

Preparedness of undergraduate dental students in the United Kingdom: a national study

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In brief

Explores the preparedness of final year undergraduate dental students based on self-assessment.

Highlights the areas of strengths of dental undergraduates in regards to clinical and behavioural skills.

Identifies areas of weakness where undergraduate dental students may benefit from additional training and experience.

Aims To evaluate the self-perceived preparedness of final year dental undergraduate students in the United Kingdom.

Methods Dental undergraduate students in their final year were invited by email through the Dental Schools Council (DSC) to provide their responses to an online preparedness assessment scale. The data analysis was carried out using the *RUMM2030* software which is specifically designed for Rasch analysis, a measurement model based on item response theory.

Results Students felt adequately prepared to carry out simple clinical procedures and communication skills. However, low scores were reported on ability to assess orthodontic treatment needs, treatment planning, crowns, endodontics, research skills, referral for suspected oral cancer and raising concerns regarding inappropriate behaviour of colleagues. **Conclusions** The scale used in this study explored the self-perceived preparedness on a range of cognitive, clinical and behavioural attributes. The data show that the students felt prepared for the majority of the attributes expected from dentists. However, a number of areas were identified where students may benefit from further training and consolidation.

Introduction

Since its inception in the United Kingdom, undergraduate dental education continues to evolve significantly. The General Dental Council (GDC) as a regulator expects the learning outcomes of undergraduate dental education to 'reflect the full range of knowledge, skills and attitudes that a student must demonstrate to the level appropriate for registration that is, *professionalism, communication, clinical and management and leadership skills*.¹ The aim is to develop a rounded professional who, in addition to being a competent clinician, will have the range of professional skills required to begin working as part of a dental team and be well prepared for independent practice. Although the GDC has defined the learning outcomes for undergraduate courses in dentistry, there is flexibility

for individual dental schools to plan and deliver undergraduate dental curricula in whatever way they deem appropriate. The GDC monitors the quality of education through regular school inspections to ensure that universities provide education and clinical training in an appropriate and transparent manner. Dental schools in the UK have developed internal processes for assuring the quality of standards. These most commonly involve external examiners, processes for validation, student surveys and feedback, and periodic reviews and transparent systems of governance.²

Undergraduate dental education is a unique pedagogical experience with distinctive challenges. Training in dentistry involves performing irreversible operative procedures on patients under supervision of experienced clinicians. Nevertheless, the students carry a moral responsibility for their clinical work. A dental programme should not only equip the students with the required knowledge and skills but should also contribute towards their psychological and social well-being, as well as the cultivation of ethical values, professionalism and team-working skills.³

Numerous studies have been carried out to investigate the skills and attributes of

undergraduate dental students in the UK. However, most of these studies focus solely on clinical skills.⁴⁻⁷ Although clinical skills are extremely important, they only represent one of several dimensions of preparedness and most studies do not capture the broader skill set expected from a new dental graduate.

The aim of this study was to report our findings on the self-perceived preparedness of final year dental undergraduate students in the United Kingdom using a newly validated scale, namely, the Dental Undergraduates Preparedness Assessment Scale (DU-PAS). DUPAS is a measurement tool that has been demonstrated to evaluate the broad range of skills and attributes expected from dental students at the time of graduation. Development and psychometric evaluation of the DUPAS have been reported elsewhere.⁸ The scale met with the rigorous psychometric demands of the Rasch model.^{9,10}

Methods

Following approval by the institutional research ethics committee, dental undergraduate students in their final year from all UK dental schools were invited by email through

