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William Merchant
The University of Northern Colorado, william.merchant@unco.edu

Yael Haskowitz

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Exploring the Factor Structure of the Experiences of Teaching and Learning Questionnaire

William Merchant
University of Northern Colorado

Yael Haskowitz
University of Northern Colorado

Introduction

How a student perceives and experiences their classroom and instructor often has an impact on their achieved learning and course progress. Student learning approaches are also something that come into play when considering student success. The Experiences of Teaching and Learning Questionnaire (ETLQ) is a survey designed to measure these constructs within the classroom setting. The purpose of this study is to test the functioning of this survey, as it was designed, with a sample of higher education students from the United States.

Development of the ETLQ began as a way to uncover the specific ways in which students learn (Entwistle, McCune, & Hounsell, 2003; Entwistle & Ramsden, 1983; Marton, Hounsell, & Entwistle, 1984; Marton & Säljö, 1976; Parpala, Lindblom-Ylänne, Komulainen, Litmanen, & Hirsto, 2010). The constructs that constitute the ETLQ began with research conducted by Marton and Säljö (1976) which suggested that surface and deep learning styles were the primary ways in which students gathered and assimilated knowledge. Deep learning was characterized as being employed by those assimilating knowledge at a more comprehensive internalizing level, while those who used surface learning tended to memorize information for the purposes of answering anticipated assignments and exams only. These learning and studying orientations are referred to as deep and surface approaches to learning in the ETLQ (Marton & Säljö, 1984).

In addition to surface and deep approaches, student awareness of and adaptation to assessments was also acknowledged in previous research and added to this survey. This perspective was named the strategic (Entwistle & Ramsden, 1983) or achieving approach (Biggs, 1987) in which students often make adjustments to how and what they study based on their interpretation of course requirements. Both of these refer to student achievement orientation and organizational methods (Entwistle & McCune, 2004). Furthermore, when organized studying is combined with a deep approach to learning, better learning outcomes are observed (Entwistle & Ramsden, 1983; Lindblom-Ylänne, 1999).

The teaching-learning environment has also been linked to student outcomes and learning strategies. In 2003 Entwistle, McCune and Hounsell identified course design and organization, teaching and assessing, the staff-student relationship, and peer support as being integral parts of the teaching-learning environment that supported quality learning. Research has also shown that perceptions of high-quality teaching-learning environments are positively related to deep and negatively related to surface approaches to learning (Entwistle & Tait, 1995; Richardson, 2005; Richardson, 2006).

Beyond student-level learning approaches and classroom perceptions, teaching methods can also be conceptualized based on their constructive alignment which refers to the intersection of learning objectives, teaching methods, and assessments according to Biggs (2003). This constructive alignment has also been found to be associated with greater frequency of the deep approach and in turn, higher quality learning (Biggs, 1999). Students' perceptions of alignment in teaching are shown to be good indicators of this construct and are similarly associated with the deep approach (Parpala et al., 2010). The ways in which students perceive a supportive peer environment are also impactful to learning (Rytkönen, Parpala, Lindblom-Ylänne, Virtanen, & Postareff, 2012). In addition, perceptions of stronger social support networks are positively related to the deep approach and negatively related to the surface approach (Entwistle et al., 2003; Parpala, Lindblom-Ylänne, Komulainen, & Entwistle, 2013). With the ETLQ's strongly established construct rationale, it is likely that the themes presented here should also be present when the questionnaire is tested with a United States student population.

However, because the psychometric properties of instruments tend to be sample dependent it is helpful for them to be validated through multiple studies (Stewart et al., 1988). As such, it is important to examine the psychometric properties of an instrument whenever it is used with samples that are different from those used in the original scale development research (Bellini & Rumrill, 2009). The original format of the ETLQ was developed for teachers within a European educational system and, more specifically, with British public school students. Follow up studies have sought to validate the factor structure of the ETLQ with a Finnish student sample, but no studies have been conducted using a sample of students from the United States. It is the goal of this study to assess how this measure functions with this additional population.

