The Association between Self-Regulated Learning and Online Learning Readiness in an Asynchronous High School Course

Dr. Mary Jaglois Orr
Assistant Professor
Director, Northwest Inland Writing Project (NIWP)
University of Idaho, Coeur d'Alene

Allen Kitchel, Ph.D.
University of Idaho

Abstract

Secondary students' online learning readiness was examined in an asynchronous economics course in the context of whether they have the ability to self-regulate cognition, motivation, behavior, and context (i.e., self-regulated learning) as they worked to achieve a successful outcome. Descriptive and inferential statistical analyses were performed on data collected from the cross-sectional sample of secondary students in grades 10 through 12 and then grouped according to their academic performance levels (high, average, and low). This procedure yielded analyses of both the contributions and predictive strength of individual variables within these two constructs. Students' perceptions of their self-efficacy, self-control, and test anxiety showed the strongest contributory and predictive strength for increased academic performance. The implications for these findings may lead educators to better prepare secondary students for online learning by modeling and facilitating self-regulated learning in primary and secondary classrooms.

Keywords: self-regulated learning, motivation, efficacy, secondary students, asynchronous online learning

Digital learning is a fixture in higher education and is becoming more common in the K-12 grades. In a 2015 report by the National Center for Education, there were almost two million students (elementary and secondary) taking online courses; of that, over 1.3 million were high school students (U.S. Dept. of Ed, 2015). Online courses have typically been offered in one of two ways: *synchronous/blended*, courses that are facilitated by an instructor in real time or *asynchronous* courses, separated by time and location (Watson, Pape, Murin, Gemin, & Vashaw, 2014). To meet the multifaceted challenges of asynchronous digital learning, effective online learners must independently engage in the learning process of goal setting, monitoring, self-control and reflection (Calcaterra, Antonietti, & Underwood, 2005; Quintana, Zhang, and Krajcik, 2005; Tsai, 2009). This level of engagement can be problematic since social cognitive theorist's report as students move through secondary grades they demonstrate lowered academic engagement and self-efficacy (Boekaerts, Smit, and Busing, 2012; Hyman, Dweck, & Cain, 1992; Wang & Eccles, 2012).

The focus of this study is to evaluate whether secondary students enrolled in asynchronous learning courses are ready to meet the challenges unique to this environment. Past studies have found a relationship between successful academic goal attainment and self-regulated learning (SRL) within a traditional classroom; and more recently in the online learning environment. Effective SRL requires critical self-assessment during a learning episode to self-regulate behavior, motivation, and cognition while working toward a goal, whether self-selected or teacher-driven (Blumenfeld, Pintrich & Hamilton, 1986; McKeachie, Pintrich, & Lin, 1985; Schunk, 1984, Schunk, 2008; Schunk & Ertmer, 2000; Zimmerman, 1986; Zimmerman & Pons, 1986).

This study seeks to add to the body of research on the association between SRL and academic performance, with a focus on secondary students in an asynchronous online learning environment.

The SRL Framework

During the 1980's social cognitive theorists observed learners as they worked toward goals in classrooms and laboratory settings (Pintrich, 2000b; Winne, 1997; Zimmerman & Pons, 1986). In 1986, a program funded by the Office of Educational Research and Improvement used correlational field studies, which found a pattern in student motivation and self-regulated learning and its association with academic performance (Duncan & McKeachie, 2005; McKeachie, Pintrich, Lin, Smith, & Sharma, 1990; Pintrich, 1988a, 1988b). Paul Pintrich (2000b) developed a conceptual framework of SRL containing the four phases of any effective learning episode and four areas for self-regulation during some or all of the phases (see Table 1).

Each identified area for regulation is dependent on the learner's affective response and self-beliefs to the task(s) required in each discipline. For example, cognitive regulation employs critical self-assessment of his/her skills, abilities and perceived value in given task (Pintrich 2000a, 2000b, 2004). Studies found proficient self-efficacy is key for employing SRL and will drive the self-regulated learner toward the goal in spite of difficult tasks s/he may encounter (Bandura, 1977; Margolis & McCabe, 2004; McCombs & Marzano, 1990; Zimmerman, Bandura, & Martinez-Pons, 1992).

