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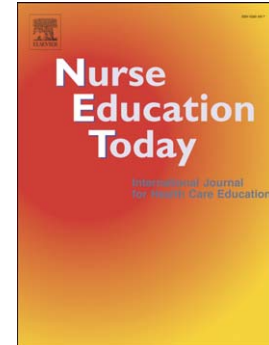
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A CONFIRMATORY FACTOR ANALYSIS OF THE STUDENT EVIDENCE-BASED PRACTICE  
QUESTIONNAIRE (S-EBPQ) IN AN AUSTRALIAN SAMPLE

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#### Abstract

**Background:** It is crucial that nursing students develop skills and confidence in using Evidence-Based Practice principles early in their education. This should be assessed with valid tools however, to date, few measures have been developed and applied to the student population.

**Objective:** To examine the structural validity of the Student Evidence-Based Practice Questionnaire (S-EBPQ), with an Australian online nursing student cohort.

**Design:** A cross-sectional study for constructing validity

**Participants and Method:** Three hundred and forty-five undergraduate nursing students from an Australian regional university were recruited across two semesters. Confirmatory Factor Analysis was used to examine the structural validity.

**Results:** Confirmatory Factor Analysis was applied which resulted in a good fitting model, based on a revised 20-item tool.

**Conclusions:** The S-EBPQ tool remains a psychometrically robust measure of evidence-based practice use, attitudes, and knowledge and skills and can be applied in an online Australian student context. The findings of this study provided further evidence of the reliability and four factor structure of the S-EBPQ. Opportunities for further refinement of the tool may result in improvements in structural validity.

## BACKGROUND

Contemporary nursing practice emphasises the integration of evidence-based approaches within clinical practice to improve patient care and outcomes. Despite the support from leading nursing authorities, and the validity of practicing within an evidence based framework, there are concerns expressed in the literature that nursing care is not always evidence based (Bonner and Sando, Koehn and Lehman, 2008; Majid et al. 2011; Olade, 2003; Saunders and Vahviläinen-Julkunen, 2016; Squires et al., 2011).

In order to prepare Registered Nurses whose practice is evidence based, universities must teach a research based curriculum (Brown et al., 2010). Nursing research subjects are possibly students' first exposure to the concepts of evidence-based practice, nevertheless, there is sometimes resistance and disinterest in research subjects (Halcomb and Peters, 2009).

Contributing to the disinterest in research subjects may be the perception that the subjects are difficult or hard to understand (Brooke et al., 2015), or there may be a lack of understanding regarding the usefulness of the research (Ax and Kincade, 2001). Conversely, students have also identified that research knowledge has given them confidence, enabling them to feel empowered within their clinical practice (Brooke et al., 2015; Koehn and Lehman, 2008).

Certainly there appears to be a variety of ideas on pedagogical approaches on how best to prepare undergraduate nurses (Aglen, 2016). Some have argued that teaching evidence-based practice should be embedded across the whole of curriculum, whilst others have suggested clear partnerships between universities and clinical areas to help students see closer links with practice (Aglen, 2016; Missal et al., 2010). Another suggestion is to provide a distinct course related to research methods or evidence-based practice within the university degree program (Christie et al., 2012; Halcomb and Peters, 2009).

Whatever the educational approach, the end goal should be that students feel more confident, knowledgeable and skilful in being able to engage in evidence-based practice in the

future. Determining this as nursing educators, requires ensuring that in part, measures are robust in helping to understand whether the teaching practices are in fact making a difference to students.

### *Measuring Evidence-Based Practice*

There are a variety of scales and instruments available to examine different aspects of evidence-based nursing practice, such as the “Knowledge, Attitude and Behaviour measure of EBP” (Johnston et al., 2003) the “Evidence-Based Practice Belief and Implementation Scale” (Melnik et al., 2008) “Self-efficacy and Outcome Expectancy in EBP” (Chang and Crowe, 2011) and the “Capability Beliefs and EBP Scale” (Wallin et al., 2012). Also, there is the “Evidenced-Based Practice Questionnaire for Nurses (EBPQ) which investigates the practice, attitude, and knowledge of nurses in regards to evidence-based practice (Upton and Upton, 2006). The structural validity of the EBPQ has been tested on a sample of social workers and overall the structure was supported (Rice, Hwang, Abrefa-Gyan, and Powell, 2010). In order to improve fit, Rice et al., (2010), correlated error terms, which was acceptable because the correlated error terms were on the same subscale and were theoretically justified (Hooper, Coughlan & Mullen, 2008).