Not only are the educational principles within the United States potentially different than those used in other countries, the follow up evaluations of the ETLQ's factor structure suggest that certain items may function differently within different student populations. Additionally, findings from comparison analyses indicate that some items and factors may benefit from reconfiguration and/or reconceptualization.

Procedures

Sampling

Participants were recruited across five semesters spanning three academic years. Because both classroom format and teacher influence were considered to be meaningful grouping variables, data was collected using a quasi-experimental classroom and format-based method. In order to ensure that class format could be analyzed after accounting for specific teacher effects, each professor taught each class format at least once.

At the beginning of each course, students were given a brief overview of the research and invited to participate. Those who elected to participate completed the LSQ, MSLQ, and general demographic data, which included information related to gender, class standing, major, and grade point average (GPA). Over the span of the semester, student grade data was also collected. At the end of each semester the ETLQ and MSLQ were administered again. Furthermore, focus groups were conducted at the end of each semester to gather qualitative insights related to student experiences.

Demographics

A total of 183 students were surveyed over the course of this program. The majority of the participants were undergraduate students (n = 125, 69%), followed by graduate students (n = 56, 31%). The sample was fairly evenly split by gender (Male, n = 93, 51%; Female, n = 91, 49%). Information was gathered from students across five different classes; including Environmental Geochemistry, Paleoceanography, Sedimentology and Stratigraphy, Urban Hydrology, and Watershed Hydrology.

Instrumentation

ETLQ. The Experiences of Teaching and Learning Questionnaire (ETLQ) measures the learning approaches that students have used during a particular course unit and their perceptions of the teaching–learning environment. It is a self-report that can be completed in person at the beginning or end of a class. The first section measures Approaches to Learning and Studying and contains 18 items with four scales related to how students have studied the course unit: deep approach (6 items); surface approach (4 items); monitoring studying (4 items); and organized studying (4 items).

The second section, Experiences of Teaching and Learning, contains 40 statements across 11 scales concerned with how students perceived the course unit. The subscales of this section are organization and structure (3 items); alignment (3 items); integration of teaching and learning (3 items); choice (2 items); encouraging high quality learning (5 items); clarity of feedback about assessments (5 items); assessing for understanding (4 items); staff enthusiasm and support (4 items); support from other students (3 items); and interest, enjoyment, relevance (5 items). All items in this and the previous section were scored on a 5-point scale ranging from “disagree” (coded as 1) to “agree” (coded as 5).

The third section contains 10 items related to the demands made by the course unit; scores are tallied using a 5-point scale with “very difficult” (coded as 1) and “very easy” (coded as 5).

The fourth section contains 8 items asking students to rate their knowledge gained; they rate each outcome on a 5-point scale ranging from “very little” (coded as 1) to “a lot” (coded as 5). Lastly, there is one item that asks how well students feel they have done in the course unit overall. They respond on a 9-point scale from “rather badly” (coded as 1) to “very well” (coded as

9).

Method

Exploratory Factor Analysis (EFA) was used to determine the optimal item specification and number of factors for the ETLQ. EFA was chosen in lieu of confirmatory factor analysis due to the fact that previous research has indicated that some items within the ETLQ cross loaded (i.e. load onto more than one factor) and that factors may not fit the data well for samples taken outside of the original demographic area. Data were analyzed using the statistical program Mplus (Version 7, Muthén & Muthén, 1998). Parameters were estimated with maximum likelihood (MR) procedure which provides standard model fit indices (Curran, West, & Finch, 1996).

Fit indices were computed between models to determine which one best fit the data. Fit indices included the Root Mean Square Error of Approximation (RSMEA), Tucker-Lewis Index (TLI), Comparative Fit index (CFI), and Standardized Root Mean Square Residual (SRMR). Any RMSEA value equal to or lower than .05 is considered to be an indication of good model fit (Schumacker & Lomax, 2010). TLI and CFI values above .90 are acceptable, however; values of .95 and higher are more desirable (Bollen, 1990). Values for the SRMR below .08 suggest good fit (Hu & Bentler, 1999).

