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Development of entrustable professional activities for dental educators: a modified Delphi study

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Abstract

Background There is a growing need for Entrustable Professional Activities (EPAs) specifically tailored to health professions educators including dental educators, whose responsibilities extend well beyond clinical expertise. Despite the breadth and complexity of these responsibilities, the current literature lacks EPA frameworks that are explicitly designed to reflect the unique and multifaceted scope of practice of dental educators.

Objective The objective of this Modified Delphi study was to develop a validated and consensus-based set of EPAs for dental educators.

Methods A three-stage consensus-building approach was employed in this study: (1) identification of existing EPAs in the literature through a systematic scoping review; (2) two rounds of a Modified Delphi exercise conducted via online questionnaires; and (3) a final in-person consensus focus group discussion to refine and finalise the list of EPAs. A total of 40 EPAs were systematically identified through a scoping review of the literature. These EPAs were subsequently evaluated by a panel of 10 experts using a three-stage modified Delphi technique. Consensus was quantitatively define as median rating of ≥3 on a 4-point Likert scale, with an item-level Content Validity Index (i-CVI) of ≥0.8. Open ended responses were thematically analysed.

Results In the first round, consensus was reached to eliminate 6 EPAs, 7 EPAs further consolidated to 2 EPAs, 12 EPAs were revised and 15 EPAs were accepted without revision. In the second round, a total of 81 EPAs, comprising 29 retained from the first round and 52 newly suggested EPAs, were reviewed. Consensus was reached to exclude 1 EPA. By the end of Round 2, 80 EPAs were brought forward to the third round, which was conducted as in-person focus group meeting. The final round resulted in the elimination of 6 EPAs and the consolidation of 9 EPAs into 3, culminating in the endorsement of 68 EPAs, which were systematically organized into 12 distinct domains.

Conclusions This study successfully developed a validated and consensus-based set of 68 EPAs tailored for dental educators, addressing a critical gap in the current literature. This set provides a foundational tool to guide professional development, performance assessment, and role definition of dental educator.

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Background

Entrustable Professional Activities (EPAs) have emerged as a valuable framework in health-based education, effectively bridging the gap between competency frameworks and practical tasks [1–3]. Introduced by ten Cate in 2005, EPAs are defined as key professional tasks or responsibilities that individuals can be entrusted to carry out independently once they have demonstrated sufficient competence [2]. They were developed in response to the challenges associated with translating broad competency frameworks into day-to-day clinical and educational practice, thereby serving as a vital link between theoretical competencies and real-world professional duties [4, 5].

While the concept of EPAs has been widely applied in clinical training and health professions education, their adaptation for academic roles, dentistry included, has been largely overlooked. To date, the application of competency-based EPAs has predominantly focused on assessing students [6–9]. There remains a notable gap in their utilisation for evaluating the competence of educators themselves.

This highlights a significant shortcoming, considering the increasingly complex and multifaceted roles of dental educators. They are tasked not only with delivering clinical training but also with curriculum design, assessment, student mentoring, research and academic leadership [10]. However, current competency frameworks do not comprehensively capture the breadth and complexity of these responsibilities. As a result, there is an urgent need for EPAs specifically tailored to health-based educators, including dental educators, whose roles extend well beyond clinical expertise. This emphasizes the necessity for structured tools, such as educator-specific EPAs, to enable transparent, competency-based evaluation and professional development for faculty members.

By translating these broad responsibilities into clearly articulated, observable, and assessable tasks, EPAs provide a common language for expectations in academic practice. They offer a practical and observable framework that defines the core tasks dental educators must be entrusted to perform independently. This facilitates clearer expectations, structured professional development, and more objective assessment of performance. Implementing EPAs for dental educators enhances quality assurance in teaching, fosters accountability, and promotes excellence in dental education by aligning educational tasks with institutional goals and learner needs.

The development of EPAs necessitates a systematic and evidence-informed approach to ensure they are firmly grounded in real-world practice and aligned with established competency frameworks. This study was undertaken with that objective in mind, to develop a set of EPAs specifically for dental educators that reflect the complexity of their roles and are informed by both literature and expert consensus. For clarity, a 'dental educator' is defined here as any individual engaged in teaching, supervising, or mentoring dental learners across academic or clinical settings, including roles such as clinical instructor, course director, postgraduate or PhD supervisor, or education scholar. Establishing this definition is essential, as it provides the foundation for interpreting the scope and relevance of the EPAs developed in this work.

Objectives

The objective of this three-round Modified Delphi study was to develop a validated and consensus-based set of EPAs for dental educators.

Methods

Study design

The Modified Delphi method is a structured group consensus technique that integrates evidence from literature, stakeholder input, and expert judgment to achieve agreement on a given topic. It is particularly valuable in contexts where empirical evidence is limited, as it harnesses the collective intelligence of a panel of experts. This collaborative process is designed to produce outcomes that are more robust and valid than those derived from individual input alone, thereby enhancing the content validity of the findings [11, 12]. In light of the limited published work on EPAs specifically for dental educators, Modified Delphi technique was selected as methodological approach for this study as it was considered the most suitable for generating expert consensus and developing a robust, context-specific framework.

The CREDES (Conducting and REporting of DElphi Studies) guidelines were employed as the methodological and reporting framework for this Delphi study to enhance its transparency, quality, and reproducibility [13].

A three-stage consensus-building approach was employed in this study: [1] identification of existing EPAs in the literature through a systematic scoping review (15th October 2024 till 23rd Feb 2025); [2] two rounds of a Modified Delphi exercise conducted via online questionnaires (First Round:17th till 31st March 2025, Second Round:15th April till 29th April 2025); and [3] a final in-person consensus focus group discussion to refine and finalise the list of EPAs (4th till 7th May 2025).

Stage 1: scoping reviewStage 1 should be in Section 2
Addressing the research question- What are the elements of EPAs for dental educators, as described in the literature? - the review adhered to the Joanna Briggs Institute scoping review framework and the Preferred Reporting Items for Systematic reviews and Meta-Analyses for Scoping Reviews methodology (PRISMA-ScR) with four [4] reviewers [14]. Employing a rigorous three-step search strategy across five electronic databases (PubMed, Google Scholar, Scopus, Cochrane Library and ProQuest), the review includes articles published between January 1, 2005 and October 1, 2024 with eligibility criteria targeted papers published in English with keywords/ Search term ("Entrusted Professional Activities" OR "Entrustable Professional Activities" OR "Entrustable profession* activit*") AND ("Dental Educator*" OR "Dental Education" OR Dentistry).

The results were summarized, coded and thematically categorized and mapped to existing competency for dental educators.

Protocol Registration The protocol have been published in JMIR Research Protocols https://doi.org/10.2196/74225 [15].

Stage 2: two rounds of online Consensus-Building using the modified Delphi method
Panel selection criteria for the modified Delphi study
A total of ten [10] expert panellists were recruited for the Modified Delphi process using purposive sampling. Informed consent to participate was obtained from all of the participants in the study. Selection was guided by predefined inclusion criteria, as stated below, to ensure relevant expertise, experience, and diversity among participants:

1. Expertise in Dental Education or Clinical Specialties

Experts were required to possess formal postgraduate qualifications in a clinical dental specialty or in dental/medical education. Additionally, participants were expected to have demonstrated substantial engagement in curriculum development, teaching, or assessment activities within undergraduate or postgraduate dental education programmes.

2. Academic and Professional Experience

Eligible participants included senior educators with a minimum of five years of experience in academic or clinical teaching following the completion of their specialty or doctoral training. Preference was accorded to individuals in senior academic roles such as Deans, Deputy Deans, Heads of Department, or Programme Coordinators, given their strategic involvement in faculty development and educator evaluation, which enables them to contribute critical and informed perspectives to the study.

3. Representation and Diversity

Efforts were made to ensure representation across a range of clinical disciplines, including but not limited to Orthodontics, Restorative Dentistry, and Oral and Maxillofacial Pathology (OMOP). Furthermore, panellists were selected from both public and private dental institutions throughout Malaysia to promote geographical and institutional diversity.

4. Willingness to Participate

All panellists were required to demonstrate a willingness and ability to participate in all rounds of the Delphi process. This included providing quantitative ratings and qualitative justifications or feedback throughout the study.

Questionnaire with 4 likert scale with open ended questions
The questionnaire was designed to evaluate each EPA based on four key characteristics adapted from the framework applied by Bruggen et al. 2022: clarity, relevance, comprehensiveness, and usefulness [14]. These dimensions were chosen to ensure each EPA was not only well-defined and applicable but also complete and valuable for practical implementation. A total of 40 items were included in the questionnaire, derived from the findings of the preceding scoping review.

Panel members were asked to rate each EPA using a 4-point Likert scale (1 = Strongly Disagree; 2 = Disagree; 3 = Agree; 4 = Strongly Agree). The use of a 4-point scale is advantageous as it eliminates neutral response options, thereby encouraging panellists to take a definitive stance. This approach facilitates a clearer distinction between agreement and disagreement, supporting more efficient identification of consensus among the panel members.

Open-ended questions were included to allow participants to provide qualitative feedback, suggest rewording or improvements, identify redundancies, or propose additional EPAs. This combination of quantitative and qualitative input ensured a comprehensive evaluation and supported the refinement of the EPA list through expert consensus.

Briefing for the panel of experts
To support panellists' understanding of the EPA concept while accommodating their busy schedules, an orientation component via video-recorded PowerPoint slides was incorporated. This material provided a comprehensive briefing of the EPA framework, including definitions, examples, and a specification template to assist participants in distinguishing EPAs from competencies. Additionally, the slides outlined the study objectives, methodology, and detailed the actions required for each round. Panel members were also offered the opportunity to contact the research team directly for any further clarification or assistance throughout the study process.

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Analysis tool

The study results were quantitatively analysed using IBM SPSS Version 29.0 based on predefined consensus criteria. In parallel, the open-ended responses were thematically analysed via NVivo software to identify emerging patterns and insights, ensuring a comprehensive understanding of both numerical trends and qualitative feedback.

Consensus criteria

Consensus was defined as a median rating of ≥3 on a 4-point scale, with at least 80% agreement of ratings of 3 or 4 (Agree or Strongly Agree) and an item-level content validity index (i-CVI) of ≥0.8. Median was chosen as it ensures central tendency in ordinal data like Likert scale, which reflect the agreement. Median is also more stable and resistant to skewing from extreme rating for small sample size of 10 panel.

Stage 3: A final in-person consensus focus group discussion

To ensure high-quality feedback, the third round was conducted through three separate focus group discussions - two held face-to-face and one conducted online. Each session comprised 3 to 4 panel members and lasted an average of approximately 90 min. All sessions were audio-recorded, verbatim transcribed using TurboScribe, and subsequently analysed to extract consensus points and identify key thematic insights. Transcription and code validated by researchers team for analytic rigor.

Results

Scoping review

The review ultimately scoped five (5) from 1,632 articles that desConsensus and Scale-Level content validity indicescribed a total of forty-three (43) EPAs. Seven (7) of these EPAs were found to overlap; therefore, they were consolidated to four (4) EPA statements following a consensus, resulting in a total of 40 final EPA statements as shown in Table 1. The review yielded seven (7) themes via NVivo software: Teaching; with five EPAs, Bedside Teaching; with seven EPAs, Surgical Teaching skills; with 7 EPAs, Mentoring and coaching; with two EPAs, Research and scholarships; with eight EPAs, Educational development; with seven EPAs and Assessment; with four EPAs. The full results of the scoping are published in BMC Medical Education https://doi.org/10.1186/s12909-025-07888-z [16].

Modified Delphi expert panel demographic

A purposive sample of 10 experts participated in the Delphi process. The panel comprised experienced dental educators with diverse professional backgrounds, many of whom held senior academic or administrative positions, including dean, deputy dean, and head of department or programme. The mean age of participants was 52.1 years (range: 45–72), with a median of 18.5 years of professional experience following their specialty qualification. The panel represented a broad mix of dental academic faculties across Malaysia, encompassing various clinical specialties. Table of demographic of the experts is as shown in Table 2.

EPA development process

The EPA development process is illustrated in the infographic below, providing a visual representation of the structured, multi-stage methodology employed in this study together with the outcome (Fig. 1).

Round 1 results

In the first round of the Delphi study, a total of 40 EPAs were evaluated by the expert panel. All ten panel members responded, yielding a 100% participation rate. Six (6) EPA were eliminated as they did not meet the predetermined thresholds (a median rating of ≥ 3 on a 4-point scale, with at least 80% agreement (ratings of 3 or 4) and an item-level content validity index (i-CVI) of ≥ 0.8). Seven EPAs (marked by Ω) were identified by panel as having overlapping content and were consolidated into two comprehensive EPAs to minimize redundancy. Twelve EPAs were revised to enhance their wording, clarity, or scope based on the panel's suggestions. Fifteen EPAs were accepted without any changes. In addition, the open ended section of Round 1 generated 52 new EPAs suggestion from the panel. These responses were thematically analysed using NVivo, with multiple discussions held among the research team to ensure transparency, rigor, and data triangulation. As a result, the 52 newly proposed EPAs, together with the 29 refined EPAs from Version 1.0, were carried forward to Round 2 for further evaluation and consensus-building. These 81 EPAs were categorised according to the domains of competencies for dental educators as outlined by Chuenjitwongsa et al. (2018) [20].

