



Measurement Properties of the Interdisciplinary Education Perception Scale in an Australian Allied Health Student Cohort

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Abstract

Purpose: Measurement of interprofessional practice perceptions of students is commonplace in the health professions education literature. There are a range of questionnaires available for researchers to use however the psychometric properties of these vary substantially. The Interdisciplinary Education Perception Scale (IEPS) has been widely used and multiple researchers have published alternative factor structures. The present study sought to build on this work by evaluating the psychometric properties of the IEPS using Rasch analysis.

Method: Three-hundred and nineteen students in two Australian osteopathy programs completed the IEPS as part of a larger project into interprofessional education. The measurement properties of the questionnaire were evaluated using Rasch analysis and reliability estimations were also generated for the IEPS.

Results: Fit to the Rasch model was achieved by modifying the original 18 item scale, however this was not unidimensional. Subsequent analysis using an alternative factor structure from the literature achieved Rasch model fit and was unidimensional. The final model produced an eight item version of the IEPS (IEPS8) with appropriate psychometric properties, including the ability to create a valid total score.

Discussion: The questionnaire developed as a result of the Rasch analysis provides researchers with a short, psychometrically sound measure of perceptions of their own profession and how their profession works with others. The results also provide an opportunity to explore perceptions pre-post intervention IPE interventions using an interval-scale measure compared to an ordinal one. Researchers are encouraged to utilise this version of the IEPS in future research as it has the potential to be able to discriminate between levels of perception of their own profession and how their profession works with others.

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1. Introduction

Inclusion of interprofessional (IP) education in health professions training programs is being advocated to improve patient safety and reduce costs associated with healthcare.¹ Evaluating student perceptions of IP collaboration and practice is required to guide the

development of, and changes to, curricula to improve engagement with IP practice. There are a range of questionnaires that have been developed to evaluate IP education before, during and after teaching and clinical programs.^{2,3} The majority of the measures listed in these reviews have only been used once, and few demonstrate adequate measurement properties to support their ongoing use.

One of the more widely used is the Interdisciplinary Education Perception Scale (IEPS).⁴ This version of the questionnaire has been used to assess IP cooperation prior to the introduction of an IP program,⁵ improvement in attitudes following an IP training program⁶ and in a pilot IP simulation program.⁷

The internal consistency of the IEPS as a whole is acceptable ($\alpha = 0.87$) for the model proposed by Luecht, Madsen, Taugher, Petterson⁴ however subscales 2 ($\alpha = 0.56$), 3 ($\alpha = 0.54$) and 4 ($\alpha = 0.52$) are well below the accepted α of 0.70. Subsequently, numerous authors have evaluated the IEPS and proposed alternative factor structures.^{8–11} The lack of agreement about a factor structure highlights there are still questions around the psychometric properties of the IEPS and additional analysis is necessary. Oates, Davidson¹² also highlight that previous IEPS studies have used classical test theory, a sample-dependent approach that limits the ability to discriminate between respondents with different interprofessional perceptions using IEPS scores.¹² The use of these sample-dependent approaches may account for the multiple IEPS factor structures reported in the literature. Item response theory approaches such as Rasch analysis are sample-independent, and allow for the evaluation of both the IEPS item and respondent on the same scale thereby providing the ability to discriminate between different perception levels. The aim of the present study is to explore aspects of the construct validity of the IEPS in an Australian osteopathy student cohort using Rasch analysis.

2. Method

This study was approved by the Victoria University and Southern Cross University Human Research Ethics Committees. Return of a completed questionnaire was taken as consent to participate in the study. No data that would identify a participant was collected.

2.1. Participants

Students enrolled in the osteopathy programs at Victoria University (Melbourne, Australia) and Southern Cross University (Lismore, Australia) were invited

to participate in the study. The present study was conducted as part of a larger investigation into Australian osteopathy student perceptions of IPE. Students completed the questionnaires on paper during March to April 2014. Both osteopathy programs were of 5 years duration, with years 3 to 5 including clinical placement activities. Neither program had instituted specific IP learning programs at the time the questionnaire was completed however students in the later years may have been exposed to other health professionals through their clinical placement activities.

2.2. Questionnaire

Participants completed a basic demographic questionnaire and the Interdisciplinary Education Perception Scale.⁴ The demographic questionnaire asked participants to indicate their age, gender and enrolled year level. The IEPS contains 18 items in four factors with each item rated on a 1 to 6 Likert-type scale representing 'strongly disagree' to 'strongly agree'. There is no neutral response category.

