Validation of a modified version of the Experiences of Teaching and Learning Questionnaire

Jukka Utriainen, Päivi Tynjälä, Eeva Kallio & Miika Marttunen
University of Jyväskylä, Finland

ABSTRACT

Providing teaching-learning environments that foster university students' learning is an essential task of higher education. Valid and reliable tools for assessing them are therefore needed. This study investigates the measurement properties of a modified version of the Experiences of Teaching and Learning Questionnaire (ETLQ). Two independent data-sets (N=1637 and N=1711) were collected from Finnish university students. Confirmatory factor analyses resulted in a modified measurement model for the ETLQ, consisting of 11 factors. The first three factors assessing the teaching-learning environment – Teaching for Understanding, Disciplinary Understanding and Supportive Teaching – were indicators of a second-order factor labeled Encouraging Learning. The remaining three environment factors were Alignment, Peer Support and Constructive Feedback. Three factors – Deep Approach, Surface Approach and Organized studying – assessed students' approaches to learning. Furthermore, items related to Critical Thinking were added to questionnaire. The measurement properties of the modified ETLQ and the practical implications are discussed.

Introduction

Recently in universities, much emphasis has been placed on the importance of powerful teaching-learning environments, that is, teaching practices that can be expected to cultivate and reward students' understanding (McCune & Entwistle, 2011). The effectiveness of mentioned environments has typically been examined via student perceptions with various methods. In many studies, these environments evaluated by students as providing good teaching have been found to be associated with more successful studying in higher education (e.g., Karagiannopoulou & Milienos, 2015; Lizzio, Wilson & Simons, 2002).

The Experiences of Teaching and Learning Questionnaire (ETLQ) is one of several instruments developed for the purpose of examining students' perceptions of their learning environments (Entwistle, McCune & Hounsell, 2003). The questionnaire was developed in UK as a part of the research project that sought to identify the elements in teaching-learning environment that supported students to engage in their studies and learning in higher education (Entwistle et al., 2003). The project resulted in longer (consisting of 77 items) and shorter (consisting of 40 items) version of ETLQ. The short version was further modified into the Finnish context, so that it shifted the focus from course level to students' degree program level (Parpala, Lindblom-Ylänne, Komulainen & Entwistle, 2013). However, some uncertainty persists as to how the constructs of the ETLQ are measured, as confirmation of measurement properties of the shortened ETLQ has been challenging (Parpala et al., 2013; Stes, De Maeyer, Gijbels & Van Petegem, 2012).

Furthermore, the various versions of ETLQ include items measuring students' learning processes or student approaches to learning, besides items assessing students' perceptions of teaching-learning environment. In contrast, short or modified versions of ETLQ do not include items measuring learning outcomes, which are included in the long version of ETLQ. However, those items measuring learning outcomes do not specifically cover critical thinking, which is widely agreed to be a key learning outcome in university education (e.g., Moore, 2013; Tremblay, Lalancette & Roseveare, 2012). The use of critical thinking is difficult for students who are applying to university (Utriainen, Marttunen, Kallio, & Tynjälä, 2017), and learning of critical thinking skills has proved to be challenging for university students (e.g., Arum & Roksa, 2011; Pascarella & Terenzini, 2005). Therefore, it is important that universities monitor how well their learning environments support the development of critical thinking. For these reasons, the present study added measures of critical thinking into the modified version of ETLQ and sought to increase the validity of it by clarifying its measurement model. Additionally, this study aimed take into account the essential learning outcome of university education by adding measures of critical thinking into modified version of ETLQ.

Teaching-learning environments in higher education

In this study, university students' learning is conceptualized through Biggs's (1987) 3P model of learning, comprising the factors *presage, process*, and *product*. First, two types of presage factors exist before engagement in learning: personal factors, which include student's prior knowledge and personal characteristics, and situational factors, which consist of institutional features, such as course structures, teaching and assessment practices. The situational presage factors pertain to the teaching-learning environment. Second, the process factors describe the cognitive and metacognitive processes of learning. Of these factors, students' approach to learning is the focus in this study. Third, the product factors measure learning process outcomes. Typical learning outcomes include student's set work and examinations, but also self-assessments such as evaluations of one's thinking skills and self-set goals.

Entwistle et al. (2003) identify four elements in the teaching-learning environment: course contexts, teaching and assessment of contents, relationship between students and staff, and students and their cultures. *Course contexts* include, among others, aims and intended learning outcomes for a specific course (Entwistle et al., 2003). Moreover, the course organization should support goal-oriented knowledge construction in authentic contexts by enabling students to make connections between their previous knowledge and the varying course materials (De Corte, 2000; McCune & Entwistle, 2011). *Teaching and assessment of contents* refer to pedagogical practices that support students' understanding of discipline-specific ways of thinking and reasoning (Entwistle, McCune & Hounsell, 2002; McCune & Entwistle, 2011). *Relationship between students and staff* describes the affective quality of the relationships between students and teachers, such as the provision of flexible instructional support for both cognitively and affectively diverse learners (De Corte, 2000; Entwistle et al., 2002; McCune, 2009). *Students and their cultures* refers to students' abilities, learning skills

and peer group relationships (Entwistle et al., 2002). Learning environments seem to increase student academic engagement and effective learning are often characterized as powerful teaching-learning environments (De Corte, 2000; Entwistle, 2009; Entwistle et al., 2002).

Several studies conducted among university students have found associations between the teaching-learning environment and learning outcomes. For example, students' perceptions of good teaching have shown positive associations with their academic achievement (Karagiannopoulou & Christodoulies, 2005), and learning of generic skills (Kember & Leung, 2009; Pascarella, Wang, Trolian & Blaich, 2013). Generic skills include attributes such as the ability to think critically and solve problems, communication skills and so forth (Bath, Smith, Stein & Swann, 2004). Likewise, a supportive relationship with peers and academic staff has proved to have a positive association with university students' academic achievement and progression (Rytkönen, Parpala, Lindblom-Ylänne, Virtanen & Postareff, 2012).

Students' approaches to learning and critical thinking

Marton and Säljö (1976) proposed two contrasting levels in the learning process, the surface level, where the student focuses on rote-learning and reproducing the learning material, and the deep-level, where the student focuses on understanding the content and meaning of the material. These two levels have since been re-labeled as student approaches to learning, hence the names *surface* approach and *deep* approach. *Organized effort* has been recognized as a third approach to studying and it is defined as well-organized studying making good use of time and effort (Entwistle, 2009).

Empirical studies have found support for connections between process factors and both the presage and product factors. First, student approaches to learning have been associated with their perceptions of the learning environment bi-directionally, as students' perceptions of the teaching-learning environment have been found to have an effect on their approaches to learning, and vice versa (Karagiannopoulou & Milienos, 2015; Richardson, 2006). Second, students' approaches to

learning are argued to be intertwined with other cognitive skills (Heikkilä & Lonka, 2006). For example, both a deep approach to learning and organized effort are positively associated with university students' learning of generic skills, whereas a surface approach to learning have a negative effect (Kreber, 2003; Rahmand & Mokhtar, 2012). Similarly, the adoption of a deep approach has often been associated with higher academic achievement (Karagiannopoulou & Christodoulies, 2005; Trigwell, Ellis & Han, 2012). However, it has been argued that the associations between student approaches to learning and academic achievement tend to be weak (Richardson, Abraham & Bond, 2012).

In this study, academic achievement is focused particularly on critical thinking skills. Critical thinking has been argued to consist of three key dimensions, specifically the skill to think rationally and reasonably, the skill to recognize alternative viewpoints, and the readiness to reflect on one's own thoughts and their quality (Flores, Matkin, Burbach, Quinn & Harding, 2012; Niu, Behar-Horenstein & Garvan, 2013). To be more specific, skills in applying information and producing explanations for one's reasoning (Facione, 1990; Halonen, 1995), and creativity and innovation (e.g., Binkley et al., 2012), have been seen as important thinking skills in the literature. Therefore, applying theoretical knowledge to practice and developing new ideas were included into the critical thinking skills. Furthermore, argumentation is at the core of critical thinking (Kuhn, 2016), and the ability to produce arguments is regarded as essential in university education across disciplines (Lea & Street, 1998). As argumentation requires students to analyze and evaluate information (Wu, 2006), the operationalization of critical thinking in the present study focuses on the analysis and evaluation of information, arguments and viewpoints (e.g., Cosgrove, 2011; Ennis, 1993), alongside with the development of new ideas. We see the inclusion of these skills in ETLQ as important, as complementing the measures of the product factors in the 3P model.

