

Australian chiropractic students' perceptions of education: validation of a questionnaire

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Background: *This study aimed to validate a questionnaire to address an absence of a measure to evaluate Australian chiropractic students' perceptions of the quality of chiropractic programs.*

Method: *Potential relevant questionnaire items were selected from the Australian chiropractic accreditation standards. Chiropractic students rated these items for clarity and relevance, which resulted in a pilot questionnaire of 47 items. Principal components analysis was used to establish the structure of the scales. Finally, intra-class correlation coefficients were used to establish the scales' test-retest reliability.*

Results: *Thirty-four items were omitted resulting in the retention of 13 items that strongly loaded onto five factors. Internal consistency was adequate. The test-*

Ce que pensent des étudiants Australiens en chiropratique des programmes de formation : validation d'un questionnaire

Contexte : *Cette étude visait à valider un questionnaire destiné à combler le manque d'outils pour connaître l'opinion d'étudiants australiens en chiropratique de la qualité des programmes d'études.*

Méthodologie : *Des points, éventuellement pertinents, ont été choisis en fonction des normes australiennes d'agrément en chiropratique. Des étudiants ont évalué leur clarté et leur pertinence; un questionnaire pilote comprenant 47 questions a été établi. Les points principaux ont servi à établir la structure des échelles. Des coefficients de corrélation interclasses ont servi à établir la fiabilité du test-retest des échelles.*

Résultats : *Trente-quatre points ont été rejetés; on en a conservé 13 portant surtout sur cinq facteurs. La cohérence interne était suffisante. La fiabilité du test-*

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Abbreviations

CCE-A: Council on Chiropractic Education of Australasia

CCE-I: Council on Chiropractic Education International

DREEM: Dundee Ready Education Environment Measure

ICC: Intra-class correlation coefficients

I-CVI: Item- Content Validity Index

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retest reliability ranged from adequate to good for four of the derived factors. The fifth was poor and omitted.

Conclusion: A valid questionnaire for assessing Australian chiropractic programs has been developed comprising four scales that enquire about: 1) quality of the educational program; 2) provision of student support services; 3) enablement of independent learning; and 4) adequacy of teaching resources.

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KEY WORDS: Education, Chiropractic, Outcome, Validation, Accreditation

Introduction

Education programs that train health professionals are required to meet standards set by regulatory bodies. The intent is to protect the public and provide high quality health care by ensuring competent training.¹ There has been increasing interest in education environments and their role in professional health care training.² Recent research has identified the need for quality measures of the learning environment for medical accreditation and accreditation process.³⁻⁶ This has also been raised as an issue for chiropractic accreditation.⁷⁻¹¹

It is proposed that the educational environment consists of two main aspects: tangible and intangible factors.¹² Tangible factors encompass objective components, such as the physical infra-structure of classrooms, training facilities, and equipment.^{12,13} Intangible factors are subjective and include subtle features such as the “personality” traits of an institution.¹² These intangible factors can be difficult to objectively measure.¹⁴ However, they are manifested in students’ everyday experiences and perceptions, which provide an avenue for measurement.¹⁵ Consequently, students are increasingly being recognised as a key source of information for assessing the educational environment particularly for re-accreditation purposes.¹⁶ However, at present there is no gold standard for assessing medical students’ perceptions of the learning environment.⁶

Such a gold standard would ideally possess evidence for validity of content, response process, internal struc-

retest allait d’adéquate à bonne pour quatre des facteurs dérivés. Le degré de fiabilité du cinquième était faible et celui-ci a été omis.

Conclusion : On a élaboré un questionnaire utile servant à évaluer des programmes d’études en chiropratique offerts en Australie. Quatre échelles ont servi à sonder les étudiants sur 1) la qualité des programmes de formation; 2) les services d’aide aux étudiants; 3) l’enseignement individualisé; et 4) la suffisance des ressources pédagogiques offerte.