As a product of their study, the 81-item self-report instrument, Motivated Strategies for Learning Questionnaire (MLSQ) was developed (Duncan & McKeachie, 2005). The MSLQ consists of two sections; motivation and learning strategies (i.e., cognition), and was segmented so the researcher could use the instrument in whole or in part based upon the focus of study (Pintrich and Garcia, 1991). The MSLQ is public domain and has been used in empirical research since its development with confidence, providing valid and reliable data for educators and researchers (Duncan & McKeachie, 2005). For this study, the revised MSLQ developed by Pintrich and DeGroot (1990) was presented online so some of the statements were revised to reflect the mode of course delivery. Pintrich and his colleagues allowed for such deviations as noted in the manual for the original MSLQ "[t]he fifteen different scales on the MSLQ can be used together or singly…[and] are designed to be modular…to fit the needs of the researcher or instructor" (Pintrich, Smith, Garcia, & McKeachie, 1991, p. 3).

Method

The Purpose

The overarching research question was whether self-regulated learning is associated with academic performance in secondary students who self-select an asynchronous online economics course. To answer this question, four sub-questions were developed and investigated.

> RQ1: Is there a significant difference among academic performance groups of students (high, average, low) based on their self-regulation scores (i.e., control, cognitive strategy use)?
>
> RQ2: Is there a significant difference among academic performance groups of students (high, average, low) based on their self-motivation scores (i.e., self-efficacy, intrinsic value, test anxiety)?
>
> RQ3: Can the scores of self-motivation (i.e., self-efficacy, intrinsic value and test anxiety) significantly predict academic performance of secondary students?
>
> RQ4: Can the scores of self-regulation (i.e., control, cognitive strategy use) significantly predict academic performance of secondary students?

Participants

The target population of this study was all secondary students enrolled in an asynchronous online economics course (N=433) delivered by the state sponsored virtual school during a summer session. Upon enrolling, every student received an email from the school's registrar requesting her/him to volunteer to take the Motivated Strategies Learning Questionnaire (MSLQ), a survey developed by Pintrich and Degroot (1990). One hundred twenty-one students volunteered to take the MSLQ, but four withdrew from the course prior to completion for unknown reasons. Their responses were not considered for this study.

The students were asked to rate their self-regulation and self-motivation on a Likert-type response scales (1=Never; 2=Sometimes, 3=Often; 4=Always). The end of course scores (EOC) were provided to the researcher by school's registrar at the end of the course. These scores were based upon students' academic performance, which included coursework, participation, and assessments. High achieving students received a score of a 90 points or higher (M=94.95, n =55). Average achieving students received a score between 75-89 points (M=83.31, n=42), and low achieving students received a score below 75 points (M=67.05, n=19).

The data collected were from only those students who both responded to the MSLQ and completed the course with an EOC score (n=117). Students' ages ranged from 15 to 18 years of age with an average of 16.2 years (M=16.2). The majority (82%) of students were female (n=94), and 18% were male (n=21). Sixty-seven of the respondents (58.2%) took the course because of scheduling conflicts such as athletics, course offerings, travel and/or they wanted more electives, etc. during their regular school day), and eighteen respondents took the course for early graduation (15.7%).

Social scientists have suggested the "*proximal similarity model*" (Trochim, 2006, para. 2) as a valid way to address generalizability (external validity) of a study. This approach uses the theory of "*gradient of similarity*" to generalize findings from one study to another that are contextually similar to each other, for example similar people, settings and time (Trochim, 2006, para. 2). Trochim (2006) wrote the best method of addressing criticisms for generalization is to conduct your study "in a variety of places, with different people …" (para. 4). The theory of gradient of similarity refers to the concept of generalizability for the findings of a study, which looks at the similarities of the persons from the study in order to generalize the findings to similar persons, in terms of another place, time, or characteristics (Trochim, 2006). Under this theory, the findings of this study could arguably be generalized to other high school students taking an asynchronous online course. The population data in this study was drawn from all of the six regions in the state of Idaho, from large and small school districts. Generalizability of the findings is strengthened in accordance to the theory of gradient of similarity, although cautions as to the interpretation of the data will be addressed later in this paper.