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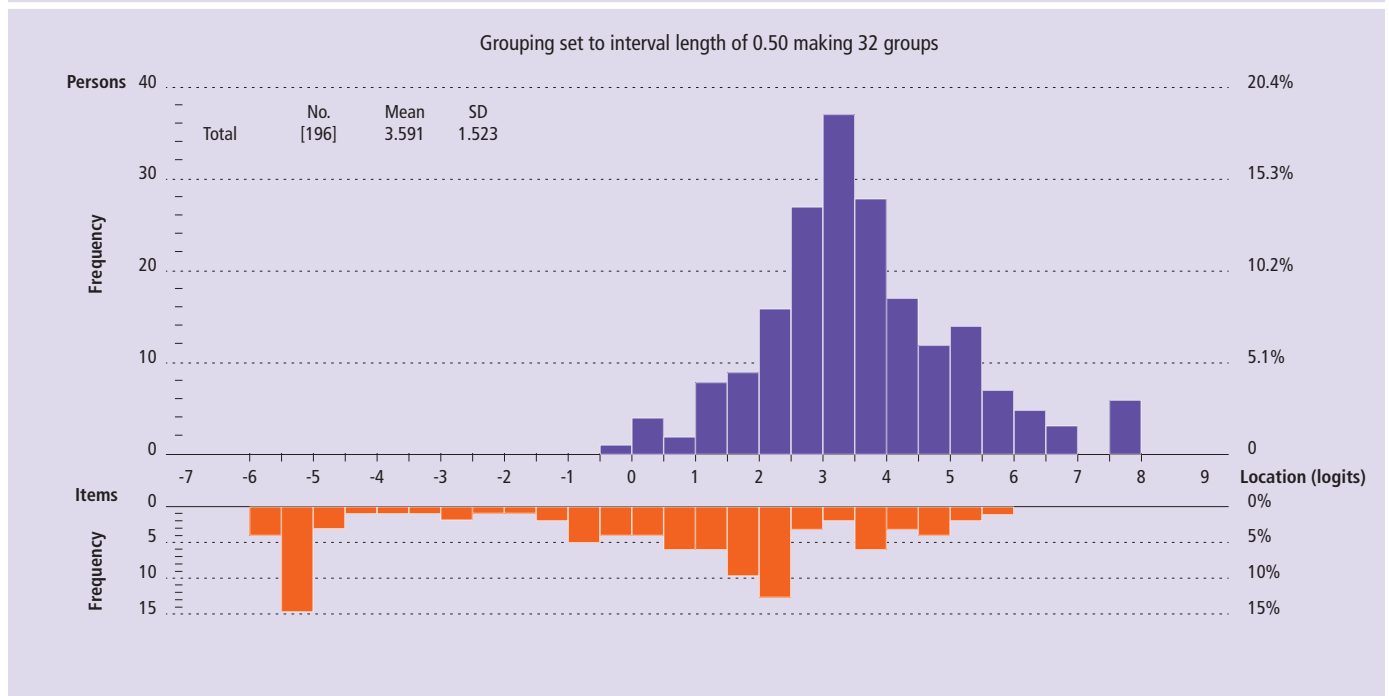
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Fig. 1 Person-item Threshold Distribution



the Dental Schools Council (DSC). The participants were invited to provide their responses to an online preparedness assessment scale. The invitations were sent directly by the policy officer of the Dental Schools Council. A reminder was sent after two weeks and the URL for the study was deactivated four weeks after the initial invitation.

The data analysis was carried out using the RUMM2030 (Perth, Western Australia: RUMM Laboratory Pty Ltd, 2010), software specifically designed for Rasch analysis, a measurement model based on item response theory.¹¹ Rasch analysis is an iterative process that identifies and studies anomalies in the data and the extent to which DUPAS data conforms to the Rasch model. Fit to the Rasch model was established using a variety of statistics to demonstrate validity, reliability, unidimensionality. Analysis also confirmed that interval level scaling had been achieved and summation of scores from DUPAS is legitimate.

Results

In total 238 participants responded to the online survey. However, complete responses were only provided by 196 students (82%). The latter included 115 females (59%) and 81 males (41%). The majority of the participants were less than 30-years-old (86%).

The summary statistics showed that the overall Rasch chi-square fit statistics for the

preparedness scale was not significant ($\chi^2 = 283.03$; d.f. = 250; $p = 0.073$), indicating an adequate fit to the Rasch model and good internal construct validity. Person separation index (PSI) identified the precision of the estimate of each person's level of ability was captured by DUPAS. PSI is analogous with internal consistency (Cronbach's alpha) of a scale in classical test theory (CTT). The PSI value for the scale data analysis was high (0.897), indicating that DUPAS was able to discriminate between three or more groups of final year undergraduates perceived level of ability with accuracy. *Differential item functioning* (DIF) of the scale was also assessed and did not identify any bias for person factors including gender and age.