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MOTS CLÉS : formation, chiropratique, résultats, validation, agrément

ture and relationship to other variables.⁶ Further it would be a ‘nimble’ questionnaire that is efficient to administer and complete, widely applicable and sensitive to change over time.⁶

The most common method for developing items in such questionnaires is to use sources thought to be related to the student experience. For example, one of the most widely used, the Dundee Ready Education Environment Measure (DREEM)¹⁷, was developed based on the Dundee University Medical School records of the curriculum planning committee meetings. The intent was to develop items that would measure the targets of ‘Health for All by the Year 2000’ i.e., a person’s ability to work productively and participate actively in the social life in the community in which they live.¹⁸ Another questionnaire, the Postgraduate Hospital Environment Measure (PHEEM), employed Postgraduate Deans and Educational Supervisors to develop and agree on a list of possible items based on a literature review.¹⁹ Hence, none of these two commonly used assessment tools used as their source of inspiration formal accreditation documentation. By deriving items from such documentation the questionnaire would potentially be ‘purpose built’ and ‘nimble’.

Presently there has been a shift in the approach by accrediting agencies to move toward a model of outcomes-based education.^{20,21} No longer do accreditation standards prescribe detailed specified curriculum content. Rather, each institution is expected to provide the means

to achieve the desired educational outcomes as well as systems for its assessment. Therefore, it would seem logical to take the regulators' expected student experiences and assess in the target population students themselves as evidence for re-accreditation purposes.

It is evident that there is a need to develop a psychometrically robust and 'nimble' tool for the evaluation of health education programs for accreditation purposes. Such a questionnaire should provide important information to be used to improve the quality of educational outcomes. Therefore, the aim of this study is to produce a valid and reliable questionnaire that captures the students' perceptions of the quality of their professional education, using chiropractic students as an example.

Methods

Human Research Ethics Committee approval was granted by Murdoch University (Project No 2017/ 112).

Development of the preliminary questionnaire

The initial questionnaire items were derived from the CCE-A 2009 and 2017 accreditation and competency standards.^{1,22} Both standards were used because the study occurred during a transition period between the 2009 and 2017 standards. This is represented in Figure 1.

The educational standards were downloaded and any criteria that related to students were extracted and copied verbatim. This created an initial item set that was refined by splitting double-barrelled statements into separate statements (See Appendix 1). Some items were then reworded to enhance their clarity or transform statements into questions. For example, the criterion "It is required that programs have a balance between formative and summative assessment", was rephrased as "Do you agree that the chiropractic program has assessment that is balanced between formative and summative assessment?" Finally, items were deleted if they were considered by the research team to be an unrealistic expectation, or largely irrelevant to students' evaluation of the quality of a CP. For example, the item "Do you agree that the chiropractic program has an admission policy that is consistently applied?" implies that students are not only aware of the presence of an admission policy, but also its content and the degree to which it is consistently applied and its subsequent impact on the CP quality.

The initial list consisted of 67 potential items (Appen-

dix 1). After splitting double-barrelled statements into separate statements, it consisted of 71 items. Irrelevant items (18) were removed. This refined this initial item set to 53 questions distributed across the following six domains: Chiropractic Program; Student Experience; Student Assessment and Learning; Staff; Resources; and the Teaching Clinic.