The development of the Experiences of Teaching and Learning Questionnaire (ETLQ)

ETLQ was introduced in 2003 (Entwistle et al., 2003), and its recent development contains 40 items measuring students' perceptions of their learning environment (comprising the scales Teaching for Understanding, Alignment, Staff Enthusiasm and Support, Interest and Relevance, Constructive Feedback and Support from Other Students) and 18 items measuring student approaches to studying (comprising the scales Deep Approach, Surface Approach, Intention to Understand and Organized Studying) (Parpala et al., 2013). In their study, Parpala et al. (2013) specified the Intention to Understand scale, which consists of items measuring more specifically students' strategy for understanding learnt material, that is one aspect of the construct deep approach. In addition, the survey has undergone several modifications.

For example, Stes et al. (2012) shortened the ETLQ, after which their measurement model showed acceptable fit to the data. They used items measuring teaching-learning environment and the model included eight scales (consisting of 25 items): Aims and congruence, Teaching for understanding, Set work and feedback, Assessing understanding, Staff enthusiasm and support, Student support, Interest and enjoyment and Student Choice (Stes et al., 2012). However, because they did not report the factor loadings of their measurement model, it was not further examined in this paper. Similarly, Rytkönen et al. (2012) shortened their questionnaire, measuring perceptions of the teaching-learning environment with four scales (consisting of 21 items), namely Relevance and Evoking Interest, Constructive Feedback, Peer Support and Alignment. Student approaches to learning was measured with 11 items, also comprising four scales: Deep Approach, Organized Studying, Intention to Understand and, Surface Approach (Rytkönen et al., 2012). Similarly, Karagiannopoulou and Milienos (2015) also modified the ETLQ, using only items that measured student perceptions of the teaching-learning environment. Their 20 items were indicators for four scales: Congruence and Coherence in Course Organization, Teaching for Understanding, Support from Other Students, and Integrative Learning and Critical Thinking (Karagiannopoulou & Milienos, 2015).

Comparison of these two modified versions of the ETLQ reveals some similarities and differences between the measurement models in the items measuring the teaching-learning environment. For example, the Peer Support factor in Rytkönen et al. (2012) study, and the Support from Other Students factor in Karagiannopoulou and Milienos (2015) had similar factor loadings. However, the factor Relevance and Evoking Interest comprised 10 items in Rytkönen et al.'s (2012) study, five of which were similar to the factor Teaching for Understanding and Encouraging Learning in Karagiannopoulou and Milienos (2015). Likewise, two of the four items that measured the Alignment factor in Rytkönen et al. (2012) matched the items that Karagiannopoulou and Milienos (2015) used to measure Congruence and Coherence in Course Organization in their study.

Unfortunately, attempts to confirm the measurement model for the modified versions of ETLQ do not seem to have reduced the lack of clarity surrounding it. For example, Asikainen et al. (2014) used ETLQ modified by Rytkönen et al. (2012), and used confirmatory factor analysis (CFA) for both the items measuring perceptions of the teaching-learning environment and students' approach to learning, and in the resulting measurement models items loaded on slightly different factors. Comparison of the factor Relevance and Evoking Interest illustrates this variability: it consisted of ten items in Rytkönen et al. (2012), but in Asikainen et al. (2014) a similarly named factor had only three items. However, Asikainen et al. (2014) had a factor Teaching for Understanding, with items identical to those in the Relevance and Evoking interest factor in Rytkönen et al. (2012). Hence, Asikainen et al. (2014) in effect extracted the Teaching for Understanding factor from the Relevance and Evoking Interest factor.

Moreover, it is unclear what constructs are consistently measured by the modified ETLQ. First, Asikainen et al. (2014) excluded the Surface Approach scale from the approaches to learning section, and Constructive Feedback and Staff Enthusiasm and Support from the teaching-learning section. However, statistical reasons aside, no theoretical justification or discussion for the removal of one of the key approaches to the learning construct was provided. Second, Karagiannopoulou and

Milienos (2015) excluded the Constructive Feedback factor and allowed the items of the Staff Enthusiasm and Support factor to load on the factor Teaching for Understanding and Encouraging Learning.

Unsuccessful attempts to verify the measurement model of ETLQ or its modified versions suggest that there might not be enough evidence of its internal structure, an important aspect of construct validity. The internal structure of the survey refers to the relationship among the items and the constructs they are intended to measure (Camara, 2003). Traditionally, the internal structure of a questionnaire is evaluated via Confirmatory Factor Analysis, which tests the theoretically justified measurement model against the data collected with the questionnaire. However, it should be noted that these differences in the measurement models could be due to the sample-specific variance. Hence, the possible changes made to measurement models should be also verified in independent samples in order to verify the changes.

Aim of the study

On the basis of the literature reviewed above, modified versions of ETLQ seem to have varying number of constructs that they measure. However, they seem to be overlapping and in many parts similar. In order to verify the internal structure of the ETLQ, a systematic approach to testing is needed. Second, since modified ETLQ lacks measures for the learning outcomes (product factors), items measuring critical thinking were added to the ETLQ to represent product factors. Hence, the purpose of this study was to clarify the measurement model for a modified ETLQ in order to achieve more valid tool for higher education institutions to assess how their students perceive teaching and learning. The starting point for the development of the measurement model is that described by Rytkönen et al. (2012), as it was developed for the Finnish higher education setting, which is also the context of this study. The initial measurement model for the modified ETLQ is shown in Figure 1.

Figure 1

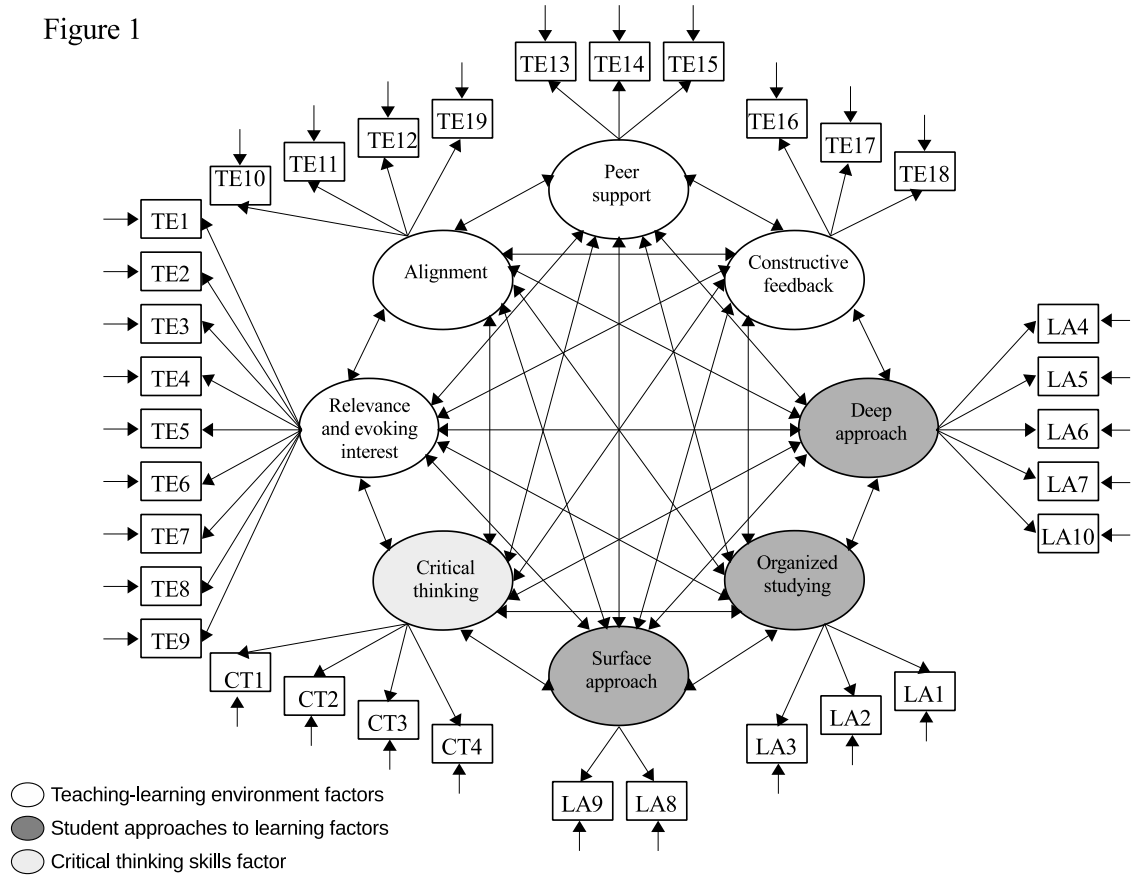

Figure 1. Initial measurement model for the modified ETLQ.

