Assessing curriculum viability

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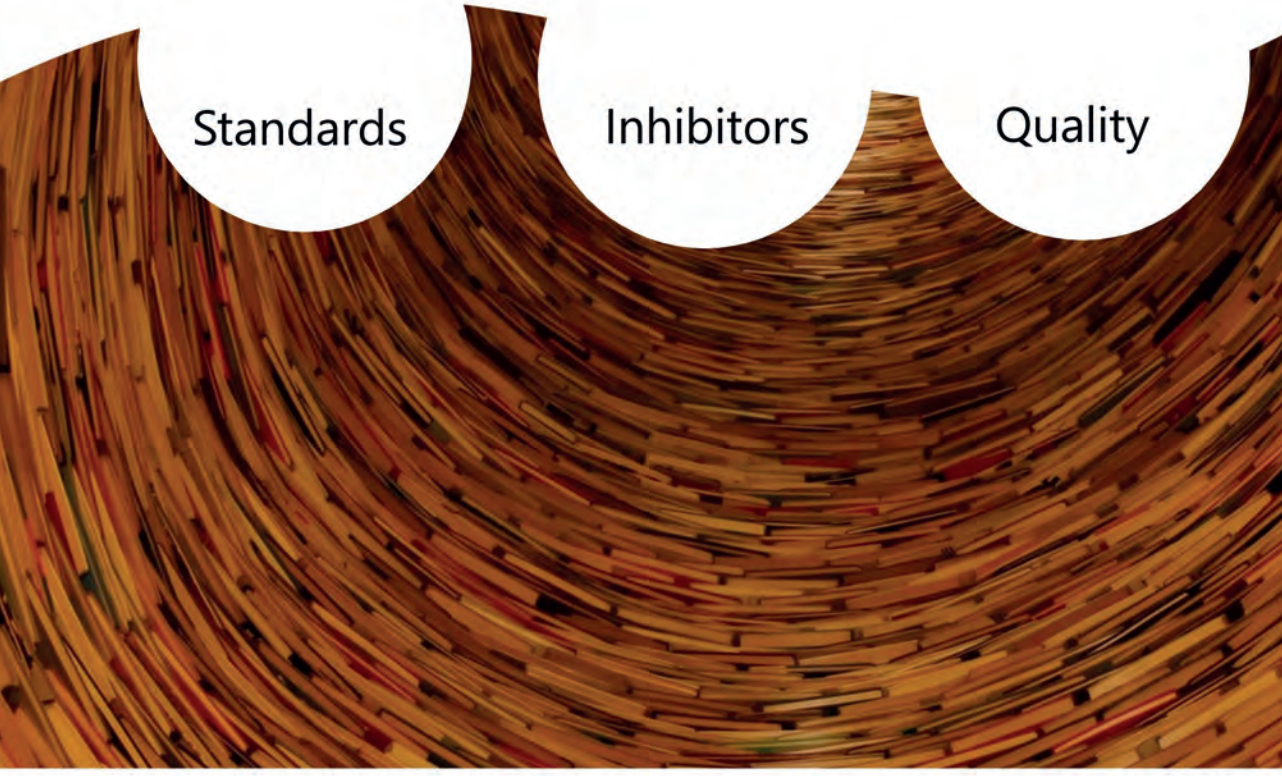

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ASSESSING CURRICULUM VIABILITY

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Assessing curriculum viability

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CHAPTER 1:

General Introduction

The quality of a curriculum is determined through curriculum evaluation that establishes its strengths and weaknesses (Bharvad, 2010). This is done by benchmarking a curriculum against certain quality standards developed by national or global accreditation bodies (Rezaeian et al., 2013; Sethi & Javaid, 2017). However, this process seems to ignore the issues that hamper the achievement of quality standards.

To address this gap, we have introduced a new term, *curriculum viability* which is defined as "the current state of a curriculum determined by the degree to which particular quality standards have or have not been met, and the inhibitors affecting the attainment of those standards" (Khan et al., 2019, p2). Currently, a curriculum viability assessment approach that can systematically identify the weaknesses and the inhibitors of a curriculum has not been reported in the literature. Though not explicitly, some inhibitors that can hamper the achievement of quality standards have been reported in the literature, including strong departmentalization due to extreme ownership of the disciplines, claiming the hours available for each discipline, miscommunication between faculty members due to limited opportunities to meet and interact, and adding content to the curriculum as desired by the faculty resulting into excessive tampering with curricular content (Abrahamson, 1978). These inhibitors clearly affect the functioning of the curriculum but are not explicitly considered in routine evaluations of the curriculum. The studies reported in this PhD thesis aim to develop a structured approach to assessing curriculum viability that can help medical institutions systematically assess their own curricula, identify deficiencies in different components of a curriculum, and suggest remedies leading to desired curriculum reforms.

This general introduction starts with describing the theoretical framework, which covers the definition of curriculum, curriculum models and types, issues faced, and curriculum quality standards. Then it describes curriculum viability and why there is a need to assess curriculum viability. This debate is then trailed by the research questions and the studies conducted to find their answers.

What is a Curriculum?

A curriculum is an educational structure that describes the activities of those involved, primarily that is teachers and students, and also those who design and implement it (Young, 2014). The curriculum has been defined in diverse ways in the literature.

Hence, it would be difficult to understand curriculum viability without knowing the different perspectives on what a curriculum is and how it evolves? Some medical educators equate the concept of the curriculum with educational materials such as syllabi and textbooks, limiting its operational boundaries (Burton & McDonald, 2001; Luke et al., 2013). However, most of the authors have a consensus that it is a series of planned educational activities for promoting the learning of students (Kate et al., 2010; Quirk & Harden, 2017; Thomas et al., 2016). These activities are documented through a master document with the details of final attainment levels and objectives of the curriculum, a rationale of developing the curriculum, educational strategies used, learning situations offered to students, assessment of students' performance and progress, faculty development activities, the educational environment, process of communication or provision of details of the curriculum to teachers and students, and its implementation and evaluation (Barradell et al., 2018; Changiz et al., 2019; Quirk & Harden, 2017; Sethi & Khan, 2019). This broader definition of curriculum has evolved over time.

The evolution of curricular *models* started from Tyler (1949), Hilda (1962), and Walker (1971) and is still an ongoing process. Curriculum development models are prescriptive, interactive, or process-based (Prideaux, 2003). Tyler (1949) described the *prescriptive* model, which defines final attainment levels and objectives, a means of attaining them through learning experiences, and a process of evaluation for determining whether outcomes have been achieved or not (Lunenburg, 2011). It was modified by Hilda (1962), who puts more emphasis on learning and teaching and their interaction, termed as an *interactive* model (Fraenkel, 1994). Walker (1971) further explained the process of development of a curriculum through his *process-based* model.

Behaviorist, constructivist, cognitivist, and humanist learning paradigms influence these curricular models, which define the perspectives of the curriculum (Posner, 1995). Apart from these perspectives, interactive and process-based models, instructional design models have guided the process of curricular development, including ADDIE (Jeffers & Poling, 2019), ASSURE (Sugiri et al., 2020), and the 4C/ID Model (Vandewaetere et al., 2015). Whatever the curriculum model may be, it shares common elements as described by Bosco (1971) in curriculum theory. Its four main components are aims, contents, methods of teaching, and evaluation. The first component (i.e., aims) describes what students are required to have learned at the end of the curriculum. The second component (i.e., contents)

describes the curricular content to be included according to the different domains of learning, i.e., knowledge, skills, and attitudes. The third component (i.e., teaching methods) is pedagogy, that is, how the curriculum is taught. The fourth component (i.e., evaluation) is about the curriculum evaluation, determining if the curriculum has successfully reached its aims.

In medical education, Harden (1986) expanded on these basic elements in his *Ten questions to develop a curriculum*. He described the curriculum as a structure that has outcomes, contents, teaching strategies, assessment, student support, faculty development, governance, and curricular implementation.

What are the Different Models and Types of Curriculum and the Issues Faced by Them?

As a curriculum is a combination of activities, it may face problems and challenges. To understand what problems a curriculum can encounter, it is important to understand the different types and models of curricula. The term curriculum has its origin in the Greek language, meaning 'racetrack'. It is an ever-changing process. Any model of curriculum, be it discipline-based, problem-based, organ-based, system-based, competency-based, or outcome-based, can be divided into three main types: official curriculum, implemented curriculum, and learned curriculum (Dent et al., 2017). The official or ideal curriculum is the desired curriculum to be delivered to the students. The implemented curriculum is the delivered curriculum that is actually being practiced/applied, whereas the learned curriculum is the curriculum that is acquired by the students (Dent et al., 2017). The difference between the official and the learned curriculum is usually due to issues in the implemented curriculum. In the field of medical education, some of these problems have been reported by Abrahamson (1978) as 'diseases' of the curriculum. These diseases in a medical curriculum make the issues more understandable to teachers/developers/doctors and include curriculosclerosis, curriculum hypertrophy, curricular carcinoma, curricular arthritis, curricular disthesia, iatrogenic curriculitis, idiopathic curriculitis, intercurrent curriculitis, and curriculum ossification. These problems, according to Abrahamson, are the ones that affect an implemented curriculum.

What are Curriculum Quality Standards?

To get an insight into the strengths and weaknesses of a curriculum, global and national accreditation bodies have devised quality standards to benchmark curricula. Quality assessment in higher education entails defining quality, setting assessment standards and comparing them with the real outcomes, and deciding to what extent standards are met (Lomas, 2002). Quality is thus defined as the degree to which standards have been achieved, for example, whether a curriculum meets basic minimum standards or standards of excellence (van Zanten et al., 2012).

Traditionally, the quality of a curriculum is determined by comparing it with different national or global accreditation standards (Rezaeian et al., 2013). Examples of these standards include World Federation of Medical Education (WFME) global standards for quality improvement; Liaison Committee for Medical Education (LCME) accreditation standards; General Medical Council's (GMC) tomorrow's doctor standards, and many other accreditation standards (Maccarrick et al., 2010). The WFME (2012) has identified nine areas that affect the quality of an undergraduate medical curriculum. These areas were identified after several expert meetings with an international panel of advisors starting from 1984 to the final adoption of the document in 2001, with a revised version published in 2012. These areas are: (1) mission and outcomes, (2) educational program, (3) assessment of students, (4) student selection, (5) academic staff/faculty, (6) educational resources, (7) program evaluation, (8) governance in administration, and (9) continuous renewal of curriculum.

Curriculum evaluators in many countries use WFME quality standards to assess the quality of the curricula. The curricula are compared against the basic and quality standards in the nine areas of the WFME standards to determine their strengths and weaknesses. However, this process only deals with the standards and ignores the inhibitors. In areas dealing with the educational program and its evaluation, the WFME only describes the educational standards and not the issues or problems (inhibitors) which can arise in the curriculum (Tackett et al., 2015). For instance, in one of the sub areas of the 'educational program' section, the WFME document describes a basic standard to be achieved as "The medical school must define the curriculum models and instructional methods employed' and the quality development standard as "the curriculum and instructional methods should ensure that the students have responsibility for their learning process and should prepare them for lifelong learning" (World Federation for Medical Education, 2012, p. 10).

But nowhere in the document, does it address the 'diseases' or issues like 'too much content', 'tampering with content' and 'overgrowth of the content', as described by Abrahamson (1978). Also, the document does not take faculty resistance in adopting new ideas into account (Watty et al., 2016; Zarei et al., 2014). Tackett et al. (2015) also points out that multiple indicators are combined in a single statement where a need to describe them separately is required. For instance, in WFME area 2 (educational program), it is stated that "The medical school must identify and incorporate in the curriculum the contributions of the behavioral sciences, social sciences, medical ethics, and medical jurisprudence that enable effective communication, clinical decision making, and ethical practices" (World Federation for Medical Education, 2012, p. 10). In this example, one single standard includes many evaluable items. Though WFME has defined the standards of the curriculum in detail, the language used to define the standards is very technical and difficult to comprehend and hence needs simplification. Including the inhibitors that hamper the attainment of the standards, will make it easier to gain insight into the weaknesses of a curriculum. This implores the need to explore the curriculum viability indicators and to develop an expert consensus on these indicators.

What is Curriculum Viability?

It is important here to differentiate curriculum viability from closely related terms such as 'curriculum analysis', 'curriculum evaluation', and 'curriculum renewal'. Curriculum analysis is defined as a process of dividing the curriculum into its constituent components, examining them separately and finding relationships between them. It identifies the philosophy and paradigms of curriculum developers and examines the implication of these beliefs (Posner, 1995). In comparison, curriculum evaluation involves systematic collection and analysis of information related to the design, implementation, and outcomes of a curriculum, benchmarked against certain quality standards. The purpose is to monitor and improve the quality and effectiveness of the program and to assess that a desired change has taken place (Bharvad, 2010; Ruhe & Boudreau, 2013). Curriculum renewal, however, is defined as the revision process with subsequent meticulous curriculum monitoring (McLeod & Steinert, 2014).

To understand the concept of curriculum viability, we have used the analogy of a living entity. Thus, a curriculum can become diseased (weak) due to certain

issues that we call inhibitors, which may hamper its good health or viability. The term curriculum viability has yet to be defined in the medical education literature. Viability (n) means ability to work as intended or to succeed (Cambridge Dictionary, 2021). It is not easy to define a viable curriculum if we think about medical education. However, considering the above-mentioned discussion, we defined curriculum viability as, '*The current state of a curriculum determined by the degree to which particular quality standards have or have not been met, and the existence of inhibitors affecting the attainment of those standards*'.

When schools implement curricula without determining curriculum viability, they can run into serious curriculum implementation issues, resulting in faculty and student dissatisfaction, and possible or impending failure of curricula. The question that arises is: How can curriculum viability can be measured? In the literature, different techniques, models, and tools have been used to identify curriculum issues. Some of these approaches include Harden's Ten Questions (Harden, 1986), Dundee Ready Educational Environment Measure (DREEM) (Roff et al., 1997), the CIPP evaluation model (Stufflebeam, 2000), and Kirkpatrick's four step curriculum evaluation model (Kirkpatrick, 2013). Although the existing approaches provide useful means to evaluate curriculum issues, they measure isolated aspects of the curriculum viability. Moreover, the existing approaches are time-demanding, expert-oriented, resource-intensive, and economically burdensome. If all inhibitors affecting curricula are known, available in a diagnostic inventory and are explored beforehand, it will help educational institutions to identify their strengths and weaknesses in advance. Keeping these issues in mind, there is a need for a systematic tool or inventory which can help curriculum experts to comprehensively assess the viability of their curriculum. In this PhD thesis, we aim to develop a theoretical framework and teacher and student questionnaires that provide a complete overview of curriculum viability.

Research Questions

This project aimed at the development of a theory and associated instruments for assessing curriculum viability. To achieve this goal, the following four research questions were designed that guided the studies reported in this dissertation:

RQ1: What standards and inhibitors of curriculum quality have been reported in the literature?

RQ2: Which standards and inhibitors addressing curriculum viability in an undergraduate medical education program do education experts agree upon, and how do they rank them according to their importance?

RQ3: What are valid and reliable teacher and student questionnaires that can measure curriculum viability inhibitors in an undergraduate medical curriculum?

RQ4: Which curriculum viability inhibitors are present in an undergraduate medical curriculum and what is the divergence and/or convergence of teachers' and students' perceptions about them?

Through answering these four research questions, we aim to develop a structured approach to assess curriculum viability that can help medical institutions to systematically assess their own curricula, identify deficiencies in different components of a curriculum, and suggest remedies leading to desired curriculum reforms.

Dissertation Outline

In this dissertation, we aim to answer the above mentioned four research questions by means of one scoping literature review and three empirical studies. Figure 1.1 provides an overview of the structure of the dissertation.

	TITLES	CONTENT
1	**Introduction**	*Problem Statement, Aim and Theoretical Framework*
2	**Study 1** Scoping Review	***RQ1:*** *What standards and inhibitors of curriculum quality have been reported in the literature?*
3	**Study 2** Delphi Study	***RQ2:*** *Which standards and inhibitors addressing curriculum viability in an undergraduate medical education programme do education experts agree upon, and how do they rank them according to their importance?*
4	**Study 3** Developing Questionnaires	***RQ3:*** *What are valid and reliable teacher and student questionnaires that can measure curriculum viability inhibitors in an undergraduate medical curriculum?*
5	**Study 4** Measuring Curriculum Viability Inhibitors	***RQ4:*** *Which curriculum viability inhibitors are present in an undergraduate medical curriculum and what is the divergence and/or convergence of teachers' and students' perceptions about them?*
6	**General Discussion**	*Study Findings, Theoretical implications, Strengths and Implications, Practical implications, and Conclusion*

Figure 1.1 demonstrates the outline of the thesis showing the contents of six chapters: introduction, four studies, their corresponding research questions, and the general discussion

Study 1 is described in chapter 2. We conducted a scoping review to find the standards and inhibitors of an undergraduate medical curriculum. The research question that guided this in-depth literature review was:

What standards and inhibitors of curriculum quality have been reported in the literature?
In this scoping review study, we conducted a literature search and reviewed the literature using a stepwise process that included forming a team comprising of four researchers (authors), registering the scoping review protocol, searching the databases, using PRISMA criteria to filter articles and Qualsyst criteria to determine the quality of selected articles. Finally, thematic analysis was conducted to report the standards and inhibitors of curriculum viability.

Study 2 is reported in chapter 3. In this empirical Delphi study, we aimed at developing expert consensus on curriculum viability indicators that were found through the scoping review and rank them according to their importance. The research question that guided this study was:

Which standards and inhibitors addressing curriculum viability in an undergraduate medical education program do education experts agree upon, and how do they rank them according to their importance?
This study comprised of two phases. In the first phase, the expert consensus was developed using a modified Delphi technique on the curriculum viability indicators. In the second phase, the experts ranked the indicators based on their importance.

