Abstract
Several attributes of students, the primary participants of e-learning systems, have been major subjects of intense research over the past decade (Bitzer and Janson 2014). Structural equation modeling is applied to examine the effects of intrinsic motivation, extrinsic motivation, student-student dialogue, and student-instructor dialogue on e-learners' perceived learning outcomes in the context of university online courses. A total of 372 valid, unduplicated responses from students who have completed at least one online course at a university in the Midwest were used to examine the structural model. The results indicated that intrinsic and extrinsic motivation exhibit higher positive correlations with student-student (SS) dialog and self-regulated learning strategy. Moreover, self-regulated learning strategies, SS dialog, and SI dialog positively affect the e-learners’ perceived learning outcomes. However, extrinsic student motivation shows a positive correlation with SS dialog, but it had no significant relationship with SI dialog.

Keywords
E-learning, intrinsic motivation, extrinsic motivation, student-student dialog, student-instructor dialog, perceived learning outcomes

Introduction
Eom and Ashill (2016) recently presented a holistic model of the e-learning success model, based on a system’s view. Their model consists of three subsystems: inputs, processes, and outputs. The inputs include three entities: students, instructors, and learning management systems. The process has three subprocesses: student self-regulation, dialog (student-student dialog and student-instructor dialog), and cognitive process. The students’ learning/cognitive process is affected by multiple dimensions of the learners’ characteristics, including biological characteristics/senses (physiological dimension); personality characteristics such as attention, emotion, motivation, and curiosity (affective dimension); information processing styles such as logical analysis, or “gut” feelings (cognitive dimension); and psychological/individual differences (psychological dimension) (Dunn et al. 1989). The output consists of learning outcomes and satisfaction.

This study empirically investigates the effects of the students’ motivation and dialogue on the students’ perceived learning outcomes in university online education. The next section reviews the related literature. We follow this with a description of the cross-sectional survey that was used to collect data and the results from a Partial Least Squares (PLS) analysis of the research model. The final section summarizes our findings and discusses the implications of the results for the e-learning area.
Research Model and Hypotheses Development

Prior research findings identified a set of 31 determinants that have a significant effect on satisfaction and learning outcomes (Bitzer and Janson 2014). Their findings include several attributes of learners, such as prior experience with learning management systems (LMS), computer experience, self-efficacy, learning styles, motivation, metacognition, and learning engagement. Of these, we focus on intrinsic and extrinsic motivation and four moderating constructs: student-student dialog, student-instructor dialog, self-regulated learning strategies including metacognition, and learning engagement. Self-regulated learning is a pivotal learning strategy needed to achieve the intended e-learning outcome.

The research model, Figure 1, is derived from a system’s view of an e-learning success model (Eom and Ashill 2016). The left side of Figure 2 contains “exogenous” latent variables, which are also known as predictor or independent latent variables. The right side includes more “outcome” or “endogenous” latent variables, also known as criterion (dependent) latent variables. The predictor constructs are further classified into the inputs and processes.
Intrinsic Motivation

A wide range of studies on students’ motivation over the past decade indicated that there are positive links between motivation and student performance (Castillo-Merino and Serradell-López 2014), motivation and student satisfaction (Eom et al. 2006) and social media engagement and motivational factors (Alt 2015). Moreover, several recent empirical studies concluded that motivation is the most important construct for explaining online students’ ability to pass exams (Chua and Don 2013; Huet et al. 2011) and that motivation has a direct, positive, and significant effect on students’ achievement (Castillo-Merino and Serradell-López 2014; Eom and Ashill 2016). Most of these studies did not differentiate between intrinsic and extrinsic motivation. However, the study of Eom and others that found positive links between intrinsic motivation and satisfaction (Eom et al. 2006).

