Task Value, Self-Regulated Learning, and Performance in a Web-Intensive Undergraduate Engineering Course: How Are They Related?

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Abstract

In this paper, the authors report on how students' perception of course material in terms of importance, utility, and interest is related to their self-regulated learning (SRL) skills and project performance in a web-intensive undergraduate learning environment. The data from 57 students were analyzed. Data sources included survey instruments, ranking questions, and project grades. The research highlights important components of online education by evaluating the connections between students' perceptions of web-intensive course value, SRL, and project performance. Findings show a significant positive relationship between task value and performance, specifically between importance of the activity and performance. From a SRL perspective, the results show a positive correlation between goal setting and performance. Significant positive correlations were also found between task value and goal setting, task strategies, help seeking, and self-evaluation. Discussion and recommendations are presented.

Keywords: web-intensive learning, task value, self-regulated learning (SRL), distance education, performance

Introduction

Numerous researchers have posited a variety of motivational constructs to explain how they affect achievement performance and choice. One is the expectancy-value model of achievement motivation (Eccles, 1983; Parsons, Adler, & Meece, 1984; Wigfield, 1994; Wigfield & Eccles, 1992, 2000). Frick

(1992) argues that interest influences "what people attend to, think about, discuss and learn more about" (p. 113). However, from a self-regulated learning (SRL) perspective, students not only regulate cognition, but also their motivational beliefs such as task value (e.g., Butler & Cartier, 2005; Pintrich, 2004).

Despite the numerous benefits that online learning offers, several challenges arise for teachers and instructional designers. The rapid growth of online distance education worldwide has prompted the need to revise delivery structures and rethink pedagogical practices. One challenge that teachers and instructional designers face involves knowledge of the level of student engagement within a course. Knowledge of this engagement allows the instructor to promote a more active learning environment as suggested by Chickering and Gamson (1987) in their seminal paper entitled "Seven Principles for Good Practice in Undergraduate Education." In online learning, active engagements are accomplished through learner–content, learner–instructor, learner–learner, and learner–technology interactions (Hanna, Glowacki-Dudka, & Conceição-Runlee, 2000; Moore & Kearsley, 1996, 2005; Palloff & Pratt, 2011). Furthermore, success factors of online learning rely not only on advanced information and communication technology, but also on the learning strategies of students. Because autonomy and responsibility are requisite if students are to play an active role in their education, the mastery of SRL skills is crucial to online learning.

Although previous research has found that SRL plays an essential role in online learning (e.g., Andrade & Bunker, 2011; Dettori & Persico, 2008; Goda, 2012), few studies have focused on the investigation of SRL in the context of online engineering education (Bourne, Harris, & Mayadas, 2005; Sun & Rueda, 2012; Yukselturk & Top, 2013). Special attention regarding the strategy of online learning delivery should be emphasized due to the opportunities it presents to encourage student performance in the field of engineering. A look into how students regulate their learning in an online environment allows us to better understand effective teaching methodologies that may be implemented. For example, physical manipulatives can be simulated virtually through a variety of multimedia formats and delivered through online learning environments to increase student access and motivation. Understanding how such methods impact online student learning is critical to a future educational model that is increasingly web-intensive. In addition, professional engineers engaged in the workforce, but desiring to maintain licensure, learn new areas of expertise, and/or obtain graduate level education may often turn to a web-intensive online environment. It is important to evaluate these individuals' engagement within the newer educational delivery model. The goal of this study was to evaluate the relationships between students' perceptions of course value, application of SRL skills, and learning performance in a web-intensive undergraduate engineering course. In this study, the analysis of task value was dissected into three components: importance, utility, and interest. Furthermore, the current study specifically focused on six components of SRL: goal setting, environment structuring, task strategies, time management, help seeking, and self-evaluation. The focus of the study was directed to the relationships among task value, SRL components, and students' learning performance in a web-intensive undergraduate engineering course.

The term *web-intensive* as it applies to a course and more specifically to this study reflects the definition proposed by Southard and Rubens (2001) for courses that "meet in a physical venue at specific intervals during the course. Additional interactions occur via the web through e-mail, chat, and discussion programs as required. Most course materials are conveyed electronically" (p. 83). In this study, lectures were broadcast through web conferencing software, and students participated in the lectures in a computer laboratory with supplemental on-site facilitation by teaching assistants. No face-to-face meetings between students and the lecturer were conducted.

Literature Review

Within traditional higher-education institutions where most of the students are on campus, delivering an online learning course may not be relevant. Reflecting the current changing times, the traditional instructional model is currently being questioned and replaced (Abdous & Yen, 2010). In fact, the very nature of the newer online course delivery method alters university-level instruction (Larreamendy-Joerns & Leinhardt, 2006). Research into online learning indicates that students engaged in online learning conditions perform slightly better than their face-to-face instructed peers. Such modest improvement indicates the viability of this new teaching technique (Means, Toyama, Murphy, Bakia, & Jones, 2009).

