

**MODIFIED MSLQ: AN ANALYSIS OF ACADEMIC MOTIVATION,
SELF-REGULATED LEARNING STRATEGIES, AND SCHOLASTIC
PERFORMANCE IN INFORMATION SYSTEMS COURSES**

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ABSTRACT

Motivational and self-regulated learning constructs have continued to pose vigorous, multi-dimensional questions for academicians. The challenge of aspiring students to elevate their social-cognitive perspective toward authentic learning, heightening the learners' interpretation of academic interactions, and articulating the role that their beliefs, cognitions, affects, and values play in scholastic performance is an evolving paradigm. The Motivational Strategies for Learning Questionnaire (MSLQ) has been used widely to assess students' general motivation to learn since 1991. Considering the learning approaches of new generation learning styles, this study modified statements in MSLQ, conducted validity tests, and investigated the relationship among academic motivation, self-regulated learning, and scholastic performance in university level information systems courses.

Keywords: MSLQ, motivation, self-regulated learning, scholastic performance, survey validation

INTRODUCTION

Collegiate management information systems courses constructed to teach computer literacy skills provide students with technical information and real-world application competencies that add value to information processing systems within business organizations. Possession of internal motivation and self-regulation learning strategies to learn computer literacy skills is a powerful resource sought by employers. Unfortunately, a skills gap perception exists between recent college graduates and employers. In 2016, CareerBuilder along with Economic Modeling Specialists Intl. (EMSI), a CareerBuilder company that provides industry-leading employment data and economic analysis via web tools and custom reports, commissioned a national Harris Poll survey of 2,300 employers, nearly half (49%) of the employers expressed concern about the growing employment and skills gap in the U. S.

Employment Gap. The U.S. Census Bureau (2015) collapses management information systems degrees into the field of business; degrees in business have experienced stability during the past five years. Relative stability and growth of management information systems occupations is encouraging; unfortunately, the advancements are insufficient. Despite the conflicting reports of STEM supply and demand and the promising gains in degrees conferred in recent years, an overall employment gap exist (Auerbach, 2016). In the US, approximately 689,685 computer and technology jobs were posted, with an average number of hires of 209,035, leaving an employment gap of 480,650 computer and technology positions unfulfilled (Auerbach, 2016).

Skills Gap. The dearth in the supply of college graduates available to fulfill the growing demand for information technology professionals is a critical issue. In addition, management information executives in business are particularly concerned about the insufficiencies of college curriculums in computer and information systems programs. A 2015 AACU study found that while 46 percent of undergraduate students believed their technology skills were current and aligned with business needs, only 37 percent of employees believed students were well-prepared and possessed new technology skills relevant to business practices (Hart Research Associates, 2015).

Adding to the complexity of closing the employment and skills gap for computer and technology workers, is a new dilemma suggesting that the definition of science, technology, engineering, and math (STEM) has broaden to include a diverse body of academic majors and occupations (National Science Board, 2016). Therefore, research in the area of computer information systems should address academic success as it relates to self-regulated learning strategies to

determine best practices that contribute to the sustainability of the information systems academic discipline and workforce placement.

LITERATURE REVIEW

Developed from social cognitive theory and cognitive development theory, self-regulated learning theory refers to how students master their own learning processes (Zimmerman & Schunk, 2001; 2008). Self-regulated learning provides a strong theoretical framework that predicts academic success. The seminal work of Albert Bandura (1986; 1997) presented self-regulated learning (SRL) as a pivotal component of any major academic endeavor. Self-regulated learning is a central research area which provides explanations of academic success. Self-regulation affects motivation, emotions, selection of learning strategies, and effort regulation and leads to increases in self-efficacy, which in turns improves academic outcomes. SRL is a concept that emphasizes the active role of the learner in goal-setting and ensuring goal attainment in a college environment (Pintrich & DeGroot, 1990; Pintrich & Garcia, 1991).

Self-regulated learning refers to one's ability to understand and control one's learning environment. Self-regulation abilities include goal setting, self-monitoring, self-instruction, and self-reinforcement (Harris & Graham, 1999; Schraw, Crippen, & Hartley, 2006). Self-regulation does not equate to mental ability, but with the ability to engage in self-regulation processes that enable learners to transform mental abilities into skills (Zimmerman, Bonner & Kovach, 2002) and developmental process behaviors (Butler, 1995, 1998, 2002) that materializes from practice and guidance (Paris & Paris, 2001). Self-regulated learning strategies help learners prepare for the invaluable capacity to transfer skills, knowledge, and abilities from one domain or setting to another and for lifelong learning opportunities (Dinsmore, Alexander, & Loughlin, 2008; Eccles, Wigfield, & Schiefele, 1998).

