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Psychometric examination of the modified Clinical Teaching Preference Questionnaire (CTPQ)

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ABSTRACT:
While peer-assisted learning (PAL) continues to gain momentum internationally among educators and curricula, its use within the paramedic profession is still novel and untested. Therefore having instruments with strong measurement properties to use in paramedic PAL is important. This study is an investigation into the dimensionality and reliability of the 10-item Clinical Teaching Preference Questionnaire (CTPQ) at a large Australian university in 2011 and 2012. Data from the CTPQ completed by first year undergraduate paramedics (N = 218) were analysed using a Principal Components Analysis (PCA) with varimax rotation. The majority of the participants were female 68% (n = 150) and aged less than 26 years of age 85% (n = 187). Results from the PCA indicated a three-factor solution, accounting for 61.3% of the total variance. All item loading coefficients were well above .40. Findings from the PCA provide preliminary results that the CTPQ is multidimensional producing a three-factor solution: Peer Learning Management, Peer-Led Supervision, and Instructor-Led Supervision. Other results demonstrated poor internal consistency and a large number of non-redundant residuals indicating further psychometric examination of the CTPQ is required.

INTRODUCTION

In recent times there has been a shift in the focus of health care professionals from the traditional approach of treating illnesses as they arise towards a more preventative approach to health care. As such, health care professionals are now expected to educate members of the community (Gebbie, Rosenstock, & Hernandez, 2003). Paramedics are not exempt from this change in focus, which is demonstrated in a number of alternative service delivery models (O'Meara, 2005; O'Meara et al., 2006; Stirling, O'Meara, Pedler, Tourle, & Walker, 2007). Paramedics are continually engaged in educating patients, their families, students, other health care professionals, and members of the community. This has led to an increased emphasis on the development of teaching proficiency during the tertiary education of health professionals, including paramedics (Husdon & Tonkin, 2008).

The concept of Peer-Assisted Learning (PAL) (often used interchangeably with Supplemental Instruction or Peer Assisted Study Sessions) allows senior students to assist their more junior peers through teaching and learning support, thus providing students with opportunities that potentially may not

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have occurred through other traditional modes of teaching. The process is designed to benefit both groups of students by reinforcing and increasing their knowledge of the subject, as well as enhancing their ability to engage in the learning process in different roles, such as student or teacher. Peer-assisted learning also has the potential to provide educational opportunities which may be unachievable by staff or might not be effectively utilised by staff given ever increasing constraints, such as larger class sizes and increased administration duties (Weyrich et al., 2009). This paper provides a psychometric appraisal of a PAL measurement tool, which has not yet been tested for use among paramedic students.

In recent times, there has been a shift in tertiary education towards a greater emphasis on "learning" rather than "teaching" (Biggs & Tang, 2007). A greater degree of focus is now placed on the construction and maintenance of high quality, learner-centered environments, a focus that encompasses PAL as one of its crucial components (Hudson & Tonkin, 2008). Other examples include scenario-based learning and patient-centered learning, both of which allow the integration and application of PAL. Peer-Assisted Learning is also seen as an option to continue providing rich, interactive learning environments through the availability of additional teaching resources in the face of reduced resources and increased student numbers (Secomb, 2008). Peer-assisted learning provides a number of advantages over academic-led learning, such as enhanced peer-to-peer relationships, as peers are perceived to be more approachable than academic staff (Secomb, 2008). Student trainers are often more familiar with their overall courses than some academic staff and are often able to easily integrate new learning concepts into the curricula context (Christiansen & Bell, 2010). In a recent systematic review of 12 articles by Secomb (2008), strong evidence was revealed that PAL is beneficial for students. Secomb postulated that PAL increased theoretical knowledge and clinical skills acquisition for learners, as well as an increased capacity to self-evaluate, increased clinical reasoning, self-confidence, and increased collaboration with peers as both teachers and students.

In recent times there has been a move in paramedic education in Australia from diploma based training towards university based degree education (Williams, Onsman, & Brown, 2009). This change is being driven by a desire to be professionally recognised and to fall in line with other mainstream health care disciplines that require degree education as a minimum (Williams, Onsman, & Brown, 2010). Due to the move towards degree-based education for paramedics, the individual ambulance services around Australia are no longer responsible for the number of potential paramedic employees. This has directly resulted in 13 universities now offering paramedic degrees. As a consequence, valuable educational resources have been stretched, such as lecturers, tutors, and other sessional staff. As such, PAL has become an attractive educational strategy for administrators and educators in paramedic departments.