Increasing course enrollments (Snyder & Dillow, 2011) have triggered some institutions to develop online synchronous courses taught by a single instructor, broadcast into a classroom, and facilitated on-site by competent teaching assistants. This supplemental method allows a greater number of students to benefit from content delivery while still allowing on-site interaction with an expert in the area learned. The technique lends itself to a lecture-lab environment quite well. With regard to the online learning modes, Southard and Rubens (2001) delineate four categories of online learning: web-based, web-intensive, web-supportive, and web-ephemeral. The course in the current study is referred to as a *web-intensive* course, setting it apart from the typical synchronous course delivery model in which there is no on-site expert interaction and students receive the lecture in isolated groups or even individually. The course was unique in that almost all lecture sessions (85% to 100%) were delivered online with the presence of teaching assistants. Advantages to this model for students were found in enhanced self-efficacy, lessened sense of isolation, and immediacy of feedback. In addition, the web-intensive model proves extremely effective for engineering courses requiring laboratory experiences and for implementation into university systems where there is resistance to embrace an online science, technology, engineering, and mathematics (STEM) curriculum (Bourne et al., 2005).

Although students today increasingly demonstrate greater familiarity with information and communication technology (ICT), many are inhibited by the use of ICT for educational purposes. The way students value learning activities using ICT can influence their academic performance. Pintrich, Smith, Garcia, and McKeachie (1991) argue that unlike *goal orientation*, which refers to the reason why a student participates in a task, *task value* refers to the student's evaluation of how important, useful, and interesting the task is. The three motivational factors indicate personal reflections about students' knowledge states and abilities, and consequential self-judgments are deemed to be the forerunners of their actions (Paris & Winograd, 1990). Noteborn, Carbonell, Dailey-Hebert, and Gijselaers (2012) argue that task value is positively related to enjoyment, negatively related to boredom, and unrelated to academic performance. A different finding is reported by Lawanto, Santoso, and Liu (2012), suggesting students' interest in the engineering design tasks is significantly related to their expectancy for success.

Furthermore, Metallidou and Vlachou (2010) and Pintrich (2000, 2003) suggest that task value is also positively related to SRL strategies. Pintrich (1999) maintains that students who value learning tasks tend to have a high learning performance. Yoon, Eccles, and Wigfield's (1996) investigation revealed that intrinsic value (i.e., liking and interest) had a positive effect on student performance. Because autonomy and responsibility are requisite for students to play an active role in their learning, the possession of SRL skills is crucial in all forms of online learning (Lynch & Dembo, 2004; Williams & Hellman, 2004). SRL refers to learners' ability and skills to understand and control their learning environment. According to Zimmerman (1994), SRL refers to students' "self-generated thoughts, feelings, and actions, which are systematically oriented toward attainment of their goals" (p. ix). Self-regulated learners are "metacognitively, motivationally, and behaviorally active participants in their own learning process" (Zimmerman, 1986, p. 308); therefore, self-regulated learners are skilled in goal-setting, self-monitoring, self-instruction, and self-reinforcement (Schraw, Crippen, & Hartley, 2006). Zimmerman's (1998) SRL model consists of three phases: forethought, performance control, and self-reflection. Similarly, other SRL models proposed by Butler and Cartier (2005) and Pintrich (2004) not only cover the regulation of cognition, but also include motivational self-regulatory aspects. Based upon these SRL models, there is a relationship between task value and SRL components.

Method

The current study investigated students' perception of the course material in terms of importance, utility, and interest (i.e., task value), and was related to their SRL skills and project performance in a web-intensive undergraduate learning environment. Survey questionnaires included questions regarding task value. Student's project scores were collected. The statistical calculations for data analysis included descriptive statistics, ranking score calculations, correlation tests, and regression tests.

Research Questions

In undertaking the study, the researchers sought to answer three research questions:

1) What was students' perceived task value) and to what degree did they exercise SRL while they were engaged in a web-intensive engineering course?
2) While students were engaged in a web-intensive engineering course, were there significant correlations between:

a) task value and learning performance?

b) SRL and learning performance?

c) task value and SRL?

3) What was the relative importance of task value and SRL with regard to their impact on students' learning performance?

Participants

Study participants were recruited from an entry-level, pre-professional mechanical engineering course at a large land-grant university in the western United States. Participation in the study was voluntary, and an incentive of 5 extra-credit points for the course was offered for participation. Prior to participation, the students completed a letter of consent. The original sample was comprised of 80 participants, of whom 57 returned completed questionnaires that usable for analysis. Among the active participants were 3females (5%) and 54 males (95%). Most of the student participants – 52 – were sophomores (91%), while 7 were freshmen (9%).