For each tested model, factors and their composing items were examined and interpreted. Items found to be cross loading or belonging to more than one factor were considered for removal so as to create a simple structure solution. A simple structure solution indicates the factor structure in which items load at near 1 or at near 0 in absolute value on a factor. Items with a loading close to 1 are clearly important in the interpretation of the factor it loads on, and items with a loading close to 0 are clearly unimportant to the factor. A simple structure solution simplifies the task of interpreting the factors. Items that are retained for each factor (i.e., items with a loading closer to 1) are then interpreted by reviewing the manifest content of the items in order to identify any theme that might tie them together. The theme is then used to name the factor, which directly influences how it is used in the future (Fabrigar, Wegener, MacCallum, & Strahan, 1999).

Results

An exploratory factor analysis was conducted on each of the three sections of the ETLQ (i.e. Approaches to learning and Studying, Experiences of Teaching and Learning, Demands made by and Knowledge Gained in the Course Unit) to determine the optimal item configuration and factor structure. Mplus allows for multiple factor solutions to be tested for each analysis. Eigenvalues, factor loadings, fit statistics, and substantive factor meaning were examined to establish the most appropriate solutions. Each section was tested separately, the results of which are presented below.

Approaches to Learning and Studying

The original Approaches to learning and Studying section of the ETLQ contains 18 items across four subscales. Initial testing included six possible factor solutions ranging from a single factor to six in total. The individual fit statistics from these competing models can be seen in Table 1. It should be noted that the five and six factor models failed to converge so their fit statistic estimates are not available.

Table 1.
Summary of Model Goodness-of-Fit Indices for Approaches to learning and Studying *EFA Models*

Model	χ^2	*df*	RMSEA	CFI	TLI	SRMR
EFA model comparisons						
One factor solution	415.36 **	135	0.118	0.640	0.592	0.092
Two factor solution	302.17 **	118	0.103	0.763	0.693	0.071
Three factor solution	219.90 **	102	0.088	0.848	0.773	0.057
Four factor solution	150.06 **	87	0.070	0.919	0.857	0.043

Notes. $^{**}p < .001$.

χ^2 = Chi-Square Test (i.e., Minimum Fit Function); RMSEA = Root-Mean-Square-Error of Approximation; CFI = Comparative Fit Index; TLI = Tucker Lewis Index; SRMR = Standardized Root-Mean-Square Residual index.

As the models increased in number of factors, each index of fit also improved. This can be seen in the RMSEA and SRMR columns in which values decrease, indicating better fit, as the number of factors goes up. Additionally, the CFI and TLI values go up, indicating better fit. While moderate improvements did occur, none brought the model to the acceptable levels as previously described. As the five and six factor models failed to converge on a solution, the four-factor model appears to best fit the data (χ^2 = 150.06, df = 87, p < .01; RMSEA = .070, CFI = .919, TLI = .857, SRMR = .043).

Additional interpretation of the Eigenvalues suggested up to a five-factor solution, as λ_1 through λ_5 were all above 1 (i.e., $\lambda_1 = 5.36$, $\lambda_2 = 1.92$, $\lambda_3 = 1.41$, $\lambda_4 = 1.25$, $\lambda_5 = 1.00$) however, due to the non-convergence of the five-factor model, the four-factor solution remained the best option. As a result, the four-factor solution was chosen for further analysis, and the details of its functioning were explored.