Findings and Analyses

Multivariate analyses of variance (MANOVA) was used to determine if any significant differences in self-regulation and self-motivation existed between the three levels of academic performance (high, average, low). Multiple regression analyses were used to test whether or not self-regulation and self-motivation were significant predictors of the academic performance of secondary students in an online economics course taken in summer session. In addition, the proportion of variance was evaluated to determine the effect size (Cohen's d) for the independent variables (Cohen, 1962). The construct scores for the subprocesses of self-regulation and self-motivation, together with the academic performance scores, were examined to understand how self-regulation and self-motivation are associated with secondary student academic performance within the online setting of this study (see Table 2). Descriptive analyses was also used on the data collected from the MSLQ responses of the secondary students.

Analyses of Hypotheses 1-4

To help answer the research questions, a series of four hypotheses were tested (see Table 3). Each of the hypothesis statements addressed secondary students who completed an online economics course during the summer session. Prior to analyzing the four hypotheses, reliability analyses were conducted to determine if the variable constructs were sufficiently reliable, as measured by the MSLQ (Cronk, 2012). Scale reliability is assumed if the coefficient is ≥.60 (Tabachnick & Fidell, 2007). After reverse coding several items as defined by the MSLQ manual, results from the tests found that the variable constructs for self-regulation (control and cognitive strategy use) and self-motivation (self-efficacy, intrinsic value, and test anxiety) were sufficiently reliable (see Table 4).

The descriptive statistics of the criterion variables for Hypotheses 1-3 (control and cognitive strategy use were considered separately among academic performance groups (see Table 5). The descriptive statistics of the criterion variables for Hypotheses 2-4 (self-motivation, specifically self-efficacy, intrinsic value, and test anxiety were considered separately among academic performance groups (see Table 6).

Results of Hypothesis 1

Null Hypothesis 1 (RQ1). *There are no significant differences among academic performance groups of students (high, average, low) based on their self-regulation scores (control and cognitive strategy use during the summer session).*

There were two criterion variables for Hypothesis 1, self-regulation (control (9-items) and cognitive strategy (13-items). Hypothesis 1 was evaluated using multivariate analyses of variance (MANOVA) to determine if any significant differences in students' self-regulation of control and cognitive strategy use existed between the high, average, and low achievers. Results revealed a significant difference did not exist: $F(4, 224) = 1.650$, *Wilks Lambda* = 0.944, $p = .163$, *partial eta-squared* = .029. Thus, the null hypothesis was retained (see Table 6).

Analysis of Hypothesis 2

***Null hypothesis 2 (RQ2*).** *There are no significant differences among academic performance groups of students (high, average, low) based on their self-motivation scores (i.e., self-efficacy, intrinsic value, test anxiety).*

Hypothesis 2 was evaluated using multivariate analyses of variance (MANOVA) to determine if any significant differences in students' regulation of motivation (self-efficacy, intrinsic value, test anxiety) existed among the three levels of academic performance.

Results from the analysis revealed that a significant difference did exist between levels of academic performance on a model containing three sub-processes of self-motivation (self-efficacy, intrinsic value, and test anxiety), $F(6, 222) = 7.119$, *Wilks Lambda* = 0.703, $p < .001$, *partial eta-squared* = .161. Thus, the null hypothesis was rejected in favor of the alternative hypothesis, indicating that the sub-process of self-motivation are shown to increase academic performance (see Table 7). Follow-up simple main effects test of the individual between-subject effects revealed that two of the three self-motivation sub-processes were significantly different across three levels of academic performance (high, average, and low). That is, when the criterion variables were considered separately, self-efficacy and test anxiety were found to be significantly different across academic performance groups ($p < .001$ and $p = .019$, respectively). However, no significant differences in students' intrinsic value scores were found between levels of academic performance ($p = .410$).

A Tukey HSD post-hoc analysis was conducted to determine which academic performance groups were significantly different (.05 level) from each other on self-motivation (self-efficacy, intrinsic value, and test anxiety). Comparing the component of s*elf-efficacy* (M =3.12, SD=0.467) among the academic performance groups, high achievers (M =3.34, SD = 0.380) scored significantly higher (p <.001) than average achievers (M = 3.01, SD = 0.460) and low achievers (M = 2.76, SD = 0.432). There was no significant difference (p = .090) found between average achievers (M = 3.01, SD = 0.460) and low achievers (M = 2.76, SD = 0.432)

