Standards for Scaffolding in Health Sciences Programmes: A Delphi Consensus Study

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ABSTRACT

INTRODUCTION: Health sciences programmes operate in complex, unpredictable contexts, underscoring the need for comprehensive scaffolding of the learning processes. Yet, the scaffolding approaches remain fragmented, and lack a shared approach to how programmes could integrate scaffolding across the curricula. The literature argues that standards result in the comprehensive implementation of educational practices. There are no reported standards related to scaffolding practices in these programmes.

OBJECTIVES: To develop standards for scaffolding in health sciences programmes utilising a consensus approach through a modified Delphi Technique.

METHODS: Following the recommendations on Conducting and REporting of DElphi Studies (CREDES), an online modified Delphi technique was applied. Evidence on the application of scaffolding in health sciences programmes, obtained through an integrative review, was synthesised to draft standards. Using purposive and snowball sampling, an international panel from diverse geographical and professional backgrounds refined and validated the standards. Descriptive statistics was utilised to analyse demographic data and consensus agreements to include standards and criteria. Qualitative analysis of textual comments ensured the synthesis and inclusion of critical divergent views and additions.

RESULTS: A total of 22 experts from around the globe agreed to participate in the study and one did not complete Delphi surveys. Most experts ($n = 18$) held a PhD; and an average of 19 years of teaching in health sciences programmes. Four standards and 27 criteria were included after achieving consensus during the two Delphi surveys rounds. The included standards focused on four areas: structuring and sequencing educational activities, resources/tools for scaffolding, structuring the programme and instructional strategies to support learning.

CONCLUSION: The principle-based standards developed in this study could direct and support scaffolding practices in health sciences programmes. The standards' emphases on macro-, meso- and micro-scaffolding present numerous opportunities for designing and applying contextually sensitive scaffolding strategies at every level of curriculum implementation.

KEYWORDS: health sciences programmes, learning, modified Delphi technique, scaffolding, standards

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Introduction

Health sciences programmes operate in complex and unpredictable contexts.[1,2] These contexts are characterised by constant changes in instructional pedagogies, curricular, technology, enrolments, and practice environments. In addition, the need for programmes to utilise multiple learning platforms is inevitable.[1,3] Learning in health sciences occurs in theoretical and practical contexts,[4–6] with a demand on students to integrate diverse disciplinary knowledge in problem-solving and patient management activities.[4,7] Feldgen and Clua[8] assert that the optimal learning of such complex graduate skills can be promoted through a systematic approach to scaffolding. In health sciences programmes, such graduate skills include communication, leadership, organisation, academic competence, clinical reasoning, metacognition, empathy, teamwork and psychomotor skills, among others.[5,9–14] These highlighted complex circumstances characterising health sciences programmes render students susceptible to challenges that demand scaffolding during their learning process.

Scaffolding commonly refers to dynamic and contingent support provided to students to assist them in accomplishing tasks that would otherwise prove difficult without such support.[15–17] As a design and a process, scaffolding integrates the systematic structuring of content, materials, tasks, and experts' support to optimise the learning of complex skills.[18–21] A further conceptualisation of scaffolding is attested through references to the curriculum level at which it is applied.[22] Macro-scaffolding is a purposeful arrangement of the general progression of modules by curriculum developers to support students' learning.[22,23] Relatedly, meso-scaffolding is the deliberate structuring of modular content and teaching-learning activities to aid students' knowledge construction from small, simple tasks that eventually build to complex assignments.[22,23] Micro-scaffolding corresponds to the 'just in time' support provided to enhance the students' learning of complex tasks.[22] Although these scaffolding levels are primarily illustrated in basic education,[22,23] their adoption can assist in the design of comprehensive approaches for effective scaffolding practice in health sciences programmes.

There is a report of increasing trends in publications describing the implementation of scaffolding in health sciences

programmes.[24] In addition, there is evidence of scaffolding applied across health sciences disciplines such as nursing,[19,25] medicine,[26–28] pharmacy,[29,30] rehabilitation health sciences[31,32] and in Interprofessional Education (IPE).[10,33] Learning in various contexts such as the physical classroom, virtual platforms, simulation laboratory, community, and clinical environments has been optimised through scaffolding.[10,14,29,34–36] Scaffolding of the programmes' learning contexts[14,37] and curricular content[38,39] support the learning of related disciplinary knowledge to match the required learning outcomes. The extent of scaffolding applications in health sciences programmes demonstrates its value in supporting learning. The diversity of scaffolding applications highlights efforts by programme developers and implementors in addressing the needs for cognitive and procedural support during the students' learning of professional competencies.