Specifically, self-regulated learning consists of three components: (1) metacognition, (2) self-control, and (3) cognitive strategies. The goal of self-regulated learning is to increase awareness of these three strategies until they are automatically employed by the learner (Bransford, Brown, & Cocking, 1999; Butler, 1995, 1998, 2002). Ideologies that affect the use and development of both the cognitive and metacognitive skills are delineated within the motivation component. Past research determined (Hackett & Benz, 1989; Lent, Lopez, & Blieschke, 1993) that the motivation component includes both self-efficacy (degree to which one is confident that one can perform a task or accomplish a goal) and epistemological beliefs (beliefs about the origin and nature of knowledge). Gottfried (1990) defines academic motivation as "enjoyment of school learning characterized by a mastery orientation; curiosity; persistence; task-value; and the learning of challenging, difficult, and novel tasks" (p. 525). In contrast, Turner (1995) considers motivation to be synonymous with cognitive engagement, which he defines as "voluntary uses of high-level self-regulated learning strategies, such as paying attention, connection, planning, and monitoring" (p. 413).

One of the most widely used instruments to assess students' use of learning strategies is the MSLQ. Based on a self-regulatory perspective on student motivation and learning, the questionnaire assesses student motivation and SRL in college students (Pintrich, Smith, Garcia, & McKeachie, 1991). There are two sections in the MSLQ: a motivational section with six sub-scales and a learning strategies section with nine sub-scales. The MSLQ was designed with the flexibility to allow researchers to select sub-section or sub-scales for their research projects. Not only has this instrument been used in many disciplines, including education psychology, biology, social science, accounting, dietetics, and teaching education; it also has been translated into many languages, including Arabic, Chinese, Czech, Estonian, French, German, Japanese, Polish, Turkish, and many others.

Lynch (2010) found correlations between grades and intrinsic and extrinsic motivation and task value. Gender differences were found in this study, including the correlation between male, but not female, self-efficacy and course grades. Bircan and Sungur (2016) also found that self-efficacy was the best predictor of science achievement test; however, the findings revealed that cognitive engagement did not significantly predict students' achievement. The final grades were found correlated with elaboration in multiple studies (Lynch, 2010; Papantoniou et al., 2012). When accessing the relationship between learning strategies in information systems courses, research found that peer learning was negatively related to course grade (Niemczyk & Savenye, 2001), critical thinking was negatively related to course graded (Chalupa, Chen, & Charles, 2001; Niemczyk & Savenye, 2001), and organization had an inverse relationship with course grade (Chalupa, Chen, & Charles, 2001).

Hashemyolia, Asmuni, Ayub, Daud, and Arif (2015) used the MSLQ among undergraduate science and social science students in Malaysia. Among the science and social science students, science possessed a significantly higher mean score for the students' effort regulation, task value, intrinsic goal orientation, and time management than social science students. This study suggested that student's motivation and use of learning strategies might be content based and vary in different subject areas.

Although MSLQ has been used successfully in accessing students' motivation and use of learning strategies for more than two decades, research had revealed concerns about the latent factor structure of the MSLQ. According to Hilpert, Stemien, van der Hoeven Kraft, and Husman (2013), the confirmatory factor analysis (CFA) did not produce a good fit in MSLQ's first development in 1990. An attempted was made to improve the fit in 1993 without success. Dunn, Lo, Mulvenon, and Sutcliffe, (2012) suggested further investigation to explore the latent factor structure of both motivation and learning strategies scales. Credé and Phillips (2011) conducted a meta-review of the MSLQ from 59 articles representing 19,900 college students and reported many relatively low validities for many of the MSLQ scales.

PURPOSE OF THE STUDY

The purpose of this study were to revise the MSLQ to access students' motivation and use of learning strategies in information systems courses and to investigate the relationship between academic motivation, self-regulated learning strategies, and scholastic performance in university-level information systems courses.

RESEARCH METHODOLOGY

This section describes the original scales in the MSLQ, the steps taken to revise the MSLQ items, the subjects participated in the study, the data collection procedures, the statistical analyses used, and the relationship between course grade and the scales in the revised MSLQ.