Comparing the component of *Test Anxiety* (M=2.08, SD=0.818), the post-hoc analysis revealed that only one significant difference (p = .048) existed between high achievers (M = 1.86, SD = 0.701) and low achievers (M = 2.37, SD = 0.843). Students in the high academic performance group scored significantly lower on test anxiety than students in the low academic performance group. However, average achievers (M = 2.23, SD = 0.889) did not score significantly higher (p = .063) on test anxiety than low achievers (M = 2.37, SD = 0.843); nor was there a significant difference (p = .810) between average achievers (M = 2.23, SD = 0.889 and high achievers (M = 1.86, SD = 0.701). Comparing the component of *Intrinsic Value*, there were no significant differences between high, average, and low academic achieving students (see Table 8).

Analysis of Hypothesis 3

Null Hypothesis 3 (RQ3): *The scores of self-regulation do not significantly predict academic performance of secondary students in an online economics course taken in summer session.*

A multiple regression analysis was conducted to determine if self-regulation and specifically its sub-processes (control and cognitive strategy) were significantly predictive of secondary students' academic performance in an online economics course during the summer session. Results from the analysis indicated that a significant relationship did exist between students' academic performance and self-regulation (control and cognitive strategy use), $R = .266$, $R^2 = .071$, $F(2, 113) = 4.293$, $p = .016$. That is, 7.1% ($R^2 = .071$) of the variance observed in the criterion variable (academic performance) was due to the model containing two self-regulation (control and cognitive strategy use). Therefore, the null hypothesis was rejected in favor of the alternative hypothesis (see Table 9).

The contribution of each predictor variable, when the others are controlled for, was evaluated using the standardized Beta for each coefficient, control made the strongest, and only significant, unique contribution in explaining the criterion variable (Beta = 9.79, p = .010). There was no significant predictive relationship between cognitive strategy and academic performance (Beta = -2.97, p = .344). After re-running the linear analysis only using the significant factor (control), (Beta = 7.29, p=.006) the resulting regression model is: y = 65.23 + 7.29(control).

Analysis of Hypothesis 4

Null hypothesis 4 (RQ4): *The scores of self-motivation do not significantly predict academic performance of secondary students in an online economics course taken in the summer session.*

A multiple regression analysis was conducted to determine if self-motivation and specifically the sub-process, self-efficacy, intrinsic value, and test anxiety) were significantly predictive of secondary students' academic performance in an online economics course taken in the summer session. Results from the analysis indicated that a significant relationship did exist between students' academic performance and self-motivation (self-efficacy, intrinsic value, and test anxiety), R = .563, R^2 = .317, F(3, 112) = 17.293, p < .001. That is, 31.7% (R^2 = .317) of the difference observed in the criterion variable (academic performance) was due to the model containing three self-motivating sub-processes. Thus, the null hypothesis was rejected in favor of the alternative hypothesis (Table 10).

The contribution of each predictor variable, when the others are controlled for, was evaluated using the standardized Beta for each coefficient. Self-efficacy made the strongest unique contribution in explaining the criterion variable (Beta = 12.80, p < .001). Furthermore, after controlling for self-efficacy and test anxiety, intrinsic value made a significant unique contribution in explaining the criterion variable (Beta = -6.04, p = .002). A negative Beta value indicates there was a negative relationship between participants' academic performance and intrinsic value. That is, as intrinsic value scores increased, academic performance decreased. Lastly, after controlling for self-efficacy and intrinsic value, test anxiety did not make a significant unique contribution in explaining academic performance (Beta = -1.51, p = .184). Thus, after re-running the linear analysis using only those variables that showed significant contribution to academic performance, i.e. self-efficacy (Beta = 14.04, p = <.001) and intrinsic value (Beta = -6. p < .002) the linear equation is y = 60.689 + 14.035(self-efficacy) – 6.099(intrinsic value).

Limitations

The survey that was used to collect data for this study relied upon self-reported responses that may not be consistent with other objective measures. The survey return rate (n=117) was less than what is recognized as an appropriate sample size out of the population of N=433 (Krajcie & Morgan, 1970), and is delimited to the specific students enrolled in the online economics course during the summer session.