Details of the quantitative analysis from Round 1 are presented in Table 3, while the combined qualitative and quantitative consensus findings are summarized in Table 4. The updated list of the outcome of Round 1, representing EPA Version 2.0, is illustrated in Table 5.

Round 2 results

In the second round of the Delphi study, a total of 81 EPAs were evaluated by the expert panel. All ten panel members participated, maintaining a 100% response rate. One (1) EPA was eliminated for not meeting the predetermined criteria (median score < 3 and/or item-level content validity index [i-CVI] < 0.8). The open-ended section of Round 2 generated very limited comments with no new suggestions of EPA.

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Table 1 The EPA version 1.0 from the scoping review. The Forty (40) EPAs were grouped into the seven (7) themes

THEME	No	EPA
Teaching	1	Lecturing[14]
	2	*Individual or small group teaching [4, 14]
	3	Large group teaching [4]
	4	Teaching lab classes and skills education [14]
	5	Teaching and facilitating learning [17]
Bedside Teaching	6	*Conducting bedside teaching [14, 18]
	7	Developing bedside teaching [18]
	8	Planning bedside teaching [18]
	9	Conducting bedside teaching assessment [18]
	10	Evaluating bedside teaching [18]
	11	Learner centered bedside teaching [4]
	12	Supervising (clinical) interns [14]
Surgical Teaching Skills	13	Role modelling [19]
	14	Feedback [19]
	15	Surgical scrub [19]
	16	Gowning and gloving [19]
	17	Infection control [19]
	18	Basic suturing skills [19]
	19	Wound management [19]
Mentoring and Coaching	20	*Mentoring, tutoring and coaching student [4, 14, 17]
	21	*Mentoring, coaching and advising faculty [17]
Research and Scholarships	22	Writing educational research proposal [17]
	23	Conducting qualitative educational research [17]
	24	Conducting quantitative educational research [17]
	25	Conducting mixed methods and consensus studies [17]
	26	Writing and publishing empirical research reports [17]
	27	Conducting and publishing literature reviews [17]
	28	Presenting at conferences and other meetings [17]
	29	Peer reviewing and editing [17]
Educational Development	30	Conducting educational needs assessments [17]
	31	Developing a curriculum blueprint [17]
	32	Instructional design for a variety of teaching and learning contexts [17]
	33	Designing, applying and revising educational quality assurance [17]
	34	Designing and implementing faculty development [17]
	35	Leading strategic education projects and policy developments[17]
	36	Designing and developing a course [14]
Assessment	37	Assessing written work of students [14]
	38	Developing and administrating tests and establishing results [14]
	39	Assessment of trainee proficiency [4]
	40	Designing, applying and revising student assessment systems [17]

*Merged and consolidated.

Details of the quantitative analysis from Round 2 are presented in Table 6, while the integrated consensus are summarized in Table 7. The updated list of the outcome of Round 2, representing EPA Version 3.0, is illustrated in Supplementary Table I.

Round 3
In the third round of the Delphi study, a total of 80 EPAs were evaluated by the expert panel. All ten panel members participated, maintaining a 100% response rate. This round was conducted through a two (2) face-to-face and one (1) online focus group discussion, which resulted in the following agreements:

1. Consolidation of 9 EPAs into 3 EPAs, as detailed in Table 8.
2. Elimination of 6 EPAs, as shown in Table 9.
3. Rearrangement of EPAs within domains to improve the logical flow and alignment of activities.
4. Relocation of one EPA to a different domain to better reflect its scope (EPA: Developing Study

Table 2 Demographic characteristics of expert panellists involved in the modified Delphi study (*n* = 10). The table summarizes participants' age, gender, professional roles, years of experience, areas of specialization, and institutional affiliation

Category	Characteristics	Frequency	Percentage
Total experts		10	100%
Gender			
	Male	5	50%
	Female	5	50%
Age (Years)			
	Range	45–72	
	Mean	52.1	
	Median	47.5	
Professional Role			
	Deputy Vice Chancellor	1	10%
	Dean		
	Current	2	20%
	Former	2	20%
	Deputy Dean Academic		
	Current	1	10%
	Former	2	20%
	Head of Department/ Programme	2	20%
Years of experience as educator (post speciality/PhD qualification)			
	Range	8–44	
	Mean	21.9	
	Median	18.5	
Field of expertise			
	Orthodontics	2	20%
	Oral Pathology and Oral Medicine	2	20%
	Restorative Dentistry	1	10%
	Paediatric Dentistry	1	10%
	Oral Maxillo-Facial Surgery	1	10%
	Dental Public Health	1	10%
	Forensic Dentistry	1	10%
	Basic Medical Sciences (with dental qualification)	1	10%
Institution			
	Universiti Sains Malaysia (USM)	2	20%
	Universiti Kebangsaan Malaysia (UKM)	2	20%
	Universiti Teknologi MARA (UiTM)	2	20%
	International Islamic University Malaysia (IIUM)	1	10%
	Universiti Malaya (UM)	1	10%
	MAHSA University	1	10%
	Universiti Sains Islam Malaysia (USIM)	1	10%

Plan from domain Educational Management to Curriculum Matters).

5. Refinement of some action verbs to enhance clarity and alignment with expected levels of performance.

6. The name of one domain was revised from "Mode of Education" to "Educational Practices" to better reflect the breadth and nature of tasks encompassed within this category.

7. Rearrangement of the domain sequence to reflect the progressive development of an educator.

The final list, representing EPA Version 4.0, consists of 68 EPAs and is shown in Table 10.

Discussion

Interpretation of findings

The findings from this three-round Modified Delphi process contribute meaningfully to this underdeveloped area by outlining EPAs that reflect the full breadth of responsibilities expected of modern dental educators.

The high level of engagement across all three-stage (100% response rate) underscores the perceived importance of this initiative among experts. In the first round, the structured use of a 4-point Likert scale and i-CVI helped ensure that only EPAs meeting minimum thresholds for relevance and clarity were retained or revised. A median ≥ 3 reflects central agreement, while ≥ 80% agreement indicates majority support. The panel's qualitative input was equally valuable, leading to the generation of 52 additional EPAs. This highlights the richness of expert experience and the need for a methodology that accommodates both quantitative scoring and narrative insights.

By Round 3, the process resulted in a final list of 68 EPAs, reflecting both consolidation and refinement across the rounds. Importantly, the panel's decisions to rearrange EPAs within domains, shift an EPA across domains, and improve action verbs demonstrate that expert consensus was not limited to content validation but also extended to structural and semantic clarity—key to the real-world utility of EPAs.

Organising the final EPAs into 12 domains reflects the multidimensional role of dental educators. This holistic representation is consistent with contemporary views on faculty development and academic performance, aligning with broader competency-based medical and dental education frameworks [10, 21].

Overall, the study supports the feasibility and value of using a Modified Delphi approach to develop EPAs and offers a replicable model for other health professions education fields. The EPAs developed here provide a foundation for professional development, accountability, and evaluation in academic dentistry, while also supporting alignment with institutional expectations and accreditation standards.

Implications for dental educators

The implementation of a structured EPA framework can positively impact dental educators.
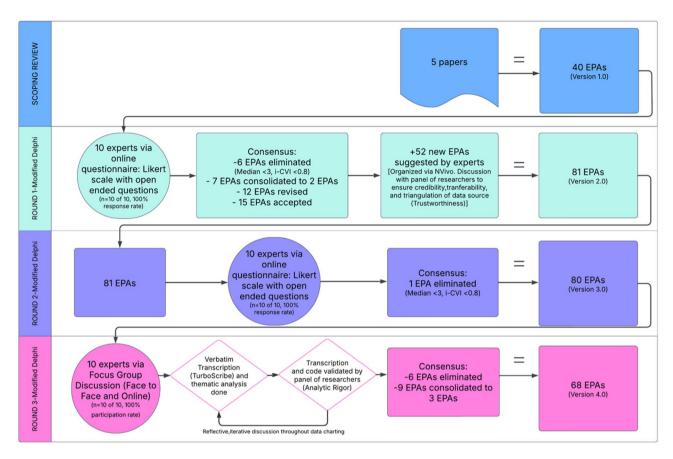
Fig. 1 Infographic summarising the structured process used to develop Entrustable Professional Activities (EPAs) for dental educators in this study. The process involved three key stages: a scoping review to generate initial items, two rounds of a Modified Delphi survey with expert panellists, and a final in-person focus group consensus meeting

Firstly, EPAs help standardise performance expectations, ensuring that dental educators across institutions understand the core tasks they are expected to master and be entrusted with. This facilitates transparent evaluation, allowing for consistent and objective assessment of educator performance in both formative and summative contexts.

Secondly, EPAs support faculty development by identifying specific areas of responsibility that can be aligned with individual growth plans, training programs, and institutional goals. They offer a clear pathway for professional progression, helping educators and administrators track development over time.

Thirdly, EPAs enable better alignment between educational responsibilities and institutional accreditation standards, thereby enhancing accountability and quality assurance. By anchoring responsibilities to observable activities, EPAs also foster trust and autonomy, reinforcing confidence in educators' capabilities.

Lastly, the implementation of EPAs encourages a competency-based culture in academic dentistry, promoting reflective practice, peer support, and continuous improvement. In sum, EPAs empower dental educators by making their contributions visible, measurable, and developmentally supported.

Strength and innovations

This study has several notable strengths. First, it employed a rigorous and systematic combined methodologies - a scoping review plus a Modified Delphi methodology which adhered to all 16 points of CREDES guideline [13]. The combination of both quantitative and qualitative approaches ensures robust consensus-building among a diverse panel of experts. The use of multiple rounds, including a final in-person focus group discussion, allowed for in-depth clarification, refinement, and validation of each EPA. Second, the study achieved a 100% response rate across all three-stages, reflecting strong engagement and commitment from the expert panel, which enhances the credibility and reliability of the findings. Third, the incorporation of open-ended feedback and thematic analysis enriched the

Table 3 Summary of quantitative analysis of the round 1 EPA Ratings, consensus Status, and items Removed. consensus was defined as a median rating of ≥ 3 on a 4-point scale, with at least 80% agreement (ratings of 3 or 4) and an item-level content validity index (i-CVI) of ≥ 0.8. Six (6) EPAs were removed in round 1 for not meeting the consensus criteria; these are marked in bold with asterisks (*)

EPA	Item	N		Mean	Median	SD	Skewness	Percentiles			IQR	Quartile Deviation	Agreement %	I-CVI
		Valid	Missing					25	50	75				
Lecturing	Item_1_Clarity	10	0	3.7	4	0.48	-1.04	3	4	4	1	0.50	100	1
	Item_1_Relevance	10	0	3.7	4	0.48	-1.04	3	4	4	1	0.50	100	1
	Item_1_Comprehensiveness	10	0	3.3	3	0.67	-0.43	3	3	4	1	0.50	90	0.9
	Item_1_Usefulness	10	0	3.7	4	0.48	-1.04	3	4	4	1	0.50	100	1
Individual or small group teaching	Item_2_Clarity	10	0	3.9	4	0.32	-3.16	4	4	4	0	0.00	100	1
	Item_2_Relevance	10	0	3.9	4	0.32	-3.16	4	4	4	0	0.00	100	1
	Item_2_Comprehensiveness	10	0	3.6	4	0.70	-1.66	3	4	4	1	0.50	90	0.9
	Item_2_Usefulness	10	0	3.7	4	0.48	-1.04	3	4	4	1	0.50	100	1
*Large group teaching	Item_3_Clarity	10	0	2.6	***2.5**	0.70	0.78	2	2.5	3	1	0.50	***50**	0.5
	Item_3_Relevance	10	0	2.8	3	0.63	0.13	2	3	3	1	0.50	***70**	0.7
	Item_3_Comprehensiveness	10	0	2.6	3	0.52	-0.48	2	3	3	1	0.50	***60**	0.6
	Item_3_Usefulness	10	0	2.7	3	0.67	0.43	2	3	3	1	0.50	***60**	0.6
Teaching lab classes and skills education	Item_4_Clarity	10	0	3.7	4	0.67	-2.28	3.75	4	4	0.25	0.13	90	0.9
	Item_4_Relevance	10	0	3.8	4	0.42	-1.78	3.75	4	4	0.25	0.13	100	1
	Item_4_Comprehensiveness	10	0	3.6	4	0.52	-0.48	3	4	4	1	0.50	100	1
	Item_4_Usefulness	10	0	3.9	4	0.32	-3.16	4	4	4	0	0.00	100	1
*Teaching and facilitating learning	Item_5_Clarity	10	0	3	3	0.94	0.00	2	3	4	2	1.00	***60**	0.6
	Item_5_Relevance	10	0	3.3	3.5	0.82	-0.69	2.75	3.5	4	1.25	0.63	80	0.8
	Item_5_Comprehensiveness	10	0	3.3	3	0.67	-0.43	3	3	4	1	0.50	90	0.9
	Item_5_Usefulness	10	0	3.2	3	0.79	-0.41	2.75	3	4	1.25	0.63	80	0.8
Conducting bedside teaching	Item_6_Clarity	10	0	3.4	3.5	0.70	-0.78	3	3.5	4	1	0.50	90	0.9
	Item_6_Relevance	10	0	3.6	4	0.52	-0.48	3	4	4	1	0.50	100	1
	Item_6_Comprehensiveness	10	0	3.4	3	0.52	0.48	3	3	4	1	0.50	100	1
	Item_6_Usefulness	10	0	3.5	3.5	0.53	0.00	3	3.5	4	1	0.50	100	1
*Developing bedside teaching	Item_7_Clarity	10	0	2.8	3	0.79	0.41	2	3	3.25	1.25	0.63	***60**	0.6
	Item_7_Relevance	10	0	3	3	0.67	0.00	2.75	3	3.25	0.5	0.25	80	0.8
	Item_7_Comprehensiveness	10	0	3.1	3	0.74	-0.17	2.75	3	4	1.25	0.63	80	0.8
	Item_7_Usefulness	10	0	3.1	3	0.74	-0.17	2.75	3	4	1.25	0.63	80	0.8
Planning bedside teaching	Item_8_Clarity	10	0	2.9	3	0.57	-0.09	2.75	3	3	0.25	0.13	80	0.8
	Item_8_Relevance	10	0	2.9	3	0.57	-0.09	2.75	3	3	0.25	0.13	80	0.8
	Item_8_Comprehensiveness	10	0	3	3	0.47	0.00	3	3	3	0	0.00	90	0.9
	Item_8_Usefulness	10	0	3	3	0.47	0.00	3	3	3	0	0.00	90	0.9
Conducting bedside teaching assessment	Item_9_Clarity	10	0	3.5	3.5	0.53	0.00	3	3.5	4	1	0.50	100	1
	Item_9_Relevance	10	0	3.4	3	0.52	0.48	3	3	4	1	0.50	100	1
	Item_9_Comprehensiveness	10	0	3.4	3	0.52	0.48	3	3	4	1	0.50	100	1
	Item_9_Usefulness	10	0	3.5	3.5	0.53	0.00	3	3.5	4	1	0.50	100	1