Leung, Trevena and Waters (2014) reviewed the instruments that are available for measuring evidence-based nursing practice and found that most instruments lacked adequate validity and reliability. Their final review of 24 instruments showed that the EBPQ was not only the most practical tool to use, but also had the highest validity (see Leung et al., 2014). The EBPQ is reputed to be easy to administer (Upton et al., 2014) and easy for the participants to complete (Upton and Upton, 2006). It has been translated and used to examine evidence-based practice in cross cultural settings (Kim et al., 2015). The strongest criticism of the EBPQ is its total reliance on self-report, the lack of performance-based screening (Leung et al., 2014), and the possibility of overinflated knowledge scores (Brown et al., 2008).

The issue of adequately assessing student nurses' use of evidence-based practice is compounded by the lack of available scales that are designed specifically for use with this population. Subsequently, Upton et al., (2016) have further developed the EBPQ for use with a student nurse population. The "Student Evidence-based Practice Questionnaire" (S-EBPQ) is a self-administered tool that is designed to measure the frequency of use of evidence-based practice, along with attitude, knowledge and skills. It can also be used to compare student nurses with postgraduate and experienced Registered Nurses, so it has the potential to be used in longitudinal studies. It is reported to have good psychometric properties using exploratory factor analysis (Upton et al., 2016).

Nursing research in relation to the evidence-based practice mostly targets registered nurses already working in a clinical setting. Given that establishing these evidence-based practice attributes should occur at a beginning level during undergraduate education, there is a need to examine these factors prior to completion of a program of study. The S-EBPQ was developed in a sample of UK nursing students, and to date has not been examined in an Australian sample, nor with an online student cohort. In addition, an extensive search of both published and grey literature has found that structural validity of the S-EBPQ has been not tested using a more stringent Confirmatory Factor Analysis.

## The Study

### *Aim*

Replication of research is considered a crucial principal of science, and for a scale to be truly valid, the factor structure should be able to be replicated across both similar and different populations. As such, this study firstly sought to replicate the factor structure of the S-EBPQ as proposed by Upton et al., (2016), by using Confirmatory Factor Analysis.

This replication study sought to test the factor structure in a university setting that not only teaches evidence-based practice in an online environment, but tends to have a slightly older

student cohort. Given that evidence-based practice is expected to be embedded into nursing education, it was hypothesised that the factor structure would hold in an online teaching environment.

## Methodology

The factor structure proposed by Upton et al., (2016) was examined using Principal Component Analysis (PCA). It is arguable that whilst this may be a starting point for testing structural validity, this approach is not without its critics. PCA includes error variance, and the factor loadings in PCA are often said to be inflated (Tabachnick and Fidell, 2007). PCA takes into account all the variance and the resultant pattern matrix may give an apparent better fit than other forms of factor analysis, for example, maximum likelihood analysis (Tabachnick and Fidell, 2007). In addition to truly testing factor structure, Confirmatory Factor Analysis is considered the gold standard. To date this has not been done on this scale, and this study will address this.

### *Participants and Setting*

Participants were recruited across two semesters in 2016 from students enrolled in an evidence-based practice course. Students were invited to participate via a message on their study desk, and course credit was provided to those who completed an online survey. Data were collected at the beginning of each semester.

Students that undertake the evidence-based practice course are generally in their third year of study, although some second year students take the course depending on their enrolment pattern. The course is offered online over 13 weeks, and covers the seven key steps of evidence-based practice (see Melnyk et al., 2010).