Context

The course is typically taught as an entry-level class in the mechanical engineering program, although others may also enroll. The course focuses on the teaching of solid modeling software, allowing students to develop mastery in the creation of typical mechanical models. Specifically, students learn to create basic part files and assemble them into complex mechanical models. In the course, the students complete two sequences of projects: The first requires students to interpret drawings, accurately create the appropriate part files, and assemble and animate; the second requires students to model a robotic arm and gripper to facilitate a manufacturing process (see Figure 1). Teaching assistants are present during the lecture to aid students in the application of demonstrated commands. The teaching assistants also provide two hours of voluntary open laboratory access to allow students to meet with them if they need extra help. Students are allotted four weeks to complete the design project, and focus mainly on designing and modeling a robotic gripper and arm.

All lecture sessions of the course (85% to 100%) are delivered synchronously online by the lecturer with the presence of teaching assistants on site. In addition, the class learning management system (LMS) provides students asynchronous access to a variety of course materials as well as allowing the instructor the ability to track student access. The students have access to assigned, optional, and informative text and video files through the LMS. Students are given extra, ungraded laboratory work problems to complete in order to practice concepts taught during the lecture. Links in the LMS are also provided to allow students to see a variety of information such as scholarship opportunities and learning objectives for the course and outcomes.

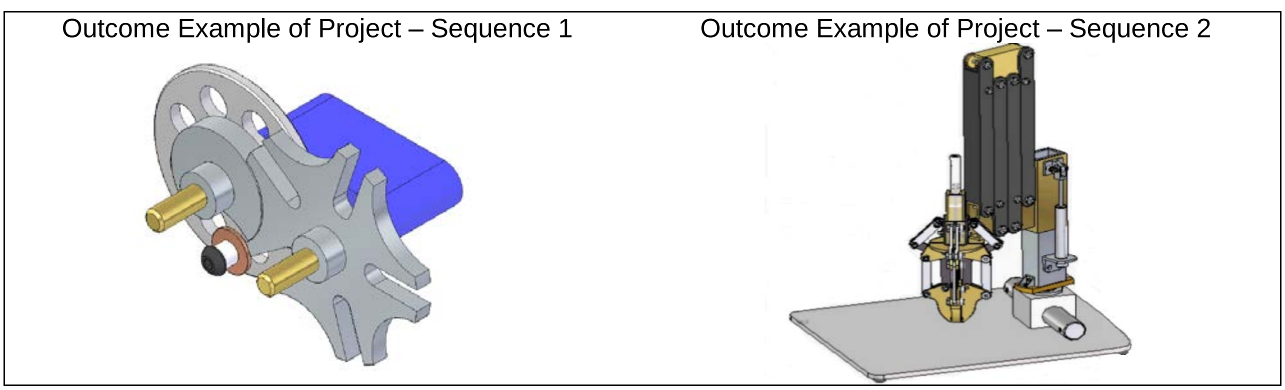

Figure 1. Examples of students' project outcomes

Instrumentation

This study involved data collected from three sources: (1) survey questionnaires; (2) ranking questions regarding task value; and (3) scores awarded for the student's projects. Six task value items from the Motivated Strategies for Learning Questionnaire (MSLQ) by Pintrich et al. (1991) were used to evaluate students' perception of the value of the course. Two items were used to evaluate each component of task value (e.g., importance, utility, and interest). Students rated themselves on a 7-point Likert scale from "not at all true of me" (a score of 1) to "very true of me" (a score of 7). The internal reliability coefficient of task value was very high (α = .90) (Pintrich et al., 1991). The Cronbach's alpha coefficient of task value based on the current data gathered in this study (N = 57) was also .90.

A 24-item Online SRL Questionnaire (OSLQ) using rating scores ranging from 1 (*strongly disagree*) to 5 (*strongly agree*) developed by Barnard, Paton, and Lan (2008) was used to evaluate students' SRL skills in a web-intensive learning environment. The OSLQ consists of six subscales: goal setting, environment structuring, task strategies, time management, help seeking, and self-evaluation. Based upon Zimmerman's (1998) SRL model, the first two subscales (i.e., goal setting and environment structuring) are part of *forethought strategies*, the next three subscales (i.e., task strategies, time management, and help seeking) are part of *performance control* strategies, and the self-evaluation subscale belongs to what is termed *self-reflection*. According to Barnard-Brak, Lan, and Paton (2010), the internal reliability score of the OSLQ was sufficient (α = .90). Cronbach's alpha coefficients for the six subscales (goal setting, environment structuring, task strategies, time management, help seeking, and self-evaluation) were .88, .92, .85, .91, .92, and .89, respectively (Barnard-Brak et al., 2010). Based on the current data of this study (N = 57), the internal reliability coefficient of the OSLQ was .83. In addition, Cronbach's alpha coefficients for the six subscales including goal setting, environment structuring, task strategies, time management, help seeking, and self-evaluation based on the current data of this study were .73, .75, .59, .63, .48, .84, respectively.