Study 3 is described in chapter 4. In this empirical study, we aimed to develop valid and reliable questionnaires that can identify the curriculum viability inhibitors, which can hamper the achievement of quality standards in an undergraduate medical institution. The research question that guided this study was:

What are valid and reliable teacher and student questionnaires that can measure curriculum viability inhibitors in an undergraduate medical curriculum?

In this study, teacher and student questionnaires developed by the authors were sent to medical educationalists for qualitative expert validation and to establish their content validity. To establish the response process validity, cognitive interviews were held with teachers and students to clarify any confusion about the meaning of items in the questionnaires. Reliability and construct validity of the questionnaires were established by responses from 575 teachers and 247 final-year medical students.

Study 4 is described in chapter 5. In this empirical study, we aimed at describing an approach to measure curriculum viability inhibitors and finding divergence or convergence between teacher and student opinions, followed by qualitative inquiry to find solutions to disagreement. The research question that guided this study was:

Which curriculum viability inhibitors are present in an undergraduate medical curriculum and what is the divergence and/or convergence of teachers' and students' perceptions about them?

Finally, chapter 6 presents a general discussion of the findings of the previously described studies. After that, theoretical and practical implications along with the strengths and limitations of the whole PhD project are discussed.

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CHAPTER 2:

Determining 'curriculum viability' through standards and inhibitors of curriculum quality: A scoping review

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Abstract

Introduction

A curriculum is dynamic entity and hence, metaphorically, can be considered 'alive'. Curricular diseases may impair its quality and hence its viability. The quality of a curriculum is typically assessed against certain quality standards only. This approach does not identify the inhibitors impeding the achievement of quality standards. The purpose of this study is to identify not only standards but also inhibitors of curriculum quality, allowing for a more comprehensive assessment of what we coin 'curriculum viability'.

Methods

We performed a scoping review of 'curriculum viability', after which 13 articles were found eligible through a meticulous search and selection process. We first identified 1233 studies based on matching keywords, title and abstract; 36 of which met our inclusion criteria. After application of the Qualsyst criteria, two independent reviewers performed a thematic analysis of the 13 articles that remained.

Results

While all studies reported on standards of quality, only two studies described both standards and inhibitors of quality. These standards and inhibitors were related to educational content and strategy, students, faculty, assessment, educational/work environment, communication, technology, and leadership.

Conclusion

The framework of curriculum viability thus developed will help identify inhibitors adversely affecting the curriculum viability and remaining hidden or un-noticed when curriculum evaluation is done.

Keywords: curriculum viability, quality standards, curricular problems, curricular diseases, curriculum evaluation, inhibitors

Introduction

The curriculum has no universal definition, but it can be viewed as a sophisticated blend of educational strategies, course content, learning outcomes, educational experiences, assessment, the educational environment, timetable and program of work (Harden, 2001; Nelson et al., 1992). It becomes outdated or riddled with problems if not regularly reviewed and renewed (Mcleod & Steinert, 2015). Being a dynamic entity, the curriculum can be considered *alive* and, in its ideal state, *healthy*. In humans, the standard values for being non-diabetic are less than 125 mg/dl (American Diabetes Association, 2016), which is one of the standards to be achieved to remain healthy. If such standard is not achieved, the person will become unhealthy (diabetic). Some factors may act as *inhibitors* to the healthy state in humans and contribute to diabetes such as: eating unhealthy food and lack of exercise. Continuing in this metaphorical vein, curricula are like humans. There are curricular inhibitors that may deter them to achieve certain expectations (standards). Relevant literature in curriculum evaluation and accreditation have more emphasis on two aspects, either on setting standards (Tackett et al. 2015) and seeking evidence to confirm their fulfillments or on describing clinical pictures of some curricular diseases (Abrahamson, 1978). There is a need to explore the curricular dynamics and interplay of their elements and most importantly indicate the inhibitors that contribute to the morbidity of curricula.

The traditional approach to determine a curriculum's health condition is to evaluate its quality. Curriculum evaluation aims to determine the curriculum's quality by comparing it *against* different national or global accreditation quality standards (Rezaeian et al., 2013). These quality standards in medical education curricula, for example, serve as *expectations* and may include, but are not limited to, the World Federation of Medical Education (WFME) global standards for quality improvement; Liaison Committee for Medical Education (LCME) accreditation standards; and General Medical Council's (GMC) 'Tomorrow's doctor' standards (Abdalla, 2014; Al-Shehri & Al-Alwan, 2013; Geffen et al., 2014; MacCarrick et al., 2010).

In this approach, quality is synonymous with the attainment of standards (Whalen, Cerchio, & Muslin, 1990), whether they are basic minimum standards or standards of excellence (World Federation for Medical Education, 2015). Consequently, the main emphasis is on defining quality, setting quality standards, comparing them with the outcomes, and on determining the extent to which standards have been met (Arthur

et al. , 2013; Mooney et al., 2010). The quality of curricula can be assessed in areas of mission and objectives, educational program, assessment, students, faculty, educational resources, program evaluation, governance and administration and continuous renewal (MacCarrick et al., 2010). Such quality assessment, however, does not aim to detect the inhibitors that potentially interfere with the attainment of quality standards, but only serves as a checklist of what is in order and what is not. Even if a school or agency does identify the inhibitors that impede the achievement of standards, it is not a structured process that has been described in the literature.

As such, insight into the degree to which quality standards have been met may not give a true reflection of a curriculum's health status. The curriculum may be meeting certain quality standards, but still be fraught with problems (inhibitors) that remain unnoticed without a purposeful effort to detect them (Abrahamson, 1978).

That said, we can identify two approaches in curriculum evaluation, namely: the *reviewers'* approach, which aims to provide a report on the current status of the curriculum against certain standards in a judgmental perspective, and the *interpreters'* approach, which investigates *why* standards have (or have not) been met in a more analytical stance. Reviewers need only standards and evidence from practice to decide, while interpreters need to study the underlying variables that contribute to the current state of the curriculum. Interpreters are like doctors of the curriculum; they gather information to diagnose the condition from different sources.

Curriculum evaluation is done by reviewers, while we would like to introduce a new term that best suit the job of the interpreters: Curriculum viability, which is the current state of a curriculum determined by the degree to which particular quality standards have or have not been met, and inhibitors affecting the attainment of those standards. Hence, measures of viability will yield added information that is more valuable for renewal and improvement than quality measures alone. Figure 2.1 shows the difference in approach and outcome of curriculum evaluation and curriculum viability.

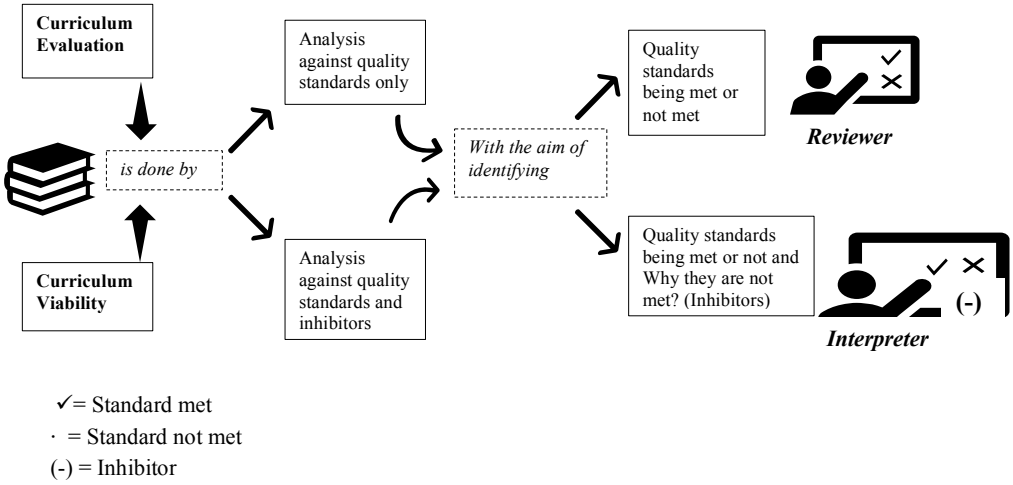

Figure 2.1: Curriculum Evaluation vs Curriculum Viability

The allusion to these inhibitors is not completely new as Abrahamson in 1978 had already identified 'Diseases of the Curriculum' and the problems (inhibitors) responsible for them. He described nine diseases in total, along with the underlying problems in some diseases. While revisiting this iconic article, we can clearly identify some inhibitors that would help curriculum *interpreters*. For instance, c*urriculo-sclerosis* is extreme departmentalization due to extreme ownership of the subject and fighting for the hours of the discipline. *Curriculum carcinoma* is curriculum imbalance due to overgrowth of a particular curriculum segment by the disparity in the powerbase of one or more disciplines. *Curriculo-arthritis* is the miscommunication between disciplines due to limited opportunities for faculty members to meet and interact. *Iatrogenic curriculitis* is the excessive tampering with the curriculum due to abrupt and unplanned response to adjust or modify changes according to meet societal demands and expectations.

The above inhibitors clearly affect a curriculum's viability or well-being, yet they are not considered as part of regular curriculum evaluations based on specific standards (Executive Council WFME, 1998; MacCarrick et al., 2010; Rezaeian et al., 2013). Sometimes the effect of inhibitors on the curriculum viability is not linear or straightforward. For instance, when faculty members resist change, this may not

directly compromise curriculum quality now, but it could hinder the implementation of new ideas, thereby indirectly affecting *future* curriculum reforms. Adding more sophistication, one inhibitor (e.g., ineffective communication among faculty members) may compromise different aspects of curriculum viability and contribute to different manifestations simultaneously.

In summary, we postulate that curriculum viability provides a better foundation for evaluation and improvement than do traditional quality measures and also provides a basis for preventive measures. In the current study, we planned to conduct a scoping review to provide a quick overview to identify not only standards, but also inhibitors of curriculum quality, thereby allowing for a more comprehensive assessment of *curriculum viability*. The study aims to address two research questions: (1) What, according to the literature, are standards of curriculum quality? (2) What inhibitors of curriculum quality, have been reported in the literature?

Methods

Search Strategy

We have used scoping review as a search strategy as it is of particular use when the topic has not yet been extensively reviewed or is of a complex nature. The purpose of a scoping review is to map the body of literature on a topic area to clarifying definition and conceptual boundaries of topic or field. It shares a number of the same processes as systematic reviews as they both use rigorous and transparent methods to identify and analyze all the relevant literature (Sargeant et al., 2014). Curriculum viability is a new concept, hence we selected scoping review as our methodology.

We started the scoping review by identifying and scrutinizing the problem, assembling the review team, and formulating research questions. Consequently, we developed a methodological and systematic search strategy by defining key terms and selecting relevant databases for our literature search. We used Web of Science as the primary database, as the search results are reproducible and reportable, and it contains high quality peer reviewed journals. Google Scholar was used to search for grey literature so that information that is yet to be peer reviewed is known to the researchers and also to double check that no relevant article is missed that was

searched through Web of Science (Haddaway et al., 2015). Other search strategies used to identify articles of interest were a manual literature search, snowballing and seeking expert help (Haig & Dozier, 2003). The details of the search strategy are given in Appendix 2.1.

Key Terms Used

To identify relevant studies, we used the key terms 'curriculum', 'viability', 'quality', 'indicators', 'education', 'evaluation', 'issues', 'diseases', 'inhibitors', 'standards and tools', in addition to the synonyms 'syllabus', 'excellence', 'marker', 'teaching and learning', 'problems' and 'instruments. We also employed Boolean operators in concatenations of multiple keywords as in: (Curriculum OR Educational Program OR Syllabus OR Course) AND (Indicators OR Standards) AND (Quality OR Excellence) AND (Problems OR Issues OR diseases OR Inhibitors).

Studies Selected

The article selection process is presented in Figure 2.2 and consisted of the following four phases: (1) identification, (2) screening, (3) determining eligibility, and (4) final inclusion of articles in the scoping review.

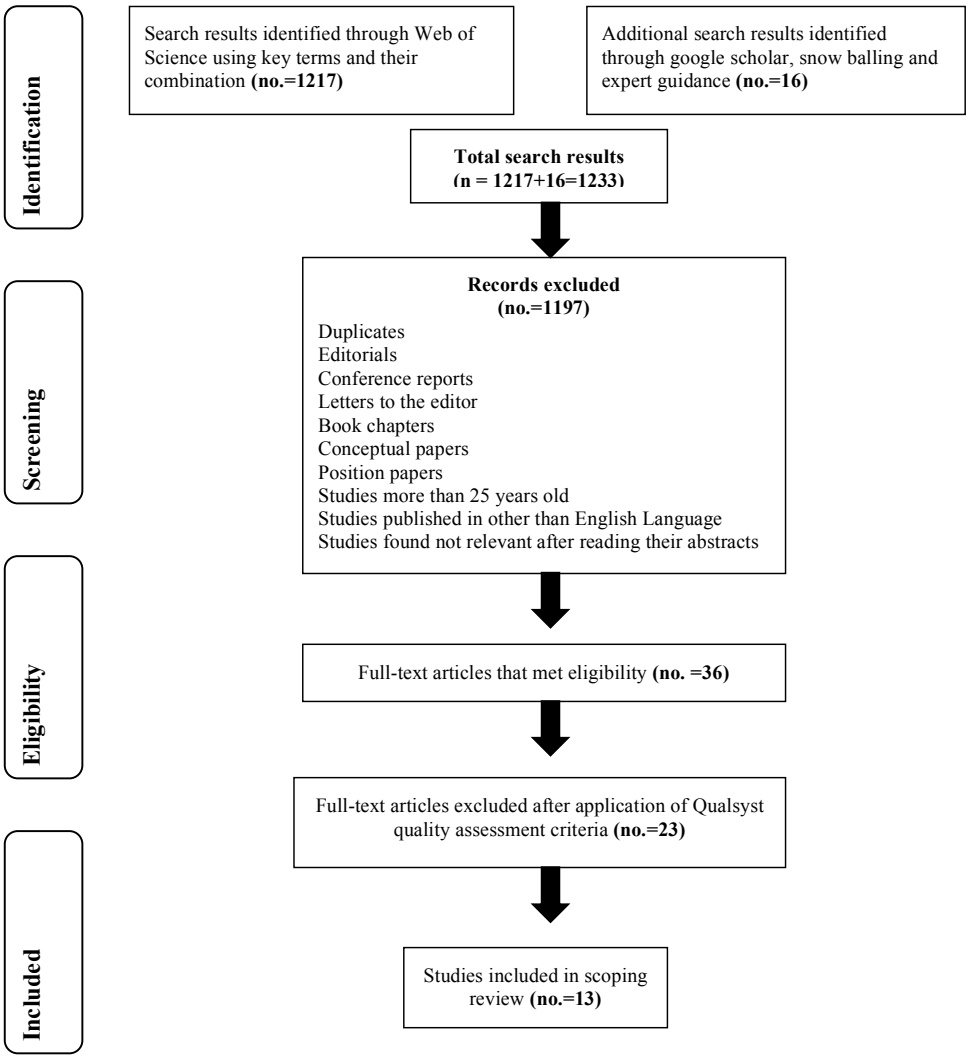

Figure 2.2 PRISMA flow diagram depicting the process of filtering articles for scoping review

In the first phase, the lead author (RAK) identified a total of 1233 records after searching the literature for studies whose keywords, titles and abstracts matched the keywords -or combinations thereof- entered. We consequently applied inclusion and exclusion criteria (see Table 2.1) and removed duplicates in the screening phase, after which 36 full-text articles remained. In the eligibility phase, these articles were read using the validated Qualsyst checklist to assess the quality of both quantitative and qualitative studies (Kmet et al. , 2004), the former containing 14, and the latter comprising 10 criteria. We scored each item on a 3-point scale (0 = No, 1 = Partial, 2 = Yes) with a maximum attainable score of 28 for the quantitative and of 20 for the qualitative studies. The final score was derived by dividing the total score by either 28 or 20 as applicable. Consistent with Kmet, Lee and Cook's (2004) approach, we flagged a final score of > 0.80 as high, 0.71-0.79 as good, 0.50-0.70 as sufficient, and < 0.5 as limited quality. The details of the finalizing the articles based on Qualsyst criteria are provided in Appendix 2.2. Thirteen articles found to be of adequate to good quality, published in the last 25 years (from 1992 to 2017), were included in the scoping review.

Table 2.1 Inclusion and exclusion criteria

Inclusion criteria	Exclusion criteria
• Original research articles and systematic reviews • Studies found through Web of Science • Studies published in last 25 years (from 1992 to 2018) • Studies related to educational research only • Studies published in English language only • Grey literature • Studies found through manual search and snowballing	• Abstracts only • Citations only • Editorials • Conference reports • Letters to the editor • Book chapters • Conceptual papers • Position papers

Data Analysis

Two authors (RAK and AS) read the 13 articles and performed a thematic analysis of the data (Sharma et al., 2015). They first used open coding to identify standards as well as inhibitors of quality, before proceeding to axial and selective coding in order to find relationships and commonalities between codes and generate themes and subthemes.

Results

The 13 articles of adequate to good quality finally included in the scoping review consisted of realist reviews, mixed-methods research studies, archival research, evaluation research and descriptive surveys. These articles are subsumed in Tables 2.2 and 2.3. While 11 articles specifically focused on standards of curriculum quality (Table 2.2), answering our first research question, only two articles covered inhibitors affecting curriculum quality (Table 2.3), touching upon our second research question. More specifically as is evident from Table 2.2, articles 1-2 discussed quality indicators for distance learning; articles 3-5 addressed quality, quality culture and quality assurance of the curriculum; article 6 concentrated on the quality of the educational environment; and articles 7-11 looked into the assessment of curriculum quality based on global WFME quality standards. Articles 1-2 in Table 2.3, on the other hand, specifically dealt with inhibitors of curriculum quality.

