questions, ten for each module. Next, a post-learning quiz and survey were administered at the end of the course module on logical database design. Finally, a post-learning quiz and survey were administered at the end

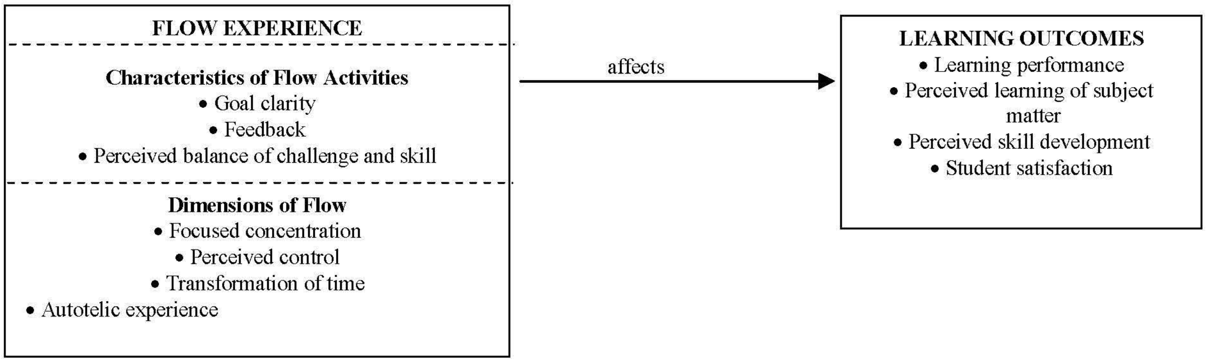

Figure 1. Research model of flow and learning outcomes

of the course module on physical database design. Students completed the online post-learning quizzes and surveys when they finished working on the module. Students who spent the entire two weeks allocated for the modules had a gap of fourteen days between the two post-test surveys.

Measures of the three characteristics of flow activities, the four flow dimensions, an overall measure of flow, perceived learning of the subject matter, perceived skill development, and student satisfaction were included in the post-learning surveys. These constructs were measured at the end of the course module. To better improve the recency of flow activity measurement, facilitate the more accurate recall of any relevant flow experience, and tie this event to a particular learning experience, many flow scholars have administered their flow recall surveys immediately following a particular relevant learning or computer-based activity (e.g. Chan and Ahern, 1999; Choi, Kim, and Kim, 2007; Egbert, 2003; Guo and Ro, 2008). This provides a minimal amount of time passage between the actual flow occurrence(s) and measurement point and minimal amount of recall distortion.

Past studies have shown, however, that flow experiences are memorable enough to be recalled even after the passing of some duration of time. For example, Jackson and Marsh (1996) asked their respondents to recall an optimal flow experience during sports activities. In the same study, they also measured flow immediately after a sports task. In both cases, participants easily recalled flow experiences. Novak, Hoffman, and Duhachek (2003) and Novak, Hoffman, and Yung (2000) also used a recall based survey in their studies on flow occurrence on the Web and specifically asked questions such as, "Can you recall a time where you experienced flow when using the Web…?" and "Please tell us more about how you felt during this flow experience while using the Web." To each of these questions, subjects were able to readily recall some relevant flow experiences from the past. Chen, Wigand, and Nilan (1999) even asked respondents to describe their "last" flow experience and were able to garner detailed responses. We follow prior research on flow (e.g., Chan, 1998) by measuring flow at the end of a learning experience. We view each course module as a whole, although there are a variety of activities in each module. The rationale for this approach is that we expect learning outcomes to be enhanced by the flow experience no matter when students experience flow during the course module.