Method

Participants and data

The data were collected in a Finnish university by means of an online questionnaire. Students were participating in a two-cycle degree system consisting of a three-year Bachelor's degree followed by a two-year Master's degree. An invitation was sent to every 1st, 3rd and 5th year student via email and, to increase the response rate, two reminders were also sent. Students represented seven faculties: Humanities, Information Technology, Education, Sports and Health Sciences, Mathematics and Science, School of Business and Economics, and Social Sciences. Two independent survey datasets,

collected in the years 2009 and 2010, were used in this study. The year 2009 population comprised 4 491 students, with a mean age of 26.1 years (*SD* = 7.1), of whom 1 637, with a mean age of 25.2 years (*SD* = 6.5), answered the survey (response rate 36.5 %). The Year 2010 population comprised 4 802 students, with a mean age of 26.1 (*SD* = 7.1). Of this population, 1 711 students, with a mean age of 25.2 years (*SD* = 7.0), participated (response rate 35.6 %). The distributions of participants by gender and study year in both samples and population are presented in Tables 1 and 2. As indicated in Table 1, in both samples females are overrepresented. In addition, in year 2009 sample third year students are overrepresented, while in year 2010 sample first year students are overrepresented (Table 2).

Table 1. Frequencies and proportions of students by gender in both populations and samples.

	2009				2010			
	Population		Sample		Population		Sample	
Gender	*f*	*%*	*f*	*%*	*f*	*%*	*f*	*%*
Female	2 968	66.1	1 165	71.2	3 095	64.5	1 205	70.4
Male	1 523	33.9	472	28.8	1 707	33.5	506	29.6
Total	4 491	100.0	1 637	100.0	4 802	100.0	1 711	100.0

Table 2. Distribution of students by study year in the 2009 and 2010 populations and samples.

	2009				2010			
	Population		Sample		Population		Sample	
Study year	*f*	*%*	*f*	*%*	*f*	*%*	*f*	*%*
1st year	1 592	35.4	553	35.1	1 722	35.8	651	39.6
3rd year	1 519	33.8	588	37.3	1 767	36.8	572	34.8
5th year	1 380	30.7	435	27.6	1 313	27.3	422	25.7
Total	4 491	100.0	1 576*	100.0	4 802	100.0	1 645*	100.0

*NOTE: study year was missing for 61 students (3.7 %) in the 2009 sample and for 66 (3.8 %) in the 2010 sample.

Questionnaire

Students' perceptions of the teaching-learning environment and their approaches to learning were measured with a modified version of the ETLQ (administered in Finnish), which surveys these

experiences on students' major subject level (Rytkönen et al., 2012). It consists of 19 items evaluating students' perceptions of their teaching-learning environment and 11 items assessing student approaches to learning. This modified ETLQ was further altered (see Table 3), so that item "I found most of what I learned in this course

unit really interesting" was removed from Relevance and evoking interest scale, because the item does not capture the idea of interest development (Hidi & Renninger, 2006). In addition, one item "I regularly received feedback from teachers on my set work" was added to Constructive feedback scale as the other items related to feedback take it for granted that feedback is given. The Intention to understand scale was only partly used in this study, because we included the item (LA10, "I've usually set out to understand for myself the meaning of what we had to learn.") from the original Intention to Understand scale in the Deep Approach scale. Furthermore, we dropped the item "In reading for this course unit, I've tried to find out for myself exactly what the author means" from the scale, because it focuses more on course level, whereas the other items were more on general level. So, teaching-learning environment scales consisted of 19 items and students' approaches to learning ten items, and four items measuring critical thinking were also added. The critical thinking items were based on the key critical thinking skills described in the theoretical background, that is, analysis and evaluation of information and ability to apply information. Additionally, ability to be creative and innovative was operationalized as the development of new ideas. All items were measured on a 5-point Likert scale, ranging from 1 (completely disagree) to 5 (completely agree).

Table 3. Items measuring students' experiences of the teaching-learning environment, approaches to learning, and critical thinking.

Item
Teaching-learning environment (TE)
TE1 This programme encouraged me to relate what I learned to issues in the wider world.
TE2 I could see the relevance of most of what we were taught in this programme.
TE3 I enjoyed being involved in this programme.
TE4 Staff helped us to see how you are supposed to think and reach conclusions in this subject.

TE5 The teaching in this programme helped me to think about the evidence underpinning different views.
TE6 This programme has given me a sense of what goes on 'behind the scenes' in this subject area.
TE7 Staff tried to share their enthusiasm about the subject with us.
TE8 What we were taught seemed to match what we were supposed to learn.
TE9 Staff were patient in explaining things which seemed difficult to grasp.
TE10 The feedback given on my work helped me to improve my ways of learning and studying.
TE11 The feedback given on my set work helped to clarify things I hadn't fully understood.
TE12 The set work helped me to make connections to my existing knowledge or experience.
TE13 I found I could generally work comfortably with other students in this programme.
TE14 Students supported each other and tried to give help when it was needed.
TE15 Talking with other students helped me to develop my understanding.
TE16 It was clear to me what was expected in the work assessed for this programme.
TE17 I could see how the set work fitted in with what we were supposed to learn.
TE18 It was clear to me what I was supposed to learn in this course unit.
TE19 I regularly received feedback from teachers on my set work.

Student approach to learning (LA)

LA1 On the whole, I've been quite systematic and organized in my studying.
LA2 I've generally put a lot of effort into my studying.
LA3 I've organized my study time carefully to make the best use of it.
LA4 I've looked carefully at the evidence before reaching my own conclusion about what I'm studying.
LA5 Ideas I've come across in my academic reading often set me off on long chains of thought.
LA6 When I've been communicating ideas, I've thought over how well I've got my points across.
LA7 If I've not understood things well enough when studying, I've tried a different approach.
LA8 I've often had trouble in making sense of the things I have to remember.
LA9 Much of what I've learned seems no more than lots of unrelated bits and pieces in my mind.
LA10 I've usually set out to understand for myself the meaning of what we had to learn.

Critical thinking (CT)

CT1 I have learnt to analyze and organize information.
CT2 I have learnt to evaluate issues critically.
CT3 I have learnt to apply theoretical knowledge on practice.
CT4 I have learnt to develop new ideas.

NOTE: TLE and SAL items are from Rytkönen et al. (2012, 248 - 249) modified version of the ETLQ (items are English translations).

Data analysis

Confirmatory factor analysis was performed by Mplus 7.3 and the other statistical analyses by IBM SPSS Statistics 22. Assessment of the first sample for univariate normality showed that this condition was not met, as the skewness ranged from -0.661 to 1.349 and kurtosis from -1.047 to 2.497. For the second sample, skewness ranged from -1.034 to 0.607, and kurtosis from -0.848 to 1.053. There was

no missing information in either dataset (except participants' study year, which was not included in the analysis). Due to the non-normality of the data, Maximum Likelihood with robust standard errors (MLR) was the estimation method used in the CFA.

The following fit indices and cutoff values for acceptable fit were used in this study: χ^2-test (ns, $p > .05$), Root Mean Square Error of Approximation (RMSEA) values close to .06, and Tucker-Lewis Index (TLI) and Comparative Fit Index (CFI) values close to .95 (Hu & Bentler, 1999). Also reported is the 90 percent confidence interval of the RMSEA.

The analysis was done in two phases. First, three CFAs were conducted to test the measurement models for each of the three parts (perceptions of the teaching-learning environment, students' approaches to learning and critical thinking) of the ETLQ separately. If one or more of these three partial measurement models showed lack of fit, the CFA was continued, adopting a model generation approach, in order to establish a model that was acceptable both statistically and theoretically (Kline, 2011). In the second phase, all three partial measurement models were combined into one complete modified measurement model, which was first tested in the year 2009 data and subsequently validated with the year 2010 data.

Results

First, the initial measurement model for the teaching-learning environment items was tested. Table 4 shows the fit indices for the model, which indicated a misfit between the model and the data. The standardized factor loadings varied as follows: for the Relevance and Evoking Interest factor from .55 to .65, for the Alignment factor from .60 to .68, for the Peer Support factor from .55 to .78, and for the Constructive Feedback factor from .30 to .83.

Next, the analysis was continued by adopting a model generation approach. This process resulted in a model where the Relevance and Evoking Interest factor was split into three first-order factors. Aside from the statistical results, the division of Relevance and Evoking Interest into three

first-order factors (see Figure 2) also made conceptual sense. The first of the first-order factors, Teaching for Understanding, consisted of items measuring teaching that support the development of personal understanding, a key concept in a powerful teaching-learning environment (McCune & Entwistle, 2011). The second first-order factor was labeled as Supportive Teaching, since its items described the affective qualities of the student-teacher relationship (Entwistle et al., 2002). The third first-order factors was Disciplinary Understanding, as its items measured how teaching exemplifying disciplinary-specific thinking encourages students' own thinking and understanding (Entwistle, 2009). Lastly, these three new factors were specified as indicators of a second-order factor, labeled Encouraging Learning (Entwistle et al., 2003).