Table 3 (continued)

EPA	Item	N Valid	N Missing	Mean	Median	SD	Skewness	Percentiles 25	Percentiles 50	Percentiles 75	IQR	Quartile Deviation	Agreement %	I-CVI
Evaluating bedside teaching	Item_10_Clarity	10	0	3.4	3.5	0.70	−0.78	3	3.5	4	1	0.50	90	0.9
	Item_10_Relevance	10	0	3.5	3.5	0.53	0.00	3	3.5	4	1	0.50	100	1
	Item_10_Comprehensiveness	10	0	3.3	3	0.67	−0.43	3	3	4	1	0.50	90	0.9
	Item_10_Usefulness	10	0	3.5	3.5	0.53	0.00	3	3.5	4	1	0.50	100	1
Learner centered bedside teaching	Item_11_Clarity	10	0	3.4	3.5	0.70	−0.78	3	3.5	4	1	0.50	90	0.9
	Item_11_Relevance	10	0	3.4	3	0.52	0.48	3	3	4	1	0.50	100	1
	Item_11_Comprehensiveness	10	0	3.5	3.5	0.53	0.00	3	3.5	4	1	0.50	100	1
	Item_11_Usefulness	10	0	3.5	3.5	0.53	0.00	3	3.5	4	1	0.50	100	1
*Supervising Clinical Interns	Item_12_Clarity	10	0	3	3	0.94	0.00	2	3	4	2	1.00	*60	0.6
	Item_12_Relevance	10	0	3.4	3	0.52	0.48	3	3	4	1	0.50	100	1
	Item_12_Comprehensiveness	10	0	3.2	3	0.79	−0.41	2.75	3	4	1.25	0.63	80	0.8
	Item_12_Usefulness	10	0	3.5	3.5	0.53	0.00	3	3.5	4	1	0.50	100	1
Role Modelling	Item_13_Clarity	10	0	3.5	4	0.71	−1.18	3	4	4	1	0.50	90	0.9
	Item_13_Relevance	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1
	Item_13_Comprehensiveness	10	0	3.7	4	0.67	−2.28	3.75	4	4	0.25	0.13	90	0.9
	Item_13_Usefulness	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1
Feedback	Item_14_Clarity	10	0	3.4	3.5	0.70	−0.78	3	3.5	4	1	0.50	90	0.9
	Item_14_Relevance	10	0	3.5	3.5	0.53	0.00	3	3.5	4	1	0.50	100	1
	Item_14_Comprehensiveness	10	0	3.4	3	0.52	0.48	3	3	4	1	0.50	100	1
	Item_14_Usefulness	10	0	3.4	3	0.52	0.48	3	3	4	1	0.50	100	1
Surgical Scrub	Item_15_Clarity	10	0	3.3	3.5	0.82	−0.69	2.75	3.5	4	1.25	0.63	80	0.8
	Item_15_Relevance	10	0	3.4	4	0.84	−1.00	2.75	4	4	1.25	0.63	80	0.8
	Item_15_Comprehensiveness	10	0	3.4	4	0.84	−1.00	2.75	4	4	1.25	0.63	80	0.8
	Item_15_Usefulness	10	0	3.4	4	0.84	−1.00	2.75	4	4	1.25	0.63	80	0.8
Gowning and Gloving	Item_16_Clarity	10	0	3.4	4	0.84	−1.00	2.75	4	4	1.25	0.63	80	0.8
	Item_16_Relevance	10	0	3.4	4	0.84	−1.00	2.75	4	4	1.25	0.63	80	0.8
	Item_16_Comprehensiveness	10	0	3.5	4	0.71	−1.18	3	4	4	1	0.50	90	0.9
	Item_16_Usefulness	10	0	3.5	4	0.71	−1.18	3	4	4	1	0.50	90	0.9
Infection Control	Item_17_Clarity	10	0	3.7	4	0.48	−1.04	3	4	4	1	0.50	100	1
	Item_17_Relevance	10	0	3.7	4	0.48	−1.04	3	4	4	1	0.50	100	1
	Item_17_Comprehensiveness	10	0	3.7	4	0.48	−1.04	3	4	4	1	0.50	100	1
	Item_17_Usefulness	10	0	3.7	4	0.48	−1.04	3	4	4	1	0.50	100	1
Basic Suturing Skills	Item_18_Clarity	10	0	3.7	4	0.67	−2.28	3.75	4	4	0.25	0.13	90	0.9
	Item_18_Relevance	10	0	3.7	4	0.67	−2.28	3.75	4	4	0.25	0.13	90	0.9
	Item_18_Comprehensiveness	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1
	Item_18_Usefulness	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1

Table 3 (continued)

EPA	Item	N Valid	N Missing	Mean	Median	SD	Skewness	Percentiles 25	Percentiles 50	Percentiles 75	IQR	Quartile Deviation	Agreement %	I-CVI
Wound Management	Item_19_Clarity	10	0	3.6	4	0.70	−1.66	3	4	4	1	0.50	90	0.9
	Item_19_Relevance	10	0	3.4	4	0.84	−1.00	2.75	4	4	1.25	0.63	80	0.8
	Item_19_Comprehensiveness	10	0	3.4	3.5	0.70	−0.78	3	3.5	4	1	0.50	90	0.9
	Item_19_Usefulness	10	0	3.5	4	0.71	−1.18	3	4	4	1	0.50	90	0.9
Mentoring, Tutoring & Coaching students	Item_20_Clarity	10	0	3.6	4	0.70	−1.66	3	4	4	1	0.50	90	0.9
	Item_20_Relevance	10	0	3.9	4	0.32	−3.16	4	4	4	0	0.00	100	1
	Item_20_Comprehensiveness	10	0	3.5	4	0.71	−1.18	3	4	4	1	0.50	90	0.9
	Item_20_Usefulness	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1
Mentoring, Coaching & Advising Faculty	Item_21_Clarity	10	0	3.4	4	0.84	−1.00	2.75	4	4	1.25	0.63	80	0.8
	Item_21_Relevance	10	0	3.6	4	0.70	−1.66	3	4	4	1	0.50	90	0.9
	Item_21_Comprehensiveness	10	0	3.5	4	0.71	−1.18	3	4	4	1	0.50	90	0.9
	Item_21_Usefulness	10	0	3.6	4	0.70	−1.66	3	4	4	1	0.50	90	0.9
Writing educational research proposal	Item_22_Clarity	10	0	3.6	4	0.70	−1.66	3	4	4	1	0.50	90	0.9
	Item_22_Relevance	10	0	3.5	4	0.71	−1.18	3	4	4	1	0.50	90	0.9
	Item_22_Comprehensiveness	10	0	3.5	4	0.71	−1.18	3	4	4	1	0.50	90	0.9
	Item_22_Usefulness	10	0	3.4	3.5	0.70	−0.78	3	3.5	4	1	0.50	90	0.9
Conducting qualitative educational research	Item_23_Clarity	10	0	3.7	4	0.48	−1.04	3	4	4	1	0.50	100	1
	Item_23_Relevance	10	0	3.4	3	0.52	0.48	3	3	4	1	0.50	100	1
	Item_23_Comprehensiveness	10	0	3.6	4	0.52	−0.48	3	4	4	1	0.50	100	1
	Item_23_Usefulness	10	0	3.5	3.5	0.53	0.00	3	3.5	4	1	0.50	100	1
Conducting quantitative educational research	Item_24_Clarity	10	0	3.7	4	0.48	−1.04	3	4	4	1	0.50	100	1
	Item_24_Relevance	10	0	3.6	4	0.52	−0.48	3	4	4	1	0.50	100	1
	Item_24_Comprehensiveness	10	0	3.6	4	0.52	−0.48	3	4	4	1	0.50	100	1
	Item_24_Usefulness	10	0	3.6	4	0.52	−0.48	3	4	4	1	0.50	100	1
Conducting mixed methods and consensus studies	Item_25_Clarity	10	0	3.7	4	0.48	−1.04	3	4	4	1	0.50	100	1
	Item_25_Relevance	10	0	3.6	4	0.52	−0.48	3	4	4	1	0.50	100	1
	Item_25_Comprehensiveness	10	0	3.6	4	0.52	−0.48	3	4	4	1	0.50	100	1
	Item_25_Usefulness	10	0	3.6	4	0.52	−0.48	3	4	4	1	0.50	100	1
Writing and publishing empirical research reports	Item_26_Clarity	10	0	3.7	4	0.48	−1.04	3	4	4	1	0.50	100	1
	Item_26_Relevance	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1
	Item_26_Comprehensiveness	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1
	Item_26_Usefulness	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1
Conducting and publishing literature reviews	Item_27_Clarity	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1
	Item_27_Relevance	10	0	3.7	4	0.48	−1.04	3	4	4	1	0.50	100	1
	Item_27_Comprehensiveness	10	0	3.7	4	0.48	−1.04	3	4	4	1	0.50	100	1
	Item_27_Usefulness	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1

Table 3 (continued)

EPA	Item	N		Mean	Median	SD	Skewness	Percentiles			IQR	Quartile Deviation	Agreement %	I-CVI
		Valid	Missing					25	50	75				
Presenting at conferences and other meetings	Item_28_Clarity	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1
	Item_28_Relevance	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1
	Item_28_Comprehensiveness	10	0	3.6	4	0.52	−0.48	3	4	4	1	0.50	100	1
	Item_28_Usefulness	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1
Peer reviewing and editing	Item_29_Clarity	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1
	Item_29_Relevance	10	0	3.7	4	0.48	−1.04	3	4	4	1	0.50	100	1
	Item_29_Comprehensiveness	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1
	Item_29_Usefulness	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1
Conducting educational needs assessments	Item_30_Clarity	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1
	Item_30_Relevance	10	0	3.9	4	0.32	−3.16	4	4	4	0	0.00	100	1
	Item_30_Comprehensiveness	10	0	3.7	4	0.48	−1.04	3	4	4	1	0.50	100	1
	Item_30_Usefulness	10	0	3.9	4	0.32	−3.16	4	4	4	0	0.00	100	1
Developing a curriculum blueprint	Item_31_Clarity	10	0	3.9	4	0.32	−3.16	4	4	4	0	0.00	100	1
	Item_31_Relevance	10	0	3.9	4	0.32	−3.16	4	4	4	0	0.00	100	1
	Item_31_Comprehensiveness	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1
	Item_31_Usefulness	10	0	3.9	4	0.32	−3.16	4	4	4	0	0.00	100	1
Instructional design for a variety of teaching and learning contexts	Item_32_Clarity	10	0	3.6	4	0.70	−1.66	3	4	4	1	0.50	90	0.9
	Item_32_Relevance	10	0	3.6	4	0.70	−1.66	3	4	4	1	0.50	90	0.9
	Item_32_Comprehensiveness	10	0	3.6	4	0.70	−1.66	3	4	4	1	0.50	90	0.9
	Item_32_Usefulness	10	0	3.6	4	0.70	−1.66	3	4	4	1	0.50	90	0.9
Designing, applying and revising educational quality assurance	Item_33_Clarity	10	0	3.6	4	0.52	−0.48	3	4	4	1	0.50	100	1
	Item_33_Relevance	10	0	3.9	4	0.32	−3.16	4	4	4	0	0.00	100	1
	Item_33_Comprehensiveness	10	0	3.6	4	0.52	−0.48	3	4	4	1	0.50	100	1
	Item_33_Usefulness	10	0	3.7	4	0.48	−1.04	3	4	4	1	0.50	100	1
*Designing and implementing faculty development	Item_34_Clarity	10	0	2.6	*2	0.84	1.00	2	2	3.25	1.25	0.63	***40**	0.4
	Item_34_Relevance	10	0	3.1	3	0.57	0.09	3	3	3.25	0.25	0.13	90	0.9
	Item_34_Comprehensiveness	10	0	3	3	0.67	0.00	2.75	3	3.25	0.5	0.25	80	0.8
	Item_34_Usefulness	10	0	3.3	3	0.67	−0.43	3	3	4	1	0.50	90	0.9
Leading strategic education projects and policy developments	Item_35_Clarity	10	0	3.6	4	0.52	−0.48	3	4	4	1	0.50	100	1
	Item_35_Relevance	10	0	3.5	3.5	0.53	0.00	3	3.5	4	1	0.50	100	1
	Item_35_Comprehensiveness	10	0	3.3	3	0.48	1.04	3	3	4	1	0.50	100	1
	Item_35_Usefulness	10	0	3.4	3	0.52	0.48	3	3	4	1	0.50	100	1
Designing and developing a course	Item_36_Clarity	10	0	3.9	4	0.32	−3.16	4	4	4	0	0.00	100	1
	Item_36_Relevance	10	0	3.9	4	0.32	−3.16	4	4	4	0	0.00	100	1
	Item_36_Comprehensiveness	10	0	3.9	4	0.32	−3.16	4	4	4	0	0.00	100	1
	Item_36_Usefulness	10	0	3.7	4	0.67	−2.28	3.75	4	4	0.25	0.13	90	0.9