The post-learning survey used existing measures whenever possible, with measures adapted to the current context. Survey items were similar to those used in prior studies by Guo and Ro (2005). Flow experience was measured using adapted questions from the Flow State Scale, which was developed and validated in previous studies (Guo, 2004; Jackson and Marsh, 1996). To elaborate, the Flow State Scale (FSS) developed by Jackson and Marsh (1996) has been adapted for use in several studies involving the measuring of flow in various sports, learning (Guo, 2004; Guo and Ro, 2008) and computer-based activities (e.g. Chan and Repman, 1999). Content validity of the FSS subscales is based on an earlier qualitative study (Jackson and Roberts, 1992) and literature review (Csikszentmihalyi, 1990). The construct validity of the scale was confirmed via factor analysis with internal reliability reported as 0.83 (Jackson and Marsh, 1996) and 0.93 (Chan, 1998) in past studies. The widespread use of adapted versions of the FSS scale in various learning, sports, and computer-based activity settings (e.g. Chan and Ahern, 1999; Chan and Repman, 1999; Guo, 2004; Guo and Ro, 2008; Jackson and Marsh, 1996) shows strong evidence of the reliability of this scale and its appropriateness for use in our particular study. In addition, one item asking subjects to rate their overall flow experience based on a short description of flow was included in the survey (Guo and Ro, 2005). Common methods bias was reduced by presenting the survey items in a mixed order.

A five-point Likert scale was used to measure the survey items. The post-learning survey for the logical database design module is presented in Appendix A.

The post-learning quizzes were used to measure learning performance. Each post-learning quiz had ten multiple-choice questions. The post-learning quizzes used the same items as the pretest quiz with each of the post-learning quizzes covering the relevant half of the pretest quiz questions.

Twenty-two students participated in the logical database design portion of the study, and twenty-three students participated in the physical database design portion of the study

6. RESULTS

Table 2 presents the means and standard deviations of the constructs measured in the study. The measures of learning performance are the number of correct items out of ten

Construct	Mean	Standard Deviation
Learning performance		
Post-test quiz	6.1	2.06
Post-test quiz minus pretest quiz	2.0	2.35
Perceived learning of the subject matter	3.6	.56
Perceived skill development	3.8	.56
Student satisfaction	4.0	.54
Overall flow score	3.1	1.05
Goal clarity	3.7	.51
Feedback	3.7	.52
Perceived balance of challenge and skill	3.9	.51
Focused concentration	3.2	.83
Perceived control	3.4	.63
Transformation of time	2.8	.53
Autotelic experience	3.2	.62

Table 2. Means and standard deviations of constructs

questions. The other items are measured using a 5-point Likert scale.

With the exception of the transformation of time construct, no statistically significant differences were found for measures of learning outcomes, the overall flow score, the characteristics of flow activities, and the dimensions of flow between the logical design module and the physical design module. The transformation of time construct had a mean of 2.7 for the logical design module and a mean of 3.0 for the physical design module (p=.041). Additionally, the age and gender of the subjects were found to have no effect on the measures of learning outcomes and flow.

The effects of flow on each of the four learning outcomes are summarized in Table 3 and discussed below. Results are first shown with the data pooled across the logical and physical database design learning modules and then separately for each of the two learning modules.

6.1 Effect of Flow on Learning Performance

Learning performance is measured in two ways: (1) a score on a post-test quiz and (2) the difference between a post-test quiz and a pretest quiz. Students scored an average of 6.1 out of 10 on the post-test quiz and gained an average of 2.0 points between the pretest quiz and the post-test quiz.

Three different types of regression models are used to test the effect of flow on learning performance. In the first regression model, the independent variable is the overall flow score. In the second regression model, the independent variables are the four dimensions of flow. In the third regression model, the independent variables are the three characteristics of flow activities.

As shown in Table 3, in general, learning performance is not predicted by the overall flow score. This is the case both when learning is measured by the post-test quiz and when learning is measured by the gain between the post-test and the pretest. In addition, learning performance is not predicted by the four dimensions of flow or by the characteristics of flow activities. This finding holds for both the pooled analysis and the analysis for the individual learning modules with the exception of a statistically significant relationship between the overall flow score and the gain between the post-test and the pretest in the physical database design learning module.