Ranking questions regarding task value were developed to provide additional information about students' task value in a web-intensive course. The subject matter expert for the course participated in brainstorming sessions to discuss and finalize relevant questions for the context of the study. The MSLQ task value component was used as a reference or guidance in developing the ranking questions. The ranking questions were categorized into three groups of questions: ranking of importance (seven items), utility (seven items), and interest (six items).

Scores gathered from the ranking questions were calculated by using a weighting system. Each individual statement was ranked by the students on a scale from 1 to 7, with 1 indicating what was the most important and 7 indicating what was the least important statement. The final rank column was developed by weighting the responses for each rank and dividing by the total ranks available (i.e., in Tables 2 and 3, dividing by 7; Table 4, dividing by 6). To illustrate this step in more detail, the number of highest ranked responses was multiplied by 7; the number of next highest ranked responses was multiplied by 6; and the number of lowest ranked responses was multiplied by 1. Summing the products of the rankings within a feature yielded the large numerators in the quotient in the weighted products column. The summed product was then divided by the total available ranks forming a weighted value. The weighted values of each distinct feature were then compared, resulting in a final ranking (1 through 7) for each of the survey items.

In addition, the third data source used in this study was the scores awarded for the student's projects. Two scores of two projects for each participant described above in section "Context of the web-intensive course" were used to represent students' learning performance.

Data Collection and Analysis Procedures

The task value scale of the MSLQ, ranking questions about task value, and the OSLQ were used in this study. Each questionnaire and ranking questions were distributed at the end of the semester. They were delivered through Qualtrics, an online survey tool. A setting within the Qualtrics software prevented students from taking the questionnaires more than once. The students were required to use their ID numbers in completing the questionnaires.

As a first step in analyzing data from the MSLQ-task value and OSLQ, 80 completed questionnaires were evaluated for irregularities. The authors looked for any student who responded to each survey item with the same answers (e.g., marked 7 for all items or blocks of items). Twenty-three suspiciously completed surveys were identified and excluded. Thus, only 57 data sets were used and analyzed. The mean values of survey items for each scale were then calculated. Students' impressions of their ranks regarding why they considered the course to be important, useful, and interesting were used to provide insights. Multiple Spearman correlation analyses were conducted to calculate correlation scores between: (a) task value and performance, (b) SRL components and performance, and (c) task value and SRL components. The decision to employ the Spearman correlation, which can be used for both continuous and ordinal data, was due to the relatively small size of the data set. Multiple linear regression tests were carried out to calculate the beta values of the relationships among task value, SRL, and performance.

Furthermore, scores of students' projects were used to represent their learning performance. The project scores ranged from 0 to 100. Descriptive statistics of the average of those scores showed that the mean score was 90.71 and the standard deviation was 5.49. Moreover, the minimum and maximum scores were 76.40 and 99.21, respectively. The reason for using project scores was due to the project activity representing an ill-defined task that captured a student's level of understanding (Leighton, Rogers, & Maguire, 1999; Ringenberg & VanLehn, 2008).

Results: Research Question 1

Students' Task Value in the Web-Intensive Engineering Course

The findings revealed that students' perception of interest in the course was higher (*M* = 6.20, *SD* = 1.01) than importance (*M* = 5.96, *SD* = 1.08) and utility (*M* = 5.98, *SD* = 1.04), although these results were not statistically significant. The range of responses students could select was within the boundaries of 1 to 7 (see Table 1).

Table 1. *Mean scores and standard deviations of task value*

	M	***SD***
Importance	**5.96**	**1.08**
1) It is important for me to learn the course material in this class.	5.99	1.15
2) Understanding the subject matter of this course is very important to me.	5.94	1.17
Utility	**5.98**	**1.04**
3) I think I will be able to use what I learn in this course in other courses.	5.80	1.26
4) I think the course material in this class is useful for me to learn.	6.16	1.04
Interest	**6.20**	**1.01**
5) I am very interested in the content area of this course.	6.17	1.09
6) I like the subject matter of this course.	6.23	1.04

Note. N = 57.