Table 2.2: Standards of curriculum quality as reported in the literature

Article	Standards of Curriculum Quality
1. A Primer on Quality Indicators of Distance Education (Chaney et al., 2009)	• Prompt feedback • Student support services • Program evaluation and assessment • Clear analysis of audience • Documented technology plan • Course structure guidelines • Active learning techniques • Respect for diverse learning styles • Faculty support services • Strong rationale for distance education that correlates to the mission of the institution • Appropriate tools and media • Reliability of technology • Course structure guidelines • Implementation of guidelines for course development • Review of instructional materials • Institutional support and services
2. Developing of indicators of an e-learning benchmarking model for higher education institutions (Sae-Khow, 2014)	• Institution and organisation • Curriculum and instructional design • Resources and information technology • Learning and teaching • Learner faculties and supporting personnel • Measurement and evaluation
3. Understanding Quality Culture in Assuring Learning at Higher Education Institutions (Njiro, 2016)	• Development of a relevant mission and vision • Achievement of internal/external standards and goals • Procurement of resources for optimal institutional functioning • Degree to which student complaints are addressed • Competence of instructors • Student engagement with faculty, staff, and administration
4. Counting quality because quality counts: differing standards in master's in medical education program (Pugsley et al., 2008)	• Modality, time frame and core teaching team of the taught component • Length of program • Length of dissertation and time allotted for its completion

Table 2.2: CONTINUED

Article	Standards of Curriculum Quality
5. Quality Assurance in Higher Education: A Review of Literature (Ryan, 2015)	• Involvement of students in quality assurance process: student's evaluation of academic programs • Faculty-student interaction
6. Development and validation of the Dundee Ready Education Environment Measure (DREEM) (Roff et al., 1997)	• Students' perceptions of teaching • Students' perceptions of teachers • Students' perceptions of atmosphere • Students' academic self-perception • Students' social self-perception
7. Designing an evaluation framework for WFME basic standards for medical education (Tackett et al., 2015)	• Mission and objectives • Educational program • Assessment of students • Students
8. Preparing for an institutional self-review using the WFME standards – An International Medical School case study (MacCarrick et al., 2010)	• Academic staff/faculty • Educational resources • Program evaluation • Governance and administration • Continuous renewal
9. Evidence-based postgraduate training. A systematic review of reviews based on the WFME quality framework (Damen et al., 2011)	
10. Evaluating a master of medical education program: Attaining minimum quality standards? (Al-Subait & Elzubeir, 2012)	
11. The importance of medical education accreditation standards (van Zanten et al., 2012)	

Table 2.3: Indicators of curriculum viability, comprising standards as well as inhibitors of curriculum quality, that have been reported in the literature

Article	Curriculum viability indicators
1. Unravelling quality culture in higher education: a realist review (Bendermacher et al., 2017)	**Standards of Curriculum quality** • Strategy for continuous improvement • Quality management systems • Staff and student involvement in organizational decision-making • Consideration of evolving student demands • Clear policies, procedures, systems, responsibilities • Flexible, people-oriented cultures • Presence of various cultures • Shared (educational) quality values • Leadership commitment and skills • Allocation of resources • Creation of partnerships, leaders' ability to influence people and process management • Creation of climate of trust and shared • understanding • Ability to perform multiple roles • Setting and communication of policies • Communication/information for quality • Provision of information on strategies and policies • Clear task requirements and responsibilities **Inhibitors of Curriculum quality** • Lack of staff and student involvement in organizational decision-making • Failure to respond to evolving student demands • Lack of policies, procedures, systems, responsibilities • Lack of resources • Rigid, control-oriented cultures • Top-down approaches to quality management implementation • Presence of strong disciplinary cultures • Research culture that undervalues education • Focus on inspection and control • Leaders acting as information gatekeepers • No/insufficient sharing of best practices across the organisation • Lack of appropriate communication channels

2. Implementing an online curriculum for medical education: examining the critical factors for success (Olson et al., 2013)	**Standards of Curriculum Quality** • Curriculum design • Instructional feedback • Curriculum implementation • Media features • Integration • Time • Learner-centered environment • **Inhibitors of Curriculum quality** • Inappropriate level of curriculum content • Low-quality quizzes • Technological barriers • User interface barriers • Low-quality integration • Perceived lack of sufficient time • Trainee resistance to new curriculum • Lack of social interaction

Correspondingly, two main themes emerged from the thematic analysis of these 13 articles: 'Standards of curriculum quality' and 'inhibitors of curriculum quality' addressing curriculum viability. These two themes, moreover, spanned eight subthemes or areas affecting the quality of the curriculum, specifically: 1) educational strategy and content, 2) students, 3) faculty, 4) assessment, 5) educational environment, 6) curricular communication, 7) technology, and 8) leadership.

Theme 1: Standards of Curriculum Quality

An analysis of the literature unearthed several factors that promote curriculum quality. Standards of a sound *educational strategy and content* contributing to curriculum quality were the presence of a robust and relevant mission and related objectives (Damen et al., 2012), a proper design, availability of instructional development and implementation guidelines, and regular reviews of instructional materials (Chaney et al., 2009). *Students* also played an important role in determining curriculum quality, with their perceptions of teaching, teachers, educational atmosphere, academic self-perception and social self-perception bearing a positive relationship to the quality of the educational environment

(Roff et al., 1997). Involving students in the organization's decision-making processes, evaluating academic programs (Ryan, 2015), letting them use active learning techniques in the case of distance learning programs (Chaney et al., 2009), and allowing them sufficient protected time (Olson et al.,2013) were all factors conducive to quality. In a similar fashion, involving faculty in multiple roles, organizational decision-making (Bendermacher et al., 2017) and in regular faculty development activities, and acquainting them with new teaching methods helped boost the quality of the curriculum. Also, teachers who respected their students' different learning approaches were important contributors to curriculum quality (MacCarrick et al., 2010).

In the area of *student assessment,* provision of prompt feedback raised curriculum quality by affording students the opportunity to become aware of their shortcomings and improve themselves (Sae-Khow, 2014). The *environment* too, could be beneficial when learner-centered as this increased learning opportunities for students (Olson et al., 2013) ; and in the case of the work environment, when characterised by a flexible and people-oriented culture, a climate of trust, and a shared understanding among faculty and support staff of educational principles used in the curriculum (Bendermacher et al., 2017). Other quality-enhancing factors were proper *communication* of the curriculum to stakeholders which increased its effectiveness (Bendermacher et al., 2017; Damen et al., 2011), use of reliable *technology* underpinned by a well-documented technology plan, and selection and use of appropriate tools and media in the case of distance-based learning (Chaney et al., 2009). Finally, effective *leadership* could drive curriculum quality, with leaders having the multifaceted capacity to create partnerships, allocate resources, influence people, process management, optimize institutional functioning and achieve standards and goals (Bendermacher et al., 2017).

Theme 2: Inhibitors of Curriculum Quality addressing Curriculum Viability

As briefly touched upon previously, only Bendermacher et al. (2017) and Olson et al. (2013) (Table 2.3) described both standards and inhibitors of curriculum quality, thereby addressing curriculum viability and answering our second research question. While Bendermacher et al. (2017) specifically focused on the organizational context elements such as communication and leadership that impact quality culture, Olson et al. explored standards and inhibitors from a distance education perspective.

Addressing the quality inhibitors, the first ones we encountered in the area of

educational strategy and content were inappropriate content and a low level of integration preventing the proper utilization of curriculum contents (Olson et al., 2013). Moreover, little social interaction and *students'* resistance to curriculum renewal, acted as barriers to learning. Further undermining curriculum quality, by detrimentally affecting quality culture, was a failure to respond to evolving student demands (Bendermacher et al., 2017). In distance learning programs, a perceived lack of sufficient time caused by excessive service obligations, a lack of protected time and infringes on personal time all compromised curriculum quality (Olson et al., 2013). Other impediments to curriculum quality were the exclusion of *faculty* from organizational decision-making (Bendermacher et al., 2017) and an unfavorable *educational/work environment*. The latter denotes a rigid, control-oriented and disciplinary culture and a research culture that undervalues education (Bendermacher et al., 2017).

While weak *communication* channels and lack of sharing of best practices across the organisation obscured the attainment of good curriculum quality (Bendermacher et al., 2017), *technological* hindrances, such as software problems during video-enhanced lectures and insufficient computer access at work did the same in the case of distance learning programs (Olson et al., 2013). To end, ineffective *leadership* could adversely affect the quality of the curriculum, which was the case when educational leaders failed to establish clear policies, procedures, systems, resources and a distribution of responsibilities, and/or acted as communication gatekeepers who focused on inspection and control only (Bendermacher et al., 2017).

Discussion

The purpose of the present scoping review was to identify standards and inhibitors of curriculum quality to assess curriculum viability. Since the assessment of a curriculum's viability requires knowledge of both standards and inhibitors of curriculum quality, we made an effort to find articles that described both elements. We found 13 studies in total of which only two studies (Bendermacher et al., 2017; Olson et al., 2013) fully met this criterion, although they did not specifically refer to these factors as assessing curriculum viability.

In our quest for standards of curriculum quality that would answer our first research question, we found different definitions and explanations of such standards in the research literature. Different quality standards appeared to exist, but the ones most often cited in the papers we reviewed, were the widely accepted WFME global standards, which are

structured according to nine broad areas of curriculum quality (World Federation for Medical Education, 2015). Although these standards enjoy wide currency and offer a holistic representation of quality, many find them difficult to interpret and use (Tackett et al., 2015). Another disadvantage is that they make no reference whatsoever to the inhibitors potentially affecting the curriculum quality. Next, a few papers included in our scoping review specifically addressed quality standards for distance learning curricula (Chaney et al., 2009; Olson et al., 2013; Sae-Khow, 2014). Comparison of the quality standards for distance-based curricula with those of their campus-based counterparts led us to conclude that the former, albeit sparse, varied and less structured, harbored the additional quality areas of 'technology' and 'protected time'.

As previously mentioned, Bendermacher et al. (2017) and Olson et al. (2013) provided an indirect answer to our second research question. In their realist review, Bendermacher et al. (2017) described the organizational context elements that inhibit quality culture. Organizational context is one of the areas that affects the curriculum quality. Harden in 1986, in his '*Ten Questions*' also describes 'Organisation of the curriculum' as one of the questions to be answered while developing the curriculum (Harden, 1986). Regarding organizational context, leadership and communication are important areas (MacCarrick et al., 2010), without which successful implementation of curriculum is not possible as they affect the quality of curriculum directly. Related to this, Bendermacher et. al (2017) have described the inhibiting elements related to ineffective leadership, lack of student and staff involvement, insufficient resources, a rigid culture, and poor communication. Olson et al. (2013) on the other hand, only addressed quality determinants pertaining to distance learning.

While it is true that reference to inhibitors related to the development, integration, content and communication of curricula is not new (Abrahamson, 1978), we did not find any recent literature on viability indicators that combined standards *and* inhibitors of curriculum quality in the areas of 'mission and objectives', 'faculty development', 'student assessment', 'student support', 'governance', 'program evaluation' and 'curriculum renewal'. Early detection of inhibitors in these areas may help prevent a curricular catastrophe from developing. Since prevention is better than cure, any curriculum assessment should not neglect to identify the inhibitors that potentially deter the attainment of desired standards.

Based on the results previously outlined, we developed a framework for curriculum viability (Table 2.4) that combines 37 standards and 19 inhibitors. Taken together, standards and inhibitors can be considered as 'indicators of curriculum viability'. They have been divided among the eight subthemes or areas affecting the quality of a curriculum, namely:

educational strategy/content, students, faculty, assessment, educational/work environment, curriculum communication, technology, and leadership.

Using this framework, curriculum interpreters can identify inhibitors that impede the achievement of standards. The framework is mainly intended towards interpreters who aim to find possible causes of a 'unhealthy curriculum'; either to prevent it from the disease or cure it. For instance, 'students' resistance to new curriculum' will not only explain the impediment of achievement of standards in the area of 'students', such as 'lack of student engagement with faculty', but it may also effect other areas such as 'assessment'. Hence the inhibitors may not only be interpreted against their standards but also as stand-alone problems that may afflict any area of the curriculum. The timely identification of these inhibitors prevents the curriculum from becoming less viable or non-viable.

The viability frame work addresses areas of the curriculum comparable to components of the curriculum as reported in literature (Harden, 1986; Kern et al., 2010; MacCarrick et al., 2010). Inhibitors against standards have been scantly reported in the literature; hence our curriculum viability framework has only considered those standards against which inhibitors were reported directly or indirectly in an impact factor journal. This is being reflected in the framework where there are greater numbers of standards in one area than in another area, and the same is true for inhibitors.

Limitations and Venues for Future Research

One of the limitations of this study is that we were unable to establish links between standards and inhibitors of curriculum quality in a holistic fashion. This is because the literature on inhibitors of curriculum quality was scant. However, our analysis of the literature did result in a framework presenting indicators of curriculum viability that embraces both standards and inhibitors. This framework as depicted in Table 2.4 may guide the further exploration of inhibitors in curriculum areas hitherto uninspected, that potentially explain why particular standards have not been met. Hence, it is important that instruments be developed that measure not only a curriculum's quality but also its viability, enabling stakeholders to obtain a true and comprehensive picture of their curriculum's current health status and to identify the reasons why specific standards have not been met. The second limitation was that we searched for English-language articles only, meaning that we may have missed some studies on curriculum quality and viability written in other languages.

Table 2.4: Framework for assessing curriculum viability

Area	Standards	Inhibitors
Educational Strategy	1. Development of relevant Mission and Objectives 2. Curriculum design 3. Length of program 4. Implementation guidelines 5. Review of instructional material	1. Low quality integration 2. In appropriate curriculum content level
Students	6. Perception of teaching 7. Perception of teachers 8. Perception of atmosphere 9. Academic self-perception 10. Social self-perception 11. Student support services 12. Student engagement with faculty, staff, and administration 13. Degree to which student complaints are addressed 14. Active learning techniques 15. Clear analysis of audience	3. Lack of time for sufficient studying 4. Neglecting Student demands 5. Student's resistance to new curriculum
Faculty	16. Ability to perform multiple roles 17. Competence of instructors 18. Staff involvement in organizational decision making 19. Faculty Development 20. Respect Diverse ways of learning	6. Lack of staff involvement in organizational decision making
Assessment	21. Prompt feedback 22. Measurement and Evaluation	7. Low quality quizzes
Educational and working Environment	23. Flexible people-oriented culture 24. Presence of various cultures 25. Climate of trust and shared understanding 26. Learner centered environment	8. Rigid, control-oriented cultures 9. Presence of strong disciplinary cultures 10. Research culture undervaluing education
Communication	27. Communicating policies and strategies 28. Communication/Information for quality	11. Lack of sharing best practices across the organization 12. Lack of appropriate communication channels 13. Lack of social interaction
Technology	29. Documented technology plan 30. Appropriate tools and media 31. Reliability of technology 32. Resources and information of technology	14. Technology Barriers 15. User interface Barriers
Leadership	33. Create partnerships 34. Influence people management 35. Achieving internal/external standards and goals 36. Procuring resources for optimal institutional functioning 37. Allocate resources	16. Lack of policies, procedures, systems, and responsibilities 17. Lack of resources 18. Acting as communication gatekeepers 19. Focus on inspection and control

Conclusion

This scoping review explored different standards and inhibitors of curriculum quality. We introduced the term 'curriculum viability' as denoting a curriculum's well-being that can be determined only by considering the degree to which quality standards have been met or not attained as well as the inhibitors affecting the attainment of those standards. We hope that this modified evaluation framework will help identify problems adversely affecting the well-being of a curriculum and remaining hidden or un-noticed when curriculum evaluation is done, thereby contributing to its improvement and innovation.

List of Abbreviations

DREEM: Dundee Ready Education Environment Measure
GMC: General Medical Council
LCME: Liaison Committee for Medical Education
WFME: World Federation of Medical Education

Appendix 2.1: Online Search Strategy

Data bases searched were Web of Science including its three data bases namely (i) Web of Science core collection (ii) MEDLINE (iii) SciELO citation Index.

Web of Science core collection further consists of six online databases which are (i) Science Citation Index Expanded, (ii) Social Science Citation Index, (iii) Arts and Humanities Citation Index, (iv) Emerging Sources Citation Index, (v) Book Citation Index and (vi) Conference Proceedings Citation Index.