Panels on two occasions used a Content Validity Index

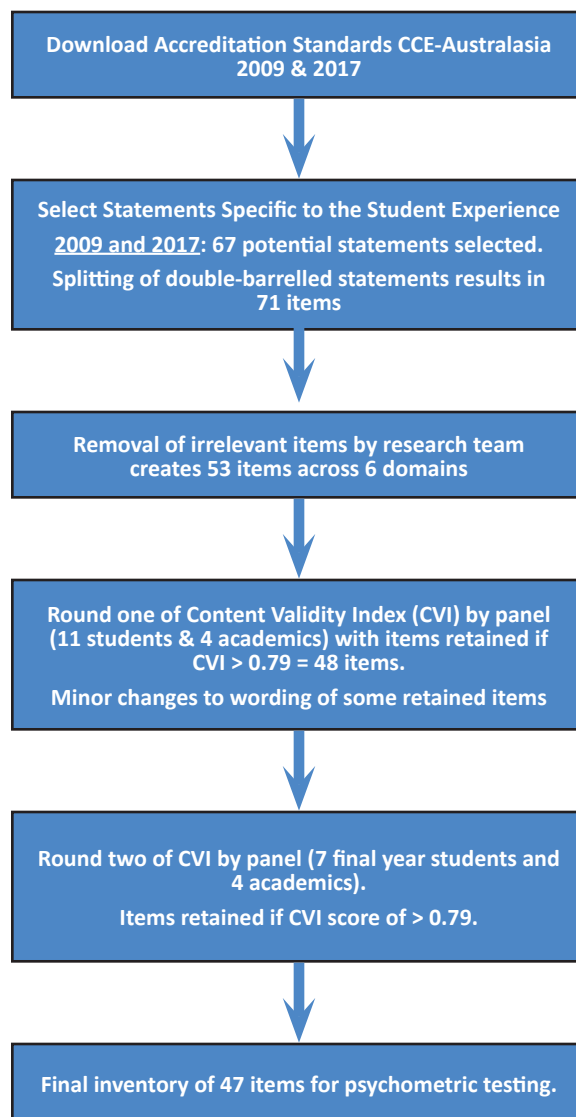


Figure 1.

Flowchart of method used to derive survey items.

(CVI) to assess the content validity of the refined initial item set.^{23,24} The composition of these panels accorded with guideline recommendations, which state that CVI panels should comprise six to twelve participants with backgrounds representative of the target population.^{23,24} We therefore recruited chiropractic students.

All fifth-year chiropractic students were asked if they would like to join the panels by chiropractic staff who did not have any classroom involvement with them. On the first occasion, the panel consisted of 11 chiropractic students who responded to this invitation. Each panel member assessed each item using four categories: not relevant; needs major revision; needs minor revision; and very relevant. Consistent with guideline recommendations, a value of ‘one’ was awarded to either the “needs minor revision” or “very relevant” categories, and ‘zero’ was awarded to either the “not relevant” or “needs major revision” categories.^{23,24} An Item-Content Validity Index (I-CVI) was calculated for each item by summing the values for each rater and then dividing by the number of raters. Based on previous research, an item was retained if its I-CVI was greater than 0.79.^{23,24} Of the 53 questionnaire items reviewed, five recorded an I-CVI below 0.79 and were subsequently deleted.

The student panel also made written recommendations to improve the phrasing of some of the 48 items that were retained from the initial item set. A smaller focus group comprising five chiropractic students who were involved in the study as part of their undergraduate study was then held to incorporate the feedback to improve the wording of the remaining items.

Next, a panel was convened to evaluate the content of the rephrased 48 items with a CVI, using the same method and criteria as described above. This panel consisted of seven chiropractic students who volunteered to further assist from the original 11-student-panel along with four chiropractic academics. On this occasion, all but one of the items recorded an I-CVI value above 0.79, resulting in a final pilot questionnaire comprising 47 items (Appendix 1).

The final pilot questionnaire was distributed to all fourth and fifth year chiropractic students at Murdoch University on two occasions at a three week interval. This time interval has been shown to reduce the potential for learning, carry-over, and recall effects.^{25,26} The rating of each item ranged from ‘strongly disagree’ (assigned a

score of 1), ‘disagree’ (a score of 2), ‘Neither agree nor disagree’ (a score of 3), ‘Agree’ (a score of 4) and finally ‘Strongly agree’ (a score of 5). The questionnaire was administered twice in order to examine its test-retest reliability.