Although there are reports of efforts to address the need to support learning, the application of scaffolding across health sciences programmes remains fragmented.[24] Evidence demonstrates that scaffolding in the health sciences is largely applied in a random and erratic fashion to address students' learning needs at modular level and on specific platforms.[26,35,38,40–43] Most of these scaffolding practices are based on educators' preferences and instincts.[24] Recommendations from such random scaffolding practices may lack guidance for a unified approach that could promote holistic scaffolding of student learning across programmes. A few exceptions include the report by Parry and Reynolds on systematic scaffolding across the Bachelor of Health Science programme.[44]

Health sciences programmes share similar teaching-learning contexts, yet there are reports of various scaffolding practices to support the learning of parallel competencies across programmes.[24] Such variability of approaches, strategies and focus of scaffolding practices by educators may lead to multiple conclusions, lessening chances to agree on best practices applicable to similar contexts or competencies. Linked to the diversification of scaffolding strategies are the inconsistencies in the conceptualisation of scaffolding in the literature.[17,22] The diversity of scaffolding conceptualisation[17,22,23] highlights possible varied interpretations and applications of the concept in disciplines such as health sciences. In most of the cases reported in health sciences programmes, scaffolding strategies are poorly harnessed and lack a shared approach to how programmes could integrate scaffolding in curricular. The lack of a harmonised approach to scaffolding in health sciences programmes can limit the support afforded to students during the learning of complex professional skills.[24] Scientifically informed consensus on how and when scaffolding should be applied in health sciences programmes could be a precursor to establishing and directing sound scaffolding practices and research. Thus, providing an insight into what is required of educators to keep pace with the expansive support needs essential to simplify the learning of complex skills in intricate contexts that define the health sciences programmes.

Standards lead to a comprehensive implementation of educational and healthcare practices.[2,45,46] The implementation of standards related to scaffolding could strengthen scaffolding practices and help to determine the extent of scaffolding in the health sciences programmes. However, currently, there are no reported standards related to scaffolding in health sciences programmes. The consideration to include standards for scaffolding in the design, implementation, monitoring and evaluation of curricula, teaching-learning materials, and related students engagement can improve learning experiences, particularly with regard to the complexities defining health sciences programmes.[14,47] This article describes a study focused on the development of standards for scaffolding in health sciences programmes through a consensus approach.

Methods

A modified Delphi technique was applied to obtain experts' opinions and elicit consensus on standards for scaffolding in health sciences programmes.[48,49] The study followed the recommendations on Conducting and REporting of DElphi Studies (CREDES).[50] The CREDES was applied in structuring the Delphi process and guided the reporting of the study findings.[50]

Purpose and rationale

The decision to opt for a modified Delphi technique in building consensus on standards for scaffolding in health sciences was fourfold. First, given the fragmented application of scaffolding in health sciences, developing standards is essential in establishing a uniform approach. Therefore, the modified Delphi technique was relevant through its ability to engage opinions and personal experiences regarding scaffolding from people with expertise in the diverse fields of health sciences education.[51–53] Second, since the projected standards target global health sciences programmes, a world view of scaffolding application through a modified Delphi technique was warranted. Thus, a modified Delphi promoted the amalgamation of explicit scaffolding knowledge available in the literature and implicit scaffolding practices of experienced global health sciences education experts. Third, the anonymity of the Delphi process encouraged relevant global health sciences education experts to respond to the survey questions freely without pressure to be in direct contact and influenced by potential dominant members.[50,52] Four, the modified Delphi technique is reported to reconcile possible divergent views[50,54,55] on scaffolding application in health sciences educational practice, an essential element in our quest to develop contextually relevant and universally acceptable standards. Considering these views, a modified Delphi was the most suitable method to elicit sound, reliable and credible evidence that would culminate into standards for scaffolding in health sciences programmes.

Selection of expert panel

A heterogeneous group of global experts were drawn from diverse geographical and professional backgrounds to

participate in the Delphi process. Purposive sampling was followed to identify health sciences educators from each continent who met the selection criteria. The identified experts were contacted via electronic mail. Purposive sampling was then complemented with a snowball sampling technique, whereby identified experts were asked to assist in identifying other potential participants for the study.[56] The selection criteria were educators with experience and publications on health sciences education scaffolding, teaching-learning support strategies, or instructional design. Individuals who could communicate in English with a minimum of a master's degree were included. Geographical representation, expertise, and health care professional specialisation[48] also guided the recruitment of experts. Potential panel members received an invitation to participate through an electronic email. The information leaflet detailed the experts' expected roles, proposed survey dates, instructions on how to access the survey link, and the expected duration of the Delphi process. Experts confirmed their willingness to participate by replying via email and giving written consent through REDCap®.

A total of 30 experts received invitations, and 22 agreed to participate in the study. The resulting sample constituted experts with broad and diverse expertise in health sciences education. The involvement of diverse global experts contributed to the rich discussions regarding the acceptance of developed standards.[57–60]

The Delphi procedure

Design of survey instruments

Evidence on scaffolding in health sciences programmes, obtained through an integrative review,[24] was synthesised to draft potential standards. The basis for using integrative review findings in drafting standards reflects our quest to harness a broader international discussion on scaffolding into the new standards. Besides, the formulation of the survey tool questions basing on scaffolding constructs from literature improved the relevancy and representativeness of the tool items, ultimately supporting the content validity of the tool. Standards statements represented the integrative review themes. The standards were structured to conform to International Organization for Standardization (ISO)[61] and World Federation for Medical Education[60] recommendations to make them clear, meaningful, appropriate, measurable, achievable, relevant, and acceptable to users. The criteria on which educators could base their evaluation of each standard were set. The criteria were then categorised according to three scaffolding levels: macro-, meso- and micro-scaffolding.[22] Explanatory statements and relevant literature references guided the authors and Delphi experts in categorising the criteria into respective scaffolding levels. Several draft versions were produced as authors iteratively reviewed the standards and associated criteria, striving to strike a balance between the health sciences programmes' scaffolding demands and the general principles guiding the processes of educational scaffolding and or standards development.