Table 2 indicates the rotated factor solution for the four-factor model. The four-factor model appeared to produce four somewhat distinct factors. However, four items cross loaded onto more than one factor (i.e., Items A6, A14, A16 and A18). Additionally, three items failed to load onto any factor at a magnitude indicating any factor association (i.e. Items A10, A13, and A15). The remaining items loadings for the four factors were moderate to high and all significant with factor loadings ranging between .447 and .900. After the removal of cross and low loading items, 11 of the original 18 questions remained. Factor 2 was composed of solely items from the original Surface learning scale of the ETLQ (i.e. Items A1, A5, A17), Factor 3 contained items from the Organized Studying and Effort Management Scale (i.e. Items A4, A7, A11) and factor 4 was comprised of items from the Deep Approach scale (i.e. Items A8, A9, A12).

Table 2.
Rotated Factor Solution

Item	Loadings			
	Four Factor			
	F 1	F 2	F 3	F 4
A1		0.455*		
A2	0.771*			
A3	0.747*			
A4			0.554*	
A5		0.900*		
A6			0.242*	0.373*
A7			0.714*	
A8				0.522*
A9				0.447*
A10		-		0.279*
A11			0.857*	
A12				0.840*
A13		0.242*		
A14	0.358*			0.381*
A15			0.195*	
A16	0.277*			0.313*
A17		0.575*		
A18	0.266*		0.220*	

Note. Items loading below .40 were suppressed. Loadings lower than .40 were reported if they were the highest for that item.

Items A2, which came from the original Monitoring approach scale of the ETLQ (i.e. “I’ve been over the work I’ve done to check my reasoning and see if it makes sense”) and A3 which came from the Deep approach scale (i.e. “I usually set out to understand for myself the meaning of what we had to learn”) were the only questions that loaded onto Factor 1. These two items in conjunction appear to be implying a self-management construct, but their conceptual similarity does not necessarily warrant the creation of an additional factor. Due to the fact that factors 2, 3, and 4, are each composed of items that only correspond to one individual ETLQ scale each, it is suggested that they retain their original names (i.e. Surface Approach, Organized Studying and Effort Management, and Deep Approach) although in abbreviated forms.

Perceptions of the Teaching-Learning Environment

The Perceptions of the Teaching-Learning Environment scale of the ETLQ contains 40 items across 11 subscales, although for the purposes of this research only 10 were used, excluding the Effort management scale which contained 3 items. Similarly, to the previous Approaches to Learning and Studying scale analysis, an EFA was conducted with models ranging between six to eleven factor solutions. The 10 and 11 factor models failed to converge. The remaining model fit statistics are presented below.

Table 3.
Summary of Model Goodness-of-Fit Indices for All EFA Models

Model	χ^2	*df*	RMSEA	CFI	TLI	SRMR
EFA model comparisons						
Six factor solution	834.92 **	555	0.058	0.903	0.986	0.041
Seven factor solution	757.74 **	521	0.055	0.918	0.878	0.037
Eight factor solution	687.09 **	488	0.053	0.931	0.89	0.034
Nine factor solution (EFA)	631.11 **	456	0.051	0.940	0.897	0.031

Notes. $^{**}p < .001$.

χ^2 = Chi-Square Test (i.e., Minimum Fit Function); RMSEA = Root-Mean-Square-Error of Approximation; CFI = Comparative Fit Index; TLI = Tucker Lewis Index; SRMR = Standardized Root-Mean-Square Residual index.

As with the Approaches to Learning and Studying analysis, model fit improved as the number of factor solutions increased. Regardless of this gradual improvement, no models managed to produce an acceptable fit. With the failure to converge of the 10 and 11 factor models, the nine factor model appeared to be the best fit for the data (χ^2 = 631.11, *df* = 456, $p < .01$; RMSEA = .051, CFI = .940, TLI = .897, SRMR = .031). Eigenvalue data are presented below.

Eigenvalues produced during model estimation suggested that the nine-factor model was the best solution based on the Eigenvalue greater than 1 guideline (i.e., $\lambda_6 = 1.29$, $\lambda_7 = 1.25$, $\lambda_8 = 1.14$, $\lambda_9 = 1.11$, $\lambda_{10} = 0.96$). Furthermore, factor solutions greater than nine did not converge, therefore excluding them from consideration. Based on these and the previously reported model fit results the nine-factor model was selected for further interpretation. Rotated factor loadings are presented below.