Data analysis

Factor analysis is a statistical procedure that simplifies data by reducing many individual items into a fewer number of items.²⁷ In order to establish the structure of the scales in the questionnaire so that they contained the least number of items and explain the most amount of variance we performed a principal components analysis with a varimax rotation. It was determined a priori that the principal components analysis would be undertaken from data obtained from the administration of the questionnaire on the first occasion. It is generally agreed that an item is of appropriate written quality (strength) and should be retained if it shares a value of at least 0.45 or higher with other items in its domain²⁷; by not sharing excessive variance (cross-loading) with other domains of greater than 0.32²⁸; and the item conceptually fitted with other items on the component²⁹.

For the validity testing, Cronbach’s alpha was used to examine the internal consistency of the scales that were derived from the retained items to determine whether all items within a scale tapped the same construct. A two-way mixed effects, absolute agreement Intra-class correlation coefficients (ICC) model was used to establish the scales’ test-retest reliability. Finally, floor and ceiling effects were explored by calculating the proportion of respondents who achieved minimum or maximum total scale scores. Floor or ceiling effects are considered to be present in a sample size of at least 50 people if more than 15% of respondents achieved the lowest or highest possible score, respectively.²⁶ All data were entered and analysed in SPSS v.24.

Results

For the flow of the study, number of participants and final questionnaire construction, see Figure. 1. In total, on the first administration the pilot questionnaire was completed by 78 students out of 111 (response rate of 70%) and 60 students (54%) on the second administration. In all, 56 students completed the questionnaire at both time points.

Questionnaire's structure

Of the 47 items in the pilot questionnaire, the factor analysis technique omitted 34 items because they were either not correlated “strongly” enough with a factor (low factor loadings) or were significantly related to a number of factors (cross-loadings). This resulted in the retention of 13 items, which strongly loaded onto five factors (Tables 1 and 2) that accounted for 70% of the total variance. These factors were conceptualised as: Factor 1: Program Quality; Factor 2: Student Support; Factor 3: Developing Independence; Factor 4: Learning Resources; and Factor 5: Teaching Clinic Staff Support of Students.

Table 1.

Total variance explained by the five extracted factors

Component	Initial Eigenvalues		
	Total	% of Variance	Cumulative %
1	3.17	24.37	24.37
2	1.79	13.78	38.15
3	1.67	12.84	50.99
4	1.23	9.46	60.45
5	1.19	9.12	69.56

Table 2.

Five factor structure of the 13 extracted items.

Rotated Component Matrix ^a	Component				
	1	2	3	4	5
Factor 1: Program Quality					
P2 The CP promotes high quality teaching.	0.72				
P4 The CP seeks to minimize risks to the students while they are learning	0.54				
P5 The CP seeks to continually improve the program	0.66				
P6 The CP content is based on evidence-based practice	0.79				
Factor 2: Student Support					
S1 Students have ways to deal with concerns or complaints		0.63			
S3 The CP provides emotional well-being support services for students		0.88			
S4 Student support services are provided by qualified personnel		0.79			
Factor 3: Developing Independence					
S11 The CP ensures that students are prepared to be responsible for their learning processes				0.86	
S12 The CP ensures that students are prepared to become lifelong learners				0.84	
Factor 4: Learning Resources					
R2 The CP provides adequate access to on-line resources			0.91		
R3 The CP lecture rooms are satisfactory			0.91		
Factor 5: Teaching clinic staff					
TC4 The teaching clinic staff are easy to gain access to					0.85
TC5 The teaching clinic staff support the students					0.81
<i>Extraction Method: Principal component analysis.</i>					
<i>Rotation method: Varimax with Kaiser Normalization.^a a. Rotation converged in 6 iterations.</i>					

Test-retest reliability

Table 4 displays the ICC values for all scales. Moderate levels of reliability were observed for scales F1 (Program Quality), F2 (Student Support), F3 (Developing Independence), and good reliability was obtained for the F4 (Learning Resources) scale.³⁰⁻³² Poor reliability was observed for the F5 (Teaching Clinic Staff) scale, which was consequently deleted, leaving a questionnaire comprising 11 items distributed across four scales. Examining the ICC for the remaining four scales combined together yielded a value of 0.95 (95% CI= 0.93-0.96), which indicated excellent reliability for the overall scale.