6.2 Effect of Flow on Students' Perceived Learning of the Subject Matter

Table 3 summarizes the results of the three regression models used to test the effect of flow on students' perceived learning of the subject matter. Perceived learning of the subject matter is predicted by the overall flow score (for the pooled analysis and for the physical database design learning module), by the dimensions of flow, and by the characteristics of flow activities. Autotelic experience is the dimension of flow found to be a statistically significant predictor of perceived learning of the subject matter in the pooled analysis. Goal clarity and feedback are statistically significant predictors of perceived learning of the subject matter in the pooled analysis.

6.3 Effect of Flow on Students' Perceived Skill Development

Table 3 summarizes the results of the three different types of regression models used to test the effect of flow on students' perceived skill development. Perceived skill development is not predicted by the overall flow score. However, perceived skill development is predicted by the dimensions of flow (in the pooled analysis only) and by the characteristics of flow. activities found to be a statistically significant predictor of perceived skill development in the pooled analysis.

6.4 Effect of Flow on Student Satisfaction

Table 3 summarizes the results of the three different types of regression models used to test the effect of flow on student satisfaction. Student satisfaction is predicted by the overall flow score for the physical database design learning module, by the dimensions of flow (for the pooled analysis and the physical database design learning module), and by the characteristics of flow activities. The dimension of flow found to be a statistically significant predictor of student satisfaction is autotelic experience in the pooled analysis. Perceived balance of challenge and skill and feedback are the characteristics of flow activities found to be statistically significant predictors of student satisfaction in the pooled analysis.

Hypothesis	Dependent Variable (Learning Outcome)	Independent Variables (Measure of Flow)	p-value
H1: There is a relationship between flow and learning performance.	Post-test quiz	Overall flow score	
		Pooled	.707
		Logical Database Design	.778
		Physical Database Design	.584
		Dimensions of flow	
		Pooled	.969
		Logical Database Design	.929
		Physical Database Design	.815
		Characteristics of flow activities	
		Pooled	.058
		Logical Database Design	.114
		Physical Database Design	.595
	Post-test minus pretest	Overall flow score	
		Pooled	.056
		Logical Database Design	.520
		Physical Database Design	.011 *
		Dimensions of flow	
		Pooled	.265
		Logical Database Design	.719
		Physical Database Design	.223
		Characteristics of flow activities	
		Pooled	.377
		Logical Database Design	.259
		Physical Database Design	.221
H2: There is a relationship between flow and students' perceived learning of the subject matter.	Perceived learning of subject matter	Overall flow score	
		Pooled	.036 *
		Logical Database Design	.420
		Physical Database Design	.028 *
		Dimensions of flow	
		Pooled	.000 ***
		Logical Database Design	.045 *
		Physical Database Design	.004 **
		Characteristics of flow activities	
		Pooled	.000 ***
		Logical Database Design	.000 ***
		Physical Database Design	.000 ***
H3: There is a relationship between flow and students' perceived skill development.	Perceived skill development	Overall flow score	
		Pooled	.408
		Logical Database Design	.607
		Physical Database Design	.539
		Dimensions of flow	
		Pooled	.013 *
		Logical Database Design	.168
		Physical Database Design	.124
		Characteristics of flow activities	
		Pooled	.000 ***
		Logical Database Design	.008 **
		Physical Database Design	.002 **
H4: There is a relationship between flow and student satisfaction.	Student satisfaction	Overall flow score	
		Pooled	.107
		Logical Database Design	.727
		Physical Database Design	.037 *
		Dimensions of flow	
		Pooled	.005 **
		Logical Database Design	.297
		Physical Database Design	.005 **
		Characteristics of flow activities	
		Pooled	.000 ***
		Logical Database Design	.003 **
		Physical Database Design	.000 ***

Table 3. Summary of results

* = p<.05; ** = p<.01; *** = p<.001

Dimension of flow activities	Effects
Focused concentration	No effects on learning outcomes.
Perceived control	No effects on learning outcomes.
Transformation of time	No effects on learning outcomes.
Autotelic experience	Affects students' perceived learning of the subject matter. Affects student satisfaction.