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Table 3 (continued)

EPA	Item	N Valid	N Missing	Mean	Median	SD	Skewness	Percentiles 25	Percentiles 50	Percentiles 75	IQR	Quartile Deviation	Agreement %	I-CVI
Assessing written work of students	Item_37_Clarity	10	0	3.6	4	0.70	-1.66	3	4	4	1	0.50	90	0.9
	Item_37_Relevance	10	0	3.9	4	0.32	-3.16	4	4	4	0	0.00	100	1
	Item_37_Comprehensiveness	10	0	3.5	4	0.85	-1.36	2.75	4	4	1.25	0.63	80	0.8
	Item_37_Usefulness	10	0	3.7	4	0.67	-2.28	3.75	4	4	0.25	0.13	90	0.9
Developing and administrating tests and establishing	Item_38_Clarity	10	0	3.5	4	0.71	-1.18	3	4	4	1	0.50	90	0.9
	Item_38_Relevance	10	0	3.8	4	0.42	-1.78	3.75	4	4	0.25	0.13	100	1
	Item_38_Comprehensiveness	10	0	3.6	4	0.70	-1.66	3	4	4	1	0.50	90	0.9
	Item_38_Usefulness	10	0	3.7	4	0.48	-1.04	3	4	4	1	0.50	100	1
*Assessment of trainee proficiency	Item_39_Clarity	10	0	3.2	3.5	0.92	-0.47	2	3.5	4	2	1.00	*70	0.7
	Item_39_Relevance	10	0	3.7	4	0.48	-1.04	3	4	4	1	0.50	100	1
	Item_39_Comprehensiveness	10	0	3.7	4	0.48	-1.04	3	4	4	1	0.50	100	1
	Item_39_Usefulness	10	0	3.7	4	0.48	-1.04	3	4	4	1	0.50	100	1
Designing, applying and revising student assessment systems	Item_40_Clarity	10	0	3.7	4	0.67	-2.28	3.75	4	4	0.25	0.13	90	0.9
	Item_40_Relevance	10	0	3.8	4	0.42	-1.78	3.75	4	4	0.25	0.13	100	1
	Item_40_Comprehensiveness	10	0	3.7	4	0.48	-1.04	3	4	4	1	0.50	100	1
	Item_40_Usefulness	10	0	3.8	4	0.42	-1.78	3.75	4	4	0.25	0.13	100	1

data, ensuring that the final EPA framework was both evidence-informed and contextually relevant. Lastly, the study addresses a significant gap in the literature by developing the first comprehensive EPA framework tailored specifically for dental educators. It offers a practical tool that aligns with competencies outlined by Chuenjitwongsa et al. 2018 [20]. It also demonstrates potential alignment with established standards such as Malaysian Qualifying Agency (MQA) in Area 4: Academic Staff and Area 7: Programme Monitoring and Continuous Quality Improvement, COPDEND (UK) [10], CODA (USA), and CanMEDS (Canada), thereby enhancing its relevance and applicability across various educational and regulatory contexts.

Limitations
Translation to practicality
This study presents a novel application of EPAs by focusing on educators rather than learners. While this conceptual extension is innovative, it remains at an early stage, and further work is required to fully establish effective assessment methods for these EPAs in practice. Specifically, there is a need for a detailed elaboration of the knowledge, skills, and attitudes that underpin each EPA, as well as mechanisms for evaluating their performance. Given that EPAs for educators may differ in scope, structure, and purpose from those traditionally designed for learners, additional refinement and adaptation are necessary. Addressing these aspects presents valuable opportunities to enhance the framework's relevance and strengthen its applicability in faculty development and assessment.

The argument of the use of the modified Delphi technique
The development of EPAs for educators is inherently exploratory and necessitates input from individuals with first-hand experience in dental education roles. In contexts where empirical data or objective benchmarks are limited, the Delphi method offers a structured and transparent means of capturing expert perspectives, iteratively refining them, and arriving at a shared framework.

We acknowledge that consensus-building approaches, such as the Delphi are not without limitations, particularly concerning the epistemic challenges of defining "expertise" and the validity of consensus as a decision-making process. It is valid to acknowledge that consensus in science does not always equate to truth. However, in the field of medical education, consensus methods have been widely and productively used to develop frameworks, competencies, and assessment tools (e.g., CanMEDS and ACGME competencies). In these applications, consensus serve as an essential starting point for operationalizing complex constructs, which can subsequently be piloted, tested, and refined in real-world settings.

Table 4 Consensus and Scale-Level content validity indices of EPA ratings for Delphi round 1. This table summarizes the outcomes of the first Delphi round: 6 EPAs were eliminated (marked in bold), 7 EPAs (indicated by Ω) were consolidated into 2 streamlined EPAs, 12 EPAs were revised based on expert feedback, and 15 EPAs were accepted without modification. S-CVI/Ave = average of all I-CVI values across the scale; threshold for validity of > 0.80 is considered acceptable for good content validity. S-CVI/UA = proportion of items with universal agreement

THEME	NO	EPA	CONSENSUS	REVISED EPA	S-CVI Av	S-CVI/ UA
Teaching	1	Lecturing	Accepted		0.86	0.45
	2	Individual or small group teaching	Accepted			
	3	**Large group teaching**	**Eliminated**			
	4	Teaching lab classes and skills education	Accepted			
	5	**Teaching and facilitating learning**	**Eliminated**			
Bedside Teaching	6	Conducting bedside teaching	Revised	Conducting bedside/Chairside teaching	0.91	0.50
	7	**Developing bedside teaching**	**Eliminated**			
	8	Planning bedside teaching	Revised	Planning bedside teaching		
	9	Conducting bedside teaching assessment	Revised	Conducting bedside teaching assessment		
	10	Evaluating bedside teaching	Revised	Evaluating bedside teaching		
	11	Learner centered bedside teaching	Revised	Learner centered bedside teaching		
	12	**Supervising (clinical) interns**	**Eliminated**			
Surgical Teaching Skills	13	Role modelling	Accepted		0.91	0.39
	14	Feedback	Revised	Providing effective feedback		
	15	ΩSurgical scrub	Consolidated	Understanding Surgical Protocol		
	16	ΩGowning and gloving				
	18	ΩBasic suturing skills				
	19	ΩWound management				
	17	Infection control	Revised	Implementing infection control		
Mentoring and Coaching	20	Mentoring, tutoring and coaching student	Revised	Mentoring and monitoring students academic progress	0.91	0.25
	21	Mentoring, coaching and advising faculty	Revised	Mentoring and coaching		
Research and Scholarships	22	Writing educational research proposal	Accepted		0.99	0.88
	23	Ω Conducting qualitative educational research	Consolidated	Conducting qualitative/quantitative/mixed mode/consensus educational research		
	24	ΩConducting quantitative educational research				
	25	ΩConducting mixed methods and consensus studies				
	26	Writing and publishing empirical research reports	Accepted			
	27	Conducting and publishing literature reviews	Accepted			
	28	Presenting at conferences and other meetings	Accepted			
	29	Peer reviewing and editing	Accepted			
Educational Development	30	Conducting educational needs assessments	Accepted		0.95	0.68
	31	Developing a curriculum blueprint	Accepted			
	32	Instructional design for a variety of teaching and learning contexts	Revised	Designing and developing instructional material/media for a variety of teaching and learning contexts		
	33	Designing, applying and revising educational quality assurance	Accepted			
	34	**Designing and implementing faculty development**	**Eliminated**			
	35	Leading strategic education projects and policy developments	Revised	Involvement in strategic education projects and policy developments		
	36	Designing and developing a course	Accepted			
Assessment	37	Assessing written work of students	Accepted		0.94	0.56
	38	Developing and administrating tests and establishing results	Accepted			
	39	**Assessment of trainee proficiency**	**Eliminated**			
	40	Designing, applying and revising student assessment systems	Revised	Calibrating, applying and revising student assessment systems		

Table 5. List of EPA version 2.0 (81 EPAs) brought forward to round 2, including 52 newly proposed EPAs (white background) and 29 refined EPAs (with grey background) from version 1.0 for further evaluation and consensus-building

DOMAIN OF COMPETENCES	EPA NO	EPA
Educational Theories and Principles (8)	1	Understanding various contemporary teaching and learning methods (Lectures, PBL, practical, clinical, online, reflection)
	2	Understanding teaching pedagogy
	3	Understanding Student centred learning
	4	Understanding Outcome-based education
	5	Understanding Competency-based education
	6	Understanding various learning styles : visual, auditory, reading/writing and kinesthetic (VARK/KOLB's)
	7	Mentoring and coaching
	8	Be familiar with Digital or Internet-mediated Learning
Modes of Education (15)	9	Lecturing
	10	Individual or small group teaching
	11	Teaching laboratory classes and skills education
	12	Conducting bedside/chairside teaching
	13	Planning bedside/ chairside teaching
	14	Conducting bedside/chairside teaching assessment
	15	Evaluating bedside/chairside teaching
	16	Learner centered bedside/chairside teaching
	17	Role modelling (Consent, communication etc)
	18	Understanding Surgical Protocol (Surgical Scrub, Gowning and gloving, basic suturing skills, wound management)
	19	Implementing infection control
	20	Conducting clinical audit
	21	Conducting case based discussion/problem based learning
	22	Outreach/community/Workplace based teaching
	23	Promote Reflection practice
Curriculum Matters (5)	24	Involvement in Curriculum Development, Implementation, delivery and evaluation.
	25	Understanding curriculum review
	26	Understanding different curriculum (conventional/mixed mode/coursework/research)
	27	Developing a curriculum blueprint
	28	Designing and developing a course
Educational Materials and Instructional Design (4)	29	Designing and developing instructional material/media for a variety of teaching and learning contexts
	30	Structuring and Delivering Instructional Content
	31	Evaluating and Refining Educational Materials/Media
	32	Integrating Innovation in Instructional Design
	33	Developing, administrating test and establishing results
	34	Assessing written work of students
	35	Evaluating assessment outcome attainment
	36	Conducting item analysis
	37	Understanding De-briefing technique
	38	Enhancing assessment feedback quality (constructive and timely)
Assessment (7)	39	Calibrating, applying and revising student assessment systems
Evaluation (7)	40	Understanding methods of evaluation to the principles educational programme
	41	Conducting educational needs assessments
	42	Teacher and teaching evaluation
	43	Exercising Self-review
	44	Evaluating curriculum effectiveness
	45	Evaluating course learning outcomes
	46	Evaluating program learning outcomes
Learner's Issue (6)	47	Supporting Learner Growth and professional well being
	48	Identifying and Addressing Learning Difficulties
	49	Providing effective feedback
	50	Identifying and customizing educational support for marginalized students
	51	Monitoring of student's behavioural change
	52	Mentoring & monitoring students academic progress
	53	Designing, applying and revising educational quality assurance
	54	Understanding accreditation and compliance management
	55	Understanding the requirements of the national quality assurance and regulatory bodies
	56	Involvement in institutional and faculty development for quality assurance
Quality Assurance (5)	57	Involvement in continuous quality improvement
Educational Management (4)	58	Developing study plan
	59	Matching the educational curriculum with the country's higher education policy
	60	Leading strategic association/society
	61	Involvement in strategic education projects/policy developments
	62	Demonstrating ethical and professional conduct
	63	Engaging in continuous professional development
	64	Respecting and maintaining professional boundaries
	65	Maintaining effective communication
Professionalism (5)	66	Practicing good team-work
	67	Understanding patient centered approach
	68	Teaching and assessing clinical competency in patient care
	69	Enhancing interprofessional collaboration in healthcare
	70	Understanding ethical, legal, and culturally competent care
	71	Imparting public health and community-based dental care
Patient Care and Healthcare System (7)	72	Preparing students for evidence-based decision-making in patient care
	73	Embracing technology in patient management
Research and scholarships (8)	74	Writing educational research proposal
	75	Understanding research methodology
	76	Conducting qualitative/quantitative/mixed mode/consensus educational research
	77	Writing and publishing empirical research reports
	78	Conducting and publishing literature reviews
	79	Presenting at conferences and other meetings
	80	Peer reviewing and editing
	81	Exposure to intellectual properties