Internal consistency

The Cronbach alpha values for each of the four retained scales ranged from 0.62 to 0.83, which indicates that all four scales had adequate levels of internal consistency (See Table 3)^{33,34}. The overall scale Cronbach alpha was excellent at 0.95.

Table 3.
Internal consistency and test-retest reliability

Factor	Scale	Cronbach Alpha	Intra-class correlation coefficient (95% CI)
1	Program quality	0.62	0.56 (0.26 – 0.74)
2	Student Support	0.71	0.69 (0.47 – 0.82)
3	Developing Independence	0.73	0.64 (0.38 – 0.79)
4	Learning Resources	0.83	0.79 (0.63 – 0.87)
5	Teaching clinic staff	0.64	0.41 (0.00 – 0.65)
Total Score	Overall	0.95	0.95 (0.93 - 0.96)

Table 4.
Item frequencies of items retained in final questionnaire.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Factor 1: Program Quality					
The CP promotes high quality teaching.	1.3	1.3	14.5	65.8	17.1
The CP seeks to minimize risks to the students while they are learning	2.6	9.2	57.9	30.3	
The CP seeks to continually improve the program	2.6	5.3	21.1	47.4	23.7
The CP content is based on evidence-based practice			5.3	42.1	52.6
Factor 2: Student Support					
Students have ways to deal with concerns or complaints	6.6	2.6	23.7	50.0	17.1
The CP provides emotional well-being support services for students	1.3	10.5	32.9	42.1	13.2
Student support services are provided by qualified personnel		4.0	28.0	48.0	20.0
Factor 3: Developing Independence					
The CP ensures students are prepared to be responsible for their learning processes	1.3	1.3	9.2	56.6	31.6
The CP ensures students are prepared to become lifelong learners		3.9	10.5	55.3	30.3
Factor 4: Learning Resources					
The CP provides adequate access to on-line resources		6.5	10.4	66.2	16.9
The CP lecture rooms are satisfactory		11.7	14.3	53.2	20.8

Table 5.
Descriptive statistics for final scales

	N	Minimum	Maximum	Mean	Std. Deviation
Factor 1: Program Quality	56	9.00	20.00	16.63	2.06
Factor 2: Student Support	55	7.00	15.00	11.15	1.99
Factor 3: Developing Independence	55	4.00	10.00	8.30	1.26
Factor 4: Learning Resources	56	4.00	10.00	7.86	1.54
Valid N (listwise)	54				

Descriptives for the final questionnaire

Table 4 displays the frequencies for all items in the retained four scales. Means and standard deviations for the four retained scales and overall total scale score are presented in Table 5. The proportion of respondents who achieved either the minimum or maximum score did not exceed 15% for any of the retained four scales, which meant that no ceiling or floor effects were observed.^{35,36}

Discussion

This is the first study we are aware of that has sought to develop a questionnaire to assess the chiropractic student study experience by using the regulators' own accreditation standards; a questionnaire that could be used by chiropractic schools to monitor students' perceptions of the quality of their course and for accreditation purposes. The final questionnaire demonstrated adequate internal consistency and test-retest reliability.

Our report details the development of a questionnaire that was designed to assess the quality of Australian chiropractic educational programs. It comprises 11 items in four scales that enquire about: 1) quality of the educational program; 2) provision of student support services; 3) enablement of independent learning; and 4) adequacy of teaching resources. In addition, psychometric testing showed that these four scales can be combined to provide an overall summary measure of the students' opinions of the quality of the chiropractic program.

The item reduction techniques employed in this study accord with best practice recommendations for the development of outcome measures.²⁶ Our interrogation of the questionnaire's structure yielded a parsimonious item set that clearly delineated four discrete constructs. How-

ever, deletion of redundant items resulted in an item set that did not assess areas of chiropractic programs such as the appropriateness of student assessments, quality of staff and teaching clinic environment. Many of the redundant items were deleted because of item cross-loading between factors, which indicates a lack of conceptual clarity for the formulation of the redundant items. It may be worthwhile to re-examine the content of the scales to identify item sets that more clearly assess the constructs that encompass student assessments, staff quality and the teaching clinic, given that it might be important to understand students' perceptions of these program areas.