Serial No.	Search Results	Key terms and their Combinations
# 1	104,285	(Teaching and learning)
# 2	3,550	(syllabus)
# 3	796,450	(course)
# 4	99,876	(Educational Program)
# 5	25,709	(Excellence)
# 6	2,121,622	(Standard)
# 7	984,578	(marker)
# 8	2,344,336	(Problems)
# 9	1,295,140	(Issues)
# 10	9,747,022	(Diseases)
# 11	512,067	(Instruments)
# 12	130,817	(curriculum)
# 13	2,402,543	(Quality)
# 14	538,731	(Indicator)
# 15	2,044,220	(Evaluation)
# 16	240,771	(Viability)
# 17	1,098,382	(Education)
# 18	1,777,173	(Inhibitors)
# 19	1,255,717	(Tools)
# 20	947,050	#12 OR #4 OR #3 OR #2
# 21	37,643	#20 AND #18
# 22	118	#18 AND #12
# 23	13	#18 AND #13 AND #12
# 24	12,705,703	#10 OR #9 OR #8
# 25	35,813	#24 AND #12
# 26	0	#18 AND #16 AND #13 AND #12 AND #10 AND #6
# 27	0	#18 AND #16 AND #14 AND #13 AND #12
# 28	25	#16 AND #13 AND #12
# 29	4	#14 AND #13 AND #12 AND #5
# 30	0	#29 AND #16
# 31	420	#14 AND #13 AND #12
# 32	200	#16 AND #12
# 33	2,142,295	#6 OR #5
# 34	108	#33 AND #13 AND #12 AND #9 AND #8
# 35	0	#18 AND #13 AND #12 AND #5
# 36	850	#14 AND #13 AND #4

# 37	0	#18 AND #13 AND #12 AND #9 AND #6
# 38	340	(Curriculum AND Quality AND Indicators AND Education)
# 39	236	(Curriculum AND Quality AND Indicators AND Education) Refined by RESEARCH AREAS (EDUCATIONAL RESEARCH OR PSYCHOLOGY)
# 40	8	(Syllabus AND Quality AND Indicators AND Education
# 41	2	(Syllabus AND Quality AND Indicators AND Education) Refined by RESEARCH AREAS (EDUCATIONAL RESEARCH OR PSYCHOLOGY)
# 42	476	(Course AND Quality AND Indicators AND Education)
# 43	258	Course AND Quality AND Indicators AND Education) Refined by RESEARCH AREAS (EDUCATIONAL RESEARCH OR PSYCHOLOGY)
# 44	398	(Educational Program AND Quality AND Indicators AND Education) Refined by RESEARCH DOMAINS (SOCIAL SCIENCES) AND RESEARCH AREAS (EDUCATIONAL RESEARCH OR PSYCHOLOGY) AND DOCUMENT TYPES (ARTICLE)
# 45	8	(Curriculum AND Excellence AND Indicators AND Education)
# 46	6	Curriculum AND Excellence AND Indicators AND Education) Refined by RESEARCH DOMAINS (SOCIAL SCIENCES) AND RESEARCH AREAS (EDUCATIONAL RESEARCH)
# 47	1	(Syllabus AND Excellence AND Indicators AND Education)
# 48	17	(Educational Program AND Excellence AND Indicators AND Education)
# 49	0	(Curriculum AND Excellence AND Markers AND Education)
# 50	0	(Syllabus AND Excellence AND Markers AND Education)
# 51	151	(Curriculum AND Excellence AND Evaluation AND Education)
# 52	5	(Syllabus AND Excellence AND Evaluation AND Education)
# 53	103	(Educational Program AND Excellence AND Evaluation AND Education) Refined by AND RESEARCH AREAS: (EDUCATIONAL RESEARCH OR PSYCHOLOGY) AND DOCUMENT TYPES: (ARTICLE OR REVIEW)
# 54	2,151	(Curriculum AND Quality AND Evaluation AND Education) Refined by: RESEARCH AREAS: (EDUCATIONAL RESEARCH OR PSYCHOLOGY) AND DOCUMENT TYPES: (ARTICLE OR REVIEW) AND RESEARCH AREAS: (EDUCATIONAL RESEARCH OR PSYCHOLOGY)
# 55	58	(Syllabus AND Quality AND Evaluation AND Education
# 56	287	TOPIC: (indicators) AND TOPIC: (curriculum) Refined by RESEARCH AREAS: (EDUCATIONAL RESEARCH OR PSYCHOLOGY)
# 57	152	TOPIC: (viability) AND TOPIC: (curriculum) Refined by RESEARCH DOMAINS: (SOCIAL SCIENCES OR SCIENCE TECHNOLOGY) AND RESEARCH AREAS: (EDUCATIONAL RESEARCH OR HEALTH CARE SCIENCES SERVICES OR PSYCHOLOGY) AND RESEARCH AREAS: (EDUCATIONAL RESEARCH OR PSYCHOLOGY)

Appendix 2.2: Assessing the quality of articles and Inter-rater agreement

Study	Methodology	Questions (Qualsyst Criteria)														Total score	%	Agreement	Quality
		1	2	3	4	5	6	7	8	9	10	11	12	13	14				
RK S1	Quantitative Cross-sectional Survey	2	1	2	NA	NA	NA	NA	2	2	1	0	NA	2	2	14/18	78	✓	G
UM S1		2	1	2	NA	NA	NA	NA	1	2	1	0	NA	2	2	13/18	72		
RK S2	Systematic Review	2	2	2	NA	2	2	2	1	2	0					15/18	83	✓	H
UM S2		2	2	2	NA	2	2	2	1	2	0					15/18	83		
RK S3	Literature Review and Document Analysis	2	1	2	NA	NA	1	1	0	2	0					9/16	56	✓	S
UM S3		2	1	2	NA	NA	1	0	0	2	0					8/16	50		
RK S4	Qualitative exploratory study	2	2	2	NA	2	2	2	NA	2	0					14/16	88	x	G-H
UM S4		2	2	2	NA	2	2	2	0	2	0					14/18	78		
RK S5	Literature Review	2	1	2	2	NA	NA	0	NA	2	1					10/16	63	✓	S
UM S5		2	0	2	2	NA	NA	0	NA	2	1					9/16	56		
RK S6	Grounded theory and Delphi	2	2	2	2	2	2	1	2	2	NA					16/18	89	✓	H
UM S6		2	2	2	2	2	2	1	1	0	NA					15/18	83		
RK S7	Document Analysis and Framework Development	2	1	2	1	1	2	2	NA	1	0					12/18	67	✓	S
UM S7		2	1	2	1	0	2	1	NA	1	1					11/18	61		
RK S8	Evaluation Review	2	0	2	1	1	1	2	NA	2	1					12/18	67	✓	S
UM S8		2	0	2	1	1	1	2	NA	2	1					12/18	67		
RK S9	Systematic Review	2	2	2	2	2	2	2	0	2	0					16/20	80	✓	H
UM S9		2	2	2	1	2	2	2	1	2	1					17/20	85		
RK S10	Mixed Method Qualitative part	2	2	2	0	2	2	2	1	1	0					14/20	70	✓	S
UM S10		2	2	2	0	1	2	2	1	2	0					14/20	70		
RK 10	Quantitative part	2	2	2	1	NA	NA	NA	1	2	2	1	0	2	2	17/22	77	✓	G
UM 10		2	2	2	2	NA	NA	NA	1	2	2	0	0	2	2	17/22	77		
RK S11	Cross sectional Survey	2	2	2	1	NA	NA	0	2	2	1	1	1	2	2	20/24	83	✓	H
UM S11		2	2	2	2	NA	NA	0	2	1	2	2	0	2	2	20/24	83		
RK S12	Realist Review	2	2	2	0	2	2	2	1	2	1					16/20	80	x	G-H
UM S12		2	2	2	0	2	2	2	0	2	1					15/20	75		
RK S13	Qualitative Focus group	2	2	2	0	2	2	2	0	2	0					14/20	70	x	S
UM S13		2	2	2	0	2	2	2	1	2	0					15/20	75		

x = No agreement. ✓ = Agreement. Quality of article: H = High > 80%, Good = 71-79%, Sufficient = 50-70%, Limited = <50%.

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CHAPTER 3:

Curriculum viability indicators: A Delphi study to determine standards and inhibitors of a curriculum.

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Abstract

Curriculum evaluation is typically done by using quality standards defined by accrediting bodies. This does not include inhibitors that hinder the achievement of standards. Hence, to address both standards and inhibitors, we have coined the new concept of 'curriculum viability'. This study establishes consensus among surveyed experts on curriculum viability indicators, i.e., standards and inhibitors, and aims to provide a framework for evaluating the curriculum viability. The study was done in two phases. In the first phase, a consensus was established on the curriculum viability indicators using the Modified Delphi Technique using two rounds. In the first round of the Delphi process, 25 experts participated, which was reduced to 19 in the second round. After two rounds, experts developed a consensus on 40 out of 44 items. These included 27 standards and 13 inhibitors. In the second phase, 18 experts rank-ordered the indicators according to their relative importance in the areas of educational content and strategies, faculty, leadership, assessment, students, educational/working environment, communication, and technology. The list of indicators provides a framework for evaluating the curriculum viability, and their ordering enables curriculum managers to prioritize them during curriculum evaluation.

Keywords: curriculum viability, quality standards, curriculum evaluation, Delphi study, Inhibitors

Introduction

Curriculum evaluation is routinely used to determine the quality of a curriculum by comparing it against certain quality standards. Curriculum evaluation may show that a curriculum is either meeting or not meeting the expected standards (Mcleod & Steinert, 2015). Usually, the curriculum evaluation does not consider inhibitors which indicate problems that may negatively affect curriculum quality and offer justifications on *why* the standards were not met.

In this paper, we introduce a new term: 'curriculum viability'. To understand curriculum viability, the terms curriculum, quality, standards, indicators, and inhibitors are explained first.

Thomas et al. defined the curriculum as a planned educational experience (Thomas et al., 2016), whereas Abrahamson characterized it as a dynamic living entity (Abrahamson, 1978). Some educators take a narrow view, with the curriculum comprising only a collection of courses and syllabi. In our viewpoint, curriculum is more than a set of syllabi and courses; rather, it involves all the materials and activities that aim to facilitate students' learning (Harden, 2001). Moreover, the definition of curriculum has evolved. Bosco (1971) described the basic structure of curriculum through his curriculum theory, including aims, contents, methods of teaching, and evaluation. As research in education has continued, the definition of curriculum has expanded, influenced by curriculum development and instructional design models (Edgar, 2012; Harden, 2001). Accreditation standards that measure the quality of medical education further expand the concept of curriculum beyond the core areas of aim, content, pedagogy, and assessment to include extended/supportive areas, such as the role of students, faculty, governance, and curriculum renewal (Gjerde & Sheehan, 1980; Karle, 2006).

When we employ the metaphor of a human being for the curriculum (Abrahamson, 1978) and consider it a dynamic living entity, we must acknowledge the probability that it may become sick. This could be due to problems affecting different components of the curriculum, as stated earlier. These problems are referred to as 'inhibitors' that impede the curriculum from meeting quality standards. Therefore, to ensure the viability or 'well-being' of a curriculum, the inhibitors of the curriculum should also be identified.

Quality in medical education can be defined in relative terms as the "state of reaching required standards as prescribed by the external agencies, and it meets those standards time and time again" (Joshi, 2012, p. 285). Here, we refer to standards as basic quality requirements that serve as a benchmark against which the quality of a program is evaluated and indicate where a program is falling short of achieving quality. They are a

separate entity from facilitators that promote the curriculum quality (Bendermacher et al., 2017). The term indicator is used to denote specific, measurable characteristics of the program on which evidence can be collected. Our term curriculum viability includes both standards and inhibitors as indicators.

Quality standards are typically laid by higher education councils and accreditation bodies and agencies. For instance, the World Federation for Medical Education (WFME) in collaboration with the World Health Organization (WHO) provides 'Basic medical education quality standards', which have wide global acceptance (Karle, 2008). The standards in each of the areas define the criteria of achieving quality but do not consider the inhibitors of the curriculum. In the literature, inhibitors affecting the curriculum quality have been reported, but they have not been considered part of the accreditation standards (Rezaeian et al., 2013; Tackett et al., 2015). For instance, in one of the sub-areas of 'educational program', the WFME document describes one standard to be achieved as, "The medical school must define the curriculum models and instructional methods employed", and another standard as "The curriculum and instructional methods should ensure that the students have responsibility for their learning process" (World Federation for Medical Education, 2012, p. 10). Still, the possible inhibitors that may impede the achievement of these standards are not stated.

Although inhibitors are not a part of quality standards, reviewers during program evaluation may explore them, based on the queries raised by the institution. Some of these queries can be: 'What are the weaknesses of a curriculum?' or 'What are the reasons for identified gaps between the developed and implemented curriculum?' (Posner, 2004). While evaluating a curriculum, some reviewers may use CIPP, Logic, or any other model relevant to curriculum evaluation (Frye & Hemmer, 2012; Ruhe & Boudreau, 2013). If a reviewer uses the CIPP model, which involves the evaluation of context, input, process, and product of a program's value, curriculum viability can provide a road map for evaluating different areas of the curriculum with an additional value of already defined inhibitors. Some of the inhibitors already identified in the literature are: extreme ownership of the subject and faculty fighting for the available hours for teaching the discipline, limited opportunities for faculty members to meet and interact, abrupt and unplanned response to adjust or modify changes in the curriculum to meet societal demands and expectations, lack of student engagement with faculty, presence of strong disciplinary cultures, a research culture that undervalues education, lack of communication channels (Bendermacher et al., 2017), lack of sufficient study time, teacher resistance to student demands, and low-quality quizzes (Olson et al., 2013). These inhibitors can inform the reviewer about the issues or challenges that may

be hindering the achievement of quality standards. One such use of curriculum viability can be that inhibitors such as 'lack of sufficient study time' and 'teacher resistance to student demands can inform the reviewers about the issues faced by students, as part of the 'input' component of the CIPP model. In the Logic model, which consists of resources, activities, outputs, and outcomes, the resources and activities are related to the inputs dedicated to the program and the actions taken by it to achieve the desired outcomes, respectively (Frye & Hemmer, 2012). Using curriculum viability indicators, the resources and activities can be evaluated considering both the standards and inhibitors in a similar way as stated for the CIPP model.

To close the gap in the curriculum evaluation literature wherein inhibitors have been largely ignored so far, we use the concept of *curriculum viability* to include both standards and inhibitors. A curriculum evaluated through the lens of curriculum viability would furnish a more realistic picture of its current status. We could not find studies that address the consensus and perceived importance of both standards and inhibitors. Hence, we performed a scoping review to explore standards and inhibitors to characterize curriculum viability. These standards and inhibitors reported in the literature were in the domains of educational strategy and content, faculty, leadership, assessment, students, educational environment, communication, and technology (Khan et al., 2019).

This study explores two questions: (1) Upon which standards and inhibitors addressing curriculum viability in undergraduate medical education, do the experts agree? (2) How do experts rank curriculum viability indicators by their importance?

Methods

This study was done in two phases. In the first phase, a pilot and two rounds of modified Delphi were conducted to establish consensus on curriculum viability indicators. In the second phase, the indicators upon which consensus was developed were rank ordered according to their relative importance. This process is depicted in Figure 3.1. The duration of the study was 11 months, including its conception, data collection, and reporting. The data were collected in 7 months. The gap between the first and second rounds of the Delphi study was 4 months; the gap between the second round of the Delphi study and the second phase of the study was 3 months. Ethical approval was obtained from the Ethical Review Committee of Riphah International University (Reference # Riphah/ERC/17/0246).

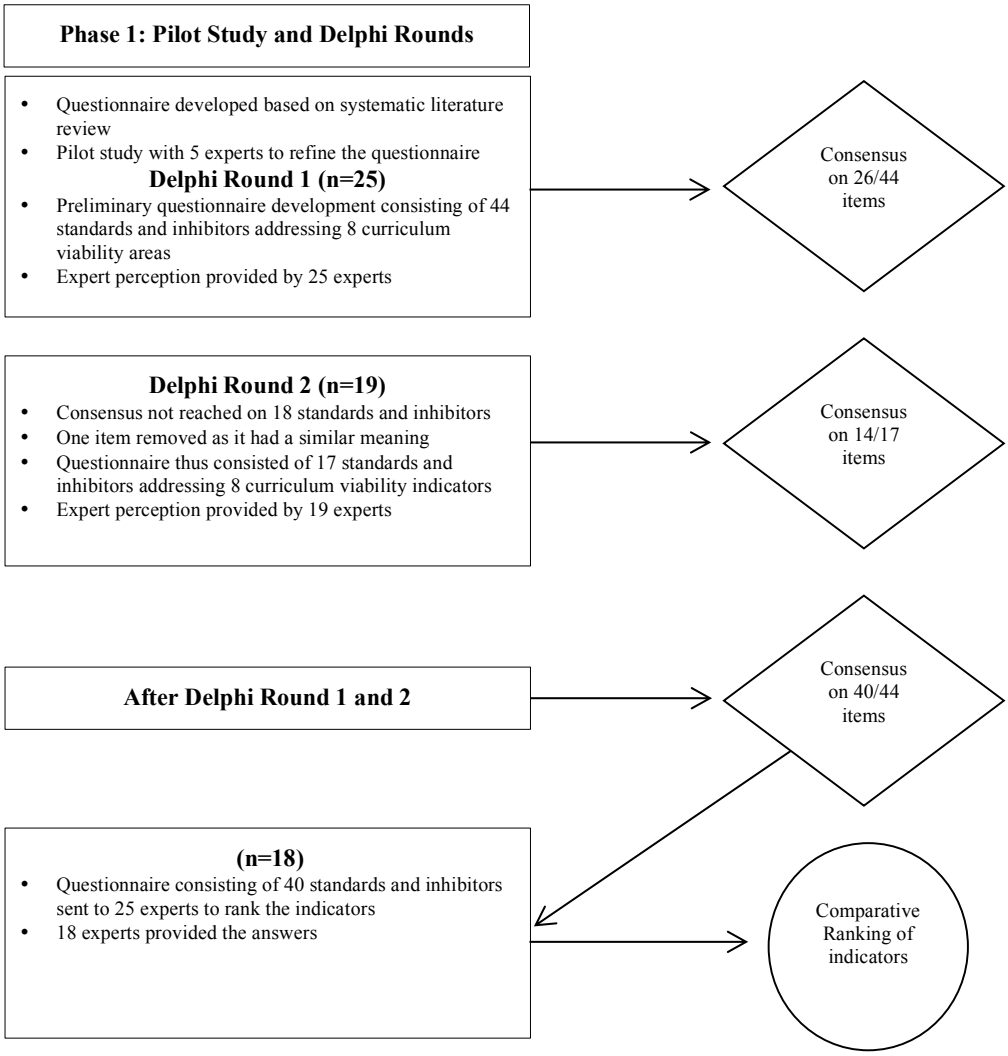

Figure 3.1: Phases of the study

Participants

Based on their formal qualifications and experience in Education, 34 experts were sent a request to participate in the Delphi study. Some of these experts were in the authors' network, while others were sent email requests because they had published on curriculum quality and/or curriculum. Among the 25 experts who agreed to participate, 12 held PhDs in educational sciences, 10 master's in health professions education, and one each in education and psychology. One participant was a PhD in Internal Medicine but was involved in medical education for 35 years. Their educational experience had a range of 14-48 years with a mean of 19 years and a median of 14 years. All experts had experience in curriculum design; 10 had experience in program evaluation, and 8 also had experience in accreditation. The experts included 15 males and 10 females from seven medical universities and two organizations, from both developing and developed countries. This was done to maximize the diversity of participants having exposure to different curricula in different regional and social contexts and also because standards and inhibitors may differ in these regions. The countries where they were working included Australia, Egypt, Malaysia, The Netherlands, Pakistan, Sri Lanka, and United States of America. Universities included Drexel University (USA), Maastricht University, Utrecht University and University of Groningen (Netherlands), The University of Western Australia (Australia), University of Kelaniya (Sri Lanka), Universiti Sains Malaysia (Malaysia), Jinnah Sindh Medical University, Khyber Medical University, Nur International University, and Riphah International University (Pakistan). One participant each was from FAIMER (Foundation of Advancement in Medical Education & Research) and WHO (World Health Organisation).