Intrinsic Motivation and Student-Student Dialogue

Recent research (Eom and Ashill 2016) suggests that in addition to the direct link between intrinsic motivation and learning outcomes, there are several mediating constructs that lead to learning outcomes. Our research model (figure 1) has three moderating constructs which affect learning outcomes. Motivation is defined as the self-generated energy that gives behavioral direction toward a particular goal (Zimmerman 1985). Motivation can be either intrinsic or extrinsic. Intrinsic motivation is the psychological feature that makes an individual do an activity for its inherent satisfaction or challenge involved in the learning process. Previous research shows that students with higher levels of intrinsic motivation manifest greater persistence (Li et al. 2005). In addition, Xie et al. (2006) find that students with higher level of intrinsic motivation exhibit higher participation rate than those with lower level of intrinsic motivation.

Therefore, we hypothesized:

H1: Students with a higher level of intrinsic motivation in online courses will report higher levels of dialogue among students.

Intrinsic Motivation and Self-regulated Learning

According to Zimmerman (1989, p.329), learners with a high level of self-regulation are “metacognitively, motivationally, and behaviourally active participants in their own learning process. Such students personally initiate and direct their own efforts to acquire knowledge and skill rather than relying on teachers, parents, or other agents of instruction.” Consequently, the learning behaviors of self-regulated students are different from other students’ behaviors in three ways: (1) selecting and using their self-regulated learning strategies to achieve desired learning outcomes, (2) continuously monitoring the learning process and being responsive to self-oriented feedback about learning effectiveness, and (3) activating their interdependent motivational processes (Zimmerman 1990). Zimmermann’s research (1989; 1990) demonstrates that motivation and self-regulated learning strategy are two constructs that are inseparable.

Therefore, we hypothesized:

H2: Intrinsic motivation will be positively related to the level of self-regulated learning.

Intrinsic Motivation and Student-Instructor Dialogue

Active participation in the learning process implies that students with a high level of intrinsic motivation initiate and direct their own efforts to acquire knowledge through actively engaging dialog between the instructor and students as well as among students. With the empirical research that investigates the relationship between intrinsic motivation and student-instructor dialogue, we hypothesize that students with high levels of intrinsic motivation will be active participants in the learning process and actively seeking help from the instructor.

Therefore, we hypothesized:

H3: Students with a higher level of intrinsic motivation in online courses will report higher levels of Student-Instructor dialogue.
Extrinsic Motivation

Extrinsic motivation, on the other hand, makes an individual take an action toward a goal to attain some separable outcome such as rewards (i.e., good grades) and recognition from peers, family, etc. (Ryan and Deci 2000). Some students are extrinsically motivated to study and seek external stimuli or rewards, or avoid pressure or punishment (Deci & Ryan, 1985; Lepper, 1988; Ryan & Deci, 2000b).

There are many possibilities of how intrinsic motivation and extrinsic motivation interact. Self-determination theory is often used to explain how the two work together. A taxonomy of human motivation includes amotivation, extrinsic motivation, and intrinsic motivation. Most empirical research in e-learning investigated the relationships between intrinsic motivation and other constructs. Nevertheless, we feel it is very important to identify the effects of extrinsic motivation on the SS dialog, SI dialog, SRL, and learning outcomes.

Extrinsic Motivation and Dialog

Xie et al. (2006) examined the relationship of the students’ intrinsic motivation and their participation in online discussions. They found that the students’ intrinsic motivation was significantly correlated with their online discussion participation. Students who had higher levels of intrinsic motivation demonstrated higher participation rates than those with lower levels of intrinsic motivation. Intrinsically motivated students demonstrated two to three times the participation rate than those who were extrinsically motivated. Study of Xie et al., however, did not differentiate student-student dialog and student-instructor dialog. We can assume that online discussions in their study did not separately measure SS dialogue and SI dialogue, but the online discussions involve both the students and the instructor.

Therefore, we hypothesized:

H_4: Students with higher levels of extrinsic motivation in online courses will report higher levels of dialogue among students.

H_6: Students with higher levels of extrinsic motivation in online courses will report higher levels of student-instructor dialog.

Extrinsic Motivation and Self-regulated Learning Strategies

As previously discussed, students with higher levels of self-regulation achieve targeted learning outcomes by implementing their self-regulated learning strategies from a wide range of learning strategies including rehearsal, elaboration, organization, critical thinking, time/study environmental management, effort regulation, peer learning, help-seeking, and metacognitive self-regulation (Pintrich et al. 1993). Further, they continuously monitor the learning process and they are responsive to self-oriented feedback about learning effectiveness, and they activate their interdependent motivational processes (Zimmermann 1990).