Table 6 Summary of quantitative analysis of the round 2 EPA Ratings, consensus Status, and items Removed. consensus was defined as a median rating of ≥3 on a 4-point scale, with at least 80% agreement (ratings of 3 or 4) and an item-level content validity index (i-CVI) of ≥0.8. One EPA(No.60) were removed in round 2 for not meeting the consensus criteria; these are marked in bold with asterisks (*)

NO	EPA	ITEM	N Valid	N Missing	Mean	Median	SD	Skewness	Percentiles 25	Percentiles 50	Percentiles 75	IQR	Quartile deviation	Agreement %	I-CVI
1	Understanding various contemporary teaching and learning methods (Lectures, PBL, practical, clinical, online, reflection)	Item_1_Clarity	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1
		Item_1_Relevance	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1
		Item_1_Comprehensiveness	10	0	3.9	4	0.32	−3.16	4	4	4	0	0.00	100	1
		Item_1_Usefulness	10	0	3.9	4	0.32	−3.16	4	4	4	0	0.00	100	1
2	Understanding Teaching Pedagogy	Item_2_Clarity	10	0	3.7	4	0.48	−1.04	3	4	4	1	0.50	100	1
		Item_2_Relevance	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1
		Item_2_Comprehensiveness	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1
		Item_2_Usefulness	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1
3	Understanding Student centred learning	Item_3_Clarity	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1
		Item_3_Relevance	10	0	3.9	4	0.32	−3.16	4	4	4	0	0.00	100	1
		Item_3_Comprehensiveness	10	0	3.7	4	0.48	−1.04	3	4	4	1	0.50	100	1
		Item_3_Usefulness	10	0	3.9	4	0.32	−3.16	4	4	4	0	0.00	100	1
4	Understanding Outcome-based education	Item_4_Clarity	10	0	4	4	0.00		4	4	4	0	0.00	100	1
		Item_4_Relevance	10	0	4	4	0.00		4	4	4	0	0.00	100	1
		Item_4_Comprehensiveness	10	0	3.9	4	0.32	−3.16	4	4	4	0	0.00	100	1
		Item_4_Usefulness	10	0	3.9	4	0.32	−3.16	4	4	4	0	0.00	100	1
5	Understanding Competency-based education	Item_5_Clarity	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1
		Item_5_Relevance	10	0	3.9	4	0.32	−3.16	4	4	4	0	0.00	100	1
		Item_5_Comprehensiveness	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1
		Item_5_Usefulness	10	0	3.9	4	0.32	−3.16	4	4	4	0	0.00	100	1
6	Understanding various learning styles : visual, auditory, reading/writing and kinesthetic (VARK/KOLB's)	Item_6_Clarity	10	0	3.7	4	0.48	−1.04	3	4	4	1	0.50	100	1
		Item_6_Relevance	10	0	3.6	4	0.52	−0.48	3	4	4	1	0.50	100	1
		Item_6_Comprehensiveness	10	0	3.6	4	0.52	−0.48	3	4	4	1	0.50	100	1
		Item_6_Usefulness	10	0	3.5	3.5	0.53	0.00	3	3.5	4	1	0.50	100	1
7	Mentoring and coaching	Item_7_Clarity	10	0	3.7	4	0.48	−1.04	3	4	4	1	0.50	100	1
		Item_7_Relevance	10	0	3.9	4	0.32	−3.16	4	4	4	0	0.00	100	1
		Item_7_Comprehensiveness	10	0	3.6	4	0.52	−0.48	3	4	4	1	0.50	100	1
		Item_7_Usefulness	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1
8	Be familiar with Digital or Internet-mediated Learning	Item_8_Clarity	10	0	3.7	4	0.48	−1.04	3	4	4	1	0.50	100	1
		Item_8_Relevance	10	0	3.6	4	0.70	−1.66	3	4	4	1	0.50	90	0.9
		Item_8_Comprehensiveness	10	0	3.6	4	0.52	−0.48	3	4	4	1	0.50	100	1
		Item_8_Usefulness	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1
9	Lecturing	Item_9_Clarity	10	0	3.7	4	0.48	−1.04	3	4	4	1	0.50	100	1
		Item_9_Relevance	10	0	3.7	4	0.48	−1.04	3	4	4	1	0.50	100	1
		Item_9_Comprehensiveness	10	0	3.7	4	0.67	−2.28	3.75	4	4	0.25	0.13	90	0.9
		Item_9_Usefulness	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1

Table 6 (continued)

NO	EPA	ITEM	N Valid	N Missing	Mean	Median	SD	Skewness	Percentiles 25	Percentiles 50	Percentiles 75	IQR	Quartile deviation	Agreement %	I-CVI
10	Individual or small group teaching	Item_10_Clarity	10	0	3.9	4	0.32	−3.16	4	4	4	0	0.00	100	1
		Item_10_Relevance	10	0	3.9	4	0.32	−3.16	4	4	4	0	0.00	100	1
		Item_10_Comprehensiveness	10	0	4	4	0.00		4	4	4	0	0.00	100	1
		Item_10_Usefulness	10	0	4	4	0.00		4	4	4	0	0.00	100	1
11	Teaching laboratory classes and skills education	Item_11_Clarity	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1
		Item_11_Relevance	10	0	4	4	0.00		4	4	4	0	0.00	100	1
		Item_11_Comprehensiveness	10	0	4	4	0.00		4	4	4	0	0.00	100	1
		Item_11_Usefulness	10	0	4	4	0.00		4	4	4	0	0.00	100	1
12	Conducting Bedside/Chairside Teaching	Item_12_Clarity	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1
		Item_12_Relevance	10	0	3.9	4	0.32	−3.16	4	4	4	0	0.00	100	1
		Item_12_Comprehensiveness	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1
		Item_12_Usefulness	10	0	3.9	4	0.32	−3.16	4	4	4	0	0.00	100	1
13	Planning Bedside/ChairsideTeaching	Item_13_Clarity	10	0	3.7	4	0.48	−1.04	3	4	4	1	0.50	100	1
		Item_13_Relevance	10	0	3.6	4	0.52	−0.48	3	4	4	1	0.50	100	1
		Item_13_Comprehensiveness	10	0	3.7	4	0.48	−1.04	3	4	4	1	0.50	100	1
		Item_13_Usefulness	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1
14	Conducting Bedside/Chairside Teaching Assessment	Item_14_Clarity	10	0	3.6	4	0.70	−1.66	3	4	4	1	0.50	90	0.9
		Item_14_Relevance	10	0	3.7	4	0.67	−2.28	3.75	4	4	0.25	0.13	90	0.9
		Item_14_Comprehensiveness	10	0	3.5	4	0.71	−1.18	3	4	4	1	0.50	90	0.9
		Item_14_Usefulness	10	0	3.7	4	0.67	−2.28	3.75	4	4	0.25	0.13	90	0.9
15	Evaluating Bedside/Chairside Teaching	Item_15_Clarity	10	0	3.7	4	0.48	−1.04	3	4	4	1	0.50	100	1
		Item_15_Relevance	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1
		Item_15_Comprehensiveness	10	0	3.7	4	0.48	−1.04	3	4	4	1	0.50	100	1
		Item_15_Usefulness	10	0	3.6	4	0.52	−0.48	3	4	4	1	0.50	100	1
16	Learner centered bedside/chairside teaching	Item_16_Clarity	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1
		Item_16_Relevance	10	0	3.9	4	0.32	−3.16	4	4	4	0	0.00	100	1
		Item_16_Comprehensiveness	10	0	3.7	4	0.48	−1.04	3	4	4	1	0.50	100	1
		Item_16_Usefulness	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1
17	Role modelling (Consent, communication etc.)	Item_17_Clarity	10	0	3.6	4	0.52	−0.48	3	4	4	1	0.50	100	1
		Item_17_Relevance	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1
		Item_17_Comprehensiveness	10	0	3.7	4	0.48	−1.04	3	4	4	1	0.50	100	1
		Item_17_Usefulness	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1
18	Understanding Surgical Protocol (Surgical Scrub, Gowning and gloving, basic suturing skills, wound management)	Item_18_Clarity	10	0	3.9	4	0.32	−3.16	4	4	4	0	0.00	100	1
		Item_18_Relevance	10	0	3.9	4	0.32	−3.16	4	4	4	0	0.00	100	1
		Item_18_Comprehensiveness	10	0	3.9	4	0.32	−3.16	4	4	4	0	0.00	100	1
		Item_18_Usefulness	10	0	3.9	4	0.32	−3.16	4	4	4	0	0.00	100	1

Table 6 (continued)

NO	EPA	ITEM	N Valid	N Missing	Mean	Median	SD	Skewness	Percentiles 25	Percentiles 50	Percentiles 75	IQR	Quartile deviation	Agreement %	I-CVI
19	Implementing infection control	Item_19_Clarity	10	0	3.9	4	0.32	−3.16	4	4	4	0	0.00	100	1
		Item_19_Relevance	10	0	4	4	0.00		4	4	4	0	0.00	100	1
		Item_19_Comprehensiveness	10	0	3.9	4	0.32	−3.16	4	4	4	0	0.00	100	1
		Item_19_Usefulness	10	0	4	4	0.00		4	4	4	0	0.00	100	1
20	Conducting clinical audit	Item_20_Clarity	10	0	3.4	3.5	0.70	−0.78	3	3.5	4	1	1	90	0.9
		Item_20_Relevance	10	0	3.5	4	0.71	−1.18	3	4	4	1	0.50	90	0.9
		Item_20_Comprehensiveness	10	0	3.5	3.5	0.53	0.00	3	3.5	4	1	0.50	100	1
		Item_20_Usefulness	10	0	3.6	4	0.52	−0.48	3	4	4	1	0.50	100	1
21	Conducting case based discussion/problem based learning	Item_21_Clarity	10	0	4	4	0.00		4	4	4	0	0.00	100	1
		Item_21_Relevance	10	0	4	4	0.00		4	4	4	0	0.00	100	1
		Item_21_Comprehensiveness	10	0	3.9	4	0.32	−3.16	4	4	4	0	0.00	100	1
		Item_21_Usefulness	10	0	4	4	0.00		4	4	4	0	0.00	100	1
22	Outreach/community/Workplace based teaching	Item_22_Clarity	10	0	3.6	4	0.52	−0.48	3	4	4	1	0.50	100	1
		Item_22_Relevance	10	0	3.6	4	0.52	−0.48	3	4	4	1	0.50	100	1
		Item_22_Comprehensiveness	10	0	3.5	3.5	0.53	0.00	3	3.5	4	1	0.50	100	1
		Item_22_Usefulness	10	0	3.6	4	0.52	−0.48	3	4	4	1	0.50	100	1
23	Promote reflection practice	Item_23_Clarity	10	0	3.7	4	0.48	−1.04	3	4	4	1	0.50	100	1
		Item_23_Relevance	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1
		Item_23_Comprehensiveness	10	0	3.7	4	0.48	−1.04	3	4	4	1	0.50	100	1
		Item_23_Usefulness	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1
24	Involvement in Curriculum Development, Implementation, delivery and evaluation.	Item_24_Clarity	10	0	4	4	0.00		4	4	4	0	0.00	100	1
		Item_24_Relevance	10	0	4	4	0.00		4	4	4	0	0.00	100	1
		Item_24_Comprehensiveness	10	0	4	4	0.00		4	4	4	0	0.00	100	1
		Item_24_Usefulness	10	0	4	4	0.00		4	4	4	0	0.00	100	1
25	Understanding Curriculum Review	Item_25_Clarity	10	0	4	4	0.00		4	4	4	0	0.00	100	1
		Item_25_Relevance	10	0	4	4	0.00		4	4	4	0	0.00	100	1
		Item_25_Comprehensiveness	10	0	3.9	4	0.32	−3.16	4	4	4	0	0.00	100	1
		Item_25_Usefulness	10	0	4	4	0.00		4	4	4	0	0.00	100	1
26	Understanding different curriculum (conventional/mixed mode/coursework/research)	Item_26_Clarity	10	0	3.6	4	0.52	−0.48	3	4	4	1	0.50	100	1
		Item_26_Relevance	10	0	3.7	4	0.48	−1.04	3	4	4	1	0.50	100	1
		Item_26_Comprehensiveness	10	0	3.7	4	0.48	−1.04	3	4	4	1	0.50	100	1
		Item_26_Usefulness	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1
27	Developing a curriculum blueprint	Item_27_Clarity	10	0	3.6	4	0.52	−0.48	3	4	4	1	0.50	100	1
		Item_27_Relevance	10	0	3.9	4	0.32	−3.16	4	4	4	0	0.00	100	1
		Item_27_Comprehensiveness	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1
		Item_27_Usefulness	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1