In addition to changes in the number of factors, item TE12 “The set work helped me to make connections to my existing knowledge or experience” loaded on the new factor Teaching for Understanding, and was fixed to zero on the Constructive Feedback factor. This was justified by the item’s wording, as it measured how assignments support the development of students’ understanding, rather than teacher feedback. Likewise, the loading of item TE8 “What we were taught seemed to match what we were supposed to learn” switched from the Relevance and Evoking Interest factor to the Alignment factor. The item measured the alignment of teaching, rather than the relevance of teaching or arousing of interest. Finally, item TE3 “I enjoyed being involved in this programme” was removed, since it had small loadings (.30 and .40) on two factors, namely Teaching for Understanding and Constructive Feedback, and it was not a good measure of either construct.

The modified measurement model for the teaching-learning environment items had acceptable fit, as shown in Table 4 (except χ^2-test). Only the TLI was just under the cut-off value of .95, but model was not further modified. All parameter estimates were statistically significant ($p < .001$).

Table 4. Fit indices of the measurement models of three different parts of the modified ETLQ.

Model	χ^2	df	p-value	RMSEA	RMSEA 90 % C.I.	CFI	TLI

Initial measurement model for teaching-learning environment factors	1494.514	146	0.00	.08	.07 - .08	.84	.82
Modified measurement model for teaching-learning environment factors	505.174	126	0.00	.04	.04 - .05	.95	.94
Initial measurement model for student approaches to learning factors	350.667	32	0.00	.08	.07 - .09	.91	.87
Modified measurement model for student approaches to learning factors	131.870	24	0.00	.05	.04 - .06	.96	.95
Critical thinking measurement model	3.072	2	0.23	.02	.00 - .06	1.00	1.00

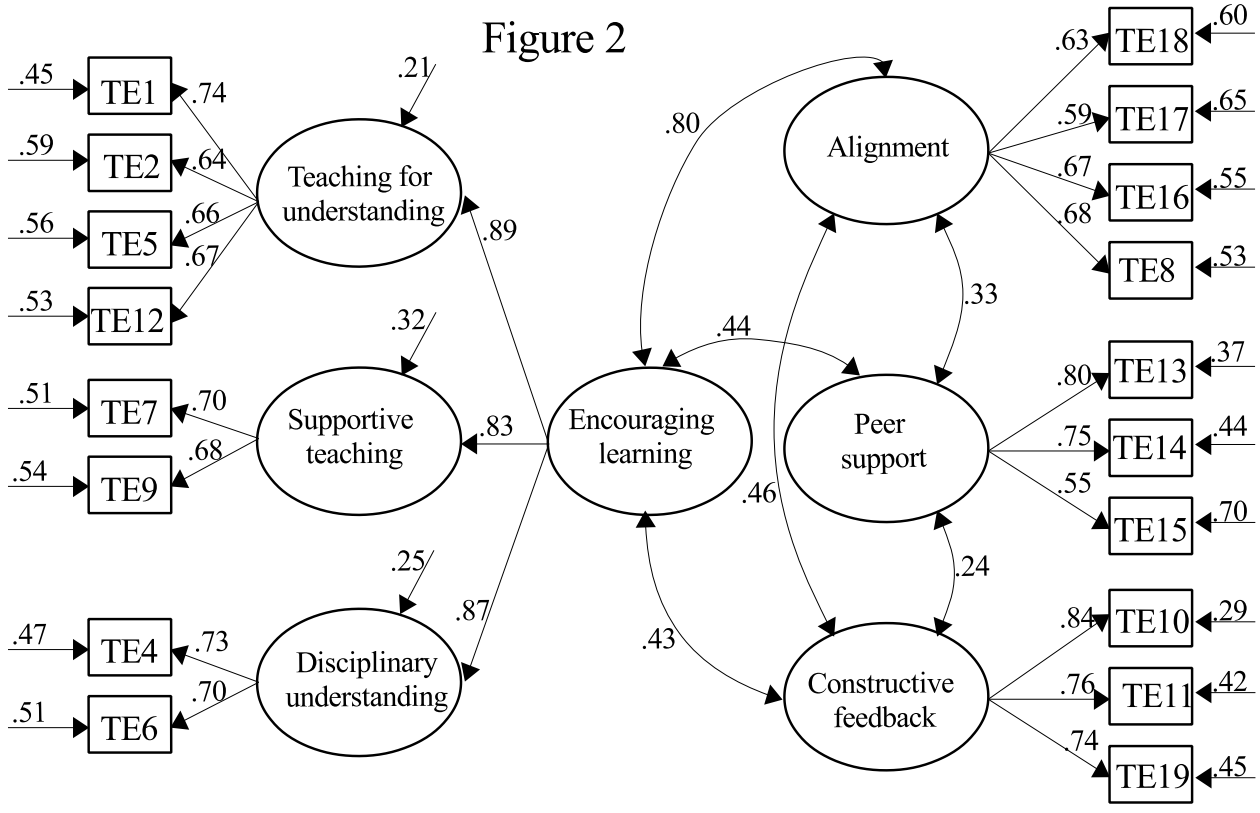

Figure 2. Modified measurement model for items measuring students' perceptions of the teaching-learning environment, including standardized parameter estimates.

Next, the measurement model for student approaches to learning was tested. The fit indices showed (see Table 4) that the model did not fit to the data. The standardized factor loadings were between .60 - .90 for Organized Studying, .46 - .78 for the Deep Approach, and .64 and .7 for the Surface Approach.

The model generating approach produced a modified measurement model for the student approaches to learning items (see Figure 3). The measurement model was re-specified so that item LA10 “I’ve usually set out to understand for myself the meaning of what we had to learn.” was removed, as the modification indices showed cross-loading on the Organized Studying factor, whereas in Rytkönen et al. (2012) this item was an indicator for the Intention to understand factor, which was not modeled in this study. All the fit indices, except the χ^2-test, indicated acceptable fit tor the modified model (see table 4). All parameter estimates were statistically significant ($p < .001$).

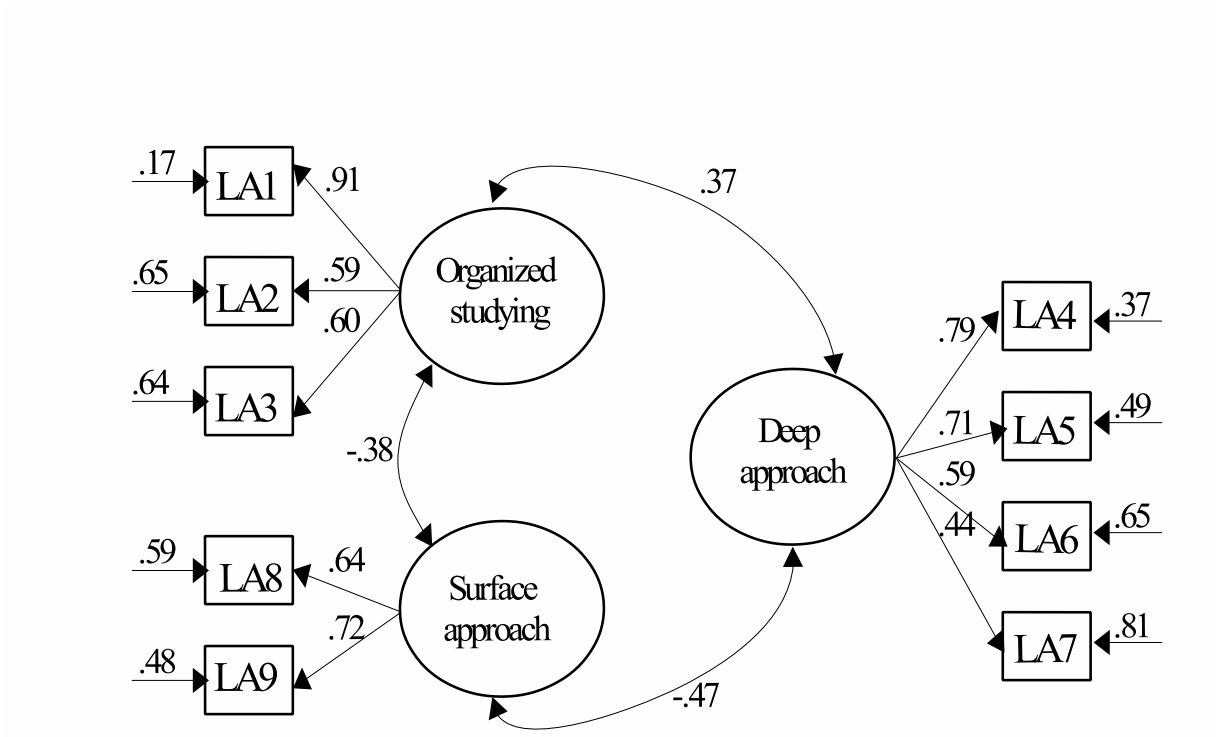

Figure 3. Modified measurement model of the students approaches to learning items, including standardized parameter estimates.