2.3. Data collection

Students were invited to complete the paper versions of the demographic questionnaire and IEPS in one of their osteopathy practical skills classes. Responses were anonymous, and students could complete the questionnaires at a time of their choosing. Participation in the study was not a requirement of any subject in either osteopathy program.

2.4. Data analysis

Data were entered into SPSS (version 21) to organise the export to other programs for data analysis. Data were exported to R¹³ to generate the descriptive statistics using the *psych* package.¹⁴

2.4.1. Rasch analysis

Data were exported from SPSS to RUMM2030¹⁵ for the Rasch analysis (RA). RA is part of the modern test theory family that seeks to fit the data to the Rasch model, compared with the data driven models in classical test theory.

RUMM2030 generated multiple statistics to evaluate overall fit to the polytomous Rasch model. A statistically significant Bonferonni adjusted chi-square indicated the data are significantly different from the polytomous Rasch model.¹⁶ Overall item and person fit was indicated by fit residual standard deviations (SD) of -1.5 to +1.5.¹⁷ The person separation index (PSI) was calculated to provide an

Table 1
Demographic data.

		Total	University	
			Victoria University	Southern Cross University
Total responses		319	263 (75%)	56 (36%)
Year Level	Year 1	131 (41%)	108 (82%)	23 (18%)
	Year 2	41 (13%)	40 (98%)	1 (2%)
	Year 3	35 (11%)	35 (100%)	0
	Year 4	52 (16%)	33 (63%)	19 (37%)
	Year 5	60 (19%)	47 (78%)	13 (22%)
Age Group	18–20	98 (31%)	95 (97%)	3 (3%)
	21–23	93 (29%)	88 (95%)	5 (5%)
	24–26	51 (16%)	44 (86%)	7 (14%)
	27–29	21 (7%)	13 (62%)	8 (38%)
	30 plus	53 (17%)	21 (40%)	32 (60%)
Gender	Male	143 (45%)	117 (82%)	26 (18%)
	Female	175 (55%)	146 (83%)	29 (17%)

indication of the internal consistency and the ability of the items to measure different levels of the latent construct.

Individual items were evaluated for fit to the polytomous Rasch model. A statistically significant Bonferonni adjusted chi-square and/or fit residual SD greater than ± 2.5 indicated misfit.^{17,18} The threshold map and category probability curves were observed to ascertain if the scale options for the item were being used in a manner consistent with the polytomous Rasch model. IEPS items were rescored where possible.^{16,19} Where rescoring did not resolve the threshold disordering, or the item did not fit the polytomous Rasch model, it was removed from the analysis.

Differential item function (DIF) was evaluated to ascertain if any of the demographic variables (age, gender, year level and university) significantly influenced the way an item was responded to.^{20,21} Where an item demonstrated DIF, it was removed from further analyses so as to produce a final questionnaire free of influence from demographics.²² Item residual correlations of > 0.2 indicated items were interdependent and removal of one of the items was required to improve the fit to the polytomous Rasch model. Person fit to the polytomous Rasch model was evaluated and responses removed from further analyses if the fit residual SD was greater than ± 2.5 .¹⁷

Once fit to the polytomous Rasch model was achieved, the dimensionality of the revised questionnaire was evaluated using the PCA/t-test approach.¹⁷ The revised questionnaire was interpreted as being unidimensional if the 95% confidence interval for the *t*-test *p*-value

contained $p = 0.05$.²³ The confidence interval was calculated using the *binom*²⁴ package in R.¹³

2.4.2. Reliability estimates

Both Cronbach's α and McDonald's ω estimates were reported in the present study to ensure that "...the reliability results are less likely to be misinterpreted"²⁵ compared to when reporting α only. The *psych*¹⁴ and *userfriendlyscience* packages²⁶ in R¹³ were used to calculate both reliability estimates. Both the omega total (ω_t) and omega hierarchical (ω_h) estimates were calculated.²⁷ The general factor or latent construct in the current study is the students' perception of interprofessional relationships. General factor reliability is represented by the ω_t value, and the proportion of the total score variance that can only be attributed to the general factor is ω_h .²⁸ The ω_t value is interpreted in the same way as Cronbach's α where values greater than 0.7 are acceptable. Revelle²⁹ suggests that ω_h values greater than 0.50 supports the calculation of a total score.