Discussion

The purpose of this study was to investigate online learning readiness of secondary students by analyzing their level of SRL (i.e., self-regulation and self-motivation) with their academic performance. Data were collected using MSLQ to test the four research questions relating to this goal. Through analyses of the data, significant findings were found to exist. An attempt at census failed; however, it could arguably be posited that the sample represented a gradients of similarity to the target population.

This study has affirmed prior research that has linked self-regulation and self-motivation in SRL with increased academic performance. It has shown that knowledge of cognitive and metacognitive is not enough to attain the ideal standard goal, that self-motivation drives the learning process forward in the face of obstacles and challenges within the task. It has shown that a high perception of self-efficacy provides a foundation for perseverance and determination in an academic setting and increases the probability of goal attainment, in other words, course completion. It can be deduced that students with low academic levels of performance require increased support by the online facilitator, which could include providing supplemental guides to reduce test anxiety. It is recommended that an experimental study be conducted in the future to further explore the association between proficient SRL and academic performance in asynchronous secondary online courses. These findings from this study not only add to the body of research into SRL and performance, but takes this theory into the growing and increasingly popular environment of digital learning in secondary education.

Tables

Table 1

Phases and Areas for Self-Regulated Learning

SRL Phases	Areas for Regulation			
	Cognition	Motivation/Affect	Behavior	Context
One: Forethought, planning, and activation	Target goal setting Prior content knowledge Metacognitive knowledge activation	Goal orientation adoption Efficacy judgments Task value	Time and effort planning Planning for self-observations of behavior	Perceptions of task Perceptions of context
Two: Monitoring	Metacognitive awareness Cognitive monitoring	Motivation and affect awareness Motivation and affect monitoring	Effort, time use, need for help awareness Effort, time use, help-seeking monitoring	Changing task and context awareness Changing task and context monitoring
Three: Control	Selection and adaptation of cognitive strategies	Selection and adaptation of strategies for managing motivation and affect	Increase/decrease effort Perseverance, Help-seeking behavior	Change or renegotiate task Change or leave context
Four: Reaction and reflection	Cognitive judgments Attributions	Affective reactions Attributions	Choice behavior	Evaluation of task Evaluation of context

Adapted from Pintrich, P.R. (2000b). Phases and areas for self-regulated learning. Handbook on Self-Regulation (p. 454)

Table 2

Composite Scores of the Sub-Processes of Self-Regulation & Self-Motivation

Variable	*M*	*SD*	Skew	Kurtosis	Min	Max
Self-efficacy	3.12	0.467	-0.178	-0.708	2.11	4.00
Intrinsic Value	2.97	0.486	-0.056	-0.414	1.67	3.89
Test Anxiety	2.08	0.818	0.728	-0.308	1.00	4.00
Control	2.91	0.359	-0.341	-0.249	2.00	3.67
Cognitive Strategy	2.86	0.427	-0.198	-0.278	1.54	3.77
Academic Performance	86.41	10.393	-0.557	-0.274	60.00	108.00

Note. The range of responses on the Likert-type scale 1=Never, 2=Sometimes, 3=Often, 4=Always

Table 3

Variables and Statistical Tests used to Evaluate Hypotheses 1-4

Hypothesis	Criterion Variable	Predictor Variable	Test
1	Self-regulation	Academic Performance	MANOVA
2	Self-motivation	Academic Performance	MANOVA
3	Academic Performance	Self-regulation	Multiple Regression
4	Academic Performance	Self-motivation	Multiple Regression

Table 4

Summary of Reliability Analysis

Variable	*N*	# of Survey Items	Cronbach's alpha
Control	116	9	.668
Cognitive Strategy Use	113	13	.793
Self-efficacy	113	9	.832
Intrinsic Value	116	9	.853
Test Anxiety	116	4	.864

Table 5

Descriptive Statistics of the Criterion Variables for Hypotheses 1 and 3 by Academic Performance Groups

Variables	*n*	*M*	*SD*.	Skew	Kurtosis	Min	Max
Control							
High	55	2.97	0.331	-0.439	-0.183	2.22	3.56
Average	42	2.89	0.392	-0.275	-0.336	2.11	3.67
Low	19	2.74	0.319	-0.529	0.222	2.00	3.22
Cognitive Strategy							
High	55	2.90	0.411	-0.181	-0.573	2.08	3.77
Average	42	2.88	0.439	-0.026	-0.935	2.15	3.77
Low	19	2.70	0.432	-0.680	2.058	1.54	3.46