### *Instrument*

The “Student Evidence-based Practice Questionnaire” (S-EBPQ) was used in this study (Upton et al., 2016). The S-EBPQ has four subscales; these are “Frequency of Practice”, “Attitude”,

Retrieving and Reviewing Evidence”, and “Sharing and Applying Evidence-Based Practice (Upton et al., 2016). The S-EBPQ has 21 positively worded questions. Responses are recorded on 7-point Likert scales. The S-EBPQ questions tend to be broad, for example “*how would you rate your knowledge of how to retrieve evidence?*” (Upton et al., 2016). The authors report that the measure demonstrates strong internal reliability, with the Cronbach’s  $\alpha$  ranging from .76 - .91 for the subscales (Upton et al., 2016).

The Practice subscale contains six questions focusing on how often the student performed evidence-based practice behaviours and includes items in relation to formulating clear questions, finding relevant evidence, and integrating and evaluating evidence in practice. The Attitude subscale contains only three questions and students are asked to rate their responses on the Likert scale against a pair of statements. The Retrieving and Reviewing subscale has seven questions examined the students’ perception of their evidence-based practice knowledge. Questions related to research skills, knowledge on accessing information and the ability to determine the validity and usefulness of the material. The Sharing and Applying subscale broadly examines evidence-based practice skills, such as the ability to identify, apply and review information and consists of five items.

### *Ethical Considerations*

Ethics approval was obtained from the University Human Research Ethics Committee. Participation was considered voluntary, and if students did not opt to complete the survey for course credit, they could apply for an alternative and equivalent piece of assessment. The S-EPBQ was part of a battery of questionnaires. Some of the other questions in the battery were directly related to the learning tasks for the subject, as too was the alternate piece of assessment. This ensured that bias was reduced. Once students entered the online survey, they created their own unique code, and anonymity was assured with no identifying information collected. The developers of the S-EBPQ granted permission to use the instrument.

### *Data Collection and Data Analysis*



Students who were enrolled in an evidence-based practice course invited to complete the survey for course credit meaning that a convenience sample was used ( $n = 416$ ). Participants completed the survey at the beginning of the semester and approximately 82% of the available participants were used in the analysis ( $n = 345$ ). The survey was collected electronically and in order to enhance survey fidelity, all items were forced-choice, meaning that all questions were required to be answered to complete the survey. In addition only completed response sets were recorded and analysed. Data were also checked for random responding.

Data were screened for normality, skewness, kurtosis, and it was noted on visual inspection that the Attitude scale was negatively skewed, whereby participants overwhelmingly supported the value of evidence-based practice. This may be considered a violation of assumptions in factor analysis, nevertheless, in large sample sizes factor analysis can still be considered a relatively robust method when assumptions are violated (Tabachnick and Fidell, 2007).

Each of the subscales were tested for reliability and the Cronbach alpha were .92 (Practice), .52 (Attitude), .94 (Retrieving and Reviewing), and .91 (Sharing and Applying). All data were analysed using IBM SPSS and AMOS Version 23.

## Results

### *Sample Characteristics*

The sample of 345 students were mostly female 296 (85.8%), which is consistent with national figures for female registered nurses of 86.78% (Nursing and Midwifery Board of Australia, 2017). Over half of the students were between the ages of 20-29 years (50.1%), with 46.6% older than 30 years. Within the cohort, 58% reported a background of working in the health sector,

with most employed as assistants in nursing (33%), enrolled nurses (17.4%), or as personal care workers (7.8%). Most had recent clinical experience within the last one to five years.

### *Determining the Factor Structure and Items*

To check the feasibility of running the CFA, a Principal Components Analysis (PCA) was conducted; four factors were specified, with direct oblimin chosen. Using the criterion set by Tabachnick and Fidell (2007), items that loaded on a single factor above .6 and below .32 on any other factor, were considered a good fit. All items loaded on a four-factor structure identical to that of the S-EBPQ (Upton et al., 2016). Also all items loaded purely on one factor except for item 6 “*Shared this information with colleagues*” which cross loaded on Factor 2 = Practice and Factor 3 = Sharing and Applying Evidence-Based Practice. This provided adequate support to run the CFA.