The draft standards presented as statements and accompanying criteria were built into an online survey instrument (REDCap.org). In the initial round, the survey instrument was structured into questions eliciting experts' opinions regarding the inclusion of four standards and 25 accompanying criteria. The instrument was structured into five sections, with the first focusing on relevant experts' biographical data. The remaining four sections represented the focus area of each standard (criteria): sequencing and structuring educational activities (10), resources and tools for scaffolding (7), structuring the programme (5) and instructional techniques that support learning (3).

In the design and content of subsequent rounds, the survey instruments depended on the outcomes and experts' responses from the previous rounds. Furthermore, before each Delphi round, the survey instruments were piloted, and the necessary modifications were made to improve their clarity and functionality.[50] The survey tools were piloted in April 2022 on three health sciences educators. The participants of the pilot were excluded from the final sample of experts. After the pilot, two items with identified flaws were reviewed. Also, modifications of the survey tool on REDCap were done in line with technical usability challenges identified during the pilot testing.

Defining consensus

Consensus was defined as greater than or equal to 80% of participants[55,62] who agreed to the inclusion of a standard or criterion. A standard or criterion which failed to reach consensus was identified for revision and recommended for further consideration in the following Delphi round.

Data collection

Data were collected through an iterative process of Delphi survey rounds. Each survey round was conducted through the online platform REDCap®. The Delphi process started in May 2022 and took approximately two months to complete. Respondents were given two weeks to complete each survey round. A two-week completion period was chosen to allow more time for experts to engage with the standards, which reduced time pressure. Reminders were sent to all experts two days before and two days after the two-week deadline. During each round, experts worked independently to review the standards and criteria and then selected the best available option (Yes, Maybe or No) to represent the decision on inclusion. Experts were expected to make suggestions, comments, and additions regarding the inclusion or exclusion of each item or statement in the survey. A textbox at the end of each survey captured experts' overall comments regarding the standards. Contributions made by each of the experts were kept

anonymous during feedback to prevent undue influence exerted by any individuals.[52,63] The Delphi process encouraged an honest, robust exchange of views between the experts and the authors. Subsequent Delphi survey rounds were planned only if the consensus of 80% agreement[62] was not reached in the previous round on at least three items.

Initial Delphi survey round. In May 2022, experts were sent an online survey comprising four standards and 25 criteria statements using a REDCap® link. The survey elicited experts' opinions regarding the inclusion of the draft standards and criteria. An opportunity to suggest additional criteria and standards was also provided. See the flowchart in Figure 1 for an overview of the Delphi rounds.

Second Delphi survey round. Standards and criteria which failed to reach a consensus after the initial round were reviewed and sent to the experts via electronic mail for the second-round survey. Reviewed standards and anonymised feedback were sent to only experts who had responded and completed the initial survey. Only reviewed standards and criteria with less than 80% consensus agreement permitted further voting and commenting. See the flowchart in Figure 1 for an overview of the Delphi rounds.

Data analysis

As part of the iterative nature of the Delphi technique, data analysis was conducted at the end of each survey round. Quantitative analysis using descriptive statistics of frequencies and percentages was utilised to analyse demographic data and consensus agreement for the inclusion of standards and criteria. Qualitative analysis of textual comments ensured the synthesis of critical divergent views and additions.

Initial Delphi survey round. Data generated from the experts' responses were extracted from REDCap® as a Microsoft Excel spreadsheet and cleaned to remove incomplete entries. Initial analysis included descriptive statistics in determining experts' demography and items that reached consensus.[64] Criteria which failed to reach a consensus were identified for revision.

Experts' comments and suggestions were collated by the first author and reviewed by all the authors. The authors individually read and used a content analysis approach for textual responses. The views of the experts and suggested revisions to the standards or criteria statements were considered to reconcile any conflicting disagreements. Through collaboration we accepted, judiciously refined, expanded, and/or modified the draft standards in line with the decisions taken, and the required technical accuracy. Qualitative analysis of textual comments assisted in identifying areas needing revision, conceptual disputes, or removal from the standards. Wording suggestions even in standards or criteria with consensus agreement were considered. However, such standards were not included in the second-round survey since they had reached an acceptable level of agreement. Updated standards and criteria were returned to the experts for the subsequent round.

Second survey round. Experts' responses were analysed and collated, recording the number of experts who included each of the revised criteria and standards and expressing them as a percentage. Criteria which failed to reach a consensus were excluded from the final standards. Experts' general comments were studied, and the necessary modifications were made. A few trivial objections made on standards that reached consensus were disregarded.