Undergraduate final year dental students' ability (person location) and item difficulty (level of ability captured by an item) are measured independently and expressed in log odd units (logits) which reflect logarithmic transformation of the raw scores. Positive values (higher logits) imply greater levels of ability while negative values (lower logits) indicate lower levels of ability. Logits can be transformed into interval level data. The scoring response categories and structure of the 50-item inventory with a maximum raw score of 100 is shown in Appendix 1.

The person-item threshold distribution is depicted in Figure 1 and shows the locations of the final year undergraduates (top half)

and level of ability captured by the DUPAS item thresholds (bottom half). The person location fit statistics showed that the mean level of ability was scored at 3.591 logits; SD 1.523, which was higher than the mean item difficulty of 0.00. A mean score of 3.591 logits translates into a raw score of 74 out of 100. The mean ability of males ($n = 81$) was 3.652; SD = 1.44 was slightly higher than the mean ability of females ($n = 115$) which was estimated to be 3.548; SD = 1.58. However, ANOVA statistics showed the effect of gender on person ability was not significant [$F(1, 195) = 0.222$, $p = 0.634$].

As would be expected with undergraduates at the point of graduation distribution of students were skewed towards the higher end of DUPAS. Output from analysis from RUMM2030 software identified the hierarchical location of the items in terms of the likelihood that students would affirm them. These item locations can be seen in Table 1 and reflect the skills expected from undergraduates at the point of graduation. For example, *taking a medical history* (location 3.48) is an easy item that all students at the point of graduation should have mastered whereas at the other end of the ability spectrum is *evaluate new dental materials* (location +3.55) as shown in Figure 1 less than 10% of students affirmed this item.

The difficulty levels of the 50 items on the scale are shown in Table 1 which lists the items in location (difficulty) order. Negative values

Appendix 1 Dental Undergraduates Preparedness Assessment Scale

Part A

1. I am able to obtain a complete medical history from my patients.
2. I am able to undertake a comprehensive, clinical oral examination
3. I am able to prescribe appropriate dental radiographs
4. I am able to undertake periapical radiographs
5. I am able to undertake bitewing radiographs
6. I am able to interpret common findings on dental radiographs
7. I am able to assess the treatment needs of patients requiring orthodontics
8. I am able to formulate a comprehensive treatment plan which addresses all treatment needs of my patients
9. I am able to provide a range of treatment options to my patients based on their individual circumstances
10. I am able to explain the merits and demerits of various treatment options to my patients
11. I am able to obtain a valid consent from my patients prior to undertaking any treatment.
12. I am able to carry out patients' treatment sessions in an appropriate order
13. I am able to prescribe drugs to my patients appropriately
14. I am able to administer inferior dental nerve blocks effectively
15. I am able to perform non-surgical periodontal treatment using appropriate methods
16. I am able to remove dental caries effectively
17. I am able to restore teeth with tooth coloured fillings appropriately
18. I am able to restore teeth with amalgam fillings appropriately
19. I am able to perform endodontic treatment on single rooted teeth appropriately
20. I am able to perform endodontic treatment on multi rooted teeth appropriately
21. I am able to provide crowns using principles of tooth preservation
22. I am able to provide mechanically sound partial dentures
23. I am able to provide mechanically sound full dentures
24. I am able to undertake non-surgical tooth extractions appropriately

Part B

25. I feel I can manage peoples' expectations of their treatment
26. I feel able to motivate my patients to encourage self-care for their dental needs
27. I recognise my personal limitations in clinical practice
28. I feel comfortable asking for help from supervisor or colleague if needed
29. I am able to refer patients with complex treatment needs appropriately
30. I feel confident referring patients with suspected oral cancer
31. I reflect on my clinical practice in order to address my learning needs
32. I have sufficient knowledge of scientific principles which underpin my dental practice
33. I am confident to evaluate new dental materials and products using an evidence-based approach
34. I am confident to interpret the results of research which may influence my practice
35. I use an evidence-informed approach in my clinical practice.
36. I feel I can manage to communicate effectively with my patients
37. I provide opportunities for my patients to express their expectations from dental treatment
38. I feel confident to address barriers to effective communication with patients appropriately
39. I feel confident to communicate potential risks of operative procedures to patients
40. I feel confident to communicate appropriately with my colleagues
41. I feel confident managing anxious patients with appropriate behavioural techniques
42. I am able to manage the behaviour of children to enable appropriate dental treatment
43. I am able to fulfil my responsibilities as an effective member of the dental team
44. I maintain accurate records of my clinical notes
45. I am able to work within the constraints of clinical appointment schedules
46. I take responsibility for my continuing professional development
47. I am aware of my legal responsibilities as a dental professional
48. I restrict my relations with my patients to a professional level
49. I feel able to raise concerns about inappropriate behaviour of my colleagues
50. I take appropriate measures to protect patient confidentiality