Through their ranking of the questions, students expressed their thoughts about why they felt the course was important, useful, and interesting (see Tables 2-4). Students marked the most important feature of the class as being "a successful factor in future classes." They felt that it was also important due to its "potential to improve the probability of getting a job." It is also interesting to note that they ranked the least important feature and second least important feature as "to visualize a conceptual design" and "to learn the software," respectively. An observation of the distribution of the ranking responses showed that the most important ranked feature, "It makes me successful in future classes," dominated with nearly 2 points above its closest competitive feature (see Table 2).

Table 3 shows that students ranked the feature of "developing skills to evaluate designs" as the most useful element of the course. This was followed by a secondary useful ranking for "developing experience in the engineering design process." Students felt that "applying what was learned in the class in future design work" was the least useful with "applying design skills used in the software" as only slightly more useful. Moreover, it is also interesting to note that participants rated the most useful feature, "I develop skills to evaluate my design," nearly 5 points above its closest competitive feature (see Table 3).

Table 4 shows the students' ranking of features in the class with regard to interest. The first-ranked feature corresponded to the facilitation or delivery style of the class. The second interesting feature was "learning the design software." Students ranked the least interesting factor as "solving and working with problems that are given in the context of engineering."

Table 2. *Ranking: Importance*

The Class Is IMPORTANT Because …	Rank							Sum of Multiplications Divided by 7	Final Rank
	1	*2*	*3*	*4*	*5*	*6*	*7*		
1) It is a required course.	18	8	2	4	4	5	16	34.00	[4]
2) It allows me to learn the software (i.e., Solid EdgeTM).	2	4	10	13	12	9	7	28.71	[6]
3) It allows me to visualize a conceptual design (i.e., solid model of a solution).	3	6	6	10	8	14	10	27.00	[7]
4) It improves the probability of me getting a job.	8	11	11	6	7	9	5	35.00	[2]
5) It implements an engineering design process (e.g., establishing design requirements).	11	8	8	8	6	9	7	34.29	[3]
6) It allows me to understand how a design solution is constructed.	4	9	9	11	13	4	7	32.14	[5]
7) It makes me successful in future classes.	11	11	11	5	7	7	5	36.86	[1]

Note. N = 57.

Table 3. *Ranking: Utility*

The Class Has Been USEFUL Because …	Rank							Sum of Multiplications Divided by 7	Final Rank
	1	*2*	*3*	*4*	*5*	*6*	*7*		
1) I learn design skills used in the software (i.e., Solid Edge™).	12	7	5	7	3	7	16	31.14	[5]
2) I can apply design skills used in the software.	3	9	10	8	7	15	5	30.43	[6]
3) I develop experience in the engineering design process (e.g., establishing design requirements).	12	6	10	4	11	4	10	33.86	[2]
4) I can apply what was learned in the class in future design work.	5	5	2	16	16	10	3	30.00	[7]
5) I develop skills to evaluate my designs.	9	12	16	6	8	4	2	39.00	[1]
6) I gain knowledge that allows me to transform my ideas into a design product.	4	14	7	8	6	11	7	32.29	[3]
7) I gain experience in hands-on design.	12	4	7	8	6	6	14	31.29	[4]

Note. N = 57.

Students' SRL in a Web-Intensive Engineering Course

An analysis of the results from the OSLQ revealed that the three subscales with higher mean scores among all questionnaire subscales were: goal setting (*M* = 3.84, *SD* = .66), environment structuring (*M* = 3.79, *SD* = .76), and help seeking (*M* = 3.25, *SD* = .70). The three subscales with lower mean scores were: time management (*M* = 2.95, *SD* = .84), self-evaluation(*M* = 2.83, *SD* = .94), and task strategies (*M* = 2.29, *SD* = .73). The range for responses had the possibility of lying within the boundaries from 1 to 5 (see Table 5). The student responses range from 1, "strongly disagree," to 5, "strongly agree," (see Table 5).

Table 4. *Ranking: Interest*

The class has been INTERESTING because …	Rank						Sum of Multiplications Divided by 7	Final Rank
	1	*2*	*3*	*4*	*5*	*6*		
1) It introduces me to the latest technology used in design.	11	8	11	11	10	6	29.86	[5]
2) I enjoy modeling designs.	4	10	12	12	4	15	30.17	[4]
3) I like learning the design software (i.e., Solid Edge™).	10	8	14	11	11	3	35.67	[2]
4) I like the course facilitation style (i.e., TA presence during online broadcast, curriculum delivery through broadcasted lectures, online resources).	16	12	8	5	5	11	37.33	[1]
5) I enjoy hands-on experiences in design (i.e., non-theoretical, applied).	8	11	8	8	12	10	32.17	[3]
6) I enjoy solving and working with problems that are given in the context of engineering.	8	8	4	10	15	12	29.33	[6]

Note. N = 57.