Ethics issues

Ethics approval to conduct the Delphi study was received from the Health Sciences Research Ethics Committee of the host university (UFS-HSD2020/1864/2302). Explanations regarding participating in the study on a voluntary basis were given to potential participants prior to signing consent. To maintain confidentiality, identifiers of experts involved in the Delphi surveys were replaced with codes before data analysis. Furthermore, experts had the right and autonomy to withdraw from the study at any stage. Lastly, confidentiality was instituted to remove the effects of academic or professional status on reaching a consensus.[53]

Results

Participants' demographic characteristics

Of the 30 potential participants approached, only 22 responded to indicate their willingness to participate, with a response rate of 73%. Of the 22 participants, 21 respondents (95%) completed the initial Delphi survey. The demographic details of those who participated are shown in Table 1. The majority of the participants (48%) were from Africa and the least were from Europe (13%). Most of the participants (18) held a PhD as their highest qualification, while the remaining three had master's degrees. Most participants worked in nursing education (8) and medical education (3), while pharmacy and physiotherapy education were each represented by one participant (Table 1). Six participants worked in university's health professions education departments, and in some cases, they contributed to more than one discipline. These participants held additional health professions education qualifications apart from their principal health discipline expertise. Two participants were educationists and instructional designers working in related university's health sciences departments. The participants had an average of 19 years of experience in health sciences education.

First Delphi survey round

Twenty-one respondents who participated in the initial Delphi survey agreed on the inclusion of all four standards. Of the 25 criteria, 19 (76%) reached consensus agreement for inclusion (see Figure 1). A total of 5 criteria (20%) needed revisions after achieving a score of less than 80% for consensus

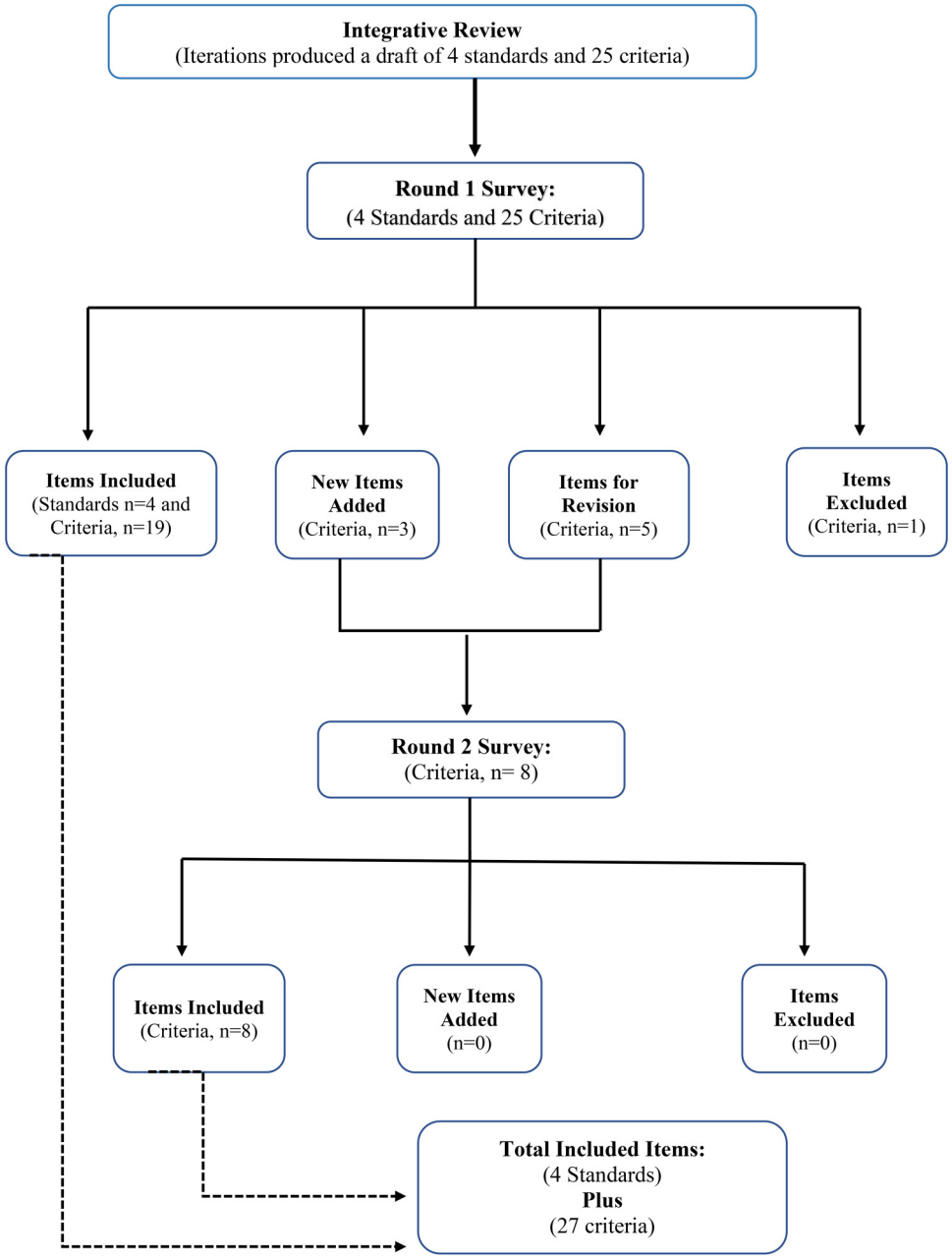

Figure 1. Flowchart showing the number and outcomes of items included in each Delphi round.[64]

agreement. One criterion was removed as its contents were regarded as similar to other criteria. Three criteria were added after studying and synthesising the experts' comments. Suggested language, expression, and structuring revisions were considered on 16 (64%) of the criteria that had reached the general agreement level of 80% during the first round. As shown in Figure 1 and Table 2, a total of 8 criteria (32%) were revised and sent for the second-round survey.