Response Categories		Numerical Score
Part A	No Experience	0
	With verbal and / or practical input from a colleague	1
	On my own, independently	2
Part B	No Experience	0
	Mostly	1
	Always	2

(lower logits) indicate lower levels of difficulty (easy items) while positive values (higher logits) imply an item with higher difficulty.

Discussion

This is the first study to investigate the cognitive attributes, clinical and affective skills of undergraduate students using the Dental Undergraduates Preparedness Assessment Scale (DU-PAS). The scale was developed using a mixed methods approach.⁸ Qualitative methods including semi-structured interviews were used to identify the essential attributes of preparedness of dental undergraduates for a smooth transition into foundation training.^{12,13} Psychometric evaluation of the scale was undertaken using the Rasch analysis, an item response theory probabilistic model. Many readers may not be familiar with the Rasch model and its application in scale development. It is suggested that interested readers may refer to the relevant literature.⁸ This study underscores the need to evaluate preparedness of undergraduate skills in the context of a range of clinical as well as behavioural attributes.

Analysis of the hierarchy of the items showed that some of the easiest items were affirmed by most of the undergraduates at the point of graduating as might be expected. It also identified that some of the more specialist aspects of dental practice are not necessarily areas that all students feel confident in. The ability to know students level of ability matched to the ability defined by individual items is one of the hallmarks of studies using Rasch analysis. Unlike CTT where it is theorised that any observed score on a measurement tool consists of a true score and error score and these cannot be determined. Rasch provides us with a clear measure of a person's ability and their location on that scale.¹⁰

Closer examination of the items as afforded by Rasch analysis demonstrated that the students were confident undertaking basic assessments of patients such as obtaining a medical history, carrying out clinical oral examination, undertaking intra oral radiographs. However, they were less confident to prescribe and interpret findings on dental radiographs. The students were least prepared to assess orthodontic treatment needs of patients. Our findings are different to those reported from another study from a dental school in the UK recently where students reported high levels of self-confidence in carrying out orthodontic assessments.¹⁴ These

Table 1 Item difficulty in location order (cont. on p 476)

Item	Location	SE	ChiSqu
Obtain medical history	-3.480	0.721	1.248
Obtain a valid consent for treatment	-2.534	0.441	2.158
Undertake clinical oral examination	-2.346	0.265	2.410
Restore teeth with tooth coloured fillings	-2.282	0.258	3.264
Administer inferior alveolar nerve blocks	-2.252	0.248	6.802
Undertake bitewing radiographs	-1.995	0.417	0.511
Undertake periapical radiographs	-1.867	0.337	4.149
Restore teeth with amalgam fillings	-1.863	0.216	4.390
Explain merits and demerits of treatment	-1.818	0.197	10.324
Maintain accurate dental records	-1.781	0.343	2.777
Carry out treatment in an appropriate order	-1.734	0.347	6.550
Communicate appropriately with colleagues	-1.695	0.346	1.491
Maintain patient confidentiality	-1.609	0.448	3.925
Communicate effectively with patients	-1.597	0.194	5.413
Explain treatment options to patients	-1.565	0.305	10.657
Encourage patient to express expectations	-1.480	0.331	6.380
Prescribe dental radiographs	-1.458	0.299	2.378
Work as effective team member	-1.413	0.179	5.835
Communicate treatment risks to patients	-1.410	0.319	2.526
Recognise personal limitations	-1.409	0.189	14.330
Interpret dental radiographs	-1.407	0.178	2.455
Restrict relations with patients to a professional level	-1.340	0.466	5.171
Comprehensive treatment planning	-1.065	0.169	6.677
Motivate patients to encourage self-care	-0.915	0.281	1.005
Self reflection	-0.849	0.319	10.787
Non-surgical periodontics	-0.385	0.293	2.270
Remove dental caries effectively	-0.180	0.192	3.161
Undertake non-surgical extractions	0.705	0.167	9.002
Recognise legal responsibilities	0.718	0.302	4.962
Manage patient's expectations	0.799	0.182	10.058
Address barriers to communication	0.809	0.286	6.339
Ask for help	0.826	0.293	2.267
Manage behaviour of children	1.372	0.215	15.108
Scientific knowledge	1.468	0.294	9.415
Prescribe drugs	1.606	0.278	2.799
Refer complex treatments	1.651	0.253	5.980
Work within time constraints of clinical appointments	1.659	0.175	3.070
Provide mechanically sound partial dentures	1.700	0.155	4.308
Manage anxious patients	1.714	0.257	7.259