The last separate measurement model tested was for the Critical Thinking skills items. The measurement model (see Figure 4) showed good fit to the data (see Table 4), as all the fit indices were above the cut-off values. The standardized factor loadings for the items ranged between .69 and .77. Additionally, all parameter estimates were statistically significant ($p < .001$).

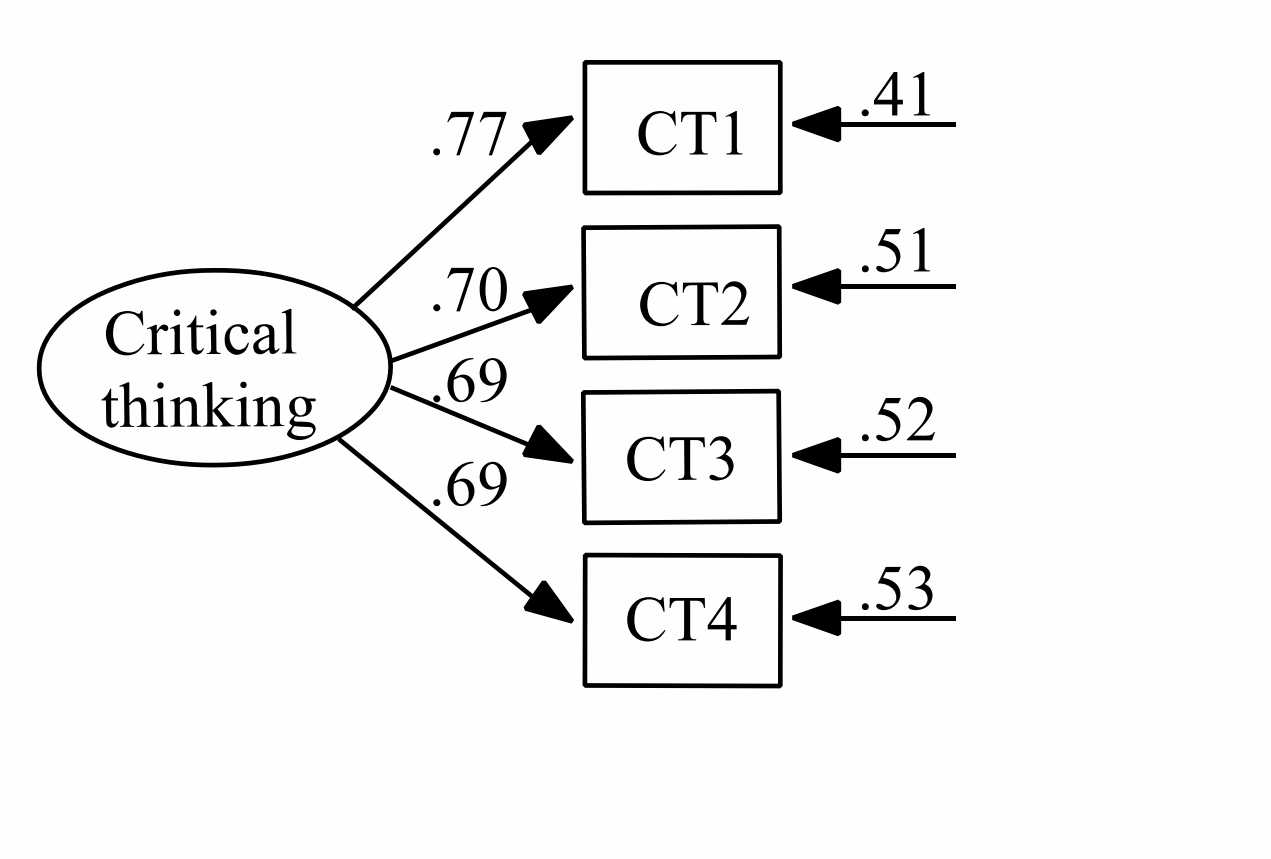

Figure 4. Measurement model for the students' perceived critical thinking skills items and standardized parameter estimates.

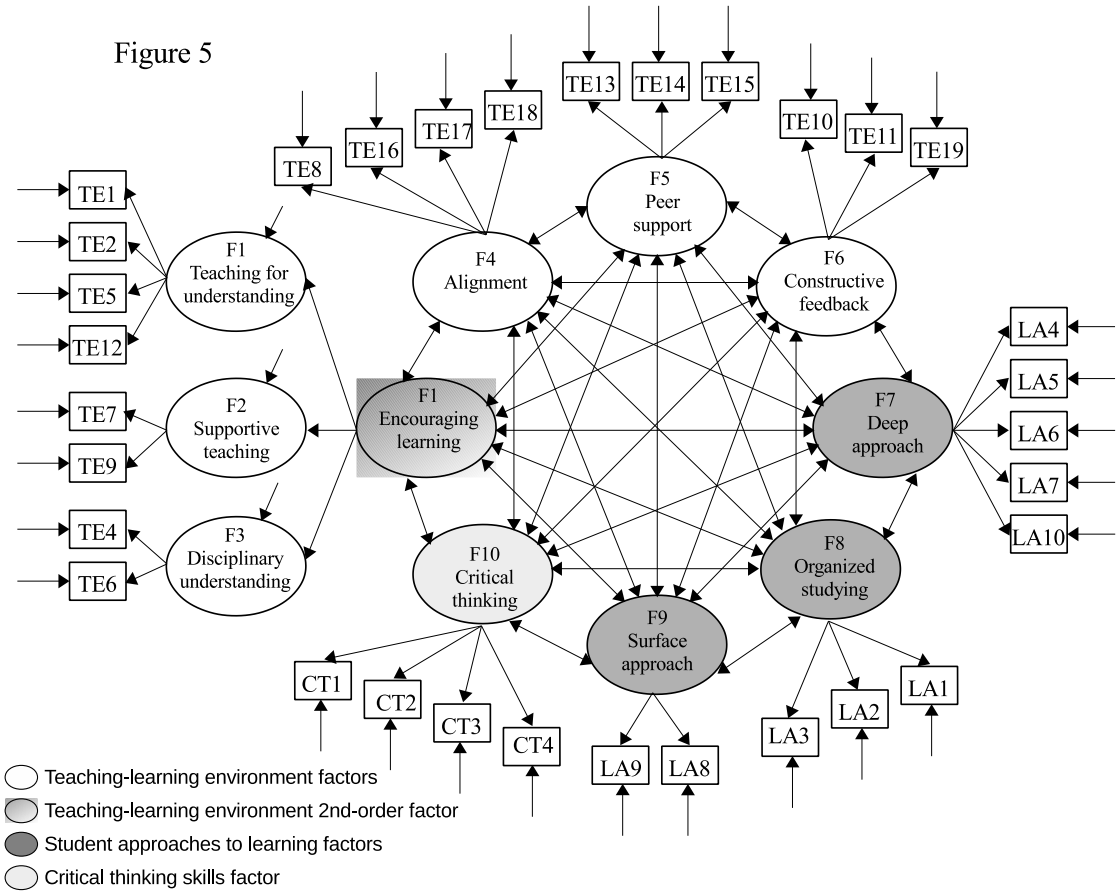

Figure 5. Complete measurement model for the modified ETLQ.

Next, the complete measurement model for the modified ETLQ (see Figure 5) was tested in both the year 2009 and 2010 samples. It showed reasonable fit to the data in the year 2009 sample, according to the fit indices (except χ^2-test, which showed lack of fit): $\chi^2(403) = 1485.081$, $p < 0.01$; RMSEA = .04, (90 % C.I. = .038, .043); CFI = .93; TLI = .92. It should be noted that both CFI and TLI were slightly under the cutoff value of .95. However, the RMSEA was clearly below the cutoff as also was its confidence interval. Similarly, the fit indices for the model in the year 2010 sample resembled the results for the year 2009 sample: $\chi^2(403) = 1491.057$, $p < 0.01$; RMSEA = .04, (90 % C.I. = .038 - .042); CFI = .94; TLI = .93. Again, the Chi-square test was rejected and both TLI and CFI were slightly below .95, while the RMSEA indicated acceptable fit.