Second Delphi survey round

Seventeen respondents (81%) completed the second Delphi survey. The expert panel did not exclude any items (Figure 1). Therefore, consensus was reached to include four standards and 27 criteria. The standards focus on structuring and sequencing educational activities (11 criteria), resources and tools for scaffolding (6 criteria), structuring the programme (6 criteria), and instructional techniques that support learning (4 criteria) (Table 2). Table 3 presents the 27 items that achieved the 80% consensus score for inclusion after two Delphi surveys.

The standards

Standard 1: sequencing and structuring of educational activities. The standard emphasises the deliberate structuring of learning

Table 1. Experts' demographic characteristics.

VARIABLE	FREQUENCY (*N* = 21)	%
Region		
■ Africa	10	48%
■ Asia	5	24%
■ Europe	3	13%
■ North America	2	10%
■ South America	1	5%
Discipline		
■ Allied Health	2	10%
■ Health Professions Education[a]	6	29%
■ Medical Education	3	13%
■ Nursing Education	8	38%
■ Other (Educationists)	2	10%
Years of experience in health sciences education		
■ 0–10	7	34%
■ 11–20	6	29%
■ 21–30	5	24%
■ 31–40	3	13%
	Average = 19 Years	

[a]Participants with additional health professions education qualifications and working in HPE university departments.

content, tasks, and environments to promote the building of profession-specific competencies among students. Associated standard criteria specify macro-scaffolding (4), meso-scaffolding (5), and micro-scaffolding (2) strategies applicable to health sciences programmes in designing curricular content that increases in complexity from the first to final year (see Table 4). The standard creates numerous opportunities that promote coherent and connected knowledge building across modules and levels of study, and promotes scaffolding through the intertwining of theoretical knowledge and authentic clinical tasks.

Standard 2: resources and tools for scaffolding. The standard focuses on the need to identify, document, and make accessible, relevant resources and tools to support learning in health sciences programmes (see Table 4). Students' access to relevant materials and resources is necessary to enhance meaningful learning, and the development of profession-specific competencies.

Standard 3: structuring the programme. The third standard emphasises the need to utilise proven educational or discipline-based frameworks or models in structuring the learning outcomes, content, and related assessments in health sciences programmes modules, levels and learning platforms (Table 4).

Standard 4: instructional techniques that support deep learning. The standard seeks to promote the application of student-centric instructional scaffolding techniques during class engagements. The four criteria guide educators to maximise opportunities that enhance meaningful learning during educator-students and peer-peer engagements (Table 4). The educators are encouraged to apply contextually sensitive scaffolding techniques that accommodate the circumstances under which learning occurs. For example, scaffolding clinical reasoning skills could take different options in various contexts. It would be best for clinicians to apply think aloud and modelling in scaffolding clinical reasoning[12] during emergency care whereas illness scripts and guidelines could support clinical reasoning in the management of a stable patient.[14] The learning of clinical reasoning may also be

Table 2. Statistics on changes made to the standards.

STANDARD	INITIAL NUMBER OF CRITERIA	TOTAL CRITERIA INCLUDED	NUMBER OF CRITERIA EXCLUDED	NUMBER OF CRITERIA ADDED	NUMBER OF CRITERIA REVISED FOR SECOND DELPHI SURVEY ROUND	TOTAL CRITERIA INCLUDED AFTER SECOND DELPHI SURVEY ROUND
Standard 1: Structuring and sequencing educational activities	10	9	0	1	2	11
Standard 2: Resources and tools for scaffolding	7	6	1	0	0	6
Standard 3: Structuring the programme	5	1	0	1	5	6
Standard 4: Instructional techniques that support learning	3	3	0	1	1	4
Total	25	19	1	3	8	27

Table 3. The four standards and 27 criteria included after reaching consensus agreement.

STANDARD	STANDARDS OUTLINE AND CRITERIA	CONSENSUS (%)
STANDARD 1: STRUCTURING AND SEQUENCING EDUCATIONAL ACTIVITIES	**Outline:** The curricular content, learning tasks, and learning environment must be structured to promote profession-specific knowledge building.	**91%**
	1.1: The curriculum increases in complexity from first to final year.	**96%**
	1.2: The programme design allows the intertwining of theoretical knowledge and authentic clinical tasks.	**81%**
	1.3: The curriculum structuring promotes a coherent and connected knowledge building across modules and levels.	**91%**
	1.4: Basic, clinical, social and systems sciences modules support attaining profession-specific outcomes.	**81%**
	1.5: Content in the modules increases in complexity.	**81%**
	1.6: Theoretical and practical modules are intertwined.	**86%**
	1.7: Modules and study guides are structured to integrate authentic teaching-learning activities.	**81%**
	1.8: Modules and study guides allow multiple opportunities for ongoing assessments that help identify existing strengths and align the level of support and guidance to the individual student's learning needs and context complexity.	**86%**
	1.9: Assessments are purposefully structured and sequenced, providing explicit linkage across assessments with preceding assessments to scaffold for the next.[b]	**94%**
	1.10: Theoretical and clinical skills learning activities support the development of professional competence.	**81%**
	1.11: Structured procedural guidelines support learning, deliberate practise, and mastery of the skill.[a]	**82%**
STANDARD 2: RESOURCES AND TOOLS FOR SCAFFOLDING	**Outline:** Essential resources and tools must be available and accessible to support students' learning.	**91%**
	2.1: Physical, human, and financial resources meet the programme's and students' scaffolding requirements.	**95%**
	2.2: A learning management system supports and guides students' access to learning resources.	**86%**
	2.3: The learning environment supports and guides students to attain stated competencies.	**81%**
	2.4: Resources that support learning are explicitly documented in the study guides and/or module outlines, supporting students in completing learning tasks.	**81%**
	2.5: Resources support and encourage the discourse and interactions among students and or between students and educators, enhancing meaningful learning.	**86%**
	2.6: Students' assessment outcomes determine the nature of resources needed to support learning.	**81%**
STANDARD 3: STRUCTURING THE PROGRAMME	**Outline:** The curriculum composition must demonstrate the application of the underlying frameworks that support the structuring of learning outcomes.	**81%**
	3.1: The education programme must be underpinned by an educational, evidence-informed theory or theories that are applied in its operations to support learning.[a]	**88%**
	3.2: Frameworks/models must be applied to guide the structure and sequencing of content across modules and levels/years of study.[a]	**94%**
	3.3: Appropriate frameworks structure learning tasks and content within a module.	**81%**