differences may be attributed to differences in the teaching, training and assessments of undergraduate students in UK dental schools.¹⁵ Perhaps a separate multi-site study focusing on orthodontic skills in undergraduate students may provide clarifications on this subject.

The students were less confident in comprehensive treatment planning to address all treatment needs of their patients and similar findings are reported in studies on foundation dentists.^{16,17} Deficiencies in treatment planning skills are reported in studies on dental students in USA.¹⁸ Nevertheless, the students felt prepared in regards to several elements of treatment planning including: explaining the merits and demerits of treatment options; encouraging patients to express their expectations of treatment; obtaining a valid consent; maintaining patient confidentiality; and carrying out treatments in an appropriate order.

Low scores were reported on the ability to refer suspected oral cancer. There is a dearth of published data on oral cancer referral skills of undergraduate dental students in the UK. However, studies from other parts of the world also show a perceived lack of knowledge and skills among dental students to recognise oral cancer which may potentially result in sub-optimal prevention and referral for oral cancer management.^{19,20} The findings of the present study underscore the need to re-evaluate and strengthen the teaching and training of dental students in regards to oral cancer recognition and referral.

With regards to operative clinical skills, the students felt well-prepared to administer inferior alveolar nerve blocks, restore teeth with tooth-coloured filling materials and amalgam and providing non-surgical periodontal treatments. Preparedness was also perceived to be adequate for caries removal, non-surgical extractions, and provision of partial and complete dentures.

However, the students felt least prepared to undertake endodontics and provide crowns. Deficiencies in endodontic skills of undergraduate students in the UK have been highlighted in a number of studies.^{14,17} Understandably, the students were less confident in undertaking endodontic treatments on multi rooted teeth compared to single root teeth. In a previous study, evaluation of the technical quality of endodontic treatments provided by dental students showed that the quality was judged to be acceptable in 49% of all the single-rooted teeth and only 17% of all the multi-rooted teeth treated by undergraduate dental students.⁶

Table 1 Item difficulty in location order (cont. from p 475)

Item	Location	SE	ChiSqu
Provide mechanically sound full dentures	1.838	0.158	7.324
Take responsibility for CPD	1.905	0.134	6.555
Perform endodontics on single rooted teeth	2.018	0.136	6.521
Use an evidence-informed approach	2.057	0.149	5.954
Provide crowns	2.381	0.144	7.584
Perform endodontics on multi rooted teeth	2.861	0.144	5.269
Assess orthodontic treatment needs	2.890	0.171	12.447
Refer oral cancer	2.949	0.116	7.779
Interpret results of research	3.215	0.266	4.279
Raise concerns	3.233	0.207	5.902

Perceived deficiencies in clinical skills of students are widely reported. However, it needs to be reiterated that clinical competence of students only represents a point on a continuum and needs several years of consolidation in clinical practice settings.^{21,22} Furthermore, competence in clinical practice is dependent on a habit of lifelong learning.²¹ Notwithstanding the need to ensure that students get further training and experience in clinical settings, there may also be a case of moderating expectations from students in regards to the level of competence which can be achieved realistically during an undergraduate programme.