Table 4. Dimensions of flow and their relationships with learning outcomes

6.5 Relationships Between the Four Dimensions of Flow Activities and Learning Outcomes

Table 4 summarizes the relationships found between the four dimensions of flow activities and learning outcomes based on the data pooled across the logical and physical database design learning modules. This table shows that the key dimension of flow that affects learning outcomes is autotelic experience.

6.6 Relationships Between the Three Characteristics of Flow Activities and Learning Outcomes

Table 5 summarizes the relationships between the three characteristics of flow activities and learning outcomes based on the data pooled across the logical and physical database design learning modules. This table shows that goal clarity, feedback, and a perceived balance of challenge and skill are all associated with at least one learning outcome.

7. CONCLUSION AND DISCUSSION

In summary, support is generally not found for a relationship between flow and learning performance as measured by a post-test quiz and as measured by the gain from a pretest to a post-test quiz (hypothesis 1). In contrast, support is found for a relationship between flow and students' perceived learning of the subject matter (hypothesis 2), students' perceived skill development (hypothesis 3), and student satisfaction (hypothesis 4).

Although we have not detected a relationship between flow and objective measures of performance, the study suggests that paying attention to the idea of flow in the design and delivery of online courses may improve students' perceptions of learning and student satisfaction. Although these outcomes are arguably less important than objective performance, it is reasonable to focus on these outcomes because students are likely to have useful perceptions of their learning. Additionally, non-objective measures of learning outcomes such as student satisfaction and students' perceptions of their learning can be an element of a business school's assessment plan developed to meet accreditation requirements (AACSB International, 2003).

The findings of the study provide specific guidance about ways in which aspects of flow can play a role in the design and delivery of online courses. As shown in Table 4, in the pooled analysis, the key dimension of flow that affects learning outcomes is autotelic experience. Autotelic experience is the idea that there is an intrinsic reward associated with tasks performed while in flow. That is, the performance of the task serves as its own reward. There is no need for an extrinsic reward to be administered in order for the person performing the task to be motivated to continue performing the task. In the context of online course design, this suggests that when courses are designed so that students enter flow while working with the course material, there may be little need for 'bells and whistles' that deliver explicit external rewards. Table 4 also suggests that designing courses with an emphasis on focused concentration, perceived control, and transformation of time may be relatively unimportant.

As shown in Table 5, in the pooled analysis, goal clarity, feedback, and a perceived balance of challenge and skill are all associated with at least one learning outcome. Feedback may be the most important element in the design of online courses since this characteristic of flow activities is associated with all three of the subjective measures of learning outcomes used in the study. The findings of this study suggest that online courses should be designed so that students are provided with clear goals and ample feedback. Clear goals can be communicated through well-written course goals and objectives, and feedback can be provided through assessments built into course materials and by giving students frequent opportunities to receive feedback from other course participants in the context of online chats, discussion boards, and group projects. Additionally, it is important that online courses be designed so that the demands of the courses are matched with the skills that students bring to the courses. In many cases, it may be possible to accomplish this by designing courses so that students are guided through course material in different ways depending on the results of pretests and other assessments embedded in course materials.

Although the findings of the study provide useful suggestions for course design and delivery, the study has several limitations. First, learning performance was measured through multiple-choice quiz questions. It is possible that learning performance as measured in other ways may be more affected by flow. Second, because of the relatively small sample size, we cannot conclude definitively that there is no relationship between flow and learning performance. Third, the study was conducted in the context of a graduate-level information management course. It is possible that the findings are not generalizable to undergraduate courses or to courses in other academic disciplines. Finally, it is possible that the findings are not generalizable to online courses that are designed differently than the course used in this study. For example, while we were able to detect elements of flow in the study, it is possible that students in other online courses may not experience flow at all.

The limitations of the study suggest several areas for future research. First, studies using measures of learning performance other than multiple-choice questions may yield additional insights into the relationship between flow and objective measures of student learning in online courses.