Table 4

Rotated Factor Solution

Item	Loadings								
	Six Factor								
	F 1	F 2	F 3	F 4	F 5	F 6	F 7	F 8	F 9
A1		-0.495*							
A2	0.833*								
A3	0.664*								
A4			0.557*						
A5		-0.868*							
A6			0.251*	0.332*					
A7			0.783*						
A8			0.211*	0.360*					0.313*
A9				0.369*					
A10		0.237*		0.309*					
A11			0.778*						
A12				0.998*					
A13		-0.217*		-0.285*			0.21		
A14	0.305*			0.260*					0.275*
A15		0.288*				0.418*			
A16	0.221*			0.264*		0.240*			
A17		-0.591*							
A18	0.307*				0.260*				
A19					0.629*				
A20					0.686*				
A21						0.596*			
A22							0.435*		
A23						0.682*			
A24							0.620*		
A25	0.209*							0.428*	
A26								0.231*	0.421*
A27	0.209*							0.236*	0.386*
A28						0.237*			
A29									0.747*
A30								0.540*	
A31						0.314*		0.345*	
A32					0.257*		0.246*	0.304*	
A33					0.224*			0.378*	
A34								0.656*	
A35								0.413*	
A36							0.483*		
A37								0.284*	0.468*
A38					0.294*	0.296*			
A39								0.375*	
A40									0.636*

Note. Items loading below .40 were suppressed. Loadings lower than .40 were reported if they were the highest for that item.

Table 4 indicates the rotated factor solution for the nine-factor model. While there was some factor differentiation, there were also numerous items that presented problems. Fourteen items cross loaded onto more than one factor (i.e. A6, A8, A10, A14, A15, A16, A18, A25, A27, A31, A32, A33, A37, A38), three items had low loading values onto their respective factors (i.e. A9, A28, A39), and two items did not positively load onto any factor (i.e. A1, A17). Loadings for the remaining items were all significant and ranged between .413 and .998.

With the cross, low, and negatively loading items removed, 18 items remained. None of the factor loading patterns from this analysis corresponded with any within the original ETLQ Perceptions of the Teaching-Learning Environment scale. Of the nine unique factors produced, three were comprised of three items, four of two items, one with only one loading item and one factor in which no items loaded. Due to the significant deviation of these loadings from their suggested ETLQ structure, and the removal of half of the original items, these item and factor combinations were not interpreted to create new conceptual constructs.

Demands Made by Unit

An EFA also was conducted on the Demands Made by Unit and Learning Achieved scales of the ETLQ. These original scales contained 18 items across four subscales. Solutions ranging from one to six factors were tested. The five and six factor models failed to converge so the one through four factor solutions are presented in Table 5 below.

Table 5.
Summary of Model Goodness-of-Fit Indices for All EFA Models

Model	χ^2	*df*	RMSEA	CFI	TLI	SRMR
EFA model comparisons						
Two factor solution (EFA)	405.36 **	135	0.118	0.640	0.592	0.092
Three factor solution (EFA)	302.17 **	118	0.103	0.763	0.693	0.071
Four factor solution (EFA)	219.90 **	102	0.088	0.848	0.773	0.057
Five factor solution (EFA)	150.06 **	87	0.070	0.919	0.857	0.043

Notes. $^{**}p < .001$.
χ^2 = Chi-Square Test (i.e., Minimum Fit Function); RMSEA = Root-Mean-Square-Error of Approximation; CFI = Comparative Fit Index; TLI = Tucker Lewis Index; SRMR = Standardized Root-Mean-Square Residual index.

As the model complexity increased as did model fit. Although the four factor model was the best fitting for the data of those tested, it still did not reach acceptable levels (χ^2 = 150.06, *df* = 87, *p* < .01; RMSEA = .070, CFI = .919, TLI = .857, SRMR = .043). Eigen values are examined below.