Standardized factor loadings and residual variances for the complete model in both samples are presented in Table 5. All parameter estimates for the complete model were statistically significant

in both samples ($p < .001$), although the correlation between factors F8 (Deep Approach) and F5 (Peer Support) had lower p-values ($p = .002$ in the year 2009 sample and .015 in the year 2010 sample), as also did the residual variance for item LA9 in the year 2009 sample ($p = .013$). Inspection of the factor loadings for the teaching-learning environment items in the first and second samples showed that they were very similar, except for the loading of item TE18, which was .59 loading in the year 2009 sample and .68 loading in the year 2010 sample. Similarly, the factor loadings for the student approach to learning items were quite similar in both samples. However, in the year 2009 sample, the loading of item LA7 was .43, as compared to .53 in the year 2010 sample. Finally, the critical thinking factor loadings were similar in both samples.

Table 5. Standardized factor loadings, residuals variances and reliabilities of factors of the complete model for the modified ETLQ in both samples[1].

Item	First-order factors										Second-order factor	Residual variance
	F1Teaching for understanding	F2 Supportive teaching	F3 Disciplinary understanding	F4 Alignment	F5 Peer support	F6 Constructive feedback	F7 Organized studying	F8 Deep approach	F9 Surface approach	F10 Critical thinking	F11 Encouraging Learning	
TE1	.73 / .75											.47 / .44
TE2	.65 / .66											.58 / .57
TE5	.66 / .70											.57 / .51
TE12	.69 / .71											.52 / .50
TE7		.70 / .69										.51 / .52
TE9		.67 / .70										.55 / .51
TE4			.71 / .73									.49 / .46
TE6			.71 / .71									.50 / .49
TE16				.67 / .72								.55 / .49
TE17				.64 / .65								.59 / .58
TE18				.68 / .70								.54 / .52
TE8				.59 / .68								.65 / .54
TE13					.80 / .75							.35 / .44
TE14					.74 / .75							.46 / .44
TE15					.55 / .58							.70 / .66
TE10						.85 / .86						.29 / .27
TE11						.76 / .81						.42 / .35
TE19						.74 / .79						.46 / .37
LA1							.90 / .83					.20 / .31
LA2							.61 / .60					.63 / .65
LA3							.60 / .66					.65 / .57
LA4								.78 / .82				.39 / .33
LA5								.72 / .76				.49 / .43
LA6								.60 / .64				.64 / .59

LA7							.45 / .53					.80 / .72
LA8								.55 / .51				.70 / .74
LA9								.84 / .91				.30 / .17
CT2									.67 / .67			.55 / .55
CT3									.70 / .73			.51 / .47
CT1									.77 / .78			.41 / .40
CT4									.70 / .71			.51 / .50
F1											.94 / .95	.12 / .11
F2											.79 / .82	.38 / .32
F3											.84 / .88	.29 / .24
Cronbach α	.77 / .79	.64 / .65	.67 / .69	.74 / .78	.74 / .73	.82 / .86	.73 / .72	.73 / .78	.63 / .63	.80 / .81	-	

[1]: In the left side of slash are values from the first sample and on the right side are values from the second sample.

Also all correlations between the factors (in Table 6) were statistically significant ($p < .001$). The correlation between the Encouraging Learning (F11) and Alignment (F4) factors was positive (.80 in 2009 and .78 in 2010). Similarly, both the Deep approach to learning (F8) and Encouraging Learning factors correlated positively (.43 in 2009 and .53 in 2010; .62 in 2009 and .59 in 2010 respectively) and the Surface approach to learning (F9) negatively (.-56 in both years) with the Critical Thinking (F10) factor.

Table 6. Factor correlations[1] of the complete measurement model for the ETLQ.

Factor	F4	F5	F6	F7	F8	F9	F10	F11
F4 Alignment	–	.33***	.47***	.28***	.24***	-.46***	.45***	.80***
F5 Peer support	.28***	–	.24***	.18***	.11**	-.19***	.34***	.44***
F6 Constructive feedback	.50***	.24***	–	.13***	.30***	-.29***	.32***	.41***
F7 Organized studying	.28***	.22***	.15***	–	.37***	-.35***	.34***	.29***
F8 Deep approach	.23***	.08*	.30***	.41***	–	-.43***	.43***	.40***
F9 Surface approach	-.41***	-.20***	-.27***	-.30***	-.37***	–	-.48***	-.56***
F10 Critical thinking	.40***	.25***	.33***	.35***	.53***	-.38***	–	.62***
F11 Encouraging learning	.78***	.36***	.52***	.29***	.42***	-.56***	.59***	–

*** = $p < .001$, ** = $p < .01$, * = $p < .05$

[1] Year 2010 correlations are below the diagonal and year 2009 correlations are above the diagonal.

Discussion

Measurement model for the modified ETLQ

The main aim of this study was to clarify the measurement properties of a modified version of the ETLQ and provide evidence of its construct validity. This aim was achieved, as shown by the modified measurement model yielded by confirmatory factor analyses. Moreover, the parameter estimates for the model were similar in both the samples tested, which further supported the validity

of the measurement model developed in this study, as it reflected clearer internal structure of the ETLQ.

Clarification of the measurement properties of the modified ETLQ mostly concerned the teaching-learning environment items. To be more precise, the factor Relevance and Evoking Interest found by Rytkönen et al. (2012) was not replicated in this study, whereas the factors Alignment, Peer Support and Constructive Feedback were. The additional item for factor Constructive Feedback did not affect the measurement properties of the model, so it seems to fit well for the modified ETLQ. The results suggest that the items measuring Relevance and Evoking interest could be measuring at least three closely related, but separate constructs. In this study, these constructs were defined and labeled as factors Teaching for Understanding, Disciplinary Understanding and Supportive Teaching. Hence, this identification of more precise constructs measuring the teaching-learning environment was in line with the results of Stes et al. (2012), who conducted CFA and specified separate factors for measuring Teaching for Understanding and Staff Enthusiasm and Support. Conversely, Karagiannopoulou and Milienos (2015) conducted EFA, which resulted in a factor measuring a broader teaching-learning environment construct, named Teaching for Understanding and Encouraging learning. To sum up, based on the results of this study and that by Stes et al. (2012), it seems that CFA results in more focused teaching-learning environment factors, when compared with EFA results (e.g., Karagiannopoulou & Milienos, 2015; Rytkönen et al., 2012).

In addition, the factors Teaching for Understanding, Disciplinary Understanding and Supportive Teaching were indicators of a second-order factor, labeled Encouraging Learning. The use of a second-order factor allows simultaneous modeling of both a broader construct of the teaching-learning environment and more focused and narrower constructs. Modeling a second-order factor also made sense theoretically, as the elements of the teaching-learning environment are suggested to be interconnected, forming a system (Entwisle, 2009). The high factor loadings of the first-order factors on the Encouraging Learning second-order factor imply that the dimensions

teaching and assessing content (operationalized as the scales Teaching for Understanding and Disciplinary Understanding) and *staff-student relationship* (operationalized as the scale Supportive Teaching) of the teaching-learning environment, are overlapping constructs (Entwistle et al., 2003).

Furthermore, the initial measurement model for the Student Approaches to Learning items was confirmed only after making some slight modifications. Hence the resulting model closely resembled the model presented in Rytkönen et al. (2012), except that in the present study the factor Intention to understand was not used. Our study suggests that the modified ETLQ tested in this study reliably measures three approaches to learning, viz. Deep Approach, Surface Approach and Organized Studying (Marton & Säljö, 1976; Entwistle, 2009). However, our decision not to use Intention to Understand scale in Rytkönen et al.'s study (2012), makes the construct deep approach narrower than originally described by Marton and Säljö (1976). Therefore, in studies that wish to focus on evaluating student approaches to learning in more detail should consider using the Intention to Understand items. However, contrary to the study by Asikainen et al. (2014), the present results did not support exclusion of the Surface Approach factor. Furthermore, there is a more specific instrument available, called ASSIST, to reliably measure students' approaches to learning in various cultures and subject areas (Teixeira et al., 2013). Hence, the differences in measuring Student Approaches to Learning with the modified ETLQ seem to be due its short form and narrowly defined constructs.

The addition of the Critical Thinking items proved to be successful, as these items had reasonable factor loadings and measured a separate construct from the teaching-learning environment and student approach to learning constructs. Therefore, we recommend inclusion of this kind learning outcome items in even short versions of ETLQ. However, as this study focused on assessing the construct validity of the modified ETLQ and especially internal structure of its scales, content validity of the critical thinking items needs to be evaluated in the future studies. It can be argued that the critical thinking scale in this study did not cover very broadly the construct. Moreover, the wordings

of these items were on very general level and hence students' might have had problems to understand their meaning. Nonetheless, the items covered important and central critical thinking skills, such as analysis and evaluation of information and development of new ideas. Additionally, operationalizations of critical thinking will always remain more or less incomplete, because critical thinking is a difficult concept to define unanimously (Flores et al., 2012).