Materials

To answer our first research question, a questionnaire containing 44 items was constructed based on a scoping review (Khan et al., 2019). The main headings constituted broad areas of the medical curriculum, whereas the subheadings comprised standards and inhibitors. This questionnaire was modified for a second round based on the consensus developed and feedback provided by the experts in the first round.

For the second phase of the study, the questionnaire was based on the 40 items on which experts agreed following the Delphi method. It had an option for the experts to order the indicators according to their importance in affecting the curriculum viability in descending order, 1 being the highest rank.

Procedure

Phase 1: Pilot Study and Delphi Rounds

This study was based on a modified Delphi method (Esmaily et al., 2008; Skulmoski, Hartman, & Krahn, 2007). We developed the content of the questionnaire for the first round through extensive literature search done for the scoping review. This is different from a traditional Delphi study in which the first round explores the content for the questionnaire through opinions of experts obtained through face-to-face discussion or distant communication modes such as email (Al-Eraky et al., 2014).

Pilot Study. A pilot study was done before Delphi Round 1 involving five participants who had done a master's program or equivalent course in health professions education or who had more than five years of experience in education. The questionnaire was sent to them via a link through email. Participants were asked to provide feedback on the questionnaire based on language, structure, understanding of the questions, accessibility of the questionnaire on the website (www.qualtrics.com), ease of browsing, and time required to fill it out. They reported satisfaction regarding the questionnaire through face-to-face meetings and via phone with the primary researcher and suggested no changes to it.

Delphi Round 1. After the pilot study, the link to the questionnaire was sent to the selected experts through email for the first round. Anonymity among the expert participants was ensured to minimize bias. They were requested to score each item according to its importance to an undergraduate medical program, based on a 5-point Likert scale (consisting of 1 = extremely important, 2 = very important, 3 = moderately important, 4 = slightly important, and 5 = not at all important). They were also asked to provide a justification if they selected the options 'extremely important' or 'not at all important'. This was done to gain an understanding of the reason behind choosing an extreme value on the 'Likert scale' so that quantitative data obtained through selecting an option were further strengthened by the qualitative data, mentioned in the results section as 'representative quotes'.

Delphi Round 2. For the second round, expert participants were again sent an email containing their individual and group results in an Excel sheet and a link to the second questionnaire, which included questions based on the items for which no consensus was reached. Anonymity was again ensured. Statements in the questionnaire that required more explanation or were not clear to the expert participants were modified by the primary author in consultation with co-authors, based on the responses from Round 1. Expert participants were asked to provide a reason if they changed their response from the previous round. This was done to understand their considerations so that we could better interpret the data. Between each round, those who did not respond were sent 2-3 reminders after a gap of three weeks. This helped increase the participation of the experts.

After two rounds, a consensus was developed for 40 out of 44 items on predetermined criteria, as explained in the data analysis section. Hence a third round was not conducted (Campbell et al., 2013).

Phase 2: Ranking the Curriculum Viability Indicators

To answer our second research question, a 40-item questionnaire comprising standards and inhibitors on which consensus was reached in the first 2 rounds was sent to all the 25 expert participants. They were asked to rate the items in the eight areas specified above so that the relative importance of these items could be determined.

Data Analysis

The consensus agreement was predetermined. For the Delphi Study, the first and second rounds were studied by analyzing the percentages of combinations of adjacent Likert scores. Although literature reports that agreement of more than 50% has also been used for consensus development (Powell, 2003; Skulmoski et al., 2007), we selected a higher percentage for agreement to make the process of selection of items more rigorous. A percentage of 80 or more on two adjacent scores was considered as agreement on that particular item. Hence, a combined percentage of 80 or more of 'extremely important' and 'very important', 'very important' and 'moderately important', 'moderately important' and 'slightly important', and 'slightly important' and 'not important at all' were used to measure consensus on a particular item.

The expert feedback (i.e., quotes) was gathered by the primary researcher (RAK) for synthesis through the Qualtrics website and shared with co-authors. Quotes were selected by three authors (RAK, UM & MAL) independently, and then consensus was reached on representative quotes, which was further validated by two co-authors (AS and JVM). Quotes that were illustrative for one of the indicators (standards or inhibitors) brought up by the experts were considered as the representative quotes. Criteria for selecting them were based on clarity and alignment with the indicators, and this helped to address the discrepancies between the quotes by the experts.

In Phase 2 of the study, the mean values of indicators were calculated to order them under each area addressing curriculum viability. The mean was calculated by dividing the sum of the total score of a particular standard or inhibitor, as marked by participants divided by the total number of participants responding. The mean values were then arranged in descending order, with the lowest value indicating the highest priority. This was done because '1' was given the highest rank order number.

Results

Twenty-five experts participated in the first round of Phase 1. This number was reduced to 19 (74% participation, 26% dropout) in the second round. After two rounds, experts developed a consensus on 40 out of 44 items (91%). These included 27 standards and 13 inhibitors. In the second phase, the final questionnaire was sent to all the experts again to rank the indicators. As shown in Table 3.1, 18 out 25 (72% participation, 28% dropout) ordered the curriculum viability indicators according to their relative importance in areas of educational content and strategies, faculty, leadership, assessment, students, educational/working environment, communication, and technology.

Standards and Inhibitors Addressing Curriculum Viability Indicators (First Research Question)

In Round 1, experts agreed on 26 out of 44 items (59%), of which 22 were standards, and 4 were inhibitors. The 18 items (41%) on which consensus was not reached included 6 standards and 12 inhibitors (see Table 3.1 on pages 56 and 57).

Table 3.1: Items (standards/inhibitors) in the questionnaire affecting curriculum viability and their ranking

Area	No.	Indicators (Standards and Inhibitors)	Phase 1 Developing Consensus		Phase 2 Ranking Indicators		Representative quotes
			R1	R2	Mean	SD	
Educational Strategies and Content *(6 items)*	01	Mission and Objectives	√	NS	1.39	1.01	• '…*without mission and objectives, it is difficult to ascertain the direction where the curriculum is leading to*'. (Mission and Objectives-R1) • '…*bad curriculum design can lead to the demise of a curriculum in the very beginning*'. (Curriculum Design-R1). • '*Without explicit guidelines, official curricula never become operational curricula*'. (Guidelines for implementing Curriculum-R1). • '*Information explosion demands regular review of instructional material*' (Reviewing instructional material-R1). • '*Integration is not the only form of making a viable curriculum; many of the top medical institutions of the world do not use integration as a curricular design yet produce great graduates.*' (Low quality of Integration-R1). • '*A viable curriculum has to be implementable*…' (Guidelines for implementing Curriculum-R2).
	02	Curriculum design	√	NS	2.32	0.98	
	03	Guidelines for implementing curriculum	x	√	2.83	0.50	
	04	Reviewing instructional material	x	√	4.00	1.00	
	05	**Irrelevant curriculum content**	**x**	√	**4.44**	**0.76**	
	06	**Low quality of integration**	**x**	**x**	**-**	**-**	
Faculty *(5 items)*	07	Competence of instructors	√	NS	1.89	1.41	• '*Staff needs faculty development … otherwise, teaching becomes a ritual dance*'. (Faculty Development-R1)
	08	Staff involvement in organizational decision making	x	√	2.79	1.20	
	09	Faculty Development	√	NS	3.00	1.45	
	10	Ability to perform multiple roles	x	√	3.37	1.18	
	11	**Lack of staff involvement in organizational decision-making**	√	**NS**	**4.68**	**1.03**	
Leadership *(6 items)*	12	Allocate resources for optimal institutional functioning	√	NS	2.28	0.73	• '*Without policy, the curriculum may become chaotic and 'stuurloos' (a Dutch word means out of control.* (Lack of policies and procedures-R1). • *'Methods are more important than money and they don't all require lots of resources.* (Lack of resources in an institute-R1).
	13	Achieving internal/external goals of the institute	√	NS	2.78	1.99	
	14	**Lack of policies and procedures**	**x**	√	**3.44**	**1.64**	
	15	**Communication gatekeepers**	**x**	√	**3.72**	**1.59**	
	16	**Lack of resources in an institute**	**x**	√	**4.28**	**1.59**	
	17	**Focus on inspection and control**	**x**	√	**4.50**	**1.26**	
Assessment *(3 items)*	18	Measurement of Student's learning outcomes	√	NS	1.79	0.77	• '*Without feedback, learning becomes a blind game*'. (Prompt Feedback to Students-R2).
	19	Prompt feedback	√	NS	1.89	0.79	
	20	**Low-quality online quizzes**	√	**NS**	**2.32**	**0.80**	

Area	No.	Indicators (Standards and Inhibitors)	Phase 1 Developing Consensus		Phase 2 Ranking Indicators		Representative quotes
			R1	R2	Mean	SD	
Students *(12 items)*	21	Student engagement with faculty, staff, and administration	√	NS	3.32	2.25	• *'Medical schools should help students develop their identity … Nothing is more demotivating than an aimless life'* (Student's Social self-perception -R1). • *'If students resist a curriculum, it simply cannot maintain its viability'*. (Student's resistance to new curriculum -R1).
	22	Student's perception of teaching	√	NS	3.58	2.35	
	23	Student support services	x	√	4.63	2.37	
	24	Student's Perception of teachers	√	NS	4.74	2.51	
	25	Student's Perception of atmosphere	√	NS	4.79	2.21	
	26	Active learning techniques	√	NS	4.79	2.59	
	27	Student's Social self-perception	√	NS	5.26	2.57	
	28	Degree to which student complaints are addressed	√	NS	6.89	1.97	
	29	**Lack of time for sufficient studying**	**x**	**√**	**8.05**	**2.24**	
	30	**Neglecting student demands**	**x**	**√**	**8.95**	**1.32**	
	31	Student's academic self-perception	x	x	-	-	
	32	**Student's resistance to new curriculum**	**x**	**x**	**-**	**-**	
Educational/ working Environment *(6 items)*	33	Learner-centered environment	√	NS	1.74	0.91	• '(Its) not a problem if the rigidity is focused on insisting on well-written objectives, aligned education methods, aligned assessment'. (Rigid control-oriented cultures-R1). • *'Students feel it (the learner-centered environment) and respond accordingly'*. (Educational/Working Environment-R2).
	34	Climate of trust and shared understanding	√	NS	1.84	0.81	
	35	Flexible people-oriented culture	√	NS	3.05	0.83	
	36	**Research culture undervaluing education**	**x**	**√**	**4.05**	**0.94**	
	37	**Presence of strong disciplinary cultures**	**x**	**√**	**4.32**	**1.08**	
	38	**Rigid control-oriented cultures**	**x**	**NS**	**-**	**-**	
Communi-cation *(3 items)*	39	Communicating policies and strategies	√	NS	1.11	0.46	• *'Lack of suitable and efficient communication channels hampers any curricular design'*. (Communicating policies and strategies -R1).
	40	**Lack of sharing best practices across the organization**	**√**	**NS**	**2.44**	**0.50**	
	41	**Lack of social interaction**	**√**	**NS**	**2.44**	**0.60**	
Technology *(3 items)*	42	Reliability of technology	√	NS	1.61	0.59	
	43	Appropriate tools and media	√	NS	1.78	0.79	
	44	Documented technology plan	√	NS	2.61	0.68	

Bold items = Inhibitors √ = Agreement on the indicator x = No Agreement NS = Not Submitted
R1 = Round 1 R2 = Round 2 SD = Standard Deviation

In Round 2, experts agreed on all but three items (91%), which included low quality of integration (item 6), students' academic self-perception (item 31), and student's resistance to new curriculum (item 32). Among these items, two were inhibitors, and one was a standard.

In Rounds 1 and 2, experts also provided reasons for selecting 'extremely important' and 'not at all important' scores. These reasons are presented as representative quotes in Table 3.1.

Importance of Curriculum Viability Indicators (Second Research Question)

In phase 2, expert participants ranked the 40 indicators in 08 areas according to their perceived importance, as shown in Table 3.1.

Discussion

This study builds and documents consensus on curriculum viability indicators and ranks them according to their relative importance. In the first phase, we have established a consensus on curriculum viability indicators in eight areas of the curriculum. Interestingly, experts have made consensus on standards more than on inhibitors. This could be because standards define the aims that a curriculum should achieve and are routinely used for curriculum evaluation (Shahabudin, 2005; van Zanten et al., 2012), whereas inhibitors represent the problems that impede the achievement of these standards (Bendermacher et al., 2017; Olson et al., 2013), which is a relatively unfamiliar concept. Routine curriculum evaluations do not explore inhibitors except when explicitly asked for by the institutions or the accreditation bodies. Hence, there is a possibility that experts in our study did not regard inhibitors as of equal importance with standards.

Unlike standards, inhibitors may not be specific to one area and may impede the achievement of standards in other areas of the curriculum as well. For example, an inhibitor such as 'irrelevant curriculum content' (Item 5 in Table 3.1) in the area 'Educational content and strategy' may affect 'Assessment' because irrelevant curriculum would result in irrelevant assessment as well. Similarly, among the inhibitors, 'lack of policies and procedures' and 'focus on inspection and control' (items 14 and

17 in Table 3.1) in the area of 'Leadership' may hinder 'faculty development' (item 9 in Table 3.1) as well.

We further concur with the experts that standards are important to portray the 'perfect' curriculum. Yet how often is a perfect curriculum encountered in reality? Curricula are like humans, seldom free of errors/diseases. If we use the analogy of a fever, treating it requires not only diagnosis but also identifying its underlying cause. Hence, for curriculum viability, the inhibitors are as important as standards, because identifying inhibitors effectively identifies the problems that the curriculum is fraught with, acting as a diagnostic tool for the prevention and treatment of curricular diseases. More research is recommended to study curriculum viability inhibitors and to explain the pathophysiology of how they affect the standards of a viable curriculum.

Inhibitors are not part of quality standards provided by the WFME, but some accrediting bodies such as the LCME in its self-study guide provide questions to explore challenges faced by the institutions. One such example is, "Is there sufficient time within and outside of formal class hours for students to acquire self-directed learning skills?" (Standards, Publications, & Notification Forms LCME, 2019).

The second objective of the current study was to rank indicators according to their relative importance. Here again, the experts uniformly ranked inhibitors lower than standards in all areas. The reasons for this could be similar to those mentioned above for reaching less consensus on inhibitors than on standards. The ranking of standards and inhibitors can be used to sort and document standards in accreditation documents according to their importance. Curriculum assessors can give marks for the standards and inhibitors according to their importance while assessing curriculum viability. This ranking can also be used to develop a tool to measure curriculum viability.

Currently, many tools are available to evaluate specific areas of a curriculum. For instance, HELES (Rusticus, Wilson, Casiro, & Lovato, 2019), DREEM (Rotthoff et al., 2012) measures the learning and educational environment respectively, PHEEM (Bari, Khan, & Rathore, 2018) assesses the Postgraduate hospital educational environment, and AIM (Sajjad, Khan, & Yasmeen, 2018) measures the implementation of assessment in medical schools. These tools are not only specific for a curriculum area but also lack options to identify possible inhibitors. The results of our study were rich enough to propose a preliminary curriculum viability framework that would address both developed (paper on curriculum) and implemented (taught) curriculum (Dent, Harden, & Hunt, 2017). Thus, based on the consensus and ranking of indicators, we have developed a framework in seven areas (Table 3.2). We excluded the area

of 'technology' as no consensus was obtained regarding inhibitors in this area. The curriculum viability framework can be used by medical educationalists, educators, and administrators to assess curriculum viability holistically and get a broad picture of the well-being of a curriculum. The curriculum viability framework can be applied in institutions to evaluate viability in different areas of the curriculum (Table 3.2). For example, 'lack of staff involvement in curricular decisions' can be checked in policy documents of the curriculum on paper and also in the curriculum committee meeting minutes in the implemented curriculum. Another inhibitor, 'low-quality quiz', can be identified for the area of assessment in the implemented curriculum. This will enable the evaluator to understand the issues responsible for non-achievement of standards in specific areas of the curriculum.

Table 3.2: Framework of curriculum viability

Areas	Curriculum Viability Indicators		Measures of Curriculum Viability	
			Curriculum on Paper	**Implemented Curriculum**
Educational Strategies and Content	1. 2. 3. 4.	Mission and Objectives (+) Curriculum design (+) Guidelines for implementing curriculum (+) Reviewing instructional material (+)	(1-4) Curricular Document	(1-3) Not Applicable (NA) (4) Minutes of Curriculum Review meetings
	5.	***Irrelevant curriculum content (-)***	***Content in Curriculum***	***Taught content***
Faculty	6. 7. 8. 9.	Competence of instructors (+) Staff involvement in organizational decision-making (+) Faculty Development (+) Ability to perform multiple roles (+)	(7-8) Curricular Document (6,9) NA	(6,9) Faculty Evaluation report, Student feedback (7,8) NA
	10.	***Lack of staff involvement in organizational decision-making (-)***	***Curricular Document***	***Curriculum committee minutes***
Leadership	11. 12.	Allocate resources for optimal institutional functioning (+) Achieving internal/external goals of the institute (+)	(11) Curricular Document (12) NA	(11) NA (12) Annual Academic Council Meetings, Interviews from Deans/ Heads of Institute
	13. ***14.*** ***15.*** ***16.***	***Lack of policies and procedures (-)*** ***Communication gatekeepers (-)*** ***Lack of resources in an institute (-)*** ***Focus on inspection and control (-)***	(13,15,16) Curricular Document (14) NA	(13-16) Onsite Inspection, Interviews from the faculty
Assessment	17. 18.	Measurement of Student's learning outcomes (+) Prompt feedback (+)	(17-18) NA	(17) Annual Academic Council Meetings (18) Faculty and student Interviews
	19.	***Low-quality quizzes (-)***	***Not Applicable***	***Post item analysis reports***
Students	20. 21. 22. 23. 24. 25. 26. 27.	Student engagement with faculty, staff, and administration (+) Perception of teaching (+) Student support services (+) Perception of teachers (+) Perception of atmosphere (+) Active learning techniques (+) Social self-perception (+) Degree to which student complaints are addressed (+)	(20) Curricular Document (21-27) NA	(20-27) Student Feedback, DREEM
	28. ***29.***	***Lack of time for sufficient studying (-)*** ***Neglecting student demands (-)***	***(28) Timetables*** ***(29) NA***	***(28-29) Student Interviews***
Educational/ Working Environment	30. 31. 32.	Learner-centered environment (+) Climate of trust and shared understanding (+) Flexible people-oriented culture (+)	(30-32) NA	(30-32) Faculty and student Interviews
	33. ***34.***	***Research culture undervaluing education (-)*** ***Presence of strong disciplinary cultures (-)***	**(33-34) NA**	**(33-34)** ***Faculty and student*** **Interviews**
Communication	35.	Communicating policies and strategies	Curricular Document	Faculty interviews
	36. ***37.***	***Lack of sharing best practices across the organization*** ***Lack of social interaction***	**(36-37) NA**	**(36-37)** ***Faculty and student Interviews***

NA = Not Applicable

Limitations

Our study had certain limitations. The questionnaire developed for data collection only had standards and inhibitors, based on what could be extracted from the literature. Although experts in our study represented 7 countries and 13 institutions, it was observed that the non-participants in the second Delphi round were from countries other than the home countries of the research team. Due to the distant nature of the applied Delphi technique, it was difficult to convince these experts to participate in the subsequent rounds of the study.