Additional interpretation of the Eigenvalues suggested that the four or five factor solution may be the most fitting for the data base on the Eigenvalue greater than 1 criteria (i.e., λ_1 = 5.36, λ_2 = 1.93, λ_3 = 1.41, λ_4 = 1.25). This in conjunction with the fit statistics above and the non-convergence of the five-factor model suggests that the four-factor model is the best choice for possible modification and exploration.

Table 6.
Rotated Factor Solution

Item	Loadings			
	Four Factor			
	F 1	F 2	F 3	F 4
A1		0.455*		
A2	0.771*			
A3	0.747*			
A4			0.554*	
A5		0.900*		
A6			0.242*	0.373*
A7			0.714*	
A8				0.522*
A9				0.447*
A10			0.174*	0.279*
A11			0.857*	
A12				0.840*
A13		0.242*		
A14	0.358*			0.381*
A15		-0.279*		
A16	0.277*			0.313*
A17		0.575*		
A18	0.266*		0.220*	

Table 6 indicates the rotated factor solution for the four-factor model. Seven of the original 18 items were removed due to cross loading (i.e., Items A6, A10, A14, A16, A18), low loading (i.e. Item A13), and not positively loading onto any factor (i.e. Item A15). The remaining items were all statistically significant with loadings ranging between .455 and .857. These remaining 11 items produced factor structures quite different from the original ETLQ organization, but the number of items removed was lower than for the previous analysis, so reinterpretation was less divergent and therefore more suitable. Factor 1 (i.e. Items A2 “The rate at which new material was introduced”; A3 “The ideas and problems I had to deal with”) appeared to be associated with demands related to adaptation. The items composing Factor 2 (i.e. Items A1 “What I was expected to know to begin with”; A5 “The amount of work I was expected to do”; A17 “Ability to track down information in the subject area”) seemed to be related to demands related to expectations and finding information. Lastly, the items in Factor 3 (i.e. Items A8 “Working with other students”, A9 “Organizing and being responsible for my own learning”, A12 “Skills or technical procedures specific to the subject”) tended to correspond to social resources as they apply to technical knowledge.

Discussion

During the course of this study, the author examined the ability of the ETLQ to model students’ perceptions of their teaching and learning environment. Results were expected to support a factor structure and item specification originally proposed by the developers of the ETLQ. Observations of the data did not support this expectation. Multiple-factor solutions were tested for each of the ETLQ’s sections, and none were able to reach a level of acceptable fit.

The original form of the ETLQ contained a total of 78 items across 19 subscales. The number of items contributing to each subscale ranged between six for the organized studying approach and two for the perception of choice measure. These subscales, while originating from strong theoretical backgrounds, had not been validated using a sample occurring in North America. This study tested the three sections of the ETLQ using exploratory factor analysis to compare the emerging item specification and factor configuration against those that occurred with samples from other nations.

The first test included items from the Approaches to Learning and Studying section of the ETLQ. This section originally contained four subscales including deep, surface, organized, and monitoring approaches to learning. The results of the analysis conducted in this research supported these factors but indicated that some items contributed to more than one factor. In measure development a “simple structure” indicates that items load onto only one factor, therefore strengthening the idea that the content of that item is unique and specific for the subscale that it is associated with. If a factor contains items that contribute to more than one concept, it cannot be said that the factor measures one single idea or is unidimensional. These items that load onto more than one item are considered to be cross loading, and in survey development, they are often selected for modification or removal. For the purposes of this study, cross loading and low loading items were not considered during factor interpretation. With these questions removed, the remaining items still fell within their originally proposed ETLQ subscales. This result indicates that these items solely contribute to their factors theoretical construct. As such, the deep, surface, and organized studying subscales from the Approaches to Learning and Studying section of the ETLQ appear to function with this sample population. The majority of items from the strategic approach subscale were removed revealing that this factor may need modification before further use.