Recent reviews of the literature point to a dearth of research on the examination of the roles of extrinsic motivation and selecting self-regulated learning strategies. The relationship between theoretically grounded constructs of motivation and various metacognitive processes is examined (Moos 2014), and it was found that extrinsic motivation significantly predicted the extent to which participants monitored their learning task goals with hypermedia. Nevertheless, the relationship between extrinsic motivation and the selection of self-regulated learning strategies has not been frequently studied. A recent study specifically investigated the effects of online students’ intrinsic and extrinsic motivation on the SRL strategies and on the students’ perceived e-learning outcomes and satisfaction (Eom 2015). The results of the study showed that both intrinsic and extrinsic student motivation did have a significantly positive association with SRL strategies and learning outcomes. We propose a mediation model where the level of extrinsic motivation is positively related to the level of self-regulated learning.

Therefore, we hypothesized:

H_5: Extrinsic motivation will be positively related to the level of self-regulated learning.
Learning Outcomes and Mediating Constructs (SS Dialog, SI Dialog and Self-Regulated Learning Strategies)

Only a few empirical studies have investigated the relationship between SI dialogue and the level of self-regulated learning. In addition to this direct effect of SI dialogue on learning outcomes, we propose a mediation model where the SI dialogue influences the selection of self-regulated learning strategies, which in turn influences the dependent variable (learning outcomes). Therefore, we hypothesized:

H₇: Student-Student Dialog will be positively related to the level of self-regulated learning.

H₈: A higher level of perceived dialogue between students and instructor in online courses will be positively related to the level of self-regulated learning.

Dialogue and Learning Outcomes

The extant literature (Hirumi 2002; Moore 1993; Vrasidas and McIsaac 1999; Woo and Reeves 2007) suggests that meaningful and positive interactions (dialogue) between the instructor and students and among students influence the learning outcomes positively. A higher level of perceived dialogue is measured by the frequency (survey questions 7 through 14) and quality of dialogue that improves the quality of the learning outcomes (survey questions 19 through 22).

Therefore, we hypothesized:

H₉: A higher level of perceived dialogue between students and students in online courses will lead to a higher level of perceived learning outcomes.

H₁₀: A higher level of perceived dialogue between students and instructor in online courses will lead to a higher level of perceived learning outcomes.

Self-Regulated Learning Strategies and Perceived Learning Outcomes

Eom and Ashill (2016) investigated the direct relationship between perceived learning outcomes and SRL strategies, and between intrinsic motivation/extrinsic motivation and perceived learning outcomes. They failed to establish a significant relationship between motivation and perceived learning outcomes and between self-regulated learning strategies and perceived learning outcomes. This is because they did not consider the fact that motivation and SRL strategies are inseparable, and they must be placed in tandem to produce learning outcomes. Any attempt to investigate the effects of either motivation or SRL independently on learning outcomes may produce insignificant or invalid results. Three well-known SRL assessment instruments (the Learning, And Study Strategies Inventory (LASSI), the Motivated Strategies for Learning Questionnaire (MSLQ), and the Self-Regulated Learning Interview Scales (SRLIS)) essentially measure the essential elements of SRL (motivation, metacognition, and behaviour) as inseparable elements (Zimmerman 2008).

Therefore, we hypothesized:

H₁₁: Students with a higher level of self-regulated learning in online courses will report higher perceived learning outcomes.

Survey Instrument and Sample

We selected the survey questionnaire from a previous study (Eom and Ashill 2016). The previous survey is in part adapted from the commonly administered IDEA (Individual Development & Educational Assessment) student rating system developed by Kansas State University. The questionnaire on motivation and student self-regulation was adapted in part from the Motivated Strategies for Learning Questionnaire (MSLQ) (Pintrich et al. 1993), an 81-item, self-reported instrument designed to measure college students' motivational orientations and their use of different learning strategies (Pintrich et al. 1991).