Due to the varied background of experts, there was a possibility of a different perspective on the utility of standards. This may have affected their decision to relate the importance of an indicator to the curriculum viability differently. However, this was also considered a strength of the study because a variety of backgrounds and experiences would provide more insights.

Future Recommendations

The curriculum viability framework provides curriculum reviewers and experts an opportunity to review the curriculum with broader insight. However, to identify strengths and weaknesses in specific areas, further research would be required, particularly on curriculum viability inhibitors, where less work has been reported in the literature. The development of validated tools to identify curriculum inhibitors can inform curriculum experts about the possible factors that can undermine the curriculum. The study further provides directions on exploring inhibitors and developing an evaluation instrument that considers both standards and inhibitors of the curriculum. Future research identifying facilitators and exploring their effect on curriculum viability would also be interesting since this is a relatively under-explored area.

Accreditation bodies can also consider re-writing standards to include curriculum inhibitors. In this respect, the data collection instrument, and the institutional self-study guide of LCME provide helpful resources. However, we recommend that inhibitors be described alongside the corresponding quality standards. This will help curriculum developers to consider the inhibitors relevant to the particular standards and to design the curriculum to avoid curricular issues in the implementation phase. For the program

evaluator, it would be easy to identify curricular issues from a set of already-identified inhibitors that may affect a curriculum.

Conclusion

This study establishes consensus on standards and inhibitors of curriculum viability reported in the literature. The curriculum viability framework we developed provides a way of evaluating the health of a curriculum by not only considering the standards to be achieved but also by identifying the inhibitors that make it challenging to reach those standards.

List of Abbreviations

AIM = Assessment Implementation Measure
CIPP = Context, Input, Process, Product
DREEM = Dundee Ready Educational Environment Measure
FAIMER = Foundation of Advancement in Medical Education and Research
HELES = Health Education Learning Environment Measure
LCME = Liaison Committee on Medical Education
PHEEM = Postgraduate Hospital Environment Measure
PhD = Doctor of Philosophy
MS Ed = Master's in education
MHPE = Master's in Health Professions Education
WFME = World Federation for Medical Education
WHO = World Health Organisation

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CHAPTER 4:

Development and validation of teacher and student questionnaires measuring inhibitors of curriculum viability

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Development and Validation of Teacher and Student Questionnaires measuring Inhibitors of Curriculum Viability.

Abstract

Introduction

Curriculum viability is determined by the degree to which quality standards have or have not been met, and by the inhibitors that affect attainment of those standards. The literature reports many ways to evaluate whether a curriculum reaches its quality standards, but less attention is paid to the identification of viability inhibitors in different areas of the curriculum that hamper the attainment of quality. The purpose of this study is to develop and establish the reliability and validity of questionnaires that measure the presence of inhibitors in an undergraduate medical curriculum.

Methods

Teacher and student questionnaires developed by the authors were sent to medical educationalists for qualitative expert validation and to establish their content validity. To establish the response process validity, cognitive interviews were held with teachers and students to clarify any confusion about the meaning of items in the questionnaires. Reliability and construct validity of the questionnaires were established by responses from 575 teachers and 247 final-year medical students.

Results

Qualitative expert validation was provided by 21 experts. The initial teacher and student questionnaires containing respectively 62 items to measure 12 theoretical constructs, and 28 items to measure 7 constructs, were modified to improve their clarity and relevance. The overall scale validity index for the questionnaires was, in order, .95 and .94. Following the cognitive interviews, the resultant teacher and student questionnaires were reduced to respectively 52 and 23 items. Furthermore, after the confirmatory analysis, the final version of the teacher questionnaire was reduced to 25 items to measure 6 constructs and the student questionnaire was reduced to 14 items to measure 3 constructs. Good-for-fit indices were established for the final model and Cronbach alphas of, in order, .89 and .81 were found for the teacher and student questionnaire.

Conclusion

The valid and reliable curriculum viability inhibitor questionnaires for teachers and students developed in this study can be used by medical schools to identify inhibitors to achieve standards in different areas of the curriculum.

Keywords: curriculum, viability inhibitors, quality standards, evaluation, construct validity

Introduction

Curriculum quality is typically assessed through curriculum evaluation (Pugsley et al., 2008), which determines the quality of a curriculum by assessing its various aspects against a particular set of standards. This process, however, does not explicitly involve finding the issues that inhibit meeting specific standards. The issues impeding the achievement of curriculum quality standards are called 'curriculum viability inhibitors' (Khan et al., 2019). Together, the presence of current inhibitors in the curriculum and the degree to which relevant standards are met make up the 'viability indicators', which determine the curriculum viability (Khan et al., 2020). Many questionnaires reportedly measure attainment of quality standards in different areas of the curriculum. For instance, DREEM, AMEET, HELES (Khan et al., 2020; Rusticus et al., 2019; Shahid et al., 2019) and JHLES (Shochet et al., 2015) measure the educational environment, and AIM measures the implementation of assessment (Sajjad et al., 2018). Yet we did not find any questionnaires that measure the inhibitors of the curriculum. Knowledge of inhibitors is particularly useful for reviewers when an existing curriculum needs to be renewed. Curriculum developers can also consider the inhibitors during the process of curriculum development, taking preventive measures to design a curriculum that has minimal issues when implemented.

Inhibitors of curriculum quality can also be explored through interviewing the stakeholders about different aspects of curriculum. However, that requires ample time and data analysis and involves perception of a rather small number of respondents compared to survey questionnaires. Certain tools developed by accreditation bodies use open-ended qualitative questionnaires to solicit views of medical educationalists or members of medical education departments. (LCME, 2019). Although medical educationalists are curriculum experts in a general sense, they may not be expert in viability inhibitors of a specific curriculum perceived and practiced by medical students and teachers at large. Therefore, there is a need to develop questionnaires that can easily be interpreted by all stakeholders involved in identifying inhibitors. The aim of this study is therefore to develop and establish the validity and reliability of student and teacher questionnaires measuring viability inhibitors.

In an earlier study, a scoping review on curriculum viability indicators showed 37 standards and 19 inhibitors (Khan et al., 2019). Thirteen studies dealt with standards,

but only two studies described both standards and inhibitors. Thus, a Delphi study was conducted to develop consensus on curriculum viability inhibitors among experts (Khan et al., 2020).

Defining and measuring the inhibitors that constitute the theoretical constructs in the questionnaires will help an educational institution find the issues that hamper the attainment of a healthy curriculum and hence to develop 'treatments' for improving curriculum viability. Some of these theoretical constructs include irrelevant curriculum content, low quality assessment, lack of social interaction, and lack of sharing best practices. Table 4.1 shows all the 12 theoretical constructs with their descriptions.

The main stakeholders of the curriculum in a medical college are teachers, students, and educational managers. Though educational managers have a significant stake in the implementation and development of the curriculum, the curriculum is mainly implemented by the teachers and experienced by the students. Accordingly, this study addresses the following questions: (1) What items in a teacher and student questionnaire are relevant to measure curriculum viability inhibitors according to medical education experts? (2) What is the content validity of the teacher and student questionnaires? (3) How do teachers and students interpret the items in the teacher and student questionnaire? And (4) what are the reliability and construct validity of the questionnaires?

Table 4.1: Inhibitors and their definitions

Inhibitor	Definition
Irrelevant curriculum content	Curricular content that does not match with curricular outcomes.
Lack of resources in an institution	Resources that are not available according to the requirement of the course/ curriculum such as funds for library, ICT facilities, support staff, student advisors etc.
Low quality assessment	Assessment that is not aligned to instructional methods and content distribution and is not in accordance with principles of assessment.
Lack of sufficient time for studying	Less time available to students for self-study and exams.
Neglecting student needs and requirements	Students' influence on the curriculum such as student evaluations and feedback taken into account when the curriculum is renewed or when new courses are developed.
Presence of strong disciplinary cultures	Culture over-concerned with procedures at the expense of efficiency, having more focus on inspection and control.
Lack of social interaction	Lack of interaction between the faculty and students and among them.
Research culture and patient care undervaluing education	Research or patient care is given more importance than teaching in terms of promotion and funding.
Lack of policies and procedures	Lack of formal policies and procedure documents in the institution affecting the curriculum and their implementation.
Leaders acting as communication gatekeepers	Leaders withholding, delaying, or passing selected information to all relevant stakeholders, e.g., teacher, students, educational managers, and maybe even others.
Lack of staff involvement in organizational decision-making	Lack of staff involvement in decisions that affect the curriculum, e.g., on the content of courses, time schedules, kind of educational activities, use of ICT etc.
Lack of sharing best practices across organisation	Lack of sharing existing practices that already possess a high level of widely agreed effectiveness.

Methods

Development and validation of the curriculum viability inhibitor questionnaires comprised two main phases, as shown in Figure 4.1. The first phase was the development of questionnaires and getting qualitative expert feedback to refine them. The second

phase was establishing the content validity, response process validity, construct validity, and reliability of the questionnaires.

This study was approved by the Institutional Review Committee at Riphah International University (Reference # Riphah/IRC/18/0394).Written informed consent was taken from all the participants.The study duration was from October 2019 to July 2020.

Phase 1: Development and qualitative content validation of Questionnaires

1-Developing the Questionnaires (n=5)
List of items were developed based on curriculum viability inhibitors reported in earlier studies (scoping review and expert consensus via Delphi technique). A team of 5 members developed and refined the initial list of questionnaire items and 12 theoretical constructs.

2-Qualitative content validation of Questionnaire (n=21)
The questionnaire was sent to Medical Education Experts for their comments on theoretical constructs and items for modification, deletion, and addition of statements answering the first research question.

Phase 2: Establishing the reliability and validity of the Questionnaires

1-Establish content validity (n=19)
Nineteen Medical education experts provided their feedback on the relevance of the content of the items to the sub-scales on Likert scale to calculate content validity index to establish content validity of the questionnaires answering the second research question.

2-Establish response process validity (Cognitive Interviews) (n=9)
Six Teachers and 3 students were selected through purposive sampling for cognitive testing to understand the response of the participants to the questions addressing the third research question. Statements were reworded or structure was altered if found ambiguous.

3-Establish Construct Validity and reliability (n teachers = 526 and students=245)
The questionnaire was completed by 526 teachers and 245 students to establish the reliability through Cronbach's alpha and construct validity through confirmatory factor analysis to address the fourth research question.

Figure 4.1: Phases of the study. Phase 1 and 2 of the study show development and validation of the teacher and student questionnaires measuring curriculum viability inhibitors

Phase 1

In this phase, answering our first research question, the authors developed the first version of the teacher and student questionnaires based on literature review, and refined the questionnaires after receiving qualitative feedback from expert medical educationalists.

Development and Qualitative Content Validation of Teacher and Student Questionnaires (Research Question 1)

Participants. Out of 27 experts who were invited based on their qualifications and experience in medical education, 21 (77%) responded and provided feedback on the first version of the questionnaire, with comments on the constructs and related items.

Materials. The first version of the teacher questionnaire had 62 items measuring 12 constructs, whereas the student questionnaire had 28 items measuring 7 constructs.

Procedure. The first author (RAK) developed the items for measuring each inhibitor based on a scoping review (Khan et al., 2019) and a consensus-building Delphi study amongst a group of experts (Khan et al., 2020). The co-authors (AS, UM, MAE, and JJM) then refined the questionnaire before sharing it with medical education experts through e-mail. The experts were asked to provide qualitative feedback on the questionnaire items to improve their clarity and relevance to the inhibitor if needed, and also to comment on deletion or addition of items.

Data Analysis. The feedback was initially analysed by the first author by organizing the comments on the items. The changes in the items suggested by experts were made based on the criteria: (1) item easy to understand, (2) relevant to the construct, (3) avoid duplication or similar meanings, (4) minimize grammatical and formatting errors, and (5) avoid double-barreled statements. The questionnaire was then shared with co-authors for their feedback and consensus on modifications to the items.

Based on the expert feedback, items were reworded for clarity and grammatical inaccuracies or deleted if found not relevant to the construct or having a meaning very similar to another item. Some items were shifted to another construct if they were not found suitable for their current construct. When multiple suggestions were given for a single item, the commonly suggested modification was used and was finalized by the discussion and agreement of the authors.

Phase 2

In this phase, the content validity, response process validity, and construct validity, along with the reliability of the questionnaires was established answering our second, third, and fourth research question, respectively.

Establishing the Content validity of Teacher and Student Questionnaires (Research question 2)

Participants. To rank the items for content relevance and clarity, 19 out of 21 (90.5%) medical education experts from Phase 1 participated in Phase 2.

Materials. The revised questionnaire (version 2) for teachers had 60 items measuring 12 constructs (see Appendix 4.1); for students, it had 28 items measuring 7 constructs (see Appendix 4.2). For both questionnaires, Likert scales were used to measure the relevance and clarity of the items. For relevance we used: 4 = very relevant, 3 = quite relevant, 2 = somewhat relevant, and 1 = not relevant. For clarity, we used: 3 = very clear, 2 = item needs revision, and 1 = not at all clear.

Procedure. The questionnaire version 2 was sent via email to 21 experts who had previously provided feedback in Phase 1, with a request to respond within 3 weeks. They were asked to score the items on the Likert scales and provide feedback to improve the items further. Out of 21 participants, 19 responded. The forms sent by 5 participants were incomplete and they were requested to send the completed forms. Only two participants complied, hence a total of 16 complete forms were included in the study.

Data Analysis. To establish content validity, quantitative and qualitative data were analyzed. For the quantitative component, the content validity index (CVI) for the individual items (I-CVI), and of the scale (S-CVI) were calculated (Artino et al., 2014), based on the scores given by the experts.

I-CVI was calculated as the number of experts in agreement divided by the total number of experts, and S-CVI was determined by calculating the average of all CVI scores across all the items. To calculate I-CVI, the relevance ratings of 3 or 4 were recoded 1, and items ranked 1 or 2 were recoded as 0. For each item, the 1s were added and divided by the total number of experts to calculate the I-CVI.

To improve the clarity of the items where a 3-point Likert scale was used, the content clarity average was calculated. The average clarity of an individual item was calculated by adding the sum of all the values given to the item divided by the total number of items. Average clarity above 2.4 (80%) was considered to be very clear (Yusoff, 2019).

The comments provided by the experts were categorized into general comments for the questionnaire and specific comments for the items. Based on these comments, the items were modified.

Establishing Response Process Validity through Cognitive Interviews (Research question 3)

Cognitive interviewing was used to answer the third research question. It is a technique that validates the understanding of items in a questionnaire by the respondents.

Participants. Interviews were held with 6 teachers and 3 students.

Materials. In version 3, the teacher questionnaire had 53 items measuring 12 constructs, and the student questionnaire had 23 items measuring 7 constructs. We used a combination of 'think aloud' and 'verbal probing' techniques (Artino et al., 2014). The participants were asked to read the item silently and think aloud what came to their mind after reading it (Willis & Artino Jr, 2013). In verbal probing, we asked scripted and spontaneous questions after the participant had read an item (Rodrigues et al., 2017). We combined the verbal probing and think-aloud techniques, as 'think aloud' acts as a cue for respondents, to yield additional information on the quality of the items as explained in the procedure section below.

Procedure. Test interviews were conducted with 1 co-author, 1 teacher, and 1 student using Zoom (zoom.us) to identify possible issues related to combining think-alouds and verbal probing. The time participants needed to answer the items in the questionnaire was also determined. The average cognitive interview lasted approximately 60 minutes for 27 items in the teacher questionnaire and 50 minutes for 23 items in the student questionnaire. We also piloted cued retrospective probing (van Gog et al., 2005), in which the primary researcher replayed the recorded think-aloud to the participant and explored the items with scripted and spontaneous probes. We found that it yielded no extra benefit in providing a cue as compared to the combination technique and also required more time.

The protocols regarding cognitive interviews for the study were planned based on the pilot interviews as they require a sustained concentration on behalf of the participants. Hence for the teacher questionnaire, we divided the 53 items in the questionnaire between 2 participants whereas the student questionnaire did not require division as it had only 23 items. To increase the credibility of the interview technique and reduce bias, another researcher (UM) was also present during each interview.