The students appear to be largely confident in their communication skills with colleagues and patients. However, addressing barriers to communication with patients was considered to be more challenging than routine communication. Moreover, the students felt least confident in raising concerns about inappropriate behaviour of colleagues. Communication skills along with professionalism are recognised as key attributes for new dental graduates.^{1,24} Lack of confidence in addressing barriers to communication and raising concerns may be attributed to limited experience in clinical settings. Perhaps there is merit in considering enhancing student experience using simulated scenarios.

Overall, the students felt least prepared with regards to using evidence-informed research in their clinical practice; evaluating new dental materials; and interpreting the results of research. Although the aforementioned attributes are included in the learning outcomes for dentists by the GDC¹ there is limited published literature aimed at evaluation of

these skills among the undergraduate students. Nevertheless, our findings corroborate those of other studies which highlight that the undergraduate dental students lack confidence regarding their knowledge and skills in evidence-based dentistry.^{25,26} Dental students need to develop skills to search and analyse high-quality evidence to practice effectively in an age of rapid technological advancements and information overload.

The study has some limitations. Firstly, the endorsement of the items on this scale was based on self-assessment by the students and it is possible the mean person ability (perceived preparedness) may be inflated. Evidence from studies on health professions training has consistently shown poor correlations between perceived self-confidence and observed competence.^{27–29} The next step may be to compare the scores of self-assessment with the assessment by dental educators and clinical supervisors, which may identify differences in scores and provide a more realistic measurement of person ability. Any differences in self-assessment and assessment by the educational supervisors can help to gauge the insight of students.³⁰ This information may be used to provide feedback to the students accordingly. Secondly, this study had a low response rate. The invitation to participate in this study was sent close to the BDS finals examinations which may have contributed to the low response rate. Although the study involved considerable planning and the sample size was adequate for psychometric analyses, the findings of this study need to be interpreted with a degree of caution. It is recommended that future national studies on undergraduate students should involve a designated

representative from each dental school to help disseminate the information about prospective studies more widely with the aim to achieve higher response rates.

Conclusions

This study explores the preparedness of undergraduate dental students in the UK. The scale used in this study explored the self-reported preparedness on a range of cognitive, clinical and behavioural attributes. The data show that the students felt prepared for majority of the attributes expected from dentists. However, a number of areas were identified where students may benefit from further training and consolidation. The findings of this study may be of interest to dental educators and other stakeholders in the UK and beyond.

1. General Dental Council. *Preparing for practice-dental team learning outcomes for registration*. London: General Dental Council, 2012.
2. Eaton K A, Reynolds P A, Mason R, Cardell R. Assuring quality. *Br Dent J* 2008; **205**: 145–150.
3. Divaris K, Barlow P J, Chendea S A *et al*. The academic environment: the students' perspective. *Eur J Dent Educ* 2008; **12 Suppl 1**: 120–130.
4. Honey J, Lynch C D, Burke F M, Gilmour A S. Ready for practice? A study of confidence levels of final year dental students at Cardiff University and University College Cork. *Eur J Dent Educ* 2011; **15**: 98–103.
5. Rodd H D, Farman M, Albadri S, Mackie I C. Undergraduate experience and self-assessed confidence in paediatric dentistry: comparison of three UK dental schools. *Br Dent J* 2010; **208**: 221–225.
6. Kumar M, Duncan H F. Radiographic evaluation of the technical quality of undergraduate endodontic 'competence' cases in the Dublin Dental University Hospital: an audit. *J Ir Dent Assoc* 2012; **58**: 162–166.
7. Durham J A, Moore U J, Corbett I P, Thomson P J. Assessing competency in dentoalveolar surgery: a 3year study of cumulative experience in the undergraduate curriculum. *Eur J Dent Educ* 2007; **11**: 200–207.
8. Ali K, Slade A, Kay E J, Zahra D, Chatterjee A, Tredwin C. Application of Rasch analysis in the development and psychometric evaluation of dental undergraduates preparedness assessment scale. *Eur J Dent Educ* 2016; doi: 10.1111/eje.12236 [Epub ahead of print].
9. Rasch G. *Probabilistic models for some intelligence and attainment tests*. Danish Institute for Educational Research T U.o.C. Copenhagen, Chicago: Danish Institute for Educational Research, The University of Chicago Press, 2010.
10. Tennant A, Conaghan P G. The Rasch measurement model in rheumatology: what is it and why use it? When should it be applied, and what should one look for in a Rasch paper? *Arthritis Rheum* 2007; **57**: 1358–1362. Review.
11. Andrich D, Sheridan B, Luo G. *Rasch models for measurement: RUMM2030*. Perth, Western Australia: RUMM Laboratory Pty Ltd. 2010.
12. Ali K, Tredwin C, Kay E J, Slade A, Pooler J. Preparedness of dental graduates for foundation training: a qualitative study. *Br Dent J* 2014; **217**: 145–149.
13. Ali K, Tredwin C, Kay E, Slade A. Transition of new dental graduates into practice: a qualitative study. *Eur J Dent Educ* 2016; **20**: 65–72.
14. Gilmour A S, Welpy A, Cowpe J G, Bullock A D, Jones R J. The undergraduate preparation of dentists: Confidence levels of final year dental students at the School of Dentistry in Cardiff. *Br Dent J* 2016; **221**: 349–354.
15. Derringer K A. Undergraduate orthodontic assessment and examination in UK dental schools. *Br Dent J* 2006; **201**: 225–229.
16. Patel J, Fox K, Grieveson B, Youngson C C. Undergraduate training as preparation for vocational training in