While the use of PAL in the medical and health care education sector has become increasingly popular over the past several decades (Iwasiw & Goldberg, 1993; Loke & Chow, 2007), the same popularity has not extended to the development of valid and reliable measures of PAL (Speyer, Pilz, van der Kruis, & Brunings, 2011). Due to the popularity of PAL and the impact that PAL could have on paramedic education and practice, it is important that PAL

measures are psychometrically evaluated, ensuring adequate validity and reliability for use within the paramedic university education sector. In this study we focus on the Clinical Teaching Preference Questionnaire (CTPQ), a scale originally created by Iwasiw and Goldenberg (1993) to evaluate the effect of PAL on nursing students in North America.

The theoretical framework for the CTPQ was based on Bandura's Social Learning Theory and educational literature relating to supervision and mentoring of peers and their instructors (Iwasiw & Goldenberg, 1993). Since its development in 1993 its use has only been reported twice, once with a cohort of athletic education students (Henning, Weidner, & Jones, 2006), and once with a cohort of nursing students (McKenna & French, 2011). While being used in both cognate and non-cognate disciplines provides valuable construct validity for an instrument, whether the CTPQ has adequate measurement properties for the paramedic profession is unknown. To the best of our knowledge, the CTPQ was first examined psychometrically in 2012 with a sample of 265 undergraduate nursing students in Australia (Williams, McKenna, French, & Dousek, 2013). Using factor analysis the authors demonstrated that the CTPQ was a valid and reliable measure with a large nursing cohort. A two-factor solution was produced with a total explained variance of 68.3% and Cronbach's alpha coefficients of .92 and .89.

In this paper we report a replication of Williams et al. (2013). Although it is important to highlight that the structure of the PAL between both studies was slightly different in terms of preparation of peer-teachers, the PAL process was otherwise quite similar.

In October 2011 and 2012 we conducted a pilot study of final year paramedic peer teachers at a large Australian university. Paramedic peer teachers were involved in teaching a number of basic life support skills and techniques to first year students, such as auscultating lung sounds, conscious state assessments, and defibrillation. Upon the completion of this two year pilot study, first year students completed the CTPQ, providing us with the data required to examine the reliability and validity of the CTPQ on a paramedic cohort. The purpose of this paper is to investigate the dimensionality and reliability of the 10-item CTPQ when completed by a group of paramedic undergraduate students from an Australian university.

METHOD

Design

A cross-sectional study using a paper-based modified version of the Clinical Teaching Preference Questionnaire (CTPQ) was administered to first year students from an undergraduate paramedic course during the final weeks of semester two (final weeks of October), 2011 and 2012.

Participants

All undergraduate paramedic students enrolled on one campus at a large Australian university were eligible to participate. Students eligible were enrolled in year one studies from the Bachelor of Emergency Health (BEH) degree at Monash University. Inclusion criteria for this study included being enrolled in the BEH and consenting to take part in the study. Participation in this study was completely voluntary. There were no exclusions.

Instrumentation

This study used the CTPQ – a 10-item measure for peer-teaching preferences, and modified two items replacing "nursing" with "paramedic". For example, "I am less anxious when performing a nursing skill in the presence of my peers than my instructor" was modified to "I am less anxious when performing a paramedic skill in the presence of my peers than my instructor." Participants rated their level of agreement with each statement on a 5-point Likert scale (*Strongly agree* = 1, *Strongly disagree* = 5). While several studies have used the CTPQ (Henning et al., 2006; McKenna & French, 2011), to our knowledge, no published literature has explored the psychometric properties of the CTPQ using paramedic students.

Procedures

Ethical approval was obtained from the university ethics committee (Monash University Human Research Ethics Committee (MUHREC)). In order to minimise the possibility of coercion for students to participate, a staff member not involved in teaching the students recruited, distributed, and collected completed questionnaires. Students received an explanatory statement detailing the study and were informed that all data collected would be de-identified and analysed on a group basis only. No follow-up was undertaken.

Data analysis

A Principal Components Analysis (PCA) Exploratory Factor Analysis using a Varimax Rotation using SPSS (version 19.0) was undertaken guided by a number of commonly used criteria. These included Kaiser's (1960) criteria (an eigenvalue greater than 1 was used) (Henson & Roberts, 2006), scree test (Cattell, 1966), cumulative percent of variance extracted, and parallel analysis (Horn, 1965). Taking a multiple criterion approach is suggested by the factor analysis literature (Hair, Anderson, Tatham, & Black, 1995; Pett, Lackey, & Sullivan, 2003). Items were only retained if their coefficients were equal to or greater than .40 (Hogarty, Hines, Kromrey, Ferron, & Mumford, 2005).