Data Analysis. Analytic memos were created based on the think-aloud and verbal probing. These memos were coded into the following categories: (1) items with no problems in understanding, (2) items with minor problems in understanding, and (3) items with major problems in understanding (Haeger et al., 2012). These categories were assigned independently by RAK and UM. Items that required more clarity were reworded and further refined through review from the remaining co-authors (AS, MAL, and JVM). The details of the response process validity for the purpose of reproducibility are provided in the Appendix 4.3.

Establishing Reliability and Construct Validity (Research question 4)

Participants. Based on the adequate sample size (minimum of 10 participants per item) reported in the literature, our target sample was 520 teachers and 230 final-year medical students, (Bentler & Chou, 1987; Mundfrom et al., 2005). A total of 575 teachers from 77 medical colleges and 247 final-year students from 12 medical colleges filled out the questionnaire. We selected those teachers who were currently involved in teaching and had been involved in implementing or developing the curriculum. Curriculum involvement was described as the development of module or course and teaching, assessing, and managing it. Final-year medical students were recruited, as they have the maximum experience of the curriculum. The designation, academic qualification, experience of teaching, experience in medical education, and type of curriculum practiced is shown in Table 4.2. Out of the 575 teachers, 526 provided complete responses, whereas 245 out of 247 students provided complete responses.

Table 4.2: Participant demographics for confirmatory factor analysis of teacher questionnaire (N=526)

Designation	Qualification in Medical Education	Experience as a Teacher	Experience in Medical Education	Type of Curricula Practiced in the Institution
Professor (22%)	PhD (3%)	>20 years (7%)	>20 years (2%)	Discipline-based (29%)
Associate Professor (18%)	Master's (44%)	16-20 years (10%)	16-20 years (1%)	Integrated (35%)
Assistant Professor (30%)	Fellowship (22%)	11-15 years (21%)	11-15 years (7%)	Problem-based (4%)
Senior lecturer (13%)	Diploma (4%)	5-10 years (30%)	5-10 years (18%)	Theme-based (3%)
Lecturer (17%)	Certificate (17%)	<5 years (32%)	<5 years (72%)	Hybrid (Mix of Discipline and Integration) (29%)
	Workshops only (10%)			

Materials. This fourth version of the teacher questionnaire had 52 items measuring 12 constructs, and the student questionnaire had 23 items measuring 7 constructs. The items had to be scored on a 5-point Likert scale: 1 = strongly disagree, 2 = somewhat disagree, 3 = neither agree nor disagree, 4 = somewhat agree, and 5 = strongly agree. The items were shuffled so that they were not grouped by the hypothesized constructs. We also shuffled the answer options in a few items and informed the respondents. We did this so that questions were carefully read and answered by the respondents to encourage response *optimizing and prevent satisficing* (Keusch & Yang, 2018; Krosnick, 1991, 2018).

Procedure. A pilot study of the questionnaire was conducted with 20 teachers and 15 medical students to ensure the smooth working of the Qualtrics link (www.qualtrics.com) and resolve any difficulty browsing through the questionnaire. No issues were reported by the participants. To maximize the response, we shared the questionnaire link through different sources. The link was sent to the Deans and Directors of medical education of the colleges through emails. They were also shared with the master's in health professions students in their WhatsApp Groups.

The invitation message stressed the formative purpose and use of the evaluations and the confidential and voluntary character of participation. To encourage participation, e-mail reminders were sent on Day-5 and Day-10, apart from reminders through WhatsApp to the Directors of medical education departments.

Data Analysis. To ascertain the internal structure of the questionnaire, internal consistency was calculated through Cronbach's Alpha. Then, we conducted confirmatory factor analysis (CFA) as we had specific expectations regarding (a) the number of factors (constructs/subscales), (b) which variables (items) reflect given factors, and (c) whether the factors correlated (Thompson, 2004).

The questionnaires were evaluated using SPSS version 26 and AMOS version 26. Regarding internal consistency, Cronbach's alpha of between .50 to .70 was considered a satisfactory internal consistency for the scale and subscales (Altman, 1991; Streiner et al., 2016; Taber, 2018). Corrected item correlation test (CITC) was calculated for the items of the subscales that had low internal consistency. CITC in the range of .2 to .4 was considered an acceptable value to retain the item (Cohen et al., 2004).

Construct validity was established via CFA. For the goodness-of-fit of the measurement model, we measured the absolute, incremental, and parsimonious fit indices. Absolute fit indices assess the overall theoretical model against the observed data, incremental or comparative fit indices compare the hypothesized model with the baseline or minimal model, whereas the parsimonious fit model index assesses the complexity of the model (Alavi et al., 2020; Ishiyaku et al., 2017). The indices used for absolute fit are root mean square error of approximation (RMSEA) < .05 as a close fit, < .08 as an acceptable fit (Loda et al., 2020), and goodness-of-fit index (GFI) > .90 as a good fit (Forza & Filippini, 1998). For incremental fit, the indices considered acceptable are comparative fit index (CFI) > .90, adjusted goodness of fit index (AGFI) > .90, Tucker Lewis Index (TLI) > .90 (Hopwood & Donnellan, 2010), and normed fit index > .90 (Islam et al., 2020). For parsimonious fit, Chi-square difference (c^2/df) < 5.0 is considered acceptable (Marsh & Hocevar, 1985; Shahid et al., 2019)

Results

Phase 1: Development of the Questionnaires (Research Question 1)

Based on the feedback provided by experts on the first version of the teacher's questionnaire answering the first research question, 5 of 62 items were deleted as they were being duplicated; 43 items were modified because they required rewording for clarity based on incorrect grammar, formatting errors, and understandability; and 3 new items were added. The result was the next version having 60 items, as shown in Table 4.3.

Regarding the student's questionnaire, 22 of 28 items were modified while 6 items were not changed. Among the 22 items modified, 21 items were reworded for lack of clarity and grammatical inaccuracies (Table 4.3).

Table 4.3: Modifications done in different versions of the teacher and student questionnaires

	Expert Feedback	**Content validity**	**Response Process Validity**	**Construct Validity**	
	Questionnaire Version 1	Questionnaire Version 2	Questionnaire Version 3	Questionnaire Version 4	Questionnaire Version 5 (final)
Teacher questionnaire					
Total Items	62	60	53	52	25
Items accepted without change	16	16	41	-	-
Items accepted after modification	43	47	11	-	-
Items deleted	5	7	1	27	-
New Items added	3	-	-	-	-
Final items	60	53	52	25	-
Student questionnaire					
Total Items	28	28	23	23	14
Items accepted without change	6	6	16	-	-
Items accepted after modification	22	17	7	-	-
Items Deleted	-	5	-	9	-
Final items	28	23	23	14	-

Phase 2: Establishing the Validity and Reliability of the Questionnaires (Research Question 2)

Content Validity Index and Content Clarity Average of the Teacher's Questionnaire

Out of 60 items, 3 items had a CVI less than .70 and were removed. Among the remaining 57 items, 3 items had a CVI between .70 and .79; they were modified according to the qualitative feedback of the experts and retained. The remaining 54 items had a CVI higher than .79. However, the experts indicated that 4 items were similar in meaning to other items and were therefore also removed. The third version of the questionnaire thus had 53 items. Overall scale content validity (SCVI/AVG) of the questionnaire was .95.

Out of 53 items, 7 had a content clarity average (CCA) of 3 (100% clarity), 38 between 2.75 and 2.93, and 12 between 2.56 and 2.68. The average clarity of the scale was 2.81. Based on the qualitative feedback, 47 items in the questionnaire were again reworded for clarity, consistency, and grammatical inadequacies (see Appendix 4.1).

Content Validity Index and Content Clarity Average of the Student Questionnaire

Out of 28 items, 2 items had a CVI less than .70 and were hence removed. Among the remaining 26 items, 3 items had a CVI between .75 and .79. Two items were retained after modification according to the expert feedback; however, 1 item was removed because of its similarity to another item. Twenty-three items had a CVI higher than .79. All items were retained except for 2 items that had a similar meaning as other items. Overall, 5 items were deleted. Version 3 of the questionnaire had 23 items with an SCVI of .94.

Regarding the content clarity, out of 23 items, 2 items had a CCA of 2, 18 had a CCA from 2.75 to 2.93 while three had a CCA from 2.46 to 2.68. The average clarity of the scale was 2.88 (see Appendix 4.2).

Response Process Validity of Teacher's Questionnaire through Cognitive Interviews (Research question 3)

Table 4.3 shows that after establishing the content validity, 53 items remained in the questionnaire. Out of the 53 items, 42 items were found to be easily understood by the

participants and required no change. Ten items needed more clarification and hence were explained in more detail by adding examples. One item was deleted as its content was also repeated in the subsequent items.

Response Process Validity of Student's Questionnaire through Cognitive Interviews (Research question 3)

Twenty-three items were tested for response process validity. Sixteen required no change as they had no ambiguities, whereas 7 items were modified by adding examples to them.

Establishing the construct validity and reliability of the questionnaires (Research question 4)

This answered our fourth research question. The KMO and Bartlett's test of sphericity for teacher and student questionnaires were .942 and .879, which indicated an adequate sample size for factor analysis. The reliability of the items before conducting CFA was found to be .941 and .870 for the teacher and student questionnaires, respectively, hence no items were removed (Kawakami et al., 2020). A one-factor model was generated for both models, which was found not to have a good fit. Afterwards, 12- and 7-factor models, as hypothesized by the authors based on published literature (Khan et al., 2020; Khan et al., 2019) and expert validation, were developed and analysed. These models were reduced to 11 and 6 factors after the deletion of items and the use of modification indices to achieve an acceptable model. Goodness of fit indices were established for these models, however factor correlations higher than 1 were found between the constructs. To correct this, closely related factors were combined. For example, 'irrelevant curriculum content' and 'low-quality assessment' had a high factor correlation (>1). They were combined to form a new factor 'Educational Program'. Tables 4.4 and 4.5 show the final teacher questionnaire with 25 items measuring 6 constructs, and the student questionnaire with 14 items measuring 3 constructs, along with the Cronbach's alpha of the subscale and Cronbach's alpha if deleted of the item. The CITC of items of 'disciplinary culture' was .25, and of 'institutional culture' were in the range of .22 to .29.

Table 4.4: Teacher questionnaire (final version) with Cronbach's alpha if deleted

		CAID of the subscales	CAID of the questionnaire
1-Educational Program (EP)			
1	The contents I teach to my students are relevant to the intended learning outcomes of the curriculum (e.g., doctor as a professional, leader, communicator, researcher, etc.).	.59	.89
2	In my institution, the content taught in one course/module helps the students to understand the related concepts in other courses/modules.	.62	.89
3	The curricular content taught in my institution contributes to making students good doctors.	.64	.89
4	I use different assessment tools to assess knowledge, skills, and attitude in a course.	.62	.89
5	I construct assessment items according to the blueprinting for an exam.	.75	.90
6	I provide regular constructive feedback to my students.	.62	.89
Cronbach alpha of the subscale		*.69*	
2-Disciplinary cultures (DC)			
7	The attendance of faculty on campus is strictly monitored through biometric thumb impressions.	-	.89
8	Students are fined if they do not adhere to institution policies.	-	.89
Cronbach alpha of the subscale		*.41*	
3-Social interaction (SI)			
9	My institution offers formal opportunities for enhancing social interaction on educational issues among students.	.50	.89
10	My institution provides interactive online discussion forums.	.58	.89
11	My institution has meeting places for students and teachers for interaction.	.65	.89
Cronbach alpha of the subscale		*.67*	
4-Institutional policies (IP)			
12	Faculty can appeal against institutional decisions without any fear.	.70	.89
13	My institution's decisions are based on defined policies and procedures.	.67	.89
14	I have been provided with a clear job description.	.70	.89

Table 4.4: CONTINUED

		CAID of the subscales	CAID of the questionnaire
15	My institution gives awards for educational innovation (e.g., development of a new assessment tool, teaching method etc.).	.72	.89
16	My teaching and research activities are considered equally important for my promotion.	.75	.89
Cronbach alpha of the subscale		*.75*	
5-Communication Practices (CP)			
17	In my institution, there are no restrictions on the use of social media such as YouTube, WhatsApp etc. for educational purposes.	.74	.89
18	In my institution, regular faculty meetings are held at departmental level where everyone has the right to voice their concerns.	.68	.89
19	In my institution, the curriculum managers clearly communicate educational changes to the faculty.	.72	.89
20	In my institution, the faculty share strategies for effective classroom management among themselves.	.67	.89
21	In my institution, the faculty share their experiences of various instructional designs (e.g., 4C ID, Gagne 9 events) amongst them.	.69	.89
22	My institutional management shares the educational courses/ modules in the curriculum with the faculty.	.68	.89
Cronbach alpha of the subscale		*.73*	
6-Faculty involvement (FI)			
23	I am invited to the meetings in which curricular issues are discussed and decisions are made.	.53	.89
24	My suggestions to update a course/module are given due consideration by committees that make curricular changes.	.46	.88
25	I have the authority to update the content of course/module in the curriculum.	.77	.89
Cronbach alpha of the subscale		*.68*	
Overall internal consistency of the questionnaire		*.89*	

CAID = Cronbach's Alpha If Deleted

Table 4.5: Student questionnaire (final version) with Cronbach's alpha if deleted

		CAID of the subscales	CAID of the questionnaire
1-Educational Program (EP)			
1	The contents taught to me are relevant to the intended learning outcomes of the curriculum (e.g., doctor as a professional, leader, communicator, researcher, etc.)	.68	.80
2	The curricular content taught in my institution contributes to making students good doctors.	.67	.80
3	In my institution, the content taught to me in one course/ module helps me to understand the related concepts in other courses/modules.	.67	.80
4	I am assessed according to intended learning outcomes of the course.	.82	.83
5	My institution uses multiple assessment tools for the assessment of students.	.74	.80
Cronbach alpha of the subscale		*.76*	
2-Student requirements (SR)			
6	My institution offers appropriate Information Communications Technology facilities (e.g., the Internet, computers, software, etc.) for students.	.63	.81
7	My institution has an appropriate infrastructure that supports educational activities such as lectures, PBL sessions, skill acquisition, etc.	.60	.81
8	My institution has adequate support services such as counseling, scholarships, etc. for students.	.61	.81
9	In my institution, a student's evaluation of the assessments/ examinations is considered important for making changes in them.	.61	.81
10	In my institution, students are encouraged to ask questions during teaching sessions.	.68	.82
Cronbach alpha of the subscale		*.68*	
3-Institutional Culture (IC)			
11	Students are fined if they do not adhere to institution policies.	.42	.83
12	Student attendance is strictly monitored through biometric thumb impression in my institution.	.40	.83
13	My institution provides opportunities for social interaction between students and teachers.	.36	.81
14	My institution provides interactive online discussion groups	.36	.82
Cronbach alpha of the subscale		*.46*	
Overall internal consistency (Cronbach's alpha) of the questionnaire		*.83*	

Table 4.6 shows the goodness-of-fit for these models, reported through ChiSq/df, RMSEA, CFI, NFI, TLI, GFI, and AGFI. Reliabilities of the teacher and student questionnaires were, in order, .901 and .834.

Figures 4.2 and 4.3 represents parsimonious, absolute, and incremental fit for our models, shown through sequential equation models. The figures show 6- and 3-factor models with 25 and 14 items, respectively, for the teacher and student questionnaires with all factor correlations being below 1.

Table 4.6: Models and confirmatory factor analysis indices

Model	ChiSq/df	GFI	RMSEA	TLI	CFI	AGFI	NFI
Teacher questionnaire							
1-factor model (52 items)	3.117	.724	.064	.719	.730	.702	.648
12-factor model (52 items)	2.421	.814	.052	.811	.828	.788	.741
11-factor model (29 items)	1.662	.936	.036	.945	.957	.913	.900
6-factor model* (25 items)	1.660	.940	.035	.950	.958	.924	.901
Student questionnaire							
1-factor model (23 items)	2.488	.821	.078	.766	.788	.785	.693
7-factor model (23 items)	1.874	.882	.060	.863	.887	.884	.790
6-factor model (17 items)	1.405	.937	.041	.957	.968	.905	.900
3-factor model* (14 items)	1.236	.953	.031	.974	.980	.931	.904

*without higher correlation factors >1

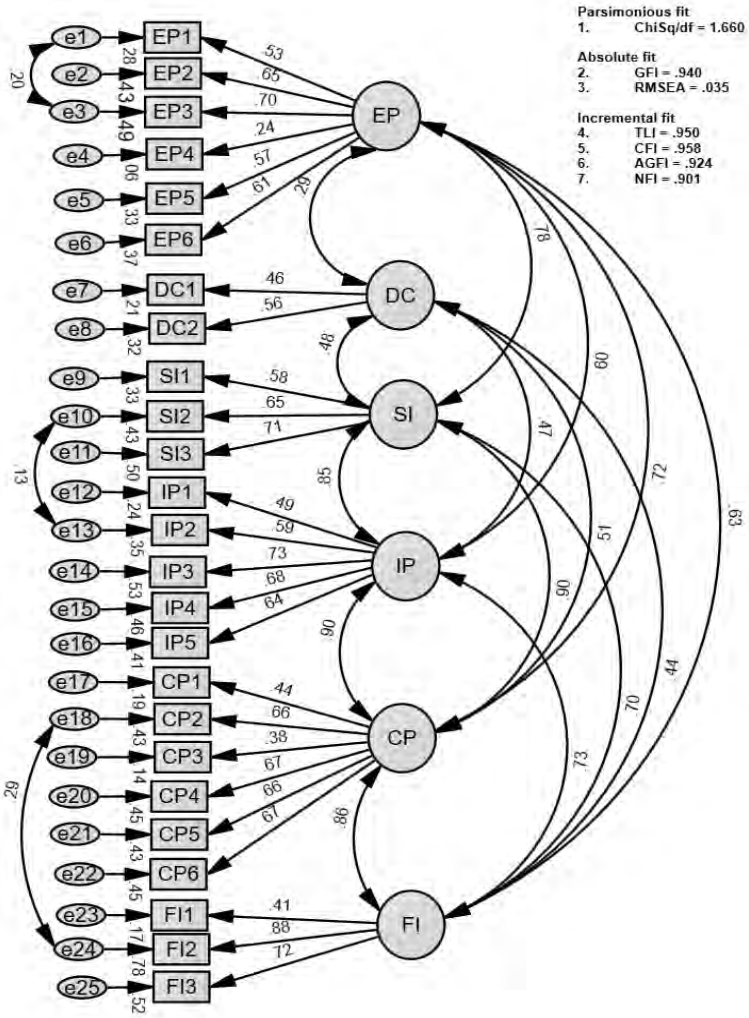

Figure 4.2: Sequential Equation Model for Teacher Questionnaire. The figure shows factor loadings, factor co-relations and good for fit indices (parsimonious, absolute, and incremental fit) for six factor model containing 25 items. Abbreviations used: EP = Educational Program, DC = Disciplinary Culture, SI= Social Interaction, IP = Institutional Policies, CP = Communication Practices, FI = Faculty Involvement, AGFI = Adjusted goodness of fit index, CFI = Comparative fit index, GFI = Goodness-of-fit index, NFI = Normed fit index, RMSEA = root mean square error of approximation, TLI = Tucker Lewis Index, c^2/df = Chi-square difference.