Second, studies conducted in undergraduate online courses and in online courses in other academic disciplines will help us understand the generalizability of the results reported here. Finally, we suggest that studies examining the

Characteristic of flow activities	Effects
Goal clarity	Affects students' perceived learning of the subject matter.
Feedback	Affects students' perceived learning of the subject matter. Affects students' perceived skill development. Affects student satisfaction.
Perceived balance of challenge and skill	Affects student satisfaction.

Table 5. Characteristics of flow activities and their relationships with learning outcomes

effect of flow in online courses designed and delivered according to different principles of instructional design be conducted in order to improve our understanding of the extent to which flow is a key psychological construct underlying learning outcomes in online courses.

8. REFERENCES

AACSB International. (2003), "Eligibility Procedures and Accreditation Standards for Business Accreditation." Tampa, FL: AACSB International - The Association to Advance Collegiate Schools of Business.

Alavi, M., Marakas, G. M., and Yoo, Y. (2002), "A Comparative Study of Distributed Learning Environments on Learning Outcomes." Information Systems Research. Vol. 13, No. 4, pp. 404-415.

Alavi, M., Yoo, Y., and Vogel, D. R. (1997), "Using Information Technology to Add Value to Management Education." Academy of Management Journal. Vol. 40, No. 6, pp. 1310-1333.

Arbaugh, J. B. (2000), "Virtual Classrooms Versus Physical Classrooms: An Exploratory Study of Class Discussion Patterns and Student Learning in an Asynchronous Internet-Based MBA Course." Journal of Management Education. Vol. 24, No. 2, pp. 207-227.

Arnone, M. (2002a), "International Consortium Readies Ambitious Distance-Education Effort." The Chronicle of Higher Education. Vol. 48, No. 42, pp. 28-30.

Arnone, M. (2002b), "Many Students' Favorite Professors Shun Distance Education." The Chronicle of Higher Education. Vol. 48, No. 35, pp. 39-40.

Borthick, A. F., and Jones, D. R. (2000), "The Motivation for Collaborative Discovery Learning Online and Its Application in an Information Systems Assurance Course." Issues in Accounting Education. Vol. 15, No. 2, pp. 181-210.

Carr, S. (2000), "Faculty Members are Wary of Distance-Education Ventures." The Chronicle of Higher Education. Vol. 116, No. 40, pp. A41-42.

Chan, T. S. (1998), "Factorial Validity and Reliability of the Adapted Flow State Scale." Presented at the Annual Meeting of the Southwest Educational Research Association, Houston, TX.

Chan, T. S., and Ahern, T. C. (1999), "Targeting Motivation -- Adapting Flow Theory to Instructional Design." Journal of Educational Computing Research. Vol. 21, No. 2, pp. 151-163.

Chan, T. S., and Repman, J. (1999), "Flow in Web Based Instructional Activity: An Exploratory Research Project." International Journal of Educational Telecommunications. Vol. 5, No. 3, pp. 225-237.

Chen, H., Wigand, R., and Nilan, M.S. (1999), "Optimal Experience of Web Activites." Computers in Human Behavior. Vol. 15, No. 5, pp. 585-608.

Choi, D. H., Kim, J., and Kim, S. H. (2007), "ERP Training with a Web-Based Electronic Learning System: The Flow Theory Perspective." International Journal of Human-Computer Studies. Vol. 65, pp. 223-243.

Csikszentmihalyi, M. (1975), Beyond Boredom and Anxiety: Experiencing Flow in Work and Play. Jossey-Bass Publishers, San Francisco.

Csikszentmihalyi, M. (1988), "The Flow Experience and Its Significance for Human Psychology." In M. Csikszentmihalyi and I.S. Csikszentmihalyi (Eds.), Optimal Experience: Psychological Studies of Flow in Consciousness (pp. 15-35). Cambridge University Press, Cambridge.