The Original Scales

The Motivation section of the original MSLQ consisted of 31 items in six scales: Intrinsic Goal Orientation, Extrinsic Goal Orientation, Task Value, Control of Learning Belief, Self-efficacy for Learning and Performance, and Test Anxiety. The Learning Strategies section consisted of 50 items in nine scales: Rehearsal, Elaboration, Organization, Critical Thinking, Metacognitive Self-Regulation, Time and Study Environment, Effort Regulation, Peer Learning, and Help Seeking (Pintrich et al., 1991).

The Revisions of the Questionnaire Items

Two senior professors revised the item making them computer information technology skill specific. Two male and two female undergraduate Information Systems majors provided feedback on wording, clarity, and order of appearance of the revised items. Based on student feedback, minor changes were made.

Subjects

Students enrolled in seven computer-related classes in the Information Systems and Operations Management Department at a large Midwestern university participated in the study. Students enrolled in the classes were required to use two or more of the following tools: Word, PowerPoint, Excel, Access, Visio, Project, Visual Basic for Applications (VBA), Microsoft Windows Server 20012, Microsoft SQL Server 2012, and the Web/Internet. The revised instrument was created using Qualtrics, and responses were scored using a 6-point Likert-type scale, from 1 (*not at all like me*) to 6 (*just like me*). A total of 304 students participated in the survey, producing 291 useable responses. Twenty-five students (8.6%) did not indicate a gender, 167 were male (57.4%), and 99 were female (34%) students. In terms of age, 23% were 18 years old, 31.6 % were 19 years old, 14.8% were 20 years old, 13.4% were 21 years old, and 8.9% were 22 years or older. A majority of students identified themselves as White (90.4%). Based

upon academic classification, approximately 17% were seniors, 18.9% were juniors, 13.1% were sophomores, and 50.5% were freshmen. Department enrollments indicated 90% from the College of Business, 5.8 % from the Applied Science and Technology College, 3.4% from the College of Sciences and Humanities, and .8% from Fine Arts.

Data Collection Procedures

Data were collected in the last week of the 2015 fall semester. Consent to collect data was obtained from the University and each professor who taught the course. Students were invited to complete the Qualtrics online survey posted on Blackboard. The online survey detailed the purpose of the study, the voluntary nature of participation, and the anonymity of responses. Student consent was required to complete the revised motivation survey. At the beginning of the 2016 spring semester, students' grades were collected from each professor.

Analysis Approach

Exploratory factor analysis (EFA) using principal components factor extraction was used to determine if the items in the Motivation section and those in the Learning Strategies section corresponded to the respective scales. To ensure that it was appropriate to perform factor analysis on the data, a measure of sample adequacy (MSA) statistics was calculated prior to performing the factor analysis (Hair, Black, Babin, & Anderson, 2010). Validity refers to the degree of adequacy and appropriateness of the interpretations and actions based on the observed scores (Hair et al., 2010; Kane 2001). In this study, confirmatory factor analysis (CFA) was used to investigate the internal validity. A path model was used as a basis for testing convergent validity and discriminant validity. Both convergent and discriminant evidence are fundamental in test validation (Hair et al., 2010), and both are considered subcategories of construct validity. Discriminant validity demonstrated that measures that should not be related are in reality not related. Following the factor analyses, the internal consistency of reliability was computed using Cronbach's coefficient alphas (Cronbach & Shavelson, 2004). Principle Component Regression was conducted to examine the relationships between motivation and course grade and the use of learning strategies and course grade.

FINDINGS

This section reports the findings of the MSA, EFA, CFA, and the relationships between grades and different scales in the MSLQ. The data collected for the Motivation section and the data collected for the Learning Strategies section were analyzed separately, and the findings are reported in following separate sections.

Motivation Section: Exploratory Factor Analysis

The data was subjected to a MSA prior to the EFA. The overall KMO (MSA) statistic was .874, and all item MSAs exceeded the desired value of .7; therefore, the MSA criteria was satisfied. The EFA result showed that all but item 1 had a communality value of .434 and item 22 had a communality value of .451. Communality values were the variance explained for each item. A low communality suggests that the factor model was not working well for that indicator, and a communality of .5 was desired. Seven factors were extracted which accounted for 60.932% of variance. The factor loadings did not correspond well to the original Motivation scales. With the exception of Test Anxiety. Items in Task Value scale (items 4, 10, 23) were loaded with items in Control Belief (items 2 and 18) and Intrinsic Goal (item 1). Cross loading occurs when a variable had two or more significant factor loadings in an EFA. Although Effort Regulation items were loaded in the same factor, some of the items were also cross-loaded in multiple factors. For example, item 13 (Extrinsic Goal Orientation) was cross-loaded in factors 1 and 6, and item 9 (Control Belief) was cross-loaded in factors 1, 3, and 6. Six items in various scales were cross-loaded in three different factors.