The results of this study showed that, in line with the theory, the presage, process and product factors in Biggs' (1987) 3P model of learning were associated with each other. For example, students who perceived teaching to be more powerful, also adopted a deeper approach to learning. This result supported the results of previous studies (Kember & Leung, 2009; Lizzio et al., 2002; Pascarella et al., 2013). Similarly, the more organized and deeper their approach to learning was, the more critical thinking students had learnt, which is in harmony with the results reported in previous studies (Kreber, 2003; Rahmand & Mokhtar, 2012). In addition, the associations between these factors were quite similar in both samples although there were some slight differences. For example, Critical Thinking factor had higher correlation with Deep Approach factor in year 2009, than it had in year 2010. One plausible explanation for these small differences could be because 2009 sample was over-represented by third year students and in 2010 sample they were underrepresented. To sum up, the modified version of ETLQ proved to be a satisfactory assessment tool for higher education purposes, both in statistical and theoretical terms.

Limitations

One limitation of this study was that both samples were drawn from just one Finnish university. The results of this study cannot therefore be generalized to student populations in other countries. However, this study focused on the development and validation of a modified version of the ETLQ, and did not aim to produce results generalizable to larger populations. Second, critical thinking skills

were defined narrowly and hence some dimensions of critical thinking were left out, such as dispositions, attitudes and reflective thinking. However, it should be borne in mind that it would be challenging to find questions that could measure dispositions and attitudes in a way that fits several fields of study.

Third, there was some lack of fit between the complete model for the modified ETLQ and the data; namely, this was indicated by the significance of the χ^2-test and the fact that both the TLI and CFI were little under the cut-off values. However, in order to keep the model in line with the theory and more parsimonious, following the approach of Byrne, Shavelson, and Muthén (1989), the model was not further altered. To conclude, the fact that both the CFI and TLI have a tendency to decrease when used with models that have a large number of variables while at the same time the RMSEA tends to improve, may explain the lack of fit detected in this study (Kenny & McCoach, 2003).

Fourth, this study focused on investigating the construct validity of the modified ETLQ, especially evaluating its internal structure. It should be noted that assessment of the internal structure of the survey provides only limited validity evidence. This study did not evaluate content validity of items or criterion validity. However, framing the scope of this article to investigation of the internal structure of the modified ETLQ was justified, because previous studies had suggested that it had persistent problems.

Fifth, there was a few years delay between data collection and data analysis and during this delay certain elements of teaching-learning environment in Finnish universities may have changed. However, this is not a problem for the present study because we were focusing mainly on the construct of the modified ETLQ rather than on how students' perceived their learning environment. Thus, possible changes in teaching-learning environment during the delay between data collection and data analysis probably do not have much effect on the results of our study.

Lastly, this study used the modified version of ETLQ, which is shorter than the original version. Hence, the constructs that were measured in the modified version might not measure exactly

the same constructs as the original version of ETLQ. In future studies it is important to verify how well these narrower constructs are in line with the original broader constructs.

Pedagogical implications and future research

From the university pedagogics perspective, in order to support students' learning and thinking, it is important to know how students perceive their teaching-learning environments (McCune & Entwistle, 2011). This study suggests that the modified ETLQ could be useful in institutes of higher education as a tool for evaluating how efficacious the teaching-learning environment is in supporting students' development of critical thinking. However, in order to develop the modified ETLQ into even a more applicable evaluation tool, the following aspects should be considered in future research.

First, the validated measurement model for the modified ETLQ needs to be further tested in different settings, in order to obtain more evidence about how the modified measurement model works. Second, it could be worthwhile further developing the critical thinking items to better take into account broader elements of critical thinking, such as ability to reflect on one's own thinking. Third, the factors Supportive Teaching, Disciplinary Understanding and Surface Approach consisted of only two items, and thus could benefit from additional items. The slightly low reliabilities of these factors might also be remedied by increasing the number of items.

Fourth, the factor loadings for few items were different for two samples (years 2009 and 2010) and it is possible that these items did not measure the teaching-learning constructs invariantly in these two samples. Therefore, in order to verify that the constructs are measured similarly in various groups, it would be important in future studies to explore the measurement invariance of the modified ETLQ between different study years, faculties, genders and other important cohorts of students. Last, it should be investigated that whether the second-order factor Encouraging Learning could be estimated

as a first-order factor. For example, the strongest indicator from each of the ETLQ's current first-order factors could be specified as indicators of a broader first-order Encouraging Learning factor.

The results of this study make a valuable contribution to the development of the modified ETLQ. Validation of the measurement model in the independent sample showed that post-hoc modifications that adhered to the original theory and statistical results, were justified. In conclusion, by adopting a more rigorous approach to the testing, it was possible to clarify the measurement properties of the modified ETLQ. Clarification of the internal structure of the modified ETLQ provides much needed construct evidence for the validity of its scales. However, for research purposes, the longer version of ETLQ provides conceptually more robust instrument.

Previous studies suggest that mastering critical thinking is a demanding task for the university applicants (Utriainen et al., 2017), and is challenging even for university students (Arum & Roksa, 2011; Pascarella & Terenzini, 2005). The results of this study indicate that emphasis on the importance of creating powerful teaching-learning environments that support students' learning processes can enhance students' learning of critical thinking skills. However, this study investigated how university students themselves perceived their learning of these skills, rather than using a separate test for measuring critical thinking. Therefore, future studies on the connections between the teaching-learning environment, students' learning process and critical thinking skills might benefit from the use of standardized critical thinking measures.

REFERENCES:

Arum, R., & Roksa, J. (2011). *Academically Adrift: Limited Learning on College Campuses.* Chicago: University of Chicago Press. [Ebrary version] Retrieved from http://site.ebrary.com

Asikainen, H., Parpala, A., Lindblom-Ylänne, S., Vanthournout, G., & Coertjens, L. (2014). The Development of Approaches to Learning and Perceptions of the Teaching-learning Environment During Bachelor Level Studies and Their Relation to Study Success. *Higher Education Studies, 4*(4), 24–36. doi:10.5539/hes.v4n4p24

Bath, D., Smith, C., Stein, S., & Swann, R. (2004). Beyond Mapping and Embedding Graduate Attributes: Bringing Together Quality Assurance and Action Learning to Create a Validated and Living Curriculum. *Higher Education Research & Development, 23*(3), 313–328. doi: 10.1080/0729436042000235427

Biggs, J. B. (1987). *Student Approaches to Learning and Studying.* Research Monograph. Hawthorn: Australian Council for Educational Research.

Biggs, J. B. (1993). What Do Inventories of Students' Learning Processes Really Measure? A Theoretical Review and Clarification. *British Journal of Educational Psychology, 63*(1), 3–19. doi: 10.1111/j.2044-8279.1993.tb01038.x

Binkley, M., O. Erstad, J. Herman, S. Raizen, M. Ripley, M. Miller-Ricci, and M. Rumble. (2012). Defining twenty-first century skills. In P. Griffin, B. McGaw, & E. Care (Eds.) *Assessment and teaching of 21st century skills* (pp. 17–66). New York: Springer.

Byrne, B. M., Shavelson, R. J., & Muthén, B. (1989). Testing for the Equivalence of Factor Covariance and Mean Structures: The Issue of Partial Measurement Invariance. *Psychological bulletin, 105*(3), 456–466. doi:10.1037/0033-2909.105.3.456

Camara, W. J. (2003). Validity: Construct. In R. Fernández-Ballesteros (Ed.), *Encyclopedia of Psychological Assessment* (pp. 1070 - 1075). London: Sage Publications

Cosgrove, R. (2011). Critical Thinking in the Oxford Tutorial: a Call for an Explicit and Systematic Approach. *Higher Education Research & Development*, *30*(3), 343–356. doi: 10.1080/07294360.2010.487259

De Corte, E. (2000). Marrying Theory Building and the Improvement of School Practice: A Permanent Challenge for Instructional Psychology. *Learning and instruction*, *10*(3), 249–266. doi: 10.1016/S0959-4752(99)00029-8

Ennis, R. H. (1993). Critical Thinking Assessment. *Theory into Practise*, *32*(3), 179–186. doi: 10.1080/00405849309543594

Entwistle, N. J. (2009). *Teaching for Understanding at University: Deep Approaches and Distinctive Ways of Thinking*. Basingstoke: Palgrave Macmillan.