(continued)

Table 3. Continued.

STANDARD	STANDARDS OUTLINE AND CRITERIA	CONSENSUS (%)
	3.4: The desired exit behaviour of the educational program/module/course is clearly defined to support students learning within their zone of proximal development.[b]	**94%**
	3.5: Teaching-learning activities apply frameworks/models to support learning complex skills or concepts and the development of competency.[a]	**88%**
	3.6: Frameworks support learning by presenting task(s) as multiple manageable learning activities that sum up for attainment of competency as a whole.[a]	**82%**
STANDARD 4: INSTRUCTIONAL TECHNIQUES THAT SUPPORT LEARNING	**Outline:** Educators must use relevant instructional scaffolding techniques to support individuals or groups of students in constructing knowledge.	**86%**
	4.1: The institutional faculty development programs and guiding documents support educators on relevant instructional strategies of scaffolding learning activities.	**81%**
	4.2: Instructional scaffolding techniques are used across all modules and levels.	**91%**
	4.3: Educators must create opportunities that promote peer-peer learning and collaboration.[b]	**88%**
	4.4: Educators apply various student-centric and contextually sensitive approaches to support students' independent knowledge building.	**86%**

[a]Criteria reached consensus agreement in second-round voting after revisions.
[b]Criteria was added by the experts during surveys.

supported through the customised use of prompt hints relative to students' diagnostic errors.[28] Furthermore, Dawn and colleagues[29] encouraged educators to apply a layered approach in structuring the learning activities to scaffold evidence-based practice; focusing on student's mastery of each stage, complementing with ongoing feedback and high-support hints to aid completion of the whole procedure. In contrast, students could utilise peer scaffolding following a worked exemplar to support learning of consultation and design of care plans in simulated or clinical contexts.[36] Learning of basic sciences knowledge in the context of a classroom can be scaffolded using a 6D approach – didactic, designate, distribute design, deliver, and discuss[26]; whereas application of a clinical model support students in designing authentic patient care presentations in clinical practice[36]. See the Table 4 for more details regarding the proposed standards.

Discussion

This article reports on proposed standards for scaffolding in health sciences programmes developed using an online, modified Delphi technique. While there is considerable evidence relating to scaffolding application in health sciences programmes, there is a lack of a unified and systematic approach to implementing scaffolding.[24] In addition, educators apply diverse scaffolding approaches to support the learning of similar competencies in health sciences programmes.[24] There is also limited evidence regarding explicit scaffolding strategies that educators could employ to support learning. Therefore, this study integrated best practices from literature and expertise from health sciences educators to propose standards that foster the effective application of scaffolding in such programmes. Four standards and 27 criteria reached consensus through two Delphi survey rounds to constitute the standards for scaffolding in health sciences programmes. The standards focused on four scaffolding areas, namely (1) Structuring and sequencing educational activities, (2) Resources and tools for scaffolding, (3) Structuring the programme, and (4) Instructional strategies that support learning. The proposed standards could direct and enhance scaffolding interventions to support learning in the complex contexts characterising health sciences programmes.

The Delphi technique is a favoured approach to guide the development of expert-approved standards.[49,50,52,65,66] However, Hasson and Keeney[67] point out that the results obtained from a Delphi survey can be a 'snapshot' of opinions from the recruited expert group, and not necessarily representative of all experts. A modified Delphi technique was followed to mitigate this deficit, as it promoted the incorporation of diverse evidence on scaffolding from literature to form new standards.[67] Using a modified Delphi not only reduced the study's potential number of rounds[67] but also ensured the alignment of findings to relevant literature in the field of health sciences education.