The structural validity of the S-EPBQ was examined via Confirmatory Factor Analysis (CFA). A good fitting model has been recommended as  $\chi^2 / (df) < 3$ , a comparative fit index (CFI)  $> .95$ , and a RMSEA  $< .05$  (Hu and Bentler, 1999), however others have considered an RMSEA close to .06 a reasonable fit providing the upper limit of the 90% confidence interval is  $< .08$  (Hooper et al., 1996). The sizes of standardised path coefficients are suggested as small  $< .10$ , medium  $\sim .30$ , and large  $> .50$  (Kline, 2005).

The initial CFA resulted in a poor fitting model, where  $\chi^2 / (df) = 4.875$ , a comparative fit index (CFI) = .873, and a RMSEA = .106 (CI<sub>90</sub> = .099 - .113). Modification indices are provided in AMOS 23 to indicate which items can be correlated to improve model fit. These indices indicated that the error terms for questions 6 & 19, 1 & 2, 14 & 15, and 19 & 20 should could be correlated. It was also noted that item 6 cross loaded on the PCA; and therefore was deleted from the final solution, leaving a 20 item questionnaire. In the final solution the four factors suggested by Upton et al. (2016) were retained, and the suggested modifications were applied to the final model. The final model can be seen in Figure 1.

<Insert Figure 1 Here>

This solution represented a reasonable fitting model, where  $\chi^2 / (df) = 2.57$ , a comparative fit index (CFI) = .951, and a RMSEA = .068 (CI<sub>90</sub> = .060 - .076). All standardised path coefficients were significant with the smallest being the path to question 1 = .4 and the largest was the path to question 14 = .89 (see Figure 1). Overall, it can be said that the revised 20 item scale represented a good fit of the data. The updated Cronbach's alpha for scale 4 after item 6 was deleted remained at .92.

### *Discussion*

This study was able to support the S-EBPQ as a valid and reliable tool to assist in examining the skills, knowledge and attitudes of nursing students by replicating this tool in an Australian online student context with similar results. The replication of the tool had been recommended by Upton et al., (2016) within an international context, and additionally, this study was also able to test the tool with a distinct student cohort.

The further contribution of this study, was the extension of using Confirmatory Factor Analysis, which revealed that with more stringent testing, a fair to good fitting model could result (see Figure 1). Whilst more error terms could have been correlated to get a better fitting model, it would have made interpretation of the model more difficult. In scale development, researchers are often having to face a trade-off between a better fitting model and a model that is easier to interpret. On this occasion the researchers took the middle ground.

Hooper et al., (2008) have argued that when error terms are correlated there needs to be a good justification, and should only be with items in the same factor (or subscale). In this study these principles were applied. Items 15 "*Ability to determine how valid*" and 16 "*Ability to determine how useful*" were similar items. It is arguable that given the sample were undergraduate nurses, the understanding of the semantic difference between valid and useful may not be fully developed. Similarly items 19 "*Sharing of ideas and information with colleagues*" &

20 “*Dissemination of new ideas*”, are arguably relatively similar in their intended meaning. This relationship was not as clear for items 1 “*Formulated a clearly answerable question*” & 2 “*Tracked down the relevant evidence*”, however both items loaded on the Practice subscale. Item 6 “*Shared this information with colleagues*”, did appear to be problematic in the PCA. On further inspection, there did appear to be similarities to item 19 “*Sharing of ideas and information with colleagues*”. Given that there was a cross loading of item 6 and a duplication of meanings between the two items, it is recommended that the tool be based on 20 items instead of the 21 item S-EBPQ.

With respect to the overall model fit, it could be argued that the positive skewness of the Attitude subscale, may have affected the overall model fit. Additionally, it was noted that the paths in this subscale were weaker comparatively to other scales. This may have resulted from the types of items included. For example, Items 7 “*I resent having my clinical practice questioned*”, and 8 “*Evidence-based practice is a waste of time*” appear emotive and therefore may elicit a stronger or more defensive response. There is no doubt that in order to implement evidence-based practice, professionals need to have a positive attitude. Perhaps an area of further development on this tool, might be to strengthen this subscale by adding several other questions, or to restructure this subscale from a semantic differential scale to a Likert scale.