Entwistle, N., McCune, V., & Hounsell, J. (2002). Approaches to Studying and Perceptions of University Teaching–Learning Environments: Concepts, Measures and Preliminary Findings. (Occasional Reports no. 1). Retrieved from http://www.etl.tla.ed.ac.uk/docs/ETLreport1.pdf

Entwistle, N., McCune, V., & Hounsell, J. (2003). Investigating Ways of Enhancing University Teaching-learning Environments: Measuring Students' Approaches to Studying and Perceptions of Teaching. In E. de Corte, L. E. Verschaffel, L. E. Entwistle & J. E. Van Merriënboer (Eds.), *Powerful learning environments: Unravelling basic components and dimensions* (pp. 89–107). Amsterdam: Pergamon.

Facione, P. A. (1990). *Critical Thinking: a Statement of Expert Consensus for Purposes of Educational Assessment and Instruction.* American Philosophical Association. (ERIC Document Reproduction Services no. ED 315 423).

Flores, K. L., Matkin, K. S., Burbach, M. E., Quinn, G. E., & Harding, H. (2012). Deficient critical thinking skills among college graduates: Implications for leadership. *Educational Philosophy and Theory*, *44*(2), 212–230. doi:10.1111/j.1469-5812.2010.00672.x

Halonen, J. S. (1995). Demystifying Critical Thinking. *Teaching of Psychology 22*(1), 75–81. doi: 10.1207/s15328023top2201_23

Hidi, S., & Renninger, K. A. (2006). The four-phase model of interest development. *Educational psychologist, 41*(2), 111–127. doi:10.1207/s15326985ep4102_4

Heikkilä, A., & Lonka, K. (2006). Studying in Higher Education: Students' Approaches to Learning, Self-regulation, and Cognitive Strategies. *Studies in Higher Education, 31*(1), 99–117. doi: 10.1080/03075070500392433

Hu, L. T., & Bentler, P. M. (1999). Cutoff Criteria for Fit Indexes in Covariance Structure Analysis: Conventional Criteria versus New Alternatives. *Structural equation modeling: a multidisciplinary journal, 6*(1), 1–55. doi: 10.1080/10705519909540118

Karagiannopoulou, E., & Christodoulides, P. (2005). The impact of Greek University students' perceptions of their learning environment on approaches to studying and academic outcomes. *International Journal of Educational Research, 43*(6), 329–350. doi: 10.1016/j.ijer.2006.05.002

Karagiannopoulou, E., & Milienos, F. S. (2015). Testing Two Path Models to Explore Relationships Between Students' Experiences of the Teaching–learning Environment, Approaches to Learning and Academic Achievement. *Educational Psychology, 35*(1), 26–52. doi: 10.1080/01443410.2014.895800

Kember, D., & Leung, D. Y. (2009). Development of a Questionnaire for Assessing Students' Perceptions of the Teaching and Learning Environment and its Use in Quality Assurance. *Learning Environments Research, 12*(1), 15–29. doi: 10.1007/s10984-008-9050-7

Kenny, D. A., & McCoach, D. B. (2003). Effect of the Number of Variables on Measures of Fit in Structural Equation Modeling. *Structural Equation Modeling: A Multidisciplinary Journal, 10*(3): 333–351. doi: 10.1207/S15328007SEM1003_1

Kline, R. B. (2011). *Principles and practice of structural equation modeling.* New York, NY: The Guilford Press.

Kreber, C. (2003). The Relationship Between Students' Course Perception and their Approaches to Studying in Undergraduate Science Courses: A Canadian Experience. *Higher Education Research and Development, 22*(1), 57–75. doi: 10.1080/0729436032000058623

Kuhn, D. A (2016). Role for Reasoning in a Dialogic Approach to Critical Thinking. *Topoi,* 1–8. doi: doi:10.1007/s11245-016-9373-4

Lea, M. R., & Street, B. V. (1998). Student writing in higher education: An academic literacies approach. *Studies in Higher Education*, *23*(2), 157–172. doi: 10.1080/03075079812331380364

Lizzio, A., Wilson, K., & Simons, R. (2002). University Students' Perceptions of the Learning Environment and Academic Outcomes: Implications for Theory and Practice. *Studies in Higher Education*, *27*(1), 27–52. doi: 10.1080/03075070120099359

Marton, F., and Säljö, R. (1976). On Qualitative Differences in Learning: I—Outcome and Process. *British Journal of Educational Psychology*, *46*(1), 4–11. doi: 10.1111/j.2044-8279.1976.tb02980.x.

McCune, V. (2009). Final Year Biosciences Students' Willingness to Engage: Teaching–learning Environments, Authentic Learning Experiences and Identities. *Studies in Higher Education*, *34*(3), 347–361. doi: 10.1080/03075070802597127

McCune, V., & Entwistle, N. (2011). Cultivating the Disposition to Understand in 21st Century University Education. *Learning and Individual Differences*, *21*(3), 303–310. doi: 10.1016/j.lindif.2010.11.017

Moore, T. (2013). Critical Thinking: Seven Definitions in Search of a Concept. *Studies in Higher Education*, *38*(4), 506–522. doi: 10.1080/03075079.2011.586995

Niu, L., Behar-Horenstein, L. S., & Garvan, C. W. (2013). Do instructional interventions influence college students' critical thinking skills? A meta-analysis. *Educational Research Review, 9*, 114–128. doi:10.1016/j.edurev.2012.12.002

Parpala, A., Lindblom-Ylänne, S., Komulainen, E., & Entwistle, N. (2013). Assessing Students' Experiences of Teaching–learning Environments and Approaches to Learning: Validation of a Questionnaire in Different Countries and Varying Contexts. *Learning Environments Research, 16*(2), 201–215. doi: 10.1007/s10984-013-9128-8

Pascarella, E. T., & Terenzini, P. T. (2005). *How college affects students. Volume 2. A third decade of research*. San Francisco, CA: Jossey-Bass.

Pascarella, E. T., Wang, J. S., Trolian, T. L., & Blaich, C. (2013). How the Instructional and Learning Environments of Liberal Arts Colleges Enhance Cognitive Development. *Higher Education, 66*(5), 569–583. doi: 10.1007/s10734-013-9622-z

Rahman, S., & Mokhtar, S. B. (2012). Structural Relationship of Learning Environment, Learning Approaches, and Generic Skills Among Engineering Students. *Asian Social Science, 8*(13), 280 – 290. doi: 10.5539/ass.v8n13p280

Richardson, J. T. (2006). Investigating the Relationship Between Variations in Students' Perceptions of their Academic Environment and Variations in Study Behaviour in Distance Education. *British Journal of Educational Psychology, 76*(4), 867–893. doi: 10.1348/000709905X69690

Richardson, M., Abraham, C., & Bond, R. (2012). Psychological correlates of university students' academic performance: a systematic review and meta-analysis. *Psychological Bulletin*, *138*(2), 353. doi: 10.1037/a0026838

Rytkönen, H., Parpala, A., Lindblom-Ylänne, S., Virtanen, V., & Postareff, L. (2012). Factors Affecting Bioscience Students' Academic Achievement. *Instructional Science, 40*(2), 241–256. doi: 10.1007/s11251-011-9176-3

Stes, A., De Maeyer, S., Gijbels, D., & Van Petegem, P. (2012). Instructional Development for Teachers in Higher Education: Effects on Students' Perceptions of the Teaching–learning Environment. *British Journal of Educational Psychology, 82*(3), 398–419. doi: 10.1111/j.2044-8279.2011.02032.x

Teixeira, C., Gomes, D., & Borges, J. (2013). The approaches to studying of Portuguese students of introductory accounting. *Accounting Education*, *22*(2), 193-210. doi: 10.1080/09639284.2013.766426

Tremblay, K., Lalancette, D. & Roseveare, D. (2012). *Assessment of higher education learning outcomes: feasibility study report. Volume 1. Design and implementation.* OECD. Retrieved from http://www.oecd.org/edu/skills-beyond-school/AHELOFSReportVolume1.pdf

Trigwell, K., Ellis, R. A., & Han, F. (2012). Relations Between Students' Approaches to Learning, Experienced Emotions and Outcomes of Learning. *Studies in Higher Education, 37*(7), 811–824. doi:10.1080/03075079.2010.549220

Utriainen, J., Marttunen, M., Kallio, E., & Tynjälä, P. (2017). University applicants' critical thinking skills: The case of the Finnish educational sciences. *Scandinavian Journal of Educational Research*, *61*(6), 629–649. doi: 10.1080/00313831.2016.1173092

Wu, S. M. (2006). Creating a contrastive rhetorical stance: Investigating the strategy of problematization in students' argumentation. *RELC Journal*, *37*(3), 329–353. doi:10.1177/0033688206071316