Csikszentmihalyi, M. (1990), Flow: The Psychology of Optimal Experience. Harper & Row, Publishers, Inc., New York.

Czikszentmihalyi, M., and LeFevre, J. (1989), "Optimal Experience in Work and Leisure." Journal of Personality and Social Psychology. Vol. 56, No. 5, pp. 815-822.

Csikszentmihalyi, M., Rathunde, K., and Whalen, S. (1997), Talented Teenagers: The Roots of Success and Failure. Cambridge, New York.

Custodero, L. A. (2002), "Seeking Challenge, Finding Skill: Flow Experience and Music Education." Arts Education Policy Review. Vol. 103, No. 3, pp. 3-9.

Egbert, J. (2003), "A Study of Flow Theory in the Foreign Language Classroom." The Modern Language Journal. Vol. 87, No. 4, pp. 499-518.

Gehring, J. (2002), "Higher Ed.'s Online Odyssey." Education Week. Vol. 21, No. 35, pp. 27-29.

Ghani, J. A. (1995), "Flow in Human-Computer Interactions: Test of a Model." In J.M. Carey (Ed.), Human Factors in Information Systems: Emerging Theoretical Bases (pp. 291-309). Ablex Publishing Corporation., Norwood, New Jersey.

Guo, Y. (2004), "Flow in Internet Shopping: A Validity Study and an Examination of a Model Specifying Antecedents and Consequences of Flow." Texas A&M University.

Guo, Y., Klein, B., Ro, Y., and Rossin, D. (2007), "The Impact of Flow on Learning Outcomes in a Graduate-Level Information Management Course." The Journal of Global Business Issues. Vol. 1, No. 2, pp. 31-39.

Guo, Y, and Ro, Y. (2005), "Capturing Flow in the Business Classroom: A Study in Progress." Proceedings of the 36th Annual Meeting of Decision Sciences Institute, San Francisco, November 19-22, pp. 14881-14886.

Guo, Y., and Ro, Y. (2008), "Capturing Flow in the Business Classroom." Decision Sciences Journal of Innovative Education. Vol. 6, No. 2, pp. 425-450.

Harrington, D. (1999), "Teaching Statistics: A Comparison of Traditional Classroom and Programmed Instruction/Distance Learning Approaches." Journal of Social Work Education. Vol. 35, No. 3, pp. 343-352.