Several iterations of EFA were conducted to refine the Motivation scales. In general, items with a MSA of lower than .5 are removed. With a sample size of 350 or greater, a loading of .30 was consider significant (Hair et al., 2010). Items with significant cross loadings were deleted. The final Motivation scales consisted of 20 items and 4 scales. Table 1 shows the factor loading. Both Test Anxiety scale and Task Value scale maintain its original items. The eight items in Self-efficacy scale were loaded in two different factors, and one of the items from Control Belief scale was

loaded with four items (5, 12, 15, and 29) from Self-efficacy. After examining the statements in MSLQ, a decision was made to rename Factor 4, ‘Expectancy.’

Table 1. Final Motivation Factor Loadings

Item	Factor		Item	Factor	
	1	2		3	4
M23_TV	.884		M5_SE	.879	
M27_TV	.862		M31_SE	.862	
M26_TV	.805		M21_SE	.862	
M17_TV	.778		M20_SE	.702	
M4_TV	.676		M6_SE		.929
M10_TV	.652		M15_SE		.921
M28_TA		.825	M18_CB		.551
M19_TA		.821	M29_SE		.533
M3_TA		.756	M12_SE		.450
M8_TA		.753			
M14_TA		.674			

Motivation Section: Confirmatory Factor Analysis

A path model was created based on the four scales resulted from the EFA. According to Hair et al. (2010), the characteristics of a good fit include a CFI of above .90, a GFI of above .90, and a RMSEA of below .07. The GFI for this model was .864, the CFI was .899, and the RMSEA was .076; therefore, the fit of the model was very close to the satisfying fit criteria. A convergent validity test, then, was conducted. Convergent validity shows items in the same motivation scale were correlated. There were two tests for convergent validity. The first was to test if the unstandardized regression weights (path coefficients) were statistically significant. The second was to test if the factor loadings (standardized regression weights) were .5 or higher. For the Motivation scales, both convergent validity tests were satisfied with all path coefficients being statistically significant and all items had satisfactory factor loadings of higher than .5.

To test discriminant validity, the comparison of root average variance explained and inter-scale correlation was produced for the model. As shown in Table 2, all motivation scales exhibited discriminant validity.

Table 2. Comparison of the Root Average Variance Explained and Inter-Scale Correlation for Motivation Scales

	Expectancy	Task Value	Text Anxiety	Self-efficacy
Expectancy	0.768			
Task Value	0.576	0.727		
Text Anxiety	-0.176	0.029	0.699	
Self-efficacy	0.695	0.701	-0.041	0.709

Motivation Section: Reliability

Cronbach’s Alpha was calculated for each of the scales. All Cronbach’s Alpha met the desired .7: Expectancy (.852), Task Value (.869), Test Anxiety (.825), and Self-efficacy (.835), Task Value (.817).

Learning Strategies Section: Exploratory Factor Analysis

The overall KMO (MSA) statistic was .880, and only two item had MSA of < .7. Item 2 had .691 and item 9 had .693, both were approaching the desired .7. The EFA has an overall KMO (MSA) of .880, and two item MSAs did not reach the desired value of .7: item 9 (.693) and item 49 (.699). The EFA result showed that six items did not exceed the

desired communality of .5: item 3 (.417), item 5 (.408), item 9 (.440), item 18 (.493), item 22 (.483), item 29 (.453), and item 3 (.486). The factors accounted for 54.303% of the variance. Items 3, 31, and 5 did not have significant loading (>.4) on any factor. Item 19 and item 32 were cross-loaded on two factors. The factor loadings did not correspond to the original Learning Strategies scales. Each factor had items loaded from multiple original scales.

The same processes were used to refine the Learning Strategies scales. The communalities loadings for many items were < .5, items that had a loading of > .4 were retained. The Learning Strategies scales consisted of 29 items and 5 scales. Table 3 shows the factor loading. After carefully analyzing each question in every factor, it was decided to rename Factor 1 as ‘Higher-Order Learning,’ Factor 2 as ‘Self-Governance,’ Factor 3 as ‘Strategic Thinking,’ Factor 4 as ‘Productivity Strategies,’ and Factor 5 as ‘Collaborative Learning.’