The CCE-A accreditation standards are congruent with the CCE-I and thus with the European and Canadian CCEs. This means that the questionnaire designed in this study may be suitable to assess the quality of chiropractic programs in Europe and Canada. However, before the instrument is used in these settings, its cross-cultural reliability and validity should be established in further validation studies to explore its general applicability. Similar studies could be done in other health care professional areas, using this as an example.

Limitations

Students who participated in the panels provided their ratings of the derived items, and it is possible that this may have been impacted by their past experiences. Also, the sample for this study was recruited from a single Australian university. It is therefore unclear if this study's findings can be generalised to other chiropractic programs in Australia and other CCEI members in Europe and Canada. Further psychometric testing of the instrument developed in this study is therefore warranted in

other chiropractic program settings. In addition to consolidating the instrument's validity and reliability, further psychometric evaluation should incorporate an assessment of the instrument's construct validity and responsiveness.

Directions for further research

The construct validity of our questionnaire should be established by concomitantly administering it with a validated generic measure of students' perspectives about the quality of university education. Such an analysis could be enhanced through incorporating measures of other constructs that have been influenced by students' educational experience. A recent systematic review of the DREEM has suggested these constructs may include quality of life, resilience, preparedness for practice, peer support, and psychological distress.²

Studies involving other chiropractic programs in other CCE regions will determine if this questionnaire is more widely applicable. Our internal testing suggested that this may be 'nimble' as the questionnaire takes students, on average, less than four minutes to complete a 'hardcopy'. We have not tested an on-line version yet.

Finally, assessing our questionnaire's responsiveness or sensitivity to change could be challenging. To establish whether our questionnaire is responsive, ideally, it would be necessary to administer the questionnaire in the same student cohort before and after they have been exposed to changes in educational program content. It is unlikely that such an assessment can be practicably undertaken.

Conclusion

The questionnaire presented in this study is the first tool that has been specifically developed to evaluate a health education programs using accreditation standards. It can potentially provide Australian educational stakeholders with information about the quality of an Australian chiropractic program's educational content and student support services, the adequacy of learning resources, and its facilitation of independent learning skills. Such material could importantly inform the direction of quality improvement programs that enhance the learning experience of chiropractic students. Nevertheless, further testing in other settings would be necessary to be certain that the results can be translated to other disciplines, other courses and in other countries.

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Appendix 1.
Original 71 items derived from CCEA accreditation standards.
Weighted Scores are included for items retained for CVI purposes

Do you agree that Murdoch University CP in general...	Weighted score
PROGRAM (P)	
P1. The CP has progression requirements and processes that are fair	0.86
P2. The CP has mechanisms to ensure quality and integrity of the programme of study.	0.91
P3. The CP promotes high quality teaching	0.89
P4. The CP promotes research.	0.98
P5. The CP seeks to minimize risks to the students while they learn	0.86
P6. The CP seeks to continually improve the program.	0.93
P7. The CP uses valid and reliable evaluations to improve the program.	0.72
P8. The CP content is based on evidence-based practice	1.00
P9. The CP can change in response to contemporary developments in health professional education	0.89
P10. The CP has a coherent educational philosophy that informs the program of study (design & delivery).	0.91
P11. It is easy to find good information about any aspect of the CP	0.70
P12. The CP is of sufficient scope to make a competent chiropractor (and quality)	0.86
P13. The CP offers a program that is relevant	0.89
P14. The CP is capable of producing good chiropractors	0.86
P15. I am clear about the learning objectives of the course.	0.93
P16. Has quality improvement processes that use valid and reliable student and other evaluations, to improve the program.	
P17. Includes representatives of the chiropractic profession for the design and management of the program.	
P18. Has mechanisms for responding in the curriculum to contemporary developments in health professional education in an effective manner.	
P19. The CP has progression requirements and processes that are and transparent	
P20. The CP promotes learning, scholarship.	
STUDENT (S)	
S1. Students have ways to be able to deal with concerns or complaints.	0.82
S2. The CP provides support to meet the learning needs of students.	0.89
S3. The CP provides emotional support services for students	0.89
Items deemed to be irrelevant to student experience and removed by the research team are crossed out /through	