- England: a survey of vocational dental practitioners' and their trainers' views. *Br Dent J* 2006; **Suppl**: 9–15.
17. Gilmour A, Jones R, Bullock A. Dental Foundation Trainees' Expectations of a Dental Graduate Final Report 2012. Available at http://www.cardiff.ac.uk/___data/assets/pdf_file/0007/26566/Dental-Foundation-Trainees-expectations-of-new-graduates.pdf (accessed March 2017).
 18. Hook C R, Comer R W, Trombly R M, Guinn J W 3rd, ShROUT M K. Treatment planning processes in dental schools. *J Dent Educ* 2002; **66**: 68–74.
 19. Uti O G, Fashina A A. Oral cancer education in dental schools: knowledge and experience of Nigerian undergraduate students. *J Dent Educ* 2006; **70**: 676–680.
 20. Burzynski N J, Rankin K V, Silverman S Jr, Scheetz J P, Jones D L. Graduating dental students' perceptions of oral cancer education: results of an exit survey of seven dental schools. *J Cancer Educ* 2002; **17**: 83–84.
 21. Harden R M. Outcome-based education: the future is today. *Med Teach* 2007; **29**: 625–629.
 22. Chambers D W. Dental curriculum and accreditation means, ends, and the continuum. *J Dent Educ* 1996; **60**: 816–820.
 23. Leach D C. Competence is a habit. *JAMA* 2002; **287**: 243–244.
 24. Buck D, Malik S, Murphy N *et al*. What makes a good dentist and do recent trainees make the grade? The views of vocational trainers. *Br Dent J* 2000; **189**: 563–566.
 25. Nieminen P, Virtanen J I. Information retrieval, critical appraisal and knowledge of evidence-based dentistry among Finnish dental students. *Eur J Dent Educ* 2016; doi: 10.1111/eje.12203.
 26. Straub-Morarend C L, Wankiiri-Hale C R, Blanchette D R *et al*. Evidence-based practice knowledge, perceptions, and behaviour: a multi-institutional, cross-sectional study of a population of US dental students. *J Dent Educ* 2016; **80**: 430–438.
 27. Barnsley L, Lyon P M, Ralston S J *et al*. Clinical skills in junior medical officers: a comparison of self-reported confidence and observed competence. *Med Educ* 2004; **38**: 358–367.
 28. Colthart I, Bagnall G, Evans A *et al*. The effectiveness of self-assessment on the identification of learner needs, learner activity, and impact on clinical practice: BEME Guide no. 10. *Med Teach* 2008; **30**: 124–145.
 29. Lai N M, Teng C L. Self-perceived competence correlates poorly with objectively measured competence in evidence based medicine among medical students. *BMC Med Educ* 2011; **11**: 25.
 30. Ali K, Tredwin C, Kay E J, Slade A, Pooler J. Preparedness of dental graduates for foundation training: a qualitative study. *Br Dent J* 2014; **217**: 145–149.