Table 3. Learning Strategies Factor Loadings

Item	Factors		Item	Factors		
	1	2		3	4	5
L35 CT	.786		L10 Meta	.660		
L27 Rhrsl	.781		L28 Rhrsl	.648		
L24 Meta	.739		L38 Elb	.605		
L20 CR	.728		L50 Elb	.598		
L41 Rhrsl	.700		L43 ER	.579		
L16 C	.682		L40 CT	.550		
L36 Elb	.675		L45 Meta	.534		
L49r Time		.743	L34 Time		.745	
L2r Meta		.672	L12 Time		.675	
L46r Time		.663	L4 Time		.644	
L6r ER		.654	L1 Org		.542	
L21r Time		.600	L47 Meta		.505	
L29r ER		.568	L14 PeerL			.742
L26r Meta		.557	L44 Help			.712
			L37_Help			.708

Learning Strategies Section: Confirmatory Factor Analysis

A path model was created based on the five scales resulted from the EFA. With this initial path model, item 43 had a Standardized Regression Weight of .419 and the factor with item 43 did not exhibit discriminant validity because its root average variance explained was smaller than the correlation with another factor. Item 40 was also removed due to its low communalities loadings in EFA. The final model consisted of 27 items and 5 scales. The GFI for this model was .866, the CFI was .877, and the RMSEA was .059. For Learning Strategies, both GFI and CIF were close to the designed .9, and the RMSEA was below the desired .07. The Learning Strategies scales satisfied both convergent validity tests with all path coefficients being statistically significant and all items had satisfactory factor loadings of higher than .5. In addition, all five scales exhibited discriminant validity.

Table 4. Final Learning Strategies Scales Root Average Variance Comparison and Inter-Scale Correlation

	Productivity Strategies	Higher-Order Organization	Self-Governance	Strategic Thinking	Collaborative Learning
Productivity Strategies	0.601				
Higher-Order Organization	0.518	0.730			
Self-Governance	0.194	-0.225	0.576		
Strategic Thinking	0.593	0.574	0.115	0.606	
Collaborative Learning	0.447	0.498	-0.184	0.563	0.653

Learning Strategies Section: Reliability

Cronbach's Alpha was calculated for each of the scales. All but one scale met the desired .7: Collaborative Learning (.688), Self-Governance (.775), Higher-Order Organization (.888), Self-Governance (.741), and Productivity Strategies (.738).

Motivation Scales with Grade

When EFA was performed to extract factors in the Motivation, factor scores were saved as variables, and these variables were used as independent variables with grade as dependent variable in the regression analysis. With all variables entered into the regression analysis, it showed an Adjusted R Square (r^2) of .177 and the F ratio was statistically significant at the .001 level. As indicated in Table 5, Test Anxiety did not predict course grade.

Table 5. Regression with Grade as the Dependent Variable and All Motivation Independent Variables

	Unstandardized Coefficients		Standardized Coefficients	<i>t</i>	Sig.
	Beta	Std. Error	Beta		
(Constant)	3.225	.037		85.998	.000
Test Anxiety	.017	.047	.024	.350	.726
Task Value	.087	.038	.124	2.272	.024
Self-efficacy	-.319	.048	-.453	-6.714	.000
Expectancy	.091	.047	.129	1.921	.056

Since the Beta coefficients provide a guide to the relative importance of the independent variables included in the equation (Hair et al., 2010), a decision was made to exclude variables that had a Beta value of <.1 from the equation. The reduced set of analyses included the dependent variable course grade and independent variable Task Value, Self-efficacy, and Expectancy. The regression analysis showed an Adjusted R Square (r^2) of .188 and an analysis of variance (ANOVA) revealed the F ratio was statistically significant at the .001 level. When the independent variables that had a Beta value of less than .1 were not included in the regression equation, Self-efficacy predicted course grade at the .001 level, and Task Value and Expectancy predicted course grade at the .05 level, as shown in Table 6.