The e-mail addresses of 3,285 online students were identified from student data files associated with every online course delivered through the online program of a university in the Midwestern United States. The survey questions were created using SurveyMonkey. The survey URL and instructions were sent to all 3,285 e-mail addresses, and a total of 372 valid, unduplicated responses were received.
Methodology

The research model (figure 1) is tested using WarpPLS, which is the structural equation modeling (SEM)-based Partial Least Squares (PLS) methodology. The model fit and quality indices were all acceptable levels.

Construct Validity

Construct validity is assessed through establishing both convergent and discriminant validities. Convergent validity refers to the extent to which a set of indicator variables load together and whether they load highly (loading >0.50) on their associated factors. Individual reflective measures are considered to be reliable if they correlate more than 0.7 with the construct they intend to measure. Table 1 shows most of the loadings, except outcome1 and outcome2, which were higher than the threshold value .7. When indicator variables do not cross-load on two or more constructs, each construct is said to be demonstrating discriminant validity. In PLS, discriminant validity was assessed using two methods. The first method examined the cross-loadings of the constructs and the measures. The second method examined the square root of the average variance extracted (AVE) for each construct with the correlation between the construct and other constructs in the model (Chin 1998; Fornell and Larcker 1981). All constructs in the estimated model fulfilled the condition of discriminant validity (see Table 1).

<table>
<thead>
<tr>
<th>Construct Items</th>
<th>Loadings</th>
<th>AVE</th>
<th>Int. Consistency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intrinsic Motivation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>intM1</td>
<td>0.855</td>
<td>0.508</td>
<td>0.487</td>
</tr>
<tr>
<td>intM2</td>
<td>0.913</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Extrinsic Motivation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>extM1</td>
<td>0.783</td>
<td>0.565</td>
<td>0.613</td>
</tr>
<tr>
<td>extM2</td>
<td>0.902</td>
<td></td>
<td></td>
</tr>
<tr>
<td>extM3</td>
<td>0.893</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Self-Regulated Learning</td>
<td></td>
<td>0.570</td>
<td>0.747</td>
</tr>
<tr>
<td>sreg1</td>
<td>0.796</td>
<td></td>
<td></td>
</tr>
<tr>
<td>sreg2</td>
<td>0.832</td>
<td></td>
<td></td>
</tr>
<tr>
<td>sreg3</td>
<td>0.855</td>
<td></td>
<td></td>
</tr>
<tr>
<td>sreg4</td>
<td>0.837</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SS dialog</td>
<td>0.801</td>
<td>0.801</td>
<td>0.917</td>
</tr>
<tr>
<td>diastu1</td>
<td>0.752</td>
<td></td>
<td></td>
</tr>
<tr>
<td>diastu2</td>
<td>0.755</td>
<td></td>
<td></td>
</tr>
<tr>
<td>diastu3</td>
<td>0.738</td>
<td></td>
<td></td>
</tr>
<tr>
<td>diastu4</td>
<td>0.719</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SI dialog</td>
<td></td>
<td>0.873</td>
<td>0.951</td>
</tr>
<tr>
<td>diaist1</td>
<td>0.730</td>
<td></td>
<td></td>
</tr>
<tr>
<td>diaist2</td>
<td>0.728</td>
<td></td>
<td></td>
</tr>
<tr>
<td>diaist3</td>
<td>0.716</td>
<td></td>
<td></td>
</tr>
<tr>
<td>diaist4</td>
<td>0.730</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Learning Outcomes</td>
<td></td>
<td>0.767</td>
<td>0.899</td>
</tr>
<tr>
<td>out1</td>
<td>0.655</td>
<td></td>
<td></td>
</tr>
<tr>
<td>out2</td>
<td>0.682</td>
<td></td>
<td></td>
</tr>
<tr>
<td>out3</td>
<td>0.738</td>
<td></td>
<td></td>
</tr>
<tr>
<td>out4</td>
<td>0.736</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 1. Model validation results

Discriminant validity is “the extent to which a construct is truly distinct from other constructs by empirical standards” (Joseph F. Hair et al. 2017, p. 115). It is established when each observed variable loads highly on its theoretically assigned construct and not highly on other constructs. Discriminant validity in PLS is assessed by comparing the square root of the average variance extracted (AVE) for each construct with the
correlation between the construct and other constructs in the model. Adequate discriminant validity is manifested when the square root of the AVE for each construct is larger than the correlation between the construct and any other construct in the model (Fornell and Larcker 1981). Table 2 shows that the square root of each AVE is larger than any correlation among any pair of latent variables, thus demonstrating discriminant validity.