3. Results

Three-hundred and nineteen responses ($N = 319$) were received from students in the two osteopathy programs – 263 from VU and 56 from SCU. The overall response rate was 63% and demographic data are presented in Table 1.

3.1. Full Interdisciplinary Education Perception Scale

All 18 items were entered into RUMM for analysis as a single measure. One participant had missing data

and was removed from the analysis. Three-hundred and eighteen responses ($N = 318$) were available for analysis. The IEPS did not fit the polytomous Rasch model on the initial analysis ($\chi^2(72, N = 317) = 263.14, p < 0.001$) using the partial credit model. The item fit residual and person fit residual were 2.45 and 1.48 respectively. The PSI was 0.84. Modifications were made by rescoring and removing items, and removing misfitting persons. Fit to the polytomous Rasch model was achieved ($\chi^2(40, N = 260) = 34.20, p = 0.724$). The item fit residual SD was 0.80, person fit residual was 0.98, and the PSI was 0.83. Binomial dimensionality testing did not support unidimensionality ($p = 0.084, 95\%CI[0.051–0.120]$) suggesting the modified IEPS was multidimensional.

3.2. Sixteen item model of the Interdisciplinary Education Perception Scale

Due to an inability to generate a unidimensional scale for the full 18-item IEPS, the 16-item model proposed by Leitch¹⁰ was subsequently evaluated for fit to the polytomous Rasch model with the partial credit model. This model was chosen as it retained the greatest number of items from the original IEPS. Initial analysis did not fit the Rasch model ($\chi^2(64, N = 318) = 234.77, p < 0.001$). The item fit was 2.40, person fit was 1.41 and the PSI was 0.79. Items 8 and 11 did not fit the polytomous Rasch model and multiple items demonstrated disordered thresholds. DIF was observed for item 6 (year level), item 11 (gender) and item 18 (university). Twenty-seven persons misfit the Rasch model. Residual correlations were observed for six item pairs. Pertinent data and figures are presented in [Supplementary File 1](#).

Fit to the polytomous Rasch model was evaluated across 2 iterations. Iteration 1 fit the Rasch model ($\chi^2(40, N = 281) = 58.97, p = 0.026$) and was considered unidimensional ($p = 0.081, 95\%CI[0.049–0.120]$) as the 95% confidence interval included $p = 0.05$. Iteration 2 demonstrated a better fit to the Rasch model ($\chi^2(32, N = 267) = 26.55, p = 0.738$) with an item fit residual of 0.81, person fit residual of 0.93 and a PSI of 0.789. Eight items were removed ([Supplementary File 2](#)) and items 10, 13, 15 and 16 were rescored ([Supplementary File 2](#)) in addition to removing data from 51 misfitting persons. No items demonstrated DIF in the final model. Binomial dimensionality testing suggested the revised 8-item IEPS (IEPS8) was unidimensional ($p = 0.074, 95\%CI[0.046–0.115]$). Reliability estimates for iteration 2 were both above an acceptable level at $\alpha = 0.81$ ($95\%CI[0.78–0.84]$) and $\omega_t = 0.81$ ($95\%CI[0.78–0.85]$).

Omega hierarchical (ω_h) was 0.60 further supporting unidimensionality. Descriptive statistics, item fit data and the raw score conversion for the IEPS8 are presented in [Supplementary File 3](#) and an overview of the item removal presented in [Supplementary File 2](#).

4. Discussion

Evaluation of student perceptions of IP education and practice can provide an insight into their willingness to engage with, or identify barriers to engagement with, IP practice. Oates, Davidson¹² highlighted that many studies evaluating changes in student perceptions of IP practice following education interventions, failed to identify any change. These authors suggest that modern test theory approaches may improve this discrimination where interval-level total scores can be calculated, potentially providing a more accurate indication that a student's perception has changed. Analysis using the polytomous Rasch model, a modern test theory approach, produced a unidimensional 8-item version of the IEPS (IEPS8) that allows for the calculation of an interval-level total score. This conversion to an interval-level score likely helps to address one of the concerns raised by Oates, Davidson¹² that the indifferent results evaluating pre-post differences with IPE interventions may be due to the lack of discrimination. The IEPS8 scoring table ([Supplementary File 3](#)) allows the total IEPS8 score to be readily converted to an interval level Rasch score out of a possible 100, for further analysis.