Health sciences education experts from diverse professional and geographical backgrounds contributed to the development of the standards. Most of the experts were in nursing education, followed by medical education, possibly due to the professions' documented scaffolding practices, as reported by Masava et al.[24] Also, most of the participants were from Africa, with

the least coming from South America, possibly due to the ease of identification of experts from professional contacts of the authors. Language barriers could have also limited participation from some regions, where the people considered as experts speak languages other than English. In addition, all the invited experts who showed willingness to participate were considered, regardless of the continent of origin. As specified by Powell,[68] and affirmed by Taylor,[69] the Delphi expert panel did not require statistical representation, but instead looked at the qualities of experts for inclusion. Therefore, the need for future refinement of these proposed standards with an additional pool of global experts must be recognised to guarantee their adoption across the global health sciences programmes.

The first standard emphasises deliberate structuring of learning content, tasks, and environments to promote the building of profession-specific competencies among students. Guzmán and Urrutia-Aguilar[70] attest to the importance of meticulous designing of physiology content to reduce its complexity, academic failure and frustration while supporting knowledge integration and comprehension. The design of health sciences curricula to create numerous opportunities for intertwining theoretical knowledge and authentic clinical tasks cannot be understated. Gonzalo and colleagues[4] highlight the need for transformation in designing health sciences programmes that promote the integration of the basic, clinical and systems sciences to better support the 21st-century student during medical training. Therefore, educational activities must be structured with increasing complexity.[37] However, pedagogical philosophies and instructional approaches vary within health sciences programmes,[71] and not all engage in learning on simple to complex educational trajectories. In addition, Kirch and Sadofsky[71] argue that the interconnectedness of any preferred educational theory–practice–philosophy is required to meet the stated learning outcomes.

The second standard focuses on students' access to relevant physical and electronic resources and tools to the support learning of professional competencies. Programmes should select relevant and evidence-based tools to make the learning task more manageable. Tools and resources selected to scaffold learning should be context-specific[72] for effective learning to occur. The pool of experts in the Delphi panel may have influenced the bias in specifications of technology-related criteria in the standard. The experts' lived experiences of using digitalised pedagogies could have favoured the inclusion of fourth industrial revolution technology-related standards.[73] However, Belland et al[74] highlight the importance of complementing resources and tools for scaffolding with educator-based scaffolds.

The third standard emphasises the utilisation of evidence-based educational and discipline-based frameworks or models in structuring the learning outcomes, content, and related assessments at the modular level of programmes. The application of relevant theories and frameworks simplifies complex skills,[75] reducing the cognitive load,[37] while also promoting the building of competency by guiding students to attempt clinical problems in small but multiple manageable portions.[75,76] Moreover, frameworks assist students in creating precise and meaningfully organised knowledge structures,[77] increasing their likelihood of completing the clinical task. Studies by Connor et al[78] and Rotter et al[79] report that clinical pathway frameworks are useful in scaffolding students to learn structured, standardised, evidence-based, and multidisciplinary clinical interventions and treatments during clinical practice. Evidence attests to how models and frameworks effectively support students' learning of clinical reasoning,[14] foundational basic sciences theory[26] and essential clinical skills.[36] Recent proposals for a milestone framework to scaffold the graduate trajectory in health sciences programmes can potentially nurture the attainment of competency-based education goals and purposes.[80]

The last standard guides educators' instructional scaffolding techniques during the classroom, simulation, and clinical engagement contexts. The standard underscores the need for student-centric scaffolding techniques that enhance meaningful peer-peer and educator-student collaboration during knowledge construction. Effective scaffolding results from educators' application of contingent and student-centric techniques that support independent knowledge-building capacity.[17,81] Such student-centric approaches and adaptive teaching allows the 'just-in-time' scaffolding adjustments necessary to keep pace with the changing support needs of students during class engagements.[21,81] The adaptive scaffolding techniques include tailored feedback, built-in prompts, rubrics, and modelling.[29,76] The need for adaptive and student-centric scaffolding strategies is critical to match the dynamism of the learning platforms and the complexities that characterise the health sciences programmes. However, educators need to be mindful of cultural, contextual, and learning factors likely to inhibit the successful adaptation to student-centred learning approaches by students.[82] Wulf[82] further recommends the need for measures to prepare students to be self-directed to promote the success of student-centred scaffolding strategies.

Eight features of the proposed standards make them relevant for evaluating scaffolding practices in health sciences programmes. First, the four proposed standards are basic and are essential for minimum scaffolding of health sciences students' learning as they are expressed using the word 'must'.[60] Second, the proposed standards promote the deliberate design, structuring, and sequencing of educational content across the programme. The result could assist in establishing a coherent scaffolding across theoretical and practical modules and diverse learning contexts defining a health sciences programme. Such a design and implementation of scaffolding across the programmes and curricula, can improve learning experiences, particularly in the complexities faced by health sciences programmes.[14,47] Third, the standards observe scaffolding elements such as contingency, fading and transfer of responsibility,[17] critical to promoting meaningful learning.

Four, the standards on tools, resources and frameworks justify the need for scaffolding principles that do not limit innovation but promote the use of strategies adaptable to students' varied scaffolding needs.[81] Five, the standards are generic and principle-based, promoting an application in diverse programmes and settings.[83,84] According to WFME,[84] principle-based standards allow for health sciences educators to incorporate supportive techniques tailored to the learning context. Such contextually sensitive techniques foster the calibration of scaffolding strategies to accommodate the circumstances under which learning occurs.