The Perceptions of Teaching and Learning Environment section of the ETLQ contained the largest number of subscales and also those with the fewest items. Typically, the fewer items a subscale contains, the less likely it will hold up to psychometric scrutiny. Many items were removed before factor interpretation due to cross, low, and negative loadings. Exploratory Factor Analysis converged on a solution of nine factors out of the original 11, but none of the item configurations matched or were similar to those in the original ETLQ subscales. These results suggest that while the themes and factors for this section may have been developed with sound theoretical knowledge, the statistical properties were not robust enough to withstand testing with an alternative sample. Future use of these perception subscales is still possible, however, conceptual overlap between themes should be considered.

The Demands Made and Learning Achieved by Unit sections of the ETLQ yielded three factors during this study. Originally containing four subscales referring to learning demands and knowledge acquisition, the emerging themes for this analysis were "demands related to adaptation", "demands related to expectations and finding information", and "social resources as they apply to technical knowledge". The first two demand centered factors are likely due to the "demand" oriented language of the original items. While the new factors shared this basic theme, the item configuration was quite different from their original proposed specification.

Limitations

Because the multivariate normality of the indicators is one of the ML assumptions in CFA, the slightly non-normal distribution shape of some of the items may have led to biased standard error estimates in the study when the ML estimation procedure was used (Kline, 2000). However, it has been found that ML estimation performs well with mild departures from normality (Chou et al., 1991; Hu et al., 1992) and can be used with non-interval data (e.g., ordinal data such as a Likert scale) with small to moderate skewness and kurtosis, especially when sample size is sufficient.

In studies, power analysis is related to four parameters, which are Alpha, Beta, statistical power and effect size, and are essential for a priori sample size resolution (Barker, Pistrang, & Elliott, 2016). A Factor Analysis is a large sample size method where sample size influences accuracy and replication of the results (Kyriazos, 2018). However, this study did not meet the minimum estimation that was needed in our statistical power for analyses regarding sample size. To go in more depth, in our ETLQ study, there were four main competing exploratory models: first section, 18 items with 4 scales; second section, 40 items across 11 scales; third section, 10 items using a 5-point scale; fourth, 8 items on a 5-point scale; lastly, 1 item on a 9-point scale. We can see that the second model (with the most items), did not have a sample size sufficient to meet its criteria. RMSEA, TLI, Cfit, and SRMR are all affected by sample size as well; a small sample size can be excessively sensitive in rejecting correct population models (Byrne, 2012). Mentioned before, any RMSEA value equal to or lower than .05 is considered to be an indication of good model fit (Schumacker & Lomax, 2010), and TLI and CFI values above .90 are acceptable, however values of .95 and higher are more desirable (Bollen, 1990). Also, values for the SRMR below .08 suggest good fit (Hu & Bentler, 1999). In this research, the four-factor model appeared to be the best for the data, but overall, no models managed to produce an acceptable fit. Consequently, there may be the possibility of not measuring the true relationships in the dataset in which the statistical power may not have detected an actual effect, and there is the potential to produce unstable correlation estimates which are more susceptible to outliers. Therefore, for future research it is recommended having a more adequate sample size. It is suggested that a sample of 300 or more is satisfactory for a factor analysis (Kyriazos, 2018; Comrey & Lee, 1992; and Comrey, Backer, & Glaser, 1973).

Conclusion

While the ETLQ is a theoretically sound measure of students' perceptions of their teaching and learning environment, a statistical analysis did not support measurement validity. The original scale was created and normed on a European student sample so some of this statistical lack of fit may be due to the North American sample used here. It is suggested that future research attempt to conduct additional analyses of the psychometric properties of the ETLQ as it applies to different student populations.

Dr. William Merchant *is a professor in Applied Statistics and Research Methods at the University of Northern Colorado. He can be reached a* *william.merchant@unco.edu*

Yael Haskowitz *is a senior statistical and research consultant at the University of Northern Colorado.*

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