Results: Research Question 2

Relationship between Task Value and Performance in a Web-intensive Engineering Course

The findings revealed a significant positive correlation between task value and performance (r = .285, p = .032). More specifically, the correlation analysis showed a significant positive correlation between importance and performance (r = .267, p = .044). In addition, although not significant, both utility (r = .150, p = .266) and interest (r = .183, p = .174) were positively correlated with learning performance.

Relationship between SRL and Performance in a Web-intensive Engineering Course

The findings revealed no significant positive correlation between overall SRL components and performance (r = .085, p = .527). However, a Spearman correlation analysis found a significant positive correlation between goal setting and performance (r = .371, p = .004). On the other hand, no significant correlation was found between any of the other five SRL components and performance: environment structuring (r = .166, p = .219); task strategies (r = -.214, p = .109); time management (r = -.025, p = .853); help seeking (r = -.049, p = .718); and self-evaluation (r = -.018, p = .893).

Relationship between Task Value and SRL in a Web-intensive Engineering Course

The findings revealed a significant positive correlation between task value and SRL (r = .410; p = .002). More specifically, a Spearman correlation analysis revealed significant positive correlations between task value and the four OSLQ subscales: goal setting (r = .263, p = .048); task strategies (r = .261, p = .050); help seeking (r = .348, p = .008); and self-evaluation (r = .384, p = .003). On the other hand, no significant correlation was found between task value and the other two OSLQ subscales: environment structuring (r = -.036, p = .791) and time management (r = .159, p = .237). The correlation scores between task value and SRL components showed that the more students valued an activity within a web-intensive course, the more likely they were to use various regulation skills. The findings suggested that students who valued the learning activities in a web-intensive engineering course tend to have higher scores on goal setting, task strategies, help seeking, and self-evaluation.

Furthermore, a regression analysis showed that task value to be a significant predictor of students' SRL, β =.223, $t(55)$ = 2.354, p = .022. Task value also explained a significant portion of variance in SRL scores [R^2 = .091, $F(1, 55)$ = 5.539, p = .022]. A multiple linear regression analysis was used to test whether task value components significantly predicted students' SRL. The results of the regression showed no significant predictor.

Table 5. *Mean scores and standard deviations of online SRL strategies*

	M	*SD*
Goal Setting	**3.84**	**.66**
1) I set standards for my assignments in online courses.	3.95	.90
2) I set short-term (daily or weekly) goals as well as long-term goals (monthly or for the semester).	3.67	1.04
3) I keep a high standard for my learning in my online courses.	3.93	.82
4) I set goals to help me manage studying time for my online courses.	3.44	.96
5) I don't compromise the quality of my work because it is online.	4.23	1.02
Environment Structuring	**3.79**	**.76**
6) I choose the location where I study to avoid too much distraction.	3.65	1.23
7) I find a comfortable place to study.	3.96	.84
8) I know where I can study most efficiently for online courses.	3.81	1.01
9) I choose a time with few distractions for studying for my online courses.	3.74	.92
Task Strategies	**2.29**	**.73**
10) I try to take more thorough notes for my online courses because notes are even more important for learning online than in a regular classroom.	2.33	.99
11) I read aloud instructional materials posted online to fight against distractions.	1.77	.96
12) I prepare my questions before joining in the chat room and discussion.	2.46	1.23
13) I work extra problems in my online courses in addition to the assigned ones to master the course content.	2.58	1.16
Time Management	**2.95**	**.84**
14) I allocate extra studying time for my online courses because I know it is time-demanding.	2.77	1.05
15) I try to schedule the same time every day or every week to study for my online courses, and I observe the schedule.	2.95	1.22
16) Although we don't have to attend daily classes, I still try to distribute my studying time evenly across days.	3.14	1.06
Help Seeking	**3.25**	**.70**
17) I find someone who is knowledgeable in course content so that I can consult with him or her when I need help.	3.56	1.10
18) I share my problems with my classmates online so we know what we are struggling with and how to solve our problems.	2.86	1.23
19) If needed, I try to meet my classmates face-to-face.	3.67	1.01
20) I am persistent in getting help from the instructor through e-mail.	2.91	1.11
Self-Evaluation	**2.83**	**.94**
21) I summarize my learning in online courses to examine my understanding of what I have learned.	2.70	1.13
22) I ask myself a lot of questions about the course material when studying for an online course.	2.77	1.04
23) I communicate with my classmates to find out how I am doing in my online classes.	3.07	1.22
24) I communicate with my classmates to find out what I am learning that is different from what they are learning.	2.79	1.19

Note. N = 57.