Do you agree that Murdoch University CP in general...	Weighted score
S4. Students' support services are provided by qualified personnel.	0.95
S5. Students are involved in the decision-making processes of the CP.	0.82
S6. Student feel that the CP promotes equity (and diversity principles).	0.89
S7. The CP has the confidence of new graduates.	0.95
S8. Protection of the public and patients is important in the CP.	0.93
S9. The CP is an enjoyable place to be to learn about chiropractic	0.91
S10. Students achieve the relevant competencies before providing patient care.	0.95
S11. Students are held to high levels of (ethical and) professional conduct.	1.00
S12. The CP ensures that students have the responsibility for their learning processes	1.00
S13. The CP ensures that students are prepared to become lifelong learners	0.95
S14. Student impairment screening and management processes are effective.	
S15. Students have access to effective grievance and appeals processes.	
S16. Students are informed of and have access to personal support services provided by qualified personnel.	
S17. Students are represented within the deliberative and decision-making processes for the program.	
S18. Equity and diversity principles are observed and promoted in the student experience.	
ASSESS / LEARNING (A/L)	
AL1. The CP uses different types of assessment Eg., both formative and summative	0.93
AL2. The CP has (consistent and) appropriate assessment to students.	0.91
AL3. The CP has (consistent and) appropriate feedback to students.	0.75
AL4. Student assessment covers important learning outcomes and competencies.	0.98
AL5. The CP has learning outcomes that address the chiropractic competency standards.	0.93
AL6. The CP teaches how to work with other health professionals	0.85
AL7. The CP teaches about cultural awareness	0.95
AL8. The CP develops your research skills.	0.93
AL9. The CP exams are fair	0.91
A10. The CP uses multiple validated assessment tools and modes including direct observation in the clinical setting.	
A11. Student assessment is related to the relevant chiropractic competency standards.	
A12. The CP has teaching and learning environments that ensure the achievement of the required learning outcomes.	
Items deemed to be irrelevant to student experience and removed by the research team are crossed out/through	

Do you agree that Murdoch University CP in general...	Weighted score
A13. The CP exams are meaningful	
A14. Has the scope of student assessment covers all learning outcomes and competencies.	
STAFF (St)	
St1. The teaching staff clearly communicate the course material	1.00
St2. It is easy to gain access to the teaching staff	1.00
St3. Teaching staff support the students.	0.89
St4. Teaching staff conduct themselves professionally.	0.93
St5. The lecturers are competent	0.98
RESOURCES (R)	
R1. The CP facilities and equipment are accessible, (well maintained, and fit for purpose).	0.82
R2. The CP provides adequate access to on-line resources.	0.80
R3. The CP lecture rooms are satisfactory	0.93
R4. The CP equipment is satisfactory	0.84
R5. The CP has the resources to facilitate the achievement of the standards necessary to be a competent chiropractor.	
CLINIC (C)	
C1. Student clinic has quality and safety practices.	0.98
C2. The student clinic has the necessary resources and equipment	0.87
C3. The clinic staff clearly communicate the course material	0.91
C4. The clinic has a mix of patients that will adequately prepare students for becoming a chiropractor.	0.89
C5. The clinical staff are easy to gain access to.	0.80
C6. The clinic staff support the students.	1.00
C7. The clinicians are conduct themselves professionally.	0.95
C8. Student clinics meet relevant jurisdictional requirements and standards.	
C9. Students are registered with the relevant regulatory authorities.	
Items deemed to be irrelevant to student experience and removed by the research team are crossed out /through	