Table 6. Regression with Grade as the Dependent Variable and All Motivation Independent Variables

	Unstandardized Coefficients		Standardized Coefficients	<i>t</i>	Sig.
	Beta	Std. Error	Beta		
(Constant)	3.225	.037		86.130	.000
Self-efficacy	-.314	.045	-.445	-7.010	.000
Task Value	.088	.038	.125	2.304	.022
Expectancy	.097	.044	.138	2.213	.028

With a Self-efficacy Beta value of .453 and the standard deviation of the dependent variable (Grade) as .70516, each one-point increase on a 6-point Likert scale on the MSLQ Self-efficacy subscale explained .319 point decrease on the course grade ($-.453 * .70516$), which is close to one-third of a letter grade.

Learning Strategies Scales with Grade

As in the regression analysis of Motivation scales and course grade, factor scores were saved in the Learning Strategies EFA as variables, and these variables were used as independent variables with grade as dependent variable in the regression analysis. With all variables entered into the regression analysis, it showed an Adjusted R Square (r^2) of .133 and an ANOVA revealed an F ratio that was statistically significant at the .001 level. Table 7 lists the regression coefficients.

Table 7. Regression with Grade as the Dependent Variable and All Learning Strategies Independent Variables

	Unstandardized Coefficients		Standardized Coefficients	<i>t</i>	Sig.
	Beta	Std. Error	Beta		
(Constant)	3.225	.038		83.786	.000
Strategic Thinking	.082	.039	.116	2.115	.035
Higher-Order Organization	-.237	.039	-.335	-6.136	.000
Self-Governance	-.040	.039	-.057	-1.049	.295
Productivity Strategies	-.083	.039	-.118	-2.160	.032
Collaborative Learning	.050	.039	.070	1.284	.200

As in the regression analysis of Motivation scales, variables that had beta value of <.1 and none significant were excluded from the equation. The reduced set of analysis included the dependent variable course grade and independent variables Strategic Thinking, Higher-Order Organization, and Self-Governance. The regression showed an Adjusted R Square (r^2) of .131 and ANOVA revealed a significant *F* at .001 level. Table 8 lists the regression coefficients.

Table 8. Regression with Grade as the Dependent Variable and Selected Learning Strategies Independent Variables

	Unstandardized Coefficients		Standardized Coefficients	<i>t</i>	Sig.
	Beta	Std. Error	Beta		
(Constant)	3.225	.039		83.676	.000
Higher-Order Organization	-.237	.039	-.335	-6.128	.000
Productivity Strategies	-.083	.039	-.118	-2.157	.032
Strategic Thinking	.082	.039	.116	2.112	.036

With a negative Beta value of Higher-Order Organization, each one-point increase on a 6-point Likert scale on the MSLQ Higher-Order Organization subscale explained .236 point decrease on the course grade ($-.335 * .70516$). This was consistent with prior findings (Chalupa, Chen, & Charles, 2001; Niemczyk & Savenye, 2001).

To evaluate the variant for the assumptions of regression analysis, residuals were used (Hair et al., 2010) and a normal probability plot of the residuals was generated to provide a visual examination. Figure 1 illustrates the plot for the Motivation analysis and Figure 2 illustrates the plot for the Learning Strategies regression analysis. As shown in these two figures, the plotted values fell fairly close along the diagonal line, which indicated that the residuals were considered to represent a normal distribution; therefore, the regression variant met the assumption of normality.