Numerous items were removed due to misfit to the polytomous Rasch model ([Supplementary File 2](#)). Item 8 potentially misfit the model due to student's perception of the nature of Australian osteopathic practice where osteopaths typically are in a solo practice or a private practice with other osteopaths.³⁰ Although Australian osteopaths co-manage patients with, and refer patients to, other health professionals^{30,31} this cooperation was not measured in a manner consistent with the Rasch model. Items 4 and 9 were also removed. Both of these items appear to be tapping the same idea of respect for one's profession and students may have some difficulty differentiating between the meaning of these two items. Item 18 demonstrated misfit and was also removed. This item was subsequently removed from the analysis. Student's may have difficulty responding to items 4, 9, and 18 as they need to put themselves 'into the shoes' of someone in a health profession other than their own.

Further, item 11 *Individuals in my profession have a higher status than individuals in other professions* also

significantly misfit the Rasch model and was removed. When responding to this item, students with lower total IEPS scores (lower levels of the latent construct) were selecting response options higher than that predicted by the Rasch model, and vice-versa. McFadyen, Maclaren, Webster⁸ suggested the wording of this item may be inappropriate for students who have yet to experience life as a health professional, and the significant misfit in the present study supports this assertion. Likely contributing to this misfit was the DIF for gender displayed by this item. Bell, Michalec, Arenson³² have posited the significant influence of gender on IP care stems from the societal status of women and the traditional gender-norms for professions such as medicine and nursing. These status differentials may be borne out in the responses to this IEPS item.

Data suggests the IEPS8 is unidimensional and the ω value of 0.60 is greater than the 0.5 suggested by Revelle²⁹ for the valid calculation of a total score.³³ This value suggests that 60% of the total score variance is accounted for by the latent construct - perception of intra- and inter-professional relationships. The reliability estimates for the IEPS8 were both above an acceptable level of 0.80 with small confidence intervals again supporting the calculation of a total score.

The major limitation of the present study is the generalizability of the IEPS8 to other health professions, and non-Australian osteopathy teaching programs. Given the practice of osteopathy in Australia differs from other parts of the world, there may be differences in perception that could systematically influence responses to the IEPS. Another limitation is the convenience sampling method employed as only those students motivated to complete the questionnaire would have done so. Another possibility is that less motivated students may not have completed the questionnaire accurately, answering each item at either end of the Likert-type scale. Further, students were not supervised when completing the questionnaire and this may have led to a situation where the students completed it by copying another student. The removal of participant responses to achieve polytomous Rasch model fit is another limitation and may represent carelessness, inattention etc. when completing the IEPS. Qualitative approaches such as interviews may help to understand why participants with extreme or misfitting responses are answering the IEPS in a particular way.

5. Conclusion

The present study has provided data for the initial evaluation of the measurement properties of a short-form version of the original IEPS. The IEPS8 may

capture a students' perception of their own profession and how their profession works with others. The responses to this modified version of the IEPS are not influenced by the student's age, gender, year level in their osteopathy program nor the university they attend. Further, a total score can be calculated to produce an interval-level measurement. As such, the IEPS8 may have an application in studies investigating pre-post differences as it has the ability to discriminate between responses comparing before and after an IPE intervention. Given the limitation with the removal of over 15% of participant responses, further evaluation of the measurement properties of the IEPS8 is required. Additionally, the IEPS8 may not capture all of the intended elements for the evaluation of IP perceptions therefore there may be value in developing additional items with subsequent psychometric testing, or testing the IEPS8 in conjunction with other IPE questionnaires. IPE researchers are encouraged to use modern test theory approaches such as Rasch analysis, when developing questionnaires to evaluate IPE. Additionally, researchers are encouraged to use these approaches to further investigate the measurement properties of IPE questionnaires currently available in the literature in their own populations.

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Availability of data

Data for this study is available from the *figshare* repository: <https://figshare.com/s/710483e7d6f574597518>.

Ethical approval

Victoria University (Melbourne, Australia) and Southern Cross University (Lismore, Australia) Human Research Ethics Committees.

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Appendix A. Supplementary material

Supplementary data associated with this article can be found in the online version at <https://doi.org/10.1016/j.hpe.2018.07.005>.

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