### *Limitations*

The selection of participants using a convenience sample gathered from one university may be considered a limitation and may have resulted in sampling bias, thereby limiting the generalizability of the findings. The skewness of the Attitude subscale may have affected the overall model fit for the CFA, and therefore it would be recommended that further testing in other samples be undertaken. Not all students who were invited to participate in the study actually participated despite been granted course credit to engage in the survey. One of the reasons for overall positive attitude scores by participants may have been a reflection that only students who

have a positive view towards EBP actually completed the survey. This potential sampling bias would be difficult to determine.

As reported by other authors (Upton et al., 2016; Ruzafa-Martinez et al., 2013), tools that rely on self-reported data are often criticised in terms of validity. Nevertheless, whilst the evidence surrounding nursing students' skills, knowledge and attitudes towards evidence-based practice is still mounting, collecting self-report data remains to be considered useful and appropriate within student populations. Future research could consider measuring the associations between self-report and skills.

### *Conclusion*

This study supports the S-EBPQ tool as a psychometrically robust measure of evidence-based practice use, attitudes, and knowledge and skills with undergraduate nursing students. The results have found that the tool is replicable within an international context and can be applicable for use with online students. In its current form, it is an adequate scale. However, like all tools, further refinement would make a good tool even better. Opportunities for further refinement of the tool such as greater discrimination of items and restructuring of a subscale, may improve the overall structural validity.

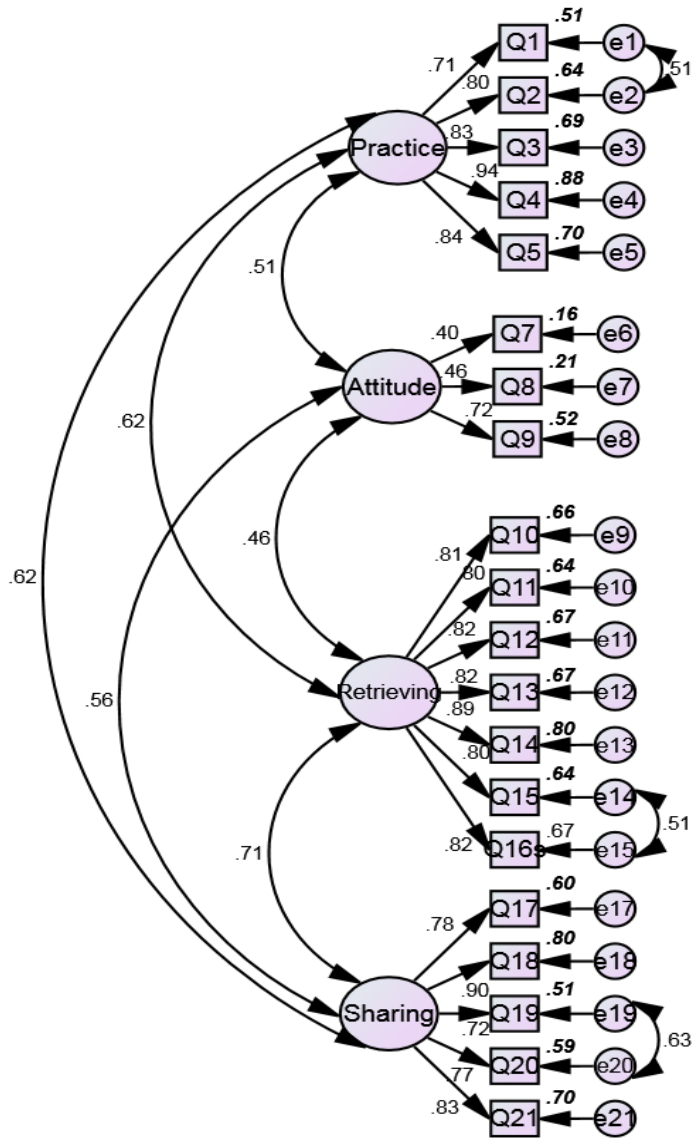
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**Figure 1.** Structure of the Student Evidence-Based Practice Questionnaire (S-EBPQ)

N.B. Correlations between latent variables and items are represented with arrows. The number next to the items in italic and bold indicates how much variance was explained in the item.