Table 6 (continued)

NO	EPA	ITEM	N Valid	N Missing	Mean	Median	SD	Skewness	Percentiles 25	Percentiles 50	Percentiles 75	IQR	Quartile deviation	Agreement %	I-CVI
28	Designing and developing a course	Item_28_Clarity	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1
		Item_28_Relevance	10	0	3.9	4	0.32	−3.16	4	4	4	0	0.00	100	1
		Item_28_Comprehensiveness	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1
		Item_28_Usefulness	10	0	3.9	4	0.32	−3.16	4	4	4	0	0.00	100	1
29	Designing and developing instructional material/ media for a variety of teaching and learning contexts	Item_29_Clarity	10	0	3.7	4	0.48	−1.04	3	4	4	1	0.50	100	1
		Item_29_Relevance	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1
		Item_29_Comprehensiveness	10	0	3.7	4	0.48	−1.04	3	4	4	1	0.50	100	1
		Item_29_Usefulness	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1
30	Structuring and delivering instructional content	Item_30_Clarity	10	0	3.6	4	0.52	−0.48	3	4	4	1	0.50	100	1
		Item_30_Relevance	10	0	3.6	4	0.52	−0.48	3	4	4	1	0.50	100	1
		Item_30_Comprehensiveness	10	0	3.7	4	0.48	−1.04	3	4	4	1	0.50	100	1
		Item_30_Usefulness	10	0	3.6	4	0.52	−0.48	3	4	4	1	0.50	100	1
31	Evaluating and refining educational materials/media	Item_31_Clarity	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1
		Item_31_Relevance	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1
		Item_31_Comprehensiveness	10	0	3.6	4	0.52	−0.48	3	4	4	1	0.50	100	1
		Item_31_Usefulness	10	0	3.6	4	0.52	−0.48	3	4	4	1	0.50	100	1
32	Integrating Innovation in Instructional Design	Item_32_Clarity	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1
		Item_32_Relevance	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1
		Item_32_Comprehensiveness	10	0	3.7	4	0.48	−1.04	3	4	4	1	0.50	100	1
		Item_32_Usefulness	10	0	3.7	4	0.48	−1.04	3	4	4	1	0.50	100	1
33	Developing, administrating test and establishing results	Item_33_Clarity	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1
		Item_33_Relevance	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1
		Item_33_Comprehensiveness	10	0	3.9	4	0.32	−3.16	4	4	4	0	0.00	100	1
		Item_33_Usefulness	10	0	3.9	4	0.32	−3.16	4	4	4	0	0.00	100	1
34	Assessing written work of students	Item_34_Clarity	10	0	3.7	4	0.48	−1.04	3	4	4	1	0.50	100	1
		Item_34_Relevance	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1
		Item_34_Comprehensiveness	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1
		Item_34_Usefulness	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1
35	Evaluating assessment outcome attainment	Item_35_Clarity	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1
		Item_35_Relevance	10	0	3.9	4	0.32	−3.16	4	4	4	0	0.00	100	1
		Item_35_Comprehensiveness	10	0	3.7	4	0.48	−1.04	3	4	4	1	0.50	100	1
		Item_35_Usefulness	10	0	3.9	4	0.32	−3.16	4	4	4	0	0.00	100	1
36	Conducting item analysis	Item_36_Clarity	10	0	4	4	0.00		4	4	4	0	0.00	100	1
		Item_36_Relevance	10	0	4	4	0.00		4	4	4	0	0.00	100	1
		Item_36_Comprehensiveness	10	0	3.9	4	0.32	−3.16	4	4	4	0	0.00	100	1
		Item_36_Usefulness	10	0	3.9	4	0.32	−3.16	4	4	4	0	0.00	100	1

Table 6 (continued)

NO	EPA	ITEM	N Valid	Missing	Mean	Median	SD	Skewness	Percentiles 25	50	75	IQR	Quartile deviation	Agreement %	I-CVI
37	Understanding de-briefing technique	Item_37_Clarity	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1
		Item_37_Relevance	10	0	3.9	4	0.32	−3.16	4	4	4	0	0.00	100	1
		Item_37_Comprehensiveness	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1
		Item_37_Usefulness	10	0	3.9	4	0.32	−3.16	4	4	4	0	0.00	100	1
38	Enhancing assessment feedback quality (constructive and timely)	Item_38_Clarity	10	0	3.7	4	0.48	−1.04	3	4	4	1	0.50	100	1
		Item_38_Relevance	10	0	3.6	4	0.52	−0.48	3	4	4	1	0.50	100	1
		Item_38_Comprehensiveness	10	0	3.6	4	0.52	−0.48	3	4	4	1	0.50	100	1
		Item_38_Usefulness	10	0	3.5	3.5	0.53	0.00	3	3.5	4	1	0.50	100	1
39	Calibrating, applying and revising student assessment systems	Item_39_Clarity	10	0	3.7	4	0.48	−1.04	3	4	4	1	0.50	100	1
		Item_39_Relevance	10	0	3.9	4	0.32	−3.16	4	4	4	0	0.00	100	1
		Item_39_Comprehensiveness	10	0	3.6	4	0.52	−0.48	3	4	4	1	0.50	100	1
		Item_39_Usefulness	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1
40	Understanding methods of evaluation to the principles educational programme	Item_40_Clarity	10	0	3.7	4	0.48	−1.04	3	4	4	1	0.50	100	1
		Item_40_Relevance	10	0	3.9	4	0.32	−3.16	4	4	4	0	0.00	100	1
		Item_40_Comprehensiveness	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1
		Item_40_Usefulness	10	0	3.9	4	0.32	−3.16	4	4	4	0	0.00	100	1
41	Conducting educational needs assessments	Item_41_Clarity	10	0	3.9	4	0.32	−3.16	4	4	4	0	0.00	100	1
		Item_41_Relevance	10	0	3.9	4	0.32	−3.16	4	4	4	0	0.00	100	1
		Item_41_Comprehensiveness	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1
		Item_41_Usefulness	10	0	3.9	4	0.32	−3.16	4	4	4	0	0.00	100	1
42	Teacher and teaching evaluation	Item_42_Clarity	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1
		Item_42_Relevance	10	0	3.9	4	0.32	−3.16	4	4	4	0	0.00	100	1
		Item_42_Comprehensiveness	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1
		Item_42_Usefulness	10	0	3.9	4	0.32	−3.16	4	4	4	0	0.00	100	1
43	Exercising self-review	Item_43_Clarity	10	0	3.7	4	0.48	−1.04	3	4	4	1	0.50	100	1
		Item_43_Relevance	10	0	3.7	4	0.48	−1.04	3	4	4	1	0.50	100	1
		Item_43_Comprehensiveness	10	0	3.7	4	0.48	−1.04	3	4	4	1	0.50	100	1
		Item_43_Usefulness	10	0	3.7	4	0.48	−1.04	3	4	4	1	0.50	100	1
44	Evaluating curriculum effectiveness	Item_44_Clarity	10	0	4	4	0.47	0.00	4	4	4	0	0.00	100	1
		Item_44_Relevance	10	0	4	4	0.47	0.00	4	4	4	0	0.00	100	1
		Item_44_Comprehensiveness	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1
		Item_44_Usefulness	10	0	3.9	4	0.32	−3.16	4	4	4	0	0.00	100	1
45	Evaluating course learning outcomes	Item_45_Clarity	10	0	3.9	4	0.32	−3.16	4	4	4	0	0.00	100	1
		Item_45_Relevance	10	0	4	4	0.00		4	4	4	0	0.00	100	1
		Item_45_Comprehensiveness	10	0	3.9	4	0.32	−3.16	4	4	4	0	0.00	100	1
		Item_45_Usefulness	10	0	4	4	0.00		4	4	4	0	0.00	100	1

Table 6 (continued)

NO	EPA	ITEM	N Valid	N Missing	Mean	Median	SD	Skewness	Percentiles 25	50	75	IQR	Quartile deviation	Agreement %	I-CVI
46	Evaluating program learning outcomes	Item_46_Clarity	10	0	3.9	4	0.32	−3.16	4	4	4	0	0.00	100	1
		Item_46_Relevance	10	0	3.9	4	0.32	−3.16	4	4	4	0	0.00	100	1
		Item_46_Comprehensiveness	10	0	3.9	4	0.32	−3.16	4	4	4	0	0.00	100	1
		Item_46_Usefulness	10	0	3.9	4	0.32	−3.16	4	4	4	0	0.00	100	1
47	Supporting learner growth and professional well being	Item_47_Clarity	10	0	3.7	4	0.48	−1.04	3	4	4	1	0.50	100	1
		Item_47_Relevance	10	0	3.7	4	0.48	−1.04	3	4	4	1	0.50	100	1
		Item_47_Comprehensiveness	10	0	3.6	4	0.70	−1.66	3	4	4	1	0.50	90	0.9
		Item_47_Usefulness	10	0	3.7	4	0.48	−1.04	3	4	4	1	0.50	100	1
48	Identifying and addressing learning difficulties	Item_48_Clarity_	10	0	3.9	4	0.32	−3.16	4	4	4	0	0.00	100	1
		Item_48_Relevance_	10	0	3.9	4	0.32	−3.16	4	4	4	0	0.00	100	1
		Item_48_Comprehensiv	10	0	3.7	4	0.48	−1.04	3	4	4	1	0.50	100	1
		Item_48_Usefulness_	10	0	3.9	4	0.32	−3.16	4	4	4	0	0.00	100	1
49	Providing effective feedback	Item_49_Clarity	10	0	3.9	4	0.32	−3.16	4	4	4	0	0.00	100	1
		Item_49_Relevance	10	0	4	4	0.00		4	4	4	0	0.00	100	1
		Item_49_Comprehensiveness	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1
		Item_49_Usefulness	10	0	3.9	4	0.32	−3.16	4	4	4	0	0.00	100	1
50	Identifying and customizing educational support for marginalized students	Item_50_Clarity	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1
		Item_50_Relevance	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1
		Item_50_Comprehensiveness	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1
		Item_50_Usefulness	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1
51	Monitoring of student's behavioural change	Item_51_Clarity	10	0	3.7	4	0.48	−1.04	3	4	4	1	0.50	100	1
		Item_51_Relevance	10	0	3.7	4	0.48	−1.04	3	4	4	1	0.50	100	1
		Item_51_Comprehensiveness	10	0	3.6	4	0.52	−0.48	3	4	4	1	0.50	100	1
		Item_51_Usefulness	10	0	3.9	4	0.32	−3.16	4	4	4	0	0.00	100	1
52	Mentoring & monitoring students academic progress	Item_52_Clarity	10	0	4	4	0.00		4	4	4	0	0.00	100	1
		Item_52_Relevance	10	0	4	4	0.00		4	4	4	0	0.00	100	1
		Item_52_Comprehensiveness	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1
		Item_52_Usefulness	10	0	3.9	4	0.32	−3.16	4	4	4	0	0.00	100	1
53	Designing, applying and revising educational quality assurance	Item_53_Clarity	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1
		Item_53_Relevance	10	0	3.9	4	0.32	−3.16	4	4	4	0	0.00	100	1
		Item_53_Comprehensiveness	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1
		Item_53_Usefulness	10	0	3.9	4	0.32	−3.16	4	4	4	0	0.00	100	1
54	Understanding accreditation and compliance management	Item_54_Clarity	10	0	3.9	4	0.32	−3.16	4	4	4	0	0.00	100	1
		Item_54_Relevance	10	0	3.9	4	0.32	−3.16	4	4	4	0	0.00	100	1
		Item_54_Comprehensiveness	10	0	3.9	4	0.32	−3.16	4	4	4	0	0.00	100	1
		Item_54_Usefulness	10	0	3.9	4	0.32	−3.16	4	4	4	0	0.00	100	1

Table 6 (continued)