A corrected-item total correlation was performed to identify the items not correlating with the factor in question. As a general rule, coefficients should be greater than .30 (Pett, Lackey, & Sullivan, 2003) highlighting good item to factor fit. Pearson's correlation coefficients were calculated to investigate the inter-relationships between the CTPQ latent variables. The internal consistency of the scale was estimated using Cronbach's alpha coefficients.

RESULTS

Participant demographics

The characteristics of the participants are described in relation to age, gender, previous tertiary education, and previous exposure to peer teaching. Of the 218 participants involved in the study, the majority of the participants were female 68.8% (n = 150), aged less than 26 years of age 85.8% (n = 187), and had not been exposed to peer teaching previously 57.8% (n = 126). The complete distribution of demographic results is reported in Table 1.

Table 1
Demographic distribution

Variable	Descriptor	N	%
Gender	Male	68	31.2
	Female	150	68.8
Age	<22 years	143	65.6
	22-25 years	44	20.2
	26-30 years	23	10.6
	31-35 years	2	0.9
	>36 years	6	2.8
Prior tertiary education	Yes	91	41.7
	No	127	58.3
Previous peer-teaching	Yes	92	42.2
	No	126	57.8

Factor Extraction Results

Although sample size is important in PCA, there are varying opinions and guiding rules of thumb cited in the literature (Gorsuch, 1983; Tabachnick & Fidell, 2007). General guides include Tabachnick and Fidell's (2007) rule of thumb that suggests at least 300 cases are needed for PCA, while Hair et al. (1995) and Pett et al. (2003) suggest that PCA can be undertaken with sample sizes of 100 or greater. The data was considered suitable for PCA following multiple rules of thumb, including the Kaiser-Meyer-Olkin Measure of Sampling Adequacy (0.601), Bartlett's Test of Sphericity (x^2 = 539.37, df = 45, p = .000), adequate sample size to variable ratio, and inspection of the correlation matrix for loadings greater than .30. Latent factors were extracted by PCA followed by varimax rotation based on Kaiser's (1960) criteria (eigenvalue > 1 rule), scree test (Cattell, 1966), cumulative percent of variance extracted, and parallel analysis (Horn, 1965).

Analysis of the 10 items revealed three factors with eigenvalues above 1, accounting for 61.3% of the total variance. Items with loadings greater than ±.40 with the factor in question were used to characterise the latent variables. Parallel analysis was undertaken using MonteCarlo (PCA for Parallel Analysis) software package. The parallel analysis also confirmed a three-factor structure, and inspection of the scree plot (Figure 1) and eigenvalues was also suggestive of a three-factor solution.

Gorsuch (1983) suggests that further latent variable examination should also be performed. This was undertaken by inspecting the correlation residual matrix generated by SPSS for high covariances. Residuals are computed between observed and reproduced correlations. Residuals of between 0.5–1.0 are considered moderate, while values over 1.0 are considered large, suggesting that additional factors may exist (Hair et al., 1995; Pett et al., 2003). Examination of the matrix produced 27 non-redundant residuals (60%) with values greater than 0.05. Further attempts at different factor structures

using both orthogonal and oblique solutions approaches did not significantly change the number of residuals. Therefore for these data, a three-factor structure was considered best-fit (Table 2). No items were deleted.