![Correlations among l.v.s. with sq. rts. of AVEs](image)

Table 2: Assessing discriminant validity

**Measurement (Outer) Model Estimation**

The test of the measurement model includes an estimation of the internal consistency and the convergent, discriminant, and factorial validity of the instrument items, as suggested by Straub et al. (2004). One item measuring the students’ intrinsic motivation exhibited low loadings and was subsequently dropped from further analysis, leaving 2 items to measure this construct. All reliability measures were above the recommended level of 0.70, thus indicating adequate internal consistency (Bernstein 1994; Fornell and Bookstein 1982). The average variance extracted scores (AVE) were also above the minimum threshold of 0.5 (Chin 1998; Fornell and Larcker 1981) and ranged from 0.508 to 0.873. When the AVE is greater than .50, the variance shared with a construct and its measures are greater than the error. This level was achieved for all of the model constructs.

**Structural (Inner) Model Results**

The structural model was evaluated using the $R^2$-square for the dependent constructs, and the size, $t$-statistics, and significance level of the structural path coefficients. The results of the warpPLS analysis indicate that the structural model explains 71% of the variance in user satisfaction, and 64% of the variance in learning outcomes. The percentage of variance explained for these two primary dependent variables is greater than 10 percent, implying satisfactory and substantive value and predictive power of the PLS model (Falk and Miller 1992).
Conclusion and Discussion

The main contributions of this study are twofold. First, in an earlier study, Eom, Ashill and Wen (2006) found no significant relationships between the students’ self-motivation and perceived learning outcomes. The motivation construct in the current study is further subdivided into intrinsic and extrinsic motivation.

As shown in the structural (inner) model results (table 3) of the all antecedent constructs hypothesized to affect learning outcomes, all of them are significant except $H_6$. This suggests that intrinsic motivation and extrinsic motivation activate the learner’s psychological learning process (self-regulated learning management). Furthermore, both types of motivation have positive associations with the level of SS dialog, SI dialog, and self-regulatory learning behavior, with an exception that there is no positive association between extrinsic student motivation and student-instructor dialog. All three mediation variables, in turn, did have a significant positive association with learning outcomes.

As the review of literature shows, there are few empirical studies that directly investigate the relationships among the four constructs (intrinsic motivation, extrinsic motivation, self-regulation, and learning outcomes) in university online education. This study provided important empirical evidence in regard to the relationship between intrinsic motivation and self-regulatory learning strategies. The results of this study showed that both intrinsic motivation and extrinsic motivation activate the self-regulation process, which in turn positively affect the learning outcomes.

Limitations and Directions for Future Research

A critical limitation of current research is that two of the constructs (SS dialog and SI dialog) only explain 8 percent and 7 percent of the variances, respectively. This implies that the current model lacks satisfactory and substantive value and predictive power of the PLS model (Falk and Miller 1992). The dialog among students and between the instructor and students are affected by a wide range of other constructs including as course design, the instructor, self-regulatory learning behavior, etc. The results of current research clearly indicate that the future research must incorporate a dynamic relationship among student motivation, the instructor’s facilitating roles, and course design as well as their overall impacts on the learning outcomes. A possible direction for future research is discussed to provide a basis for guiding future empirical research to build robust technology-mediated learning theories (Eom 2017).

The future research model needs to further explore the identification of the antecedent of motivation and the roles of motivation as a mediating variable affecting e-learning outcomes. The current study’s self-regulation construct included the strategies of metacognition, effort regulation, and organization. Future
students should focus on separately identifying the relationships between each of the self-regulatory learning strategies.

REFERENCES