NO	EPA	ITEM	N Valid	N Missing	Mean	Median	SD	Skewness	25	50	75	IQR	Quartile deviation	Agreement %	I-CVI
55	Understanding the requirements of the national quality assurance and regulatory bodies	Item_55_Clarity	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1
		Item_55_Relevance	10	0	3.9	4	0.32	−3.16	4	4	4	0	0.00	100	1
		Item_55_Comprehensiveness	10	0	3.9	4	0.32	−3.16	4	4	4	0	0.00	100	1
		Item_55_Usefulness	10	0	3.9	4	0.32	−3.16	4	4	4	0	0.00	100	1
56	Involvement in institutional and faculty development for quality assurance	Item_56_Clarity	10	0	3.6	4	0.52	−0.48	3	4	4	1	1	100	1
		Item_56_Relevance	10	0	3.7	4	0.48	−1.04	3	4	4	1	0.50	100	1
		Item_56_Comprehensiveness	10	0	3.7	4	0.48	−1.04	3	4	4	1	0.50	100	1
		Item_56_Usefulness	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1
57	Involvement in continuous quality improvement	Item_57_Clarity	10	0	3.9	4	0.32	−3.16	4	4	4	0	0.00	100	1
		Item_57_Relevance	10	0	4	4	0.00		4	4	4	0	0.00	100	1
		Item_57_Comprehensiveness	10	0	3.9	4	0.32	−3.16	4	4	4	0	0.00	100	1
		Item_57_Usefulness	10	0	4	4	0.00		4	4	4	0	0.00	100	1
58	Developing study plan	Item_58_Clarity	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1
		Item_58_Relevance	10	0	3.9	4	0.32	−3.16	4	4	4	0	0.00	100	1
		Item_58_Comprehensiveness	10	0	3.7	4	0.48	−1.04	3	4	4	1	0.50	100	1
		Item_58_Usefulness	10	0	3.7	4	0.48	−1.04	3	4	4	1	0.50	100	1
59	Matching the educational curriculum with the country's higher education policy	Item_59_Clarity	10	0	3.9	4	0.32	−3.16	4	4	4	0	0.00	100	1
		Item_59_Relevance	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1
		Item_59_Comprehensiveness	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1
		Item_59_Usefulness	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1
60	*Leading strategic association/society	Item_60_Clarity	10	0	3.3	3.5	0.82	−0.69	2.75	3.5	4	1.25	0.63	80	0.8
		Item_60_Relevance	10	0	3.3	3	0.67	−0.43	3	3	4	1	0.50	90	0.9
		Item_60_Comprehensiveness	10	0	3.1	3	0.88	−0.22	2	3	4	2	1.00	*70	*0.7
		Item_60_Usefulness	10	0	3.3	3	0.67	−0.43	3	3	4	1	0.50	90	0.9
61	Involvement in strategic education projects/policy developments	Item_61_Clarity	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1
		Item_61_Relevance	10	0	3.7	4	0.48	−1.04	3	4	4	1	0.50	100	1
		Item_61_Comprehensiveness	10	0	3.5	4	0.71	−1.18	3	4	4	1	0.50	90	0.9
		Item_61_Usefulness	10	0	3.6	4	0.52	−0.48	3	4	4	1	0.50	100	1
62	Demonstrating ethical and professional conduct	Item_62_Clarity	10	0	4	4	0.00		4	4	4	0	0.00	100	1
		Item_62_Relevance	10	0	4	4	0.00		4	4	4	0	0.00	100	1
		Item_62_Comprehensiveness	10	0	3.9	4	0.32	−3.16	4	4	4	0	0.00	100	1
		Item_62_Usefulness	10	0	4	4	0.00		4	4	4	0	0.00	100	1
63	Engaging in continuous professional development	Item_63_Clarity	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1
		Item_63_Relevance	10	0	3.9	4	0.32	−3.16	4	4	4	0	0.00	100	1
		Item_63_Comprehensiveness	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1
		Item_63_Usefulness	10	0	3.9	4	0.32	−3.16	4	4	4	0	0.00	100	1

Table 6 (continued)

NO	EPA	ITEM	N Valid	N Missing	Mean	Median	SD	Skewness	Percentiles 25	50	75	IQR	Quartile deviation	Agreement %	I-CVI
64	Respecting and maintaining professional boundaries	Item_64_Clarity	10	0	4	4	0.00		4	4	4	0	0.00	100	1
		Item_64_Relevance	10	0	4	4	0.00		4	4	4	0	0.00	100	1
		Item_64_Comprehensiveness	10	0	3.9	4	0.32	−3.16	4	4	4	0	0.00	100	1
		Item_64_Usefulness	10	0	4	4	0.00		4	4	4	0	0.00	100	1
65	Maintaining effective communication	Item_65_Clarity	10	0	3.9	4	0.32	−3.16	4	4	4	0	0.00	100	1
		Item_65_Relevance	10	0	4	4	0.00		4	4	4	0	0.00	100	1
		Item_65_Comprehensiveness	10	0	3.9	4	0.32	−3.16	4	4	4	0	0.00	100	1
		Item_65_Usefulness	10	0	4	4	0.00		4	4	4	0	0.00	100	1
66	Practicing good team-work	Item_66_Clarity	10	0	3.9	4	0.32	−3.16	4	4	4	0	0.00	100	1
		Item_66_Relevance	10	0	4	4	0.00		4	4	4	0	0.00	100	1
		Item_66_Comprehensiveness	10	0	3.9	4	0.32	−3.16	4	4	4	0	0.00	100	1
		Item_66_Usefulness	10	0	4	4	0.00		4	4	4	0	0.00	100	1
67	Understanding patient centered approach	Item_67_Clarity	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1
		Item_67_Relevance	10	0	3.9	4	0.32	−3.16	4	4	4	0	0.00	100	1
		Item_67_Comprehensiveness	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1
		Item_67_Usefulness	10	0	3.9	4	0.32	−3.16	4	4	4	0	0.00	100	1
68	Teaching and assessing clinical competency in patient care	Item_68_Clarity	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1
		Item_68_Relevance	10	0	3.9	4	0.32	−3.16	4	4	4	0	0.00	100	1
		Item_68_Comprehensiveness	10	0	3.7	4	0.48	−1.04	3	4	4	1	0.50	100	1
		Item_68_Usefulness	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1
69	Enhancing interprofessional collaboration in healthcare	Item_69_Clarity	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1
		Item_69_Relevance	10	0	3.9	4	0.32	−3.16	4	4	4	0	0.00	100	1
		Item_69_Comprehensiveness	10	0	3.7	4	0.48	−1.04	3	4	4	1	0.50	100	1
		Item_69_Usefulness	10	0	3.7	4	0.48	−1.04	3	4	4	1	0.50	100	1
70	Understanding ethical, legal, and culturally competent care	Item_70_Clarity	10	0	3.7	4	0.48	−1.04	3	4	4	1	0.50	100	1
		Item_70_Relevance	10	0	3.9	4	0.32	−3.16	4	4	4	0	0.00	100	1
		Item_70_Comprehensiveness	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1
		Item_70_Usefulness	10	0	3.9	4	0.32	−3.16	4	4	4	0	0.00	100	1
71	Imparting public health and community-based dental care	Item_71_Clarity	10	0	3.7	4	0.48	−1.04	3	4	4	1	0.50	100	1
		Item_71_Relevance	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1
		Item_71_Comprehensiveness	10	0	3.6	4	0.52	−0.48	3	4	4	1	0.50	100	1
		Item_71_Usefulness	10	0	3.7	4	0.48	−1.04	3	4	4	1	0.50	100	1
72	Preparing students for evidence-based decision-making in patient care	Item_72_Clarity	10	0	3.9	4	0.32	−3.16	4	4	4	0	0.00	100	1
		Item_72_Relevance	10	0	3.9	4	0.32	−3.16	4	4	4	0	0.00	100	1
		Item_72_Comprehensiveness	10	0	3.7	4	0.48	−1.04	3	4	4	1	0.50	100	1
		Item_72_Usefulness	10	0	3.9	4	0.32	−3.16	4	4	4	0	0.00	100	1

Table 6 (continued)

NO	EPA	ITEM	N Valid	N Missing	Mean	Median	SD	Skewness	Percentiles 25	Percentiles 50	Percentiles 75	IQR	Quartile deviation	Agreement %	I-CVI
73	Embracing technology in patient management	Item_73_Clarity	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1
		Item_73_Relevance	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1
		Item_73_Comprehensiveness	10	0	3.6	4	0.52	−0.48	3	4	4	1	0.50	100	1
		Item_73_Usefulness	10	0	3.7	4	0.48	−1.04	3	4	4	1	0.50	100	1
74	Writing educational research proposal	Item_74_Clarity	10	0	3.7	4	0.48	−1.04	3	4	4	1	0.50	100	1
		Item_74_Relevance	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1
		Item_74_Comprehensiveness	10	0	3.6	4	0.52	−0.48	3	4	4	1	0.50	100	1
		Item_74_Usefulness	10	0	3.7	4	0.48	−1.04	3	4	4	1	0.50	100	1
75	Understanding research methodology	Item_75_Clarity	10	0	3.9	4	0.32	−3.16	4	4	4	0	0.00	100	1
		Item_75_Relevance	10	0	3.9	4	0.32	−3.16	4	4	4	0	0.00	100	1
		Item_75_Comprehensiveness	10	0	3.7	4	0.48	−1.04	3	4	4	1	0.50	100	1
		Item_75_Usefulness	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1
76	Conducting qualitative/quantitative/mixed mode/ consensus educational research	Item_76_Clarity	10	0	3.7	4	0.48	−1.04	3	4	4	1	0.50	100	1
		Item_76_Relevance	10	0	3.7	4	0.48	−1.04	3	4	4	1	0.50	100	1
		Item_76_Comprehensiveness	10	0	3.6	4	0.52	−0.48	3	4	4	1	0.50	100	1
		Item_76_Usefulness	10	0	3.7	4	0.48	−1.04	3	4	4	1	0.50	100	1
77	Writing and publishing empirical research reports	Item_77_Clarity	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1
		Item_77_Relevance	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1
		Item_77_Comprehensiveness	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1
		Item_77_Usefulness	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1
78	Conducting and publishing literature reviews	Item_78_Clarity	10	0	3.6	4	0.52	−0.48	3	4	4	1	0.50	100	1
		Item_78_Relevance	10	0	3.6	4	0.52	−0.48	3	4	4	1	0.50	100	1
		Item_78_Comprehensiveness	10	0	3.4	3.5	0.70	−0.78	3	3.5	4	1	0.50	90	0.9
		Item_78_Usefulness	10	0	3.6	4	0.52	−0.48	3	4	4	1	0.50	100	1
79	Presenting at conferences and other meetings	Item_79_Clarity	10	0	3.7	4	0.48	−1.04	3	4	4	1	0.50	100	1
		Item_79_Relevance	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1
		Item_79_Comprehensiveness	10	0	3.6	4	0.70	−1.66	3	4	4	1	0.50	90	0.9
		Item_79_Usefulness	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1
80	Peer reviewing and editing	Item_80_Clarity	10	0	3.7	4	0.48	−1.04	3	4	4	1	0.50	100	1
		Item_80_Relevance	10	0	3.8	4	0.42	−1.78	3.75	4	4	0.25	0.13	100	1
		Item_80_Comprehensiveness	10	0	3.7	4	0.48	−1.04	3	4	4	1	0.50	100	1
		Item_80_Usefulness	10	0	3.6	4	0.52	−0.48	3	4	4	1	0.50	100	1
81	Exposure to intellectual properties	Item_81_Clarity	10	0	3.6	4	0.52	−0.48	3	4	4	1	0.50	100	1
		Item_81_Relevance	10	0	3.6	4	0.52	−0.48	3	4	4	1	0.50	100	1
		Item_81_Comprehensiveness	10	0	3.5	4	0.71	−1.18	3	4	4	1	0.50	90	0.9
		Item_81_Usefulness	10	0	3.7	4	0.48	−1.04	3	4	4	1	0.50	100	1

Table 7 Consensus and Scale-Level content validity indices of EPA ratings for Delphi round 2. This table summarizes the outcomes of the second Delphi round: 1 EPA was eliminated (marked in bold). S-CVI/Ave = average of all I-CVI values across the scale; threshold for validity of > 0.80 is considered acceptable for good content validity. S-CVI/UA = proportion of items with universal agreement