Hoffman, D., and Novak, T. (1996), "Marketing in Hypermedia Computer-Mediated Environments: Conceptual Foundations." Journal of Marketing. Vol. 60, pp. 50-68.
Honan, W. (1997), "Northwestern University Takes a Lead in Using the Internet to Add Sound and Sight to Courses." New York Times. May 28, 1997, p. A17.
Jackson, S. A., and Marsh, H. W. (1996), "Development and Validation of a Scale to Measure Optimal Experience: The Flow State Scale." Journal of Sport & Exercise Psychology. Vol. 18, No. 1, pp. 17-35.
Jackson, S. A., and Roberts, G. C. (1992), "Positive Performance States of Athletes: Toward a Conceptual Understanding of Peak Performance." The Sport Psychologist. Vol. 6, pp. 156-171.
Kiili, K. (2005), "Content Creation Challenges and Flow Experience in Educational Games: The IT-Emperor Case." The Internet and Higher Education. Vol. 8, No. 3, pp. 183-198.
Konradt, U., Filip, R., and Hoffmann, S. (2003), "Flow Experience and Positive Affect During Hypermedia Learning." British Journal of Educational Technology. Vol. 34, No. 3, pp. 309-327.
Lundgren, T. D., and Nantz, K. S. (2003), "Student Attitudes Toward Internet Courses: A Longitudinal Study." Journal of Computer Information Systems. Vol. 43, No. 3, pp. 61-66.
McFarland, D., and Hamilton, D. (2005/2006), "Factors Affecting Student Performance and Satisfaction: Online Versus Traditional Course Delivery." Journal of Computer Information Systems. Vol. 46, No. 2, pp. 25-33.
Novak, T.P., Hoffman, D.L., and Duhachek, A. (2003), "The Influence of Goal-Directed and Experiential Activities on Online Flow Experiences." Journal of Consumer Psychology. Vol. 13, No. 1-2, pp. 3-16.
Novak, T.P., Hoffman, D.L., and Yung, Y.F. (2000), "Measuring the Customer Experience in Online Environments: A Structural Modeling Approach." Marketing Science. Vol. 19, No. 1, pp. 22-42.
Piccoli, G., Ahmad, R., and Ives, B. (2001), "Web-Based Virtual Learning Environments: A Research Framework and a Preliminary Assessment of Effectiveness in Basic IT Skills Training." MIS Quarterly. Vol. 25, No. 4, pp. 401-426.
Rathunde, K. (2003), "A Comparison of Montessori and Traditional Middle Schools: Motivation, Quality of Experience, and Social Context." The NAMTA Journal. Vol. 28, No. 3, pp. 13-52.
Rea, D. W. (2000), "Optimal Motivation for Talent Development." Journal for the Education of the Gifted, Vol. 23, No. 2, pp. 187-216.
Shernoff, D. J., Czikszentmihalyi, M., Shneider, B., and Shernoff, E. S. (2003), "Student Engagement in High School Classrooms from the Perspective of Flow Theory." School Psychology Quarterly. Vol. 18, No. 2, pp. 158-176.
Shuell, T. J. (1986), "Cognitive Conception of Learning." Review of Educational Research. Vol. 56, pp. 475-500.
Thirunarayanan, M., and Perez-Prad, A. (2001), "Comparing Web-Based and Classroom-Based Learning: A Quantitative Study." Journal of Research on Computing in Education. Vol. 34, No. 2, pp. 131-137.
Webster, J., Trevino, L. K., and Ryan, L. (1993), "The Dimensionality and Correlates of Flow in Human-Computer Interactions." Computers in Human Behavior. Vol. 9, pp. 411-426.
Zhang, D., Zhao, J., Zhou, L., and Nunamaker, J. (2004), "Can E-learning Replace Classroom Learning?" Communications of the ACM. Vol. 47, No. 5, pp. 75-79.

AUTHOR BIOGRAPHIES

Don Rossin received his B.S. from Boston University, his M.B.A. from California State University, Fresno, and his Ph.D. from University of California at Los Angeles. He is currently Associate Professor of Operations Management at School of Management, University of Michigan-Dearborn. His current research is in new performance measures and models for supply chain management. He has published articles on many supply chain management topics in *Management Science*, *Decision Sciences*, *Production and Operations Management*, *Journal of Operations Management*, *Computers and Industrial Engineering*, and *OMEGA*.

Young K. Ro is an Assistant Professor of Operations Management at the University of Michigan-Dearborn. He holds B.S. and M.S. degrees in industrial engineering from Purdue University and a Ph.D. degree in industrial and operations engineering from the University of Michigan. His work experience includes various positions at the Intel Corporation, Eli Lilly & Company, and TRW Automotive. At present, he is engaged in several projects concerning product architecture and firm relationships in the supply chain context as well as pedagogical work on learning outcomes. His work has appeared in journals such as the *IEEE Transactions on Engineering Management*, the *International Journal of Automotive Technology & Management*, the *International Journal of Manufacturing Technology & Management*, the *Journal of Business & Management*, and the *Decision Sciences Journal of Innovative Education*, among others.

Barbara D. Klein is an Associate Professor of MIS at the University of Michigan-Dearborn. She received her Ph.D. in Information and Decision Sciences from the University of Minnesota, her M.B.A. from the State University of New York at Albany, and her B.A. from the University of Iowa. She has published in *MIS Quarterly*, *Omega*, *Information & Management*, *Database*, *Information Resources Management Journal*, and other journals. Her research interests include information quality, user error behavior, and information systems pedagogy. Professor Klein has worked in the information systems field at IBM, Exxon, and AMP.