The scope of standards developed in this study extends beyond the commonly cited micro-scaffolding or instructional scaffolding,[17,28] and includes macro- and meso-scaffolding. Meso-scaffolding and macro-scaffolding promote the meticulous planning of curricula and modules to enhance the scaffolding of learning.[22] Thus, enhancing the holistic application of scaffolding across various platforms and programme levels, which promotes sound practices in scaffolding students' learning of essential skills in health sciences. This way, the standards have the potential to support the building of high cognitive skills and essential graduate competencies which include clinical reasoning, the creation of models, the designing of care plans, the performance of complex psychomotor skills, and evidence-based practice.[11,13]

The four proposed standards may assist in creating a seamless transition from the design of educational activities, using evidence-based frameworks and context-relevant tools or resources, to implementing scaffolding strategies that result in meaningful learning. The standards promote the application of pre-planned hard scaffolds to simplify potentially difficult tasks, and soft scaffolds customised to the students' learning needs.[85] Scaffolding is commonly applied to address specific student learning needs in modules and learning platforms,[26,35,38,41,86] with few occasions in programme scaffolding.[44,80] Nevertheless, the standards proposed in this study support the proposition by Coombs[19] that scaffolding in health sciences should be both a design and a process.

The final essential feature across all four standards is the need to link the scaffolding of content and outcomes with ongoing assessments. Purposeful structuring of assessments and the effective use of related outcomes and feedback assist the health sciences educator in determining the nature of resources and support for learning.[87,88] The World Federation for Medical Education[89] and Vandewaetere and colleagues[90] argue that assessment feedback is essential to enhance competency development. The proposed milestone framework emphasises the need to match the competency milestones and scaffolding support expected in a health sciences programme.[80]

Strengths and limitations

The use of a modified Delphi technique following the CREDES guideline ensured that the results of this Delphi study are credible and sound.[48,50] CREDES provides a structure to the Delphi process, as well as detailed justifications for pragmatic adjustments of each step, making it easy to reproduce our approach in similar contexts. The structured conversation of Delphi allowed anonymous experts' contributions, iterations, and controlled feedback to refine the standards.[48] Besides, selecting a heterogeneous group of panellists from diverse backgrounds ensured the use of available expertise in developing the standards.[52] The inclusion of instructional design educationalists ensured that the standards were aligned with relevant education principles.

Social constructivism was the most cited educational theory in the reviewed articles, and influenced the drafting of the standards presented in this article.[24] This bias towards constructivism may render the standards more applicable to curriculum models underpinned by the social constructivism learning theory. Health sciences educators from disciplines other than nursing and medical education were limited in this Delphi panel. However, the standards could be representative as they were distilled from literature developed by most health professions, including rehabilitation health disciplines. Since the panel was Africa-heavy, and included only English-speaking experts, generalisability in non-English contexts may be a challenge. It is essential to note that the recruitment of experts for this study was not exhaustive, leaving room for additional inputs into the standards in future research. Therefore, additional reviews with more scaffolding experts and health sciences educators from other countries or disciplines may be warranted to refine the standards for relevance across health sciences programmes worldwide. Also, considering that health sciences education does not stand still, several periodic scientific reviews of the standards may be necessary to promote the applicability of the standards in future global health sciences programmes. Moreover, according to Kleinhenz and colleagues,[83] generic standards statements like the ones presented in this study have the likelihood of varied interpretations from users. We recommend empirically testing the proposed standards' usability in a health sciences programme. It could be interesting to investigate how the standards will perform when applied to evaluate programmes in non-English-speaking contexts, and those underpinned by philosophies other than social constructivism.

Conclusion

Health sciences programmes operate in intricate, unpredictable, and diverse learning contexts, underscoring the need for scaffolding. Such scaffolding is often fragmented and poorly harnessed to direct and support effective student learning, necessitating the need for standards. Using a consensus approach through the modified Delphi technique, four standards and 27 criteria were developed with inputs from an international expert panel drawn from diverse geographical and professional backgrounds. The principle-based standards

represented the four main areas: structuring and sequencing educational activities, resources and tools for scaffolding; structuring the programme; and instructional strategies that support learning. The standards could serve as one common thread, tying together various approaches and strategies relevant to scaffolding in the diverse learning contexts of the programmes. The standards' emphasis on macro-, meso- and micro-scaffolding present numerous opportunities for the design and application of contextually sensitive scaffolding strategies at every level of curriculum implementation. Scaffolding the curriculum, promoting students' access to resources, tools and frameworks for scaffolding, and the use of student-centric scaffolding techniques can potentially produce a programmatic scaffolding approach to match the support needs of the students. The standards could direct and support the evaluation of the design and implementation of scaffolding practices to ensure optimum support for students learning in health sciences programmes.

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Authors contributions

All authors contributed to the study concept, design, data collection and analysis. BM drafted the Delphi survey tools, which were reviewed by CNN and YB. BM analysed the biographical data and items for consensus agreement. BM, CNN and YB analysed the textual data to extract additional opinions from experts. BM was responsible for the drafting of the manuscript. All authors have read, reviewed, and approved the final manuscript.

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Statements and declarations

This article is based on a study done by Beloved Masava in fulfilment of his PhD thesis under the supervision of Champion N. Nyoni and Yvonne Botma. We declare that the present manuscript is not being considered for publication elsewhere and has not already been published elsewhere.

Supplemental material

Supplemental material for this article is available online.

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