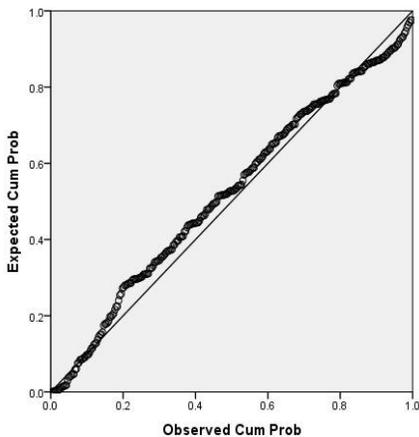


Figure 1. Normal Probability Plot—Motivation

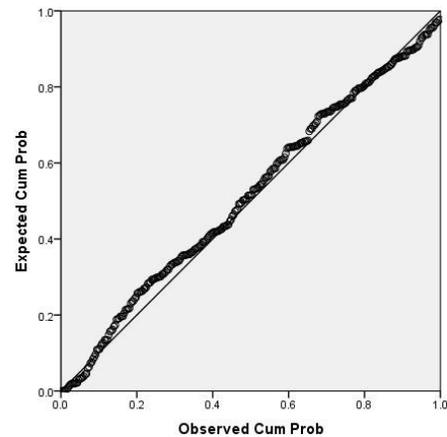


Figure 2. Normal Probability Plot—Learning Strategies

DISCUSSION

The EFA and CFA revealed that a modified four-factor model had a better fit to the data than the original five-factor Motivation model. This modified model consisted of a new Expectancy scale and three original scales: Task Value, Test Anxiety, and Self-efficacy. For Learning Strategies section, a modified five-factor model had a better fit than the original nine-factor model. Many of the items did not load into their original Learning Strategies scales, and new names were created for the scales: Productivity Strategies, Higher-Order Organization, Self-Governance, Strategic Thinking, and Collaborative Learning. One interesting finding was that all reverse-coded items (2, 6, 21, 26, 29, 46, and 49) were loaded into the same factor, although they were not from the same scales in the original MSLQ. Rao and Sachs (1999) found reverse-coded items were cluster in the same factor in their study as well. They suggested that the respondents might have trouble answering the reverse-coded statements. Based on measurement theory, Dunn et al. (2012) removed all reverse-coded items before their analyses. Prior research and the findings of this current study suggested that the reverse-coded items should either be reworded or eliminated in future search.

This study found that self-efficacy had a negative effect on grade, as much as one-third of a letter grade. This finding contradicted with prior research conducted in physics (Lynch, 2010) and science classes (Bircan & Sungur, 2016). Since today's college students grew up using basic computer technologies, it might be possible that when students possess a high degree of self-efficacy about their computer information skills, their effort was minimal resulting in a lower grade. Although the prediction of task value and expectancy on better grades was statistically significant, the practical significant was negligible, with a .089 and a .095 increase respectively on a 4-point grade scale. This study also revealed a negative prediction of grade from Higher-Order Organization. Three of the items in this newly renamed scale was in the Critical Thinking scales in the original MSLQ. In the study conducted by Chalupa, Chen, and Charles (2001), Critical Thinking had an inverse relationship with course grade. In Chen's (2002) study, the Learning Strategies section of the MSLQ was used to investigate the relationship between learning strategies and achievement. A positive relationship between effort regulation and paper-and-pencil test score was found, but the relationship between learning strategies and lab assignments (hands-on exercises with the use of computers) was inconclusive because a normal probability plot indicated that the data collected did not meet the assumption of normality. Figure 3 shows the plot adopted from Chen's Study. The comparison of the plot in Figure 2 and in Figure 3 reveals an improvement; however, the findings in this study continued to show an illogical inverse relationship between the use of cognitive strategies and course grade. In addition, the current study found that the more students used the newly renamed 'Productivity Strategies,' a slightly lower grade was earned, and the more they used 'Strategic Thinking,' they earned a slightly higher grade. Although these were statistically significant, the grade that they affected (-.083 and .082 respectively on a 4-point scale) were negligible, similar to findings in the Motivation section.

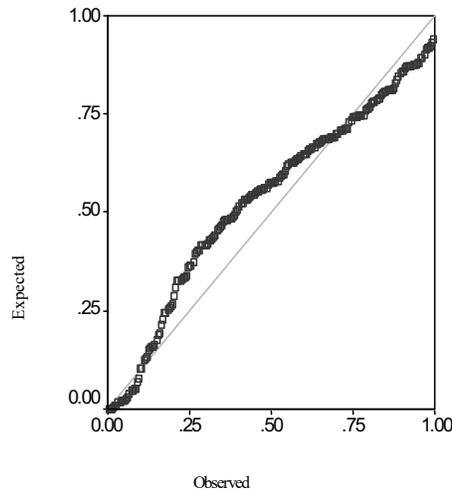


Figure 3. Normal Probability Plot—Lab Assignment (Adopted from Chen,

CONCLUSION

Further modification of the Motivation for Learning Strategies (MSLQ) explicit to computer information systems courses has practical implications for curriculum development and workplace implementation. However, prior to effective classroom integration, additional item analysis is warranted. Specifically, reverse-coded items require scrutiny considering the motivation and learning strategy characteristics of the current student population. Most notably, results from the modified MSLQ survey extracted from the present study, implied that in order for students to advance their computer information systems academic outcome, educators need to facilitate a process that enables students to resolve their self-efficacy percepts in relationship to scholastic performance; higher self-efficacy resulted in lower grades. Establishment of an authentic motivation and learning strategies research instrument may enable students to attain higher levels of scholastic performance contributing to the closure of the computer information systems employment and skills gap.

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