Table 6

Descriptive Statistics of the Criterion Variables for Hypotheses 2 and 4 by Academic Performance Groups

Variables	*n*	*M*	*SD*	Skewness	Kurtosis	Min	Max
Self-efficacy							
High	55	3.34	0.380	-0.496	0.295	2.22	4.00
Average	42	3.01	0.460	0.226	-0.588	2.11	4.00
Low	19	2.76	0.416	0.352	-0.652	2.22	3.56
Intrinsic Value							
High	55	2.95	0.508	-0.202	-0.354	1.67	3.89
Average	42	3.04	0.453	0.032	-0.580	2.11	3.89
Low	19	2.87	0.480	0.432	0.414	2.00	3.89
Test Anxiety							
High	55	1.86	0.701	1.073	0.687	1.00	3.75
Average	42	2.23	0.889	0.522	-0.696	1.00	4.00
Low	19	2.37	0.843	0.259	-0.470	1.00	4.00

Table 7

Summary of Multivariate Main Effects Derived from MANOVA Analysis of Hypothesis 1

Effect	Statistic	Value	*F*	Hypothesis *df*	Error *df*	Sig.	Partial Eta Squared
Intercept	Wilks' Lambda	0.017	3203.250	2	112	< .001	.983
Academic Performance	Wilks' Lambda	0.944	1.650	4	224	.163	.029

Note. Criterion variables = Control and Cognitive Strategy Use

Table 8

Summary of Multivariate Main Effects Derived from MANOVA Analysis of Hypothesis 2

Effect	Statistic	Value	*F*	*H df*	Error *df*	Sig.	Partial Eta Squared
Intercept	Wilks' Lambda	0.012	3012.477	3	111	< .001	.988
Academic Performance	Wilks' Lambda	0.703	7.119	6	222	< .001	.161

Note. Criterion variables = Self-efficacy, Intrinsic Value, and Test Anxiety

Table 9

Summary of Tukey HSD Post-hoc Analysis for Hypothesis 2

Criterion Variable	(I)	(J)	*M* Difference (I-J)	*SE*	Sig.	95% CI Lower	95% CI Upper
Self-Efficacy	High	Average	0.327*	0.085	.001	0.125	0.530
		Low	0.571*	0.111	< .001	0.308	0.834
	Average	High	-0.327*	0.085	.001	-0.530	-.125
		Low	0.244	0.115	.090	-0.029	0.517
Intrinsic Value	High	Average	-0.085	0.099	.668	-0.321	0.151
		Low	0.088	0.129	.773	-0.218	0.394
	Average	High	0.085	0.099	.668	-0.151	0.321
		Low	0.173	0.134	.401	-0.145	0.491
Test Anxiety	High	Average.	-0.372	0.163	.063	-0.759	0.016
		Low	-0.508*	0.212	.048	-1.011	-0.004
	Average	High	0.372	0.163	.063	-0.016	0.759
		Low	-0.136	0.220	.810	-0.659	0.387

*The mean difference is significant at the .05 level

Table 10

Model Summary Generated from Multiple Regression Analysis of Hypothesis 3

Source	*R*	R^2	*SE*	*F*	Sig
Omnibus Model	.266	.071	10.108	4.293	.016
	Unstandardized Coefficients		Standardized Coefficients		
	Beta	*SE*	Beta	*t*	Sig.
(Constant)	66.46	7.795		8.526	<.001
Control	9.79	3.724	0.34	2.629	.010
Cognitive Strategy	-2.97	3.130	-0.12	-0.950	.344

Note. Criterion Variable = Academic Performance

Table 9

Model Summary Generated from Multiple Regression Analysis of Hypothesis 4

Source	*R*	R^2	*SE*	*F*	Sig
Omnibus Model	.563	.317	8.706	17.293	< .001
	Unstandardized Coefficients		Standardized Coefficients		
	Beta	Std. Error	Beta	*t*	Sig.
(Constant)	67.52	7.922		8.523	< .001
Self-efficacy	12.80	2.227	0.58	5.747	< .001
Intrinsic Value	-6.04	1.931	-0.28	-3.129	.002
Test Anxiety	-1.51	1.126	-0.12	-1.337	.184

Note. Criterion Variable = Academic Performance

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