Results: Research Question 3

The Relative Importance of Task Value and SRL with Regard to Their Contribution to Students' Learning Performance

A multiple linear regression test was used to investigate whether task value components significantly predicted students' performance. The test revealed that three components of task value explained 8.1%of variance [R^2 = .081, F(3, 53) = 1.559, p = .210]. Although not significant, it was found that importance had the highest Beta value [β =.391, t(53) = 1.635, p = .108] compared to utility [β = -.160, t(53) = -.730, p = .468] and interest [β = .002, t(53) = .011, p = .991].

Furthermore, a multiple linear regression analysis was used to test whether SRL components significantly predicted students' performance. The results of regression analysis showed that six SRL components explained 23.9% of the variance [R^2 = .239, F(6, 50) = 2.612, p = .028]. It was found that goal setting significantly predicted students' performance [β =.495, t(50) = 3.322, p = .002].

The researcher also conducted a multiple linear regression analysis to examine which variable, among task value and SRL components, was more important to predict student performance. The results showed that nine components (i.e., three task value and six SRL) explained 30.6% of the variance [R^2 = .306, F(9, 47) = 2.304, p = .031]. It was found that goal setting significantly predicted students' performance [β =.390, t(47) = 2.375, p = .022]. Accordingly, it must be assumed that there are other factors that might contribute to student performance and should be investigated in future research. In addition, because no significant value was found, the present study could not conclude which variable, between task value [β = .238, t(54) = 1.714, p = .092] and SRL [β = -.056, t(54) = -.402, p = .690] constructs, is a more important predictor of performance.

Discussion

Distance education has emerged in response to the need to provide access to those who would not otherwise be able to participate in face-to-face courses. The rapid growth of online distance education worldwide has prompted the need to revise delivery structures and rethink pedagogical practices that were once appropriate. Bourne et al. (2005) envisage that in the ensuing decades, it is likely traditional collegiate on-campus and online education will become more blended so that students can secure their education from any institution. Understanding the relationships among task value, SRL, and performance will potentially benefit instructors as well as policymakers in designing models of online learning that will help students learn. Informed by the results of the current study, instructors, especially teachers of engineering majors, can be more creative in designing the materials and instructions for online delivery. Our study reported that students may have different perceptions about the value of their courses and how the value impacts their performance. The instructors of online engineering education programs may also obtain additional insights into the essential role of goal setting in learning activity. Moreover, policymakers may suggest that engineering college administrators can enhance faculty professional development activities in online learning through a focus on student task value and SRL. The effort should focus on improving instructors' understanding of student learning skills, the theoretical foundation of an online learning environment, and assessment principles/tools of student learning skills profile.

Relationship between Task Value and Performance

Previous studies have revealed that task value is positively correlated with academic achievement (e.g., Pintrich, 1999; Yoon et al., 1996). Similarly, findings from this study also revealed that student task value in a web-intensive engineering course had a significant positive correlation with student project performance. Students who value the tasks within a course are more motivated and engaged, thus increasing their ability to master them. In addition, students' perception of the importance of software, concepts, and theory in their learning performance can affect motivation and facilitate mastery. This mastery is clearly revealed by the assessment techniques implemented in the class provided those assessments are representative of what has been demonstrated and taught. The results were encouraging because students in a web-intensive course are not solely focused on getting a grade and completing the curriculum.

Relationship between SRL and Performance

Literature suggests that online learners should employ SRL skills to succeed in their learning activities (e.g., Lynch & Dembo, 2004; Williams & Hellman, 2004). The current study revealed that only goal setting is positively correlated with project performance. Other studies found significance only for the relationship between self-efficacy, performance, and verbal ability but not for intrinsic goal orientation, time and study environment management, help seeking, and Internet self-efficacy (Lynch & Dembo, 2004). Cheung (2004) concluded that students' goal setting influences skills of dealing with study efforts (e.g., time management), retrieving prior knowledge, and response to problems or case studies in the course. Goal setting is related to motivation and the drive to perform (Locke & Bryan, 1966; Locke & Latham, 1990; Wei, Chen, Kinshuk, & Hsu, 2009), which is then directly linked to successful performance. Findings of the current study corroborated that perception. Furthermore, students who are goal oriented tend to focus on achievement and the acquisition of skills. As the results indicated, the students were focused on acquiring design strategies to subsequently apply in engineering. This focus on developing the ability to use the content of the class to improve engineering decisions requires mandatory software mastery. Considering that the sample were college freshmen and sophomores and not the more typical, nontraditional student in online courses, it was refreshing to observe that "show a common goal orientation" and "success correlation" were still fundamentals for students despite the learning medium.