Yi Maggie Guo is an Assistant Professor of Management Information Systems at University of Michigan – Dearborn. She received her Ph.D. from Texas A&M University and her MS from the University of Nebraska at Omaha. Her research interests include flow theory, online shopping experience, flow and business education, consumer behaviors in electronic commerce, and agent-based systems in knowledge management. Her work has appeared in *Decision Support Systems*, *Information Resources Management Journal*, *Information Systems Journal*, *Decision Sciences Journal of Innovative Education*, *Journal of Organizational and End User Computing*, *Journal of Global Business Issues*, Proceedings of Americas Conference on Information Systems (AMCIS), Proceedings of Annual Hawaii International Conference on System Sciences, and edited books, Social and Cognitive Impacts of E-Commerce on Modern Organizations (M. Khosrowpour, ed.) and Advanced Topics of Information Resources Management Volume 2 (M. Khosrowpour, ed.).

APPENDIX A
Post-Learning Survey for Logical Database Design Module

1. I developed the ability to communicate clearly about the logical database design concept.
2. I understand the importance of normalization in logical database design.
3. I was challenged during the lesson.
4. It was very clear to me that I was learning the material well.
5. I can define normalization in logical database design.
6. My attention was focused entirely on the lesson.
7. I have learned a lot in the lesson.
8. I felt total comprehension of what I was learning.
9. I was not concerned with what others may have been thinking of me.
10. I can explain logical database design well.
11. Time changed (either slowed down or sped up) during the lesson.
12. I really enjoyed the experience of the lesson.
13. I believed my learning ability would allow me to meet the challenge of the lesson.
14. The lesson was useful.
15. Time appeared to go by very quickly.
16. The material in the lesson was easy.
17. I had a strong sense of what I wanted to learn in this lesson.
18. The objectives of the lesson have been accomplished.
19. It was no effort to keep my mind on what was happening in the lesson.
20. I was aware of how well I was learning the material in the lesson.
21. I was stimulated to learn more about logical database design.
22. I was not worried about my learning during the lesson.
23. I gained a good understanding of the logical database design concept.
24. I felt like I could control my learning during the lesson.
25. I lost track of time.
26. The learning experience left me feeling great.
27. My ability to critically analyze the normal form of a database relation was improved.
28. In general, my learning skills and ability are at a high level.
29. It felt like time flew by during the lesson.
30. The content of the lesson was difficult to understand.
31. I knew clearly what I wanted to learn during the lesson.
32. I understood merging relations.
33. I found the current lesson to be a good learning experience.
34. I had a good idea throughout the lesson about how well I was learning.
35. Time flew by.
36. I felt in total control of my mind during the lesson.
37. I became more interested in logical database design during the lesson.
38. I loved the feeling of learning in this lesson and want to capture it again.
39. My learning abilities were well matched with the challenge of the lesson.
40. I was completely focused on the current lesson.
41. At times during the lesson, it almost seemed like things were happening in slow motion.
42. The challenge of the material was at a high level during the lesson.
43. I was not thinking about myself during the lesson.
44. I knew what I wanted to achieve for today's lesson.
45. I felt I was competent enough to understand the key concepts of this lesson.
46. I found the learning experience during this lesson extremely rewarding.
47. The goals of the lesson were clearly defined.
48. I could tell by my understanding of the lesson how well I was learning.
49. I experienced total concentration during the lesson.
50. I had a feeling of total control during the lesson.
51. I learned to identify central ideas in logical database design during the lesson.
52. I was not concerned with how I was learning during the lesson.
53. The way time passed seemed to be different from normal during the lesson.
54. Given a choice, I would take part in another lecture similar to the current lesson.

The term “flow” is used to describe a state of mind sometimes experienced by people who are deeply involved in some activity. Flow has been described as an intrinsically enjoyable experience accompanied by a deep sense of involvement and a loss of awareness of the passage of time.

55. I was in flow during this lesson.

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