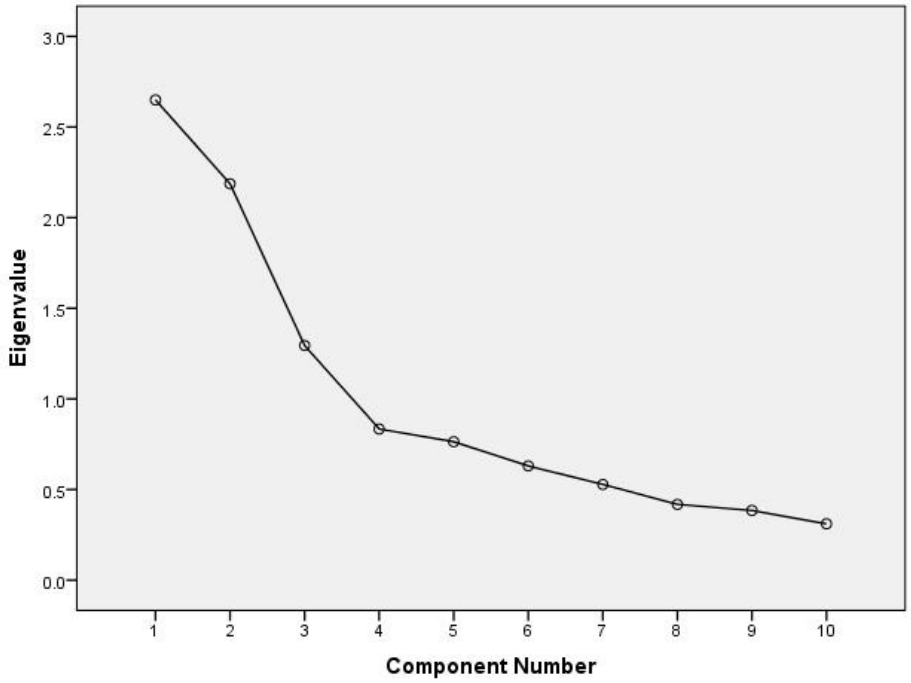

Figure 1. Scree plot indicating a three-factor solution.

The three resultant factors were descriptively labelled as:

- Factor 1: *Peer Learning Management*. There were three items that loaded on this factor, with loadings ranging from .71 to .73 (explained variance 26.49%). The highest loading item within the factor was: "I am less anxious when performing a paramedic skill in the presence of my peers than my instructor."
- Factor 2: *Peer-Led Supervision*. There were three items that loaded on this factor, with loadings ranging from .67 to .80 (explained variance 21.87%). The highest loading item within the factor was: "My peers are more supportive to me when I am performing a paramedic skill than my instructor."
- Factor 3: *Instructor-Led Supervision*. There were four items that loaded on this factor, with loadings ranging from .49 to .81 (explained variance 12.95%). The highest loading for Factor 3 was: "My ability to problem solve improves more from instructor teaching than from my peers."

Cronbach's alpha coefficients were used to assess the internal consistency of each of the three factors identified from the PCA. The Cronbach's alpha calculation for the entire scale produced a less than ideal reliability coefficient of .64. Individual factors also produced Cronbach's alpha coefficients less than the accepted .70 (Factor 1: .64; Factor 2: .66; Factor 3: .66) suggesting poor internal consistency of the modified version of the CTPQ (Hair et al., 1995).

Table 2
Correlation matrix (Principal Components Analysis with varimax rotation)

Component Matrix							
	Factor						
Item	**1**	**2**	***3***	h^2	r_{it}	**Mean**	**SD**
I am less anxious when performing a paramedic skill in the presence of my peers than my instructor (item 3)	**.733**			.573	.134	3.07	0.83
Being taught clinical skills by my peers increases my interaction and collaboration with other students more than when being taught by my instructor (item 4)	**.717**			.693	.318	2.91	0.90
I can communicate more freely with my peers than with my instructor (item 7)	**.710**			.541	.389	2.99	1.18
My peers are more supportive to me when I am performing a paramedic skill than my instructor (item 9)		**.806**		.514	.379	2.94	1.08
I am more self-confident and able to perform independently because of being taught by my peers, more so than by my instructor (item 10)		**.754**		.611	.334	2.90	1.07
The feedback I receive from my peers is from a student's viewpoint, therefore more honest, realistic, helpful than from my instructor (item 8)		**.670**		.695	.387	2.86	1.04
My ability to problem solve improves more from instructor teaching than from my peers (item 2)			**.819**	.636	.580	2.94	1.03
I learn more from my instructor than my peers (item 6)			**.708**	.470	.029	3.20	0.97
I feel freer to approach my instructor for help than I do my peers (item 1)			**.651**	.678	.222	3.11	0.91
Being taught clinical skills by my instructor increases my sense of responsibility more than by being taught by my peers (item 5)	**.486**		**.490**	.720	.329	3.12	0.84
Eigenvalues	2.65	2.18	1.29				
Explained Variance	26.49	21.87	12.95				

Note. Bolded loadings highlight item allocation for each factor.
h^2 = communality; r_{it} = corrected item-total correlations; SD = standard deviation.

Table 3
Pearson correlation coefficients between Factors 1-3

	Factor 1	**Factor 2**	**Factor 3**
Factor 1	1.000		
Factor 2	-.172*	1.000	
Factor 3	.328*	.462*	1.000

*p < .05 level, two-tailed.

The Pearson correlation coefficients between the three factors are given in Table 3. Although the size of a correlation coefficient should be analysed with some caution, particularly when sample sizes are small (Cohen, 1988), results suggest that the inter-factor correlations were small between the three factors.