	DOMAIN OF COMPETENCES	EPA	Consensus	S-CVI/Ave	S-CVI/ UA
1	Educational Theories and Principles [8]	EPA 1: Understanding various contemporary teaching and learning methods (Lectures, PBL, practical, clinical, online, reflection)	Accepted	0.99	0.97
		EPA 2: Understanding Teaching Pedagogy	Accepted		
		EPA 3: Understanding Student centred learning	Accepted		
		EPA 4: Understanding Outcome-based education	Accepted		
		EPA 5: Understanding Competency-based education	Accepted		
		EPA 6: Understanding various learning styles : visual, auditory, reading/writing and kinesthetic (VARK/KOLB's)	Accepted		
		EPA 7: Mentoring and coaching	Accepted		
		EPA 8: Be familiar with digital or internet-mediated learning	Accepted		
2	Modes of Education [15]	EPA 9: Lecturing	Accepted	0.99	0.88
		EPA 10: Individual or small group teaching	Accepted		
		EPA 11: Teaching laboratory classes and skills education	Accepted		
		EPA 12: Conducting bedside/chairside teaching	Accepted		
		EPA 13: Planning bedside/chairside teaching	Accepted		
		EPA 14: Conducting bedside/chairside teaching assessment	Accepted		
		EPA 15: Evaluating bedside/chairside teaching	Accepted		
		EPA 16: Learner centered bedside/chairside teaching	Accepted		
		EPA 17: Role modelling (Consent, communication etc.)	Accepted		
		EPA 18: Understanding surgical protocol (Surgical Scrub, gowning and gloving, basic suturing skills, wound management)	Accepted		
		EPA 19: Implementing infection control	Accepted		
		EPA 20: Conducting clinical audit	Accepted		
		EPA 21: Conducting case based discussion/problem based learning	Accepted		
		EPA 22: Outreach/community/workplace based teaching	Accepted		
		EPA 23: Promote reflection practice	Accepted		
3	Curriculum Matters [5]	EPA 24: Involvement in curriculum development, implementation, delivery and evaluation.	Accepted	1.00	1.00
		EPA 25: Understanding curriculum review	Accepted		
		EPA 26: Understanding different curriculum (conventional/mixed mode/ coursework/research)	Accepted		
		EPA 27: Developing a curriculum blueprint	Accepted		
		EPA 28: Designing and developing a course	Accepted		
4	Educational Materials and Instructional Design [4]	EPA 29: Designing and developing instructional material/media for a variety of teaching and learning contexts	Accepted	1.00	1.00
		EPA 30: Structuring and delivering instructional content	Accepted		
		EPA 31: Evaluating and refining educational materials/media	Accepted		
		EPA 32: Integrating innovation in instructional design	Accepted		
5	Assessment [7]	EPA 33: Developing, administrating test and establishing results	Accepted	1.00	1.00
		EPA 34: Assessing written work of students	Accepted		
		EPA 35: Evaluating assessment outcome attainment	Accepted		
		EPA 36: Conducting item analysis	Accepted		
		EPA 37: Understanding De-briefing technique	Accepted		
		EPA 38: Enhancing assessment feedback quality (constructive and timely)	Accepted		
		EPA 39: Calibrating, applying and revising student assessment systems	Accepted		

Table 7 (continued)

	DOMAIN OF COMPETENCES	EPA	Consensus	S-CVI/Ave	S-CVI/ UA
6	Evaluation [7]	EPA 40: Understanding methods of evaluation to the principles educational programme	Accepted	1.00	1.00
		EPA 41: Conducting educational needs assessments	Accepted		
		EPA 42: Teacher and teaching evaluation	Accepted		
		EPA 43: Exercising self-review	Accepted		
		EPA 44: Evaluating curriculum effectiveness	Accepted		
		EPA 45: Evaluating course learning outcomes	Accepted		
		EPA 46: Evaluating program learning outcomes	Accepted		
7	Learner's Issue [6]	EPA 47: Supporting learner growth and professional well being	Accepted	1.00	0.96
		EPA 48: Identifying and addressing learning difficulties	Accepted		
		EPA 49: Providing effective feedback	Accepted		
		EPA 50: Identifying and customizing educational support for marginalized students	Accepted		
		EPA 51: Monitoring of student's behavioural change	Accepted		
		EPA 52: Mentoring & monitoring students academic progress	Accepted		
8	Quality Assurance [5]	EPA 53: Designing, applying and revising educational quality assurance	Accepted	1.00	1.00
		EPA 54: Understanding accreditation and compliance management	Accepted		
		EPA 55: Understanding the requirements of the national quality assurance and regulatory bodies	Accepted		
		EPA 56: Involvement in institutional and faculty development for quality assurance	Accepted		
		EPA 57: Involvement in continuous quality improvement	Accepted		
9	Educational Management [4]	EPA 58: Developing study plan	Accepted	0.95	0.69
		EPA 59: Matching the educational curriculum with the country's higher education policy	Accepted		
		EPA 60: Leading strategic association/society	**Eliminated**		
		EPA 61: Involvement in strategic education projects/policy developments	Accepted		
10	Professionalism [5]	EPA 62: Demonstrating ethical and professional conduct	Accepted	1.00	1.00
		EPA 63: Engaging in continuous professional development	Accepted		
		EPA 64: Respecting and maintaining professional boundaries	Accepted		
		EPA 65: Maintaining effective communication	Accepted		
		EPA 66: Practicing good team-work	Accepted		
11	Patient Care and Healthcare System [7]	EPA 67: Understanding patient centered approach	Accepted	1.00	1.00
		EPA 68: Teaching and assessing clinical competency in patient care	Accepted		
		EPA 69: Enhancing interprofessional collaboration in healthcare	Accepted		
		EPA 70: Understanding ethical, legal, and culturally competent care	Accepted		
		EPA 71: Imparting public health and community-based dental care	Accepted		
		EPA 72: Preparing students for evidence-based decision-making in patient care	Accepted		
		EPA 73: Embracing technology in patient management	Accepted		
12	Research and scholarships [8]	EPA 74: Writing educational research proposal	Accepted	0.99	0.91
		EPA 75: Understanding research methodology	Accepted		
		EPA 76: Conducting qualitative/quantitative/mixed mode/consensus educational research	Accepted		
		EPA 77: Writing and publishing empirical research reports	Accepted		
		EPA 78: Conducting and publishing literature reviews	Accepted		
		EPA 79: Presenting at conferences and other meetings	Accepted		
		EPA 80: Peer reviewing and editing	Accepted		
		EPA 81: Exposure to intellectual properties	Accepted		

Table 8 EPA consolidated in round 3 (9EPAs to 3EPAs)

NO	EPA	Consolidated to:
12	Conducting Bedside/Chairside Teaching	Teaching in clinical setting
13	Planning Bedside/Chairside Teaching	
14	Conducting Bedside/Chairside Teaching Assessment	
15	Evaluating Bedside/Chairside Teaching	
16	Learner Centered Bedside/Chairside Teaching	
47	Supporting Learner Growth and Professional Well Being	Supporting Learner Growth and professional well-being (including marginalised and underserved student)
50	Identifying and Customizing Educational Support for Marginalized Students	
54	Understanding Accreditation and Compliance Management	Understanding Accreditation and Compliance Management of regulatory bodies
55	Understanding the Requirements of the National Quality Assurance and regulatory bodies	

Table 9 6 EPAs eliminated in round 3

NO	EPA	Main reason for elimination	Quotes
37	Understanding De-briefing technique	Overlapped with EPA Reflection	[P4]: Reflection is the things that are more familiar in our field. Reflection and giving feedback that is more simple terms to be used rather than debriefing technique.
40	Understanding methods of evaluation to the principles educational programme	Overlapped with Domain 1	[P3]: Because when you talk already earlier in domain 1, they should know understanding of everything, isn't it? Principles and…
51	Monitoring of student's behavioural change	Not readily attainable by all dental educators/ Implementation issue	[P1]: Not all mentor can pick up the behaviour change also. The challenge would be on the implementation part. Importance is there but the implementation part is challenging. [P3]: Yeah. Again. Because (EPA47) might encompass the professional well-being of the students.
53	Designing, applying and revising educational quality assurance	Overlapped with EPA 56 "Involvement in institutional and Faculty Development for Quality Assurance"	[P4]: Repetition of 56
63	Respecting and Maintaining Professional Boundaries	Overlapped with EPA 61"Demonstrating Ethical and Professional Conduct"	[P3]: 61 and 63, how does it differs? [P5]: Yeah, I would say the same. [P3]: So, you can just keep 61 rather than having the 63.
77	Conducting and publishing literature reviews	Can be inclusive in EPA75 "Conducting qualitative/quantitative/mixed mode/consensus research'	[P3]: You don't need to be very specific to literature review alone. One should understand that literature comes together with the research.

Future directions

Following the development of this consensus-based EPA framework for dental educators, the next essential step will be to pilot the EPAs in real-world academic settings. This phase will facilitate the evaluation of their applicability, feasibility, sensitivity, and specificity in assessing educator performance, while also providing insights into their effectiveness in distinguishing between different levels of competence and guiding entrustment decisions. Piloting will further enable the translation of the EPA framework into a structured assessment scheme, incorporating refined performance descriptors and thresholds to support both formative and summative evaluations of academic roles and responsibilities. While the identification of 68 EPAs represents a comprehensive starting point, it may also pose challenges for governance, including rater training and portfolio management. Therefore, pilot testing will be critical to assess practicality. This process will further clarify whether the EPAs should function as a universal set or be organized into role-based tracks or subsets, ultimately supporting the development of a streamlined 'core' EPA set with optional, locally adaptable extensions, enabling programs to envision feasible implementation strategies.

Table 10 EPA version 4.0 – Final outcome of the modified Delphi technique outlining 68 EPAs consolidated in 12 domains of competencies for dental educators

68 EPA VERSION 4.0			
DOMAIN NO	DOMAIN OF COMPETENCES	EPA NO	EPA
1	Educational Theories and Principles (8)	1	Comprehend various contemporary teaching and learning methods (Lectures, PBL, practical, clinical, online, reflection)
		2	Comprehend teaching pedagogy
		3	Comprehend student centred learning
		4	Comprehend outcome-based education
		5	Comprehend competency-based education
		6	Comprehend various learning styles : visual, auditory, reading/writing and kinaesthetic (VARK/KOLB's)
		7	Comprehend mentoring and coaching
		8	Be familiar with digital or internet-mediated learning
2	Educational Practices (11)	9	Lecturing
		10	Perform Individual or small group teaching
		11	Perform laboratory classes and skills education teaching
		12	Teaching in clinical setting
		13	Display role modelling (Consent, communication etc.)
		14	Follow surgical protocol (Surgical Scrub, gowning and gloving, basic suturing skills, wound management)
		15	Follow infection control
		16	Conducting clinical audit
		17	Conducting case based discussion/problem based learning
		18	Perform outreach/community/workplace based teaching
		19	Perform reflection practice
3	Educational Materials and Instructional Design (4)	20	Designing and developing instructional material/media for a variety of teaching and learning contexts
		21	Delivering instructional content
		22	Evaluating and refining educational materials/media
		23	Integrating innovation with element of technology in instructional design
4	Assessment (6)	24	Developing, administrating test and establishing results
		25	Assessing students work across written/oral/practical/clinical modalities
		26	Conducting item analysis
		27	Evaluating assessment outcome attainment
		28	Enhancing assessment feedback quality (constructive and timely)
		29	Calibrating, applying and revising student assessment systems
5	Curriculum Matters (6)	30	Comprehend different curriculum structure (conventional/mixed mode/coursework/research)
		31	Comprehend curriculum review
		32	Involvement in curriculum development, implementation and delivery (execution of curriculum)
		33	Designing and developing a course
		34	Developing a curriculum blueprint
		35	Developing study plan
6	Evaluation (6)	36	Conducting programme educational needs assessments
		37	Evaluating educator and teaching methods
		38	Exercising self-review
		39	Evaluating course learning outcomes
		40	Evaluating program learning outcomes
		41	Evaluating curriculum effectiveness
7	Educational Management (2)	42	Matching the educational curriculum with the country's higher education policy
		43	Involvement in strategic education projects/policy developments
8	Quality and Accreditation (3)	44	Understanding accreditation and compliance management of regulatory bodies
		45	Involvement in institutional and faculty development for quality assurance
		46	Involvement in continuous quality improvement
9	Learner's Issue (4)	47	Supporting learner growth and professional well-being (including marginalised and underserved student)
		48	Identifying and addressing learning difficulties
		49	Providing effective feedback
		50	Mentoring & monitoring students' academic progress

Table 10 (continued)

68 EPA VERSION 4.0			
10	Research and scholarships (7)	51	Comprehend research methodology
		52	Writing research proposal
		53	Conducting qualitative/quantitative/mixed mode/consensus research
		54	Writing and publishing research output
		55	Presenting at conferences and other meetings
		56	Peer reviewing and editing
		57	Exposure to intellectual properties
11	Patient Care and Healthcare System (7)	58	Understanding patient centred approach
		59	Teaching and assessing clinical competency in patient care
		60	Enhancing interprofessional collaboration in healthcare
		61	Understanding ethical, legal, and culturally competent care
		62	Imparting public health and community-based dental care
		63	Preparing students for evidence-based decision-making in patient care
		64	Embracing technology in patient management
12	Professionalism (4)	65	Demonstrating ethical and professional conduct
		66	Engaging in continuous professional development
		67	Maintaining effective communication
		68	Practicing good team-work

Conclusion

This study successfully developed a validated and consensus-based set of 68 EPAs tailored for dental educators, addressing a critical gap in the current literature. Through structured, three-round Modified Delphi process of iterative expert input and thematic analysis, the final EPA framework was developed to reflect the complex and multifaceted roles of dental educators across diverse domains. This validated set of EPAs serves as a foundational tool to support professional development, performance assessment, and role clarification within academic dental institutions.

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12909-025-08119-1.

> Supplementary Material 1.

Authors' contributions

NAB conducted the initial research, which was reviewed by all co-authors (MSBY, NSR, and MIAH). All authors were actively involved in the discussions and execution of the three rounds of the Modified Delphi Technique. These discussions ensured the rigor and triangulation of the data. The manuscript was primarily authored by NAB, with MSBY, NSR, and MIAH providing critical oversight and guidance throughout the writing process. The final version of the manuscript was reviewed, commented on, and approved by all authors prior to submission.

Declarations

Ethics approval and consent to participate

This study received ethical approval from the Human Research Ethics Committee of Universiti Sains Malaysia (HREC), under the reference code: USM/JEPeM/KK/24030224 and adhered to the Declaration of Helsinki.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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