Furthermore, no significant correlation was found between other SRL subscales (i.e., environment structuring, task strategies, time management, help seeking, and self-evaluation) and performance. The authors expected to obtain findings similar to Cobb's (2003) study in a web-based setting, which found a positive significant relationship between time and study management and performance, and metacognitive self-regulation and performance. The difference between the findings of this study and those of Cobb's may be attributed to the measurement of the performance. Cobb used the current grade that students achieved "in the course at the time they completed the questionnaire" (p. 71). In this study, student performance was measured by two project scores. The way students used the learning management system may not have been closely related to the way they completed the projects. Rather, the students may have focused more on their interactions with peers and teaching assistants while engaged in their projects.

Relationship between Task Value and SRL

Previous studies conducted by Metallidou and Vlachou (2010) and Pintrich (2000, 2003) revealed that students with high value beliefs are more self-regulated competent learners than those with lower value beliefs. This study supported the previous studies. A data analysis of MSLQ (i.e., task value subscale) and OSLQ questionnaires found a positive correlation between task value and SRL. More specifically, students' task value was positively correlated with goal setting, task strategies, help seeking, and self-evaluation. The findings also revealed that task value significantly predicted students' SRL. Although there are other factors that may contribute to students' SRL skills, the knowledge gathered from this study suggests that stakeholders (e.g., teachers, course designers) need to emphasize how students value their learning activity especially within a web-based intensive course.

Limitations

This study has certain limitations that should be considered for further research. First, the small sample (N = 57) of the current study limits its generalizability even to other engineering programs. Readers may need to interpret the results carefully because this study is context specific and involves a limited sample. In addition, the context of a web-based intensive course can be extended by involving more diverse participants: not only engineering students, but also students from other fields. Second, the readers should note that the task value scale was taken from the MSLQ. Although the scale was not designed specifically for online learning or web-intensive course, the authors chose it for two reasons: (1) Currently, the authors could not find a specific task value instrument for a web-intensive course context; and (2) The task value scale from the MSLQ is general enough to be applied to any context. The authors asked the participants of the current study to reflect on the web-intensive course while completing the task value questionnaire. In addition, future researchers may want to add more items to the task value scale in the MSLQ. According to the analysis from the authors of the current paper, the components of importance, utility, and interest of the MSLQ task value had two questionnaire items. The effort will enhance the comprehensiveness of importance, utility, and interest components. Third, regarding the sample, although this is a normal distribution of students, it should be noted that this is typical for engineering in which most students are male. However, it would be important to collect more data on female engineering students to identify gender-based differences. In addition, expanding the study to include other ethnicities would also prove enlightening.

Recommendations

Based on the findings of this study, recommendations for the implementation of a web-intensive course as applicable to four constituencies – course designers, students, instructors, and future researchers – are suggested here.

- *Recommendations for course designers*. Emphasizing the importance of the course design might be helpful to improve student performance. As an example, it should prove advantageous to describe the relevance of the course to future related courses. The findings of the current study revealed that importance was the best predictor of student performance. However, the findings indicated that freshmen and sophomore students focused more on interest. Armed with this finding, the course designer may consider constructing a learning environment that highlights the importance and utility of the course. For example, the first online lesson could emphasize the importance and utility of the course. It is proposed that a balance of perception regarding importance, utility, and interest could increase performance.

- *Recommendations for students.* Students need to identify and evaluate their goal setting to help them organize their learning strategies throughout the learning process to improve performance. According to the findings, students' goal setting was the best predictor of performance compared to other SRL components. In a web-intensive learning environment, students should also be aware of the "unconventional" environment as well as effective learning strategies, time management, help seeking, and self-evaluation.
- *Recommendations for instructors*. Encouraging students to value the course might be helpful to trigger their SRL skills. Instructors should find an appropriate method to help first- and second-year students to recognize the importance, utility, and interest of the course. Methods should involve the instructor's explanation of the significance of the course in the students' academic and professional career, an introduction to state-of-the-art technology, involvement of the students within an authentic and perceived real engineering design process, and assisting students with responsive support as they engage in a web-intensive learning environment. Moreover, helping students to exercise their SRL skills with regard to environment structuring, task strategies, time management, help seeking, and self-evaluation will also prompt them to improve their level of success in the course. In a web-intensive learning environment, the instructor can design projects that require the employment of the learning management system to enhance or highlight these particular SRL skills during the project completion process.
- *Recommendations for researchers*. Assessment of students' task value and SRL is an essential topic in research on learning specifically within online or web-intensive courses. The authors suggest that future researchers in this area should include a longitudinal study to investigate the relationship between learning achievement in a web-intensive course and students' performance in future courses. Furthermore, since there are a limited number of instruments that can be used to assess task value, efforts should be allocated to formulate and develop task value instruments specific for online or web-intensive courses. In addition, because the current study revealed relatively low Cronbach's alpha coefficients of several OSLQ scales, SRL researchers may need to improve OSLQ items for any context, similar to the current study.

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