DISCUSSION

The results that we obtained from our study support previous studies that have investigated PAL, with both students and educators being receptive to the concept of PAL and its benefits (McKenna & French, 2011). Peer-assisted learning is becoming an important approach within the tertiary education sector, while in parallel, professional industry bodies expect students to have developed teaching and learning skills (Iwasiw & Goldenberg, 1993; McKenna & French, 2011; Secomb, 2008). It is evident from the data that we obtained that PAL has many positive aspects to offer students in the future and will hopefully become a regular component of the curricula for paramedic university-based education. The increased level of confidence that is gained from participating in PAL will hopefully result in future utilisation of the concept of PAL by the students who participated, and those students will become the future PAL educators. In addition, this study has provided preliminary evidence that the CTPQ has confirmed multidimensionality through strong item loading coefficients above .40 and adequate total explained variance based upon the findings from the PCA.

To our knowledge this is the first time the psychometric properties of the CTPQ have been examined using data from an undergraduate paramedic cohort, and as such, provides important data for the PAL community, particularly those involved in paramedic teaching and learning. However, while results confirm a three-factor scale, a number of issues with these data still exist that require ongoing examination before the scale can be safely considered valid and reliable. For example, future investigation of the CTPQ needs to confirm whether the scale is indeed multidimensional. As these data illustrated, improvements are required in a number of areas, namely the low explained variance (61.3%), the high number of non-redundant residuals, and the large number of corrected item-total correlations below .30 (Pett et al., 2003). In addition, the low Cronbach's alpha coefficient demonstrates that the scale does not have adequate internal consistency (Hair et al., 1995; Tabachnick & Fidell, 2007). It is clear that future work is required to replicate findings from this study. We would recommend that other elements of reliability testing such as test-retest should be carried out with other future studies. Other researchers might also consider performing a confirmatory factor analysis to test model fit in order to better understand the latent variables in question.

Comparing the results of this study to the nursing CTPQ psychometric paper (Williams et al., 2013) highlights some clear differences in both dimensionality and reliability. This study found a three-factor solution compared with a two-factor structure using a nursing cohort. Of note, the same four items (6, 2, 5, 1) representing the Instructor-Led Supervision subscale were consistent in both studies. In addition, the nursing study produced strong internal consistency results. Cronbach's alpha coefficients for the nursing cohort were .92 and .89 compared with .64 and .66 for the paramedic cohort. The number of non-redundant residuals between the two

studies (27 vs. 5) also reflects the uncertainty of whether the CTPQ is a two or three factor latent structure. Again, further studies with paramedic cohorts should focus on this with multivariate statistical approaches such as Structural Equation Modelling.

The majority of the literature surrounding PAL demonstrates a positive experience for peers (Dickson, Harrington, & Carter, 2011; Glynn, MacFarlane, Kelly, Cantillon, & Murphy, 2006; Hunt & Ellison, 2010; Nikendei, Andreesen, Hoffmann, & Junger, 2009; Secomb, 2008), and this is reflected in the results that were obtained in this study. For example, there were several items that obtained a mean score of greater than 3. The item "the feedback that I receive from my peers is from a student's viewpoint, therefore more honest, realistic, and helpful than from my instructor" produced the highest mean score. Studies by Chojecki et al. (2010), Scott (2005), and Harmer, Huffman and Johnson (2011) all showed improved communication skills between peers and tutors. These studies also showed that students were receptive to the feedback and advice that was provided to them by peers. The ability to be receptive to feedback provided by fellow health care professionals is a positive trait for paramedic students to hold, as the vast majority of learning that occurs in health care and paramedicine is through peer to peer communication (Cooper, 2005). The feedback provided by the tutors also has the potential effect of boosting the self-confidence of peers.

This study has several important limitations. The first is the sample size. While the sample was large enough to perform a PCA, future work should attempt to obtain larger samples than those used in this study. Secondly, the use of self-reporting data has numerous respondent bias issues. Thirdly, the data were gathered from one institution, which limits the external validity of the findings, particularly given the different PAL variations that exist. Given the paucity of psychometric analysis of the CTPQ, future work should also attempt to address other elements of validity (construct theory, and criterion-related validity) and reliability (test-retest).

CONCLUSION

Findings from the PCA provide preliminary results that the CTPQ is multidimensional, producing a three-factor solution: Peer Learning Management, Peer-Led Supervision, and Instructor-Led Supervision. Other findings demonstrated poor internal consistency and a large number of non-redundant residuals, suggesting further replication studies are required before widespread use of the CTPQ among paramedic student cohorts. Future studies are required to build upon these preliminary analyses before the CTPQ can be considered valid and reliable.

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