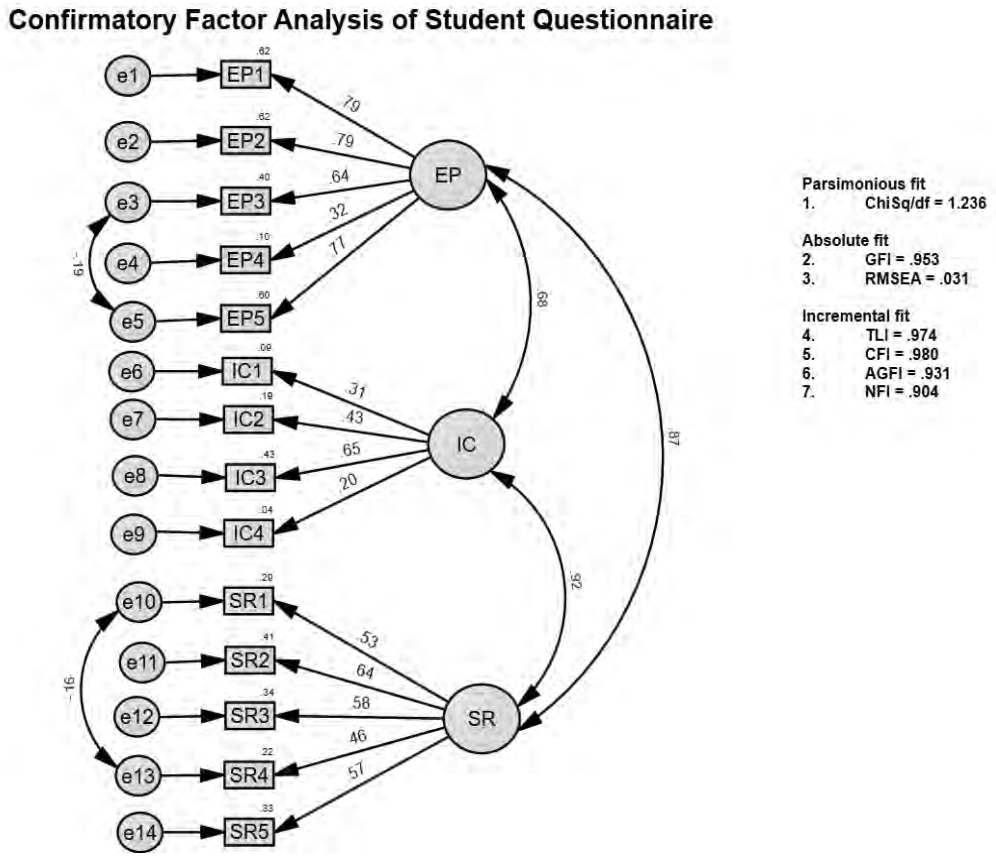

Figure 4.3: Sequential Equation Model for Student Questionnaire. The figure shows factor loadings, factor co relations and good for fit indices (parsimonious, absolute, and incremental fit) for three factor model containing 14 items. Abbreviations used: EP = Educational Program, IC = Institutional Culture, SR = Student Requirements.

Discussion

The main objective of the study was to develop two valid and reliable questionnaires that can measure curriculum viability inhibitors, so that curriculum reviewers, developers, and implementers can use these questionnaires to identify the inhibitors in the implemented curriculum based on the feedback of faculty and students.

Many questionnaires that measure teacher and student perceptions about educational environments have been reported in the literature, (Bari et al., 2018; Roff, 2005; Rusticus et al., 2019; Sajjad et al., 2018) but not on curriculum viability inhibitors explicitly. Through this study, we have developed two valid and reliable questionnaires that collectively identify curriculum viability inhibitors. The teacher questionnaire in our study covers the educational content and assessment, faculty involvement, institutional policies, social interaction, disciplinary culture, and communication practices. In comparison with the 'Assessment of medical education environment by Teachers'(AMEET) questionnaire (Shahid et al., 2019; Shehnaz et al., 2015), our questionnaire covers a wider range of areas of the curriculum. The AMEET addresses the educational environment in areas like perception of teaching, learning activities, students' learning and collaborative atmosphere, and professional self-perception. Though it covers the educational environment in detail, it does not focus on social interaction, institutional policies, communication practices and faculty involvement relevant to the inhibitors of the curriculum. Regarding the student's perception about the medical education curriculum, questionnaires that measure learning environments include the Health Professions Learning Environment Survey (HELES) (Rusticus et al., 2019), Johns Hopkins Learning Environment Scale (JHLES) (Shochet et al., 2015), and Dundee Ready Educational Environment Measure (DREEM) (Roff, 2005). These questionnaires focus on the learning environment of the institution. For instance, DREEM addresses the students' perception of learning, teachers, atmosphere, and students' academic self-perceptions and social self-perceptions. However, the student questionnaire in our study focuses specifically on the curriculum viability inhibitors that affects the curriculum such as irrelevant curriculum content and low-quality assessment. In addition, it also addresses issues such as student requirements, presence of strong disciplinary cultures and lack of social interaction. Also, student questionnaire in our study has two common constructs with the teacher questionnaire.

This study also shows that teachers and students have their own perceptions of the same curriculum as (Könings et al., 2014). Eight items under two constructs (Educational program and Institutional culture) related to learning outcomes, curricular content, assessment, disciplinary culture, and social interaction are identical in the

teacher and student questionnaires developed in our study. Thus, these questionnaires will inform program evaluators about the congruence or disagreement between students and teachers in these areas. In case of congruence, responses will strengthen the diagnosis of curriculum inhibitors; however, a differing opinion will require further investigation, such as qualitative inquiry based on interviews or focus group discussions with the faculty on the areas where a differing opinion has been reported.

A main strength of our study was the extensive method of developing the questionnaires as per the guidelines and steps reported in the literature (Al-Ansari et al., 2017; Alavi et al., 2020; Artino et al., 2014; Kim et al., 2016; Loda et al., 2020; Marsh & Hocevar, 1985; Scantlebury et al., 2001). It also became clear that having two different questionnaires for students and teachers is necessary. Another strength of our study was that the teacher respondents in our study belonged to 77 medical colleges with varied experience, from junior to senior academic positions and involved in teaching different curriculum (Table 4.2).

Analysis of internal consistency using Cronbach's α showed an acceptable level of internal consistency for the total scales (.89 and .83 for teacher and student questionnaires, respectively) and subscales (.67 to .76) identified from the confirmatory factor analysis (figure 4.2 and 4.3) for the 'educational program', 'social interaction', 'institutional policies', 'communication practices', 'faculty involvement' for the teacher questionnaire and 'educational program' and 'student requirements' for the student questionnaire. This is consistent with the alpha values reported in the literature (Field, 2018; Koohpayehzadeh et al., 2014; Taber, 2018; Yusoff, 2012). Two of the subscales 'disciplinary culture' (teacher questionnaire) and 'institutional culture'(student questionnaire) had low internal consistency in the range of .41and .46, respectively. However, subscale with value less than .40 (Cronbach's $\alpha = 0.37$) has been retained in a questionnaire if it was unidimensional with fewer number of items (Itani et al., 2017), which was the case for the two subscales (Tables 4.4 and 4.5) in our study . Furthermore, values of Cronbach's alpha less than 0.7 are common for one-dimensional scales with less than 10 items and have been justified in the literature (Cortina, 1993; Schmitt, 1996; Sijtsma, 2009). In addition, regarding both these sub-scales in our study, they were an important measure of discipline and social activities regarding the institutional culture. Hence another reason to retain the items in these subscales was to maintain the content validity (Cortina, 1993; Loewenthal & Lewis, 2018). Also the corrected item-to-total correlation (CITC) for all items in these subscales was > 0.2, which confirmed that each item belonged to its corresponding subscale (Cohen et al., 2004). CITC is another measure of internal consistency and values between .2 to .4 are indicative that the items in the subscales are good measure of the corresponding construct (Cohen et al., 2004; Piedmont, 2014).

The study was not without limitations. We recruited participants in a ratio of 1:10 for the items in a questionnaire, which is considered adequate-to-good for the sample size. However, it is generally accepted that a larger sample size is better (Mundfrom et al., 2005). The sample size in ratios of 1:20 has been recommended (Hair et al., 1995). Recruiting more participants may have yielded even better models. Another limitation of our study is that the confirmatory factor analysis was conducted in medical schools of mainly one country. However, teachers and students were from 77 and 12 medical colleges, respectively, experiencing different models of curricula. It is therefore expected that these questionnaires will be valid and reliable for different models of curriculum.

We advocate using these two questionnaires to identify issues in a curriculum that inhibit the achievement of quality standards. We further recommend that construct validity of the questionnaires be established in other countries, especially where the need for translation of the questionnaires will be required. To allow for difference in opinion of student and teachers about certain areas of the curriculum, we suggest further research to identify the reasons and their solutions for this difference in opinion, which can be a foundation for improving these questionnaires.

Conclusion

We have developed valid and reliable teacher and student questionnaires that can be used to identify the inhibitors of curriculum viability. These questionnaires can be used by medical colleges to identify the inhibitors that hamper the achievement of quality standards. This will help in proposing solutions to address the inhibitors and improve the quality of the curriculum and will be preventive in nature to prepare for possible issues.

List of Abbreviations

AIM = Assessment Implementation Measure
DREEM = Dundee Ready Educational Environment Measure
HELES = Health Education Learning Environment Measure
JHLES = Johns Hopkins Learning Environment Scale
PhD = Doctor of Philosophy

Appendix 4.1: Teacher questionnaire and its modification based on content validity

(A=Accepted, AM=Accepted after modification, D=Deleted)

Constructs (Factor/ Latent variables)	Items to measure curriculum inhibitors (Observed variables)	I-CVI	CCA	Decision
Irrelevant curriculum content	1. Content of the course is according to the curricular learning outcomes.	1	2.9375	AM
	2. The topics I teach are relevant to the outcomes of the course.	1	2.75	AM
	3. The content helps the students to understand other related concepts.	0.75	2.8125	AM
	4. The curricular content contributes to making students better health professionals.	0.875	2.6875	AM
Lack of resources in an institution	5. There are adequate resources available to me to facilitate my teaching activities.	1	2.875	AM
	6. The institution provides appropriate IT facilities to facilitate my teaching activities.	1	2.9375	AM
	7. The institution has the infrastructure that supports educational activities such as lectures, PBL sessions, skills acquisition, etc.	1	2.875	AM
	8. I have adequate access to library facilities and online resources.	0.875	2.9375	AM
	9. I have ample support staff to facilitate my teaching activities.	0.75	2.75	AM
	10. I have enough time to prepare for my teaching activities.	0.875	3	A
Low-quality assessment	11. The assessment in my course is according to intended learning outcomes.	1	2.75	A
	12. I use different assessment tools to assess knowledge, skills, and attitude in a course effectively.	1	2.75	AM
	13. I conduct regular formative assessments for my students.	1	2.9375	A
	14. I provide regular constructive feedback to my students	1	2.9375	A
	15. I construct assessment items according to the table of specification for an exam	1	2.875	AM
Lack of sufficient time for studying	16. My students have sufficient time for self-study in their schedule.	1	2.9375	A
	17. Students have adequate time off to study for exam preparation.	1	2.9375	AM
	18. The timetable is overloaded with planned teaching activities.	0.875	2.5625	AM
Neglecting student needs and require-ments	19. Students have significant participation in our educational committees.	1	2.6875	AM
	20. Students have an important input in our educational committees.	0.8125	2.625	D
	21. Student evaluations and feedback are considered important for making changes in the courses.	1	2.625	AM
	22. Student evaluations and feedback are considered for modifying assessments.	1	2.6875	AM
	23. Student input is taken in developing new courses according to their passion and need.	0.6875	2.5625	D
	24. I design my teaching activities to fully engage my students in teaching and learning activities.	1	2.75	AM
	25. I encourage my students to ask questions during my teaching activities.	1	3	A
Presence of strong disciplinary cultures	26. There is a strong hierarchy of positions within the departments of my organisation.	0.8125	2.6875	AM
	27. The presence of faculty on campus is strictly monitored through biometric thumb/attendance.	0.75	2.8125	AM
	28. Students are fined if they do not adhere to institution policies.	0.8125	2.9375	A
	29. Student committees and societies are (strictly) monitored by the faculty/ administration.	0.6875	2.8125	D
Lack of social interaction	30. My institution offers formal opportunities for enhancing social interaction on educational issues among students.	1	2.8125	A
	31. Interactive online discussion sessions are provided by my institution.	1	3	AM
	32. My institution has meeting places for students and teachers for interaction.	0.875	2.875	A

Research culture and patient care under-valuing education	33.	My teaching activities are appreciated similar to research and/or clinical activities by the institution.	0.8125	2.75	AM
	34.	The institution gives awards for educational innovation.	1	2.8125	AM
	35.	Faculty gives more importance to research and/or patient care than teaching students.	1	2.875	AM
	36.	The institution provides more resources for research than for teaching.	0.9375	2.6875	AM
	37.	My teaching and research activities are considered equally important for my promotion.	1	3	A
	38.	I have ample funding for patient care compared to funding for my teaching activities.	0.625	2.625	D
Lack of policies and procedures	39.	Educational committees in my institution consistently follow the laid-down procedures.	1	2.9375	AM
	40.	My institution provides a clear educational vision and mission.	1	2.9375	A
	41.	My institution has clear policies and procedures that support the teaching and learning process.	1	3	A
	42.	I have been provided with a clear job description.	1	3	A
	43.	Institution's decisions are based on defined policies and procedures.	1	3	AM
	44.	Faculty can appeal against organizational decisions without any fear.	0.875	2.875	AM
	45.	Educational committees can rely on clearly formulated policies that help them to perform their tasks.	1	2.9375	D
Leaders acting as Communi-cation gatekeepers	46.	There are no restrictions on the use of social media in the institution for educational purposes.	1	2.9375	AM
	47.	We have regular faculty meetings held at the departmental level where everyone has the right to voice their concerns.	1	2.9375	AM
	48.	Appropriate actions are taken on the concerns raised in the faculty meetings.	1	3	AM
	49.	Educational changes are clearly communicated to the faculty.	1	2.875	AM
Lack of staff involvement in organi-zational decision	50.	I am invited to the meetings in which curricular issues are discussed and decisions are made.	1	3	A
	51.	I am not encouraged to attend meetings in which curricular issues are discussed and decisions are made.	0.8125	2.625	D
	52.	My suggestions are given due consideration by committees that make curricular changes.	1	3	A
	53.	I have the authority to update the content of my courses.	0.9375	2.8125	AM
	54.	Timetable is developed by keeping the commitments of the faculty involved.	1	2.8125	AM
	55.	I can manage my workload as per my educational activities.	0.9375	2.75	A
	56.	I attend regular meetings for teachers and students in our institution.	1	2.8125	D
Lack of sharing best practices across organi-sation	57.	Effective support for student learning is ensured through regular meetings of students and teachers.	0.68	2.6875	D
	58.	We share strategies for effective classroom management among our colleagues.	1	2.9375	AM
	59.	We share effectiveness of different instructional designs amongst the faculty.	1	2.75	AM
	60.	Educational courses and programs are shared with the faculty.	1	2.75	AM

Appendix 4.2: Student questionnaire and its modification based on content validity

(A=Accepted, AM=Accepted after modification, D=Deleted)

Domain (Inhibitors)	Items to measure curriculum inhibitors	I-CVI	CCR	Decision
Irrelevant curriculum content	1. Content of the courses taught to me is according to the stated learning outcomes.	1	2.9375	AM
	2. My teachers teach course contents aligned to the topic being taught.	1	2.6875	AM
	3. The content of the courses that I follow is irrelevant to my future professional requirements/job.	0.75	2.6875	AM
	4. The content of the courses that I follow helps me to understand other related topics.	0.75	2.8125	AM
Lack of resources in an institution	5. My institution offers appropriate IT facilities.	1	3	AM
	6. The institution has an appropriate infrastructure that supports educational activities such as lectures, PBL sessions, skill acquisition, etc.	1	2.8125	AM
	7. Adequate library facilities are available in our institution.	1	3	AM
	8. Adequate student support services are available for my help	0.8125	2.6875	AM
Low-quality assessment	9. I am assessed according to intended learning outcomes of the course.	1	3	A
	10. The institution uses multiple assessment tools for the assessment of students.	1	2.9375	AM
	11. Teachers provide regular feedback to students on educational activities to enhance their learning.	1	2.9375	AM
	12. Regular feedback is provided to us by our teachers.	1	2.9375	D
Lack of sufficient time for studying	13. There is sufficient time allocated in the curriculum for self-study	1	2.9375	AM
	14. There is insufficient time for preparation for exams.	1	2.9375	AM
	15. I am happy with the preparatory leaves before exams.	0.75	2.875	D
	16. The timetable is overloaded with teaching and learning activities.	0.8125	2.9375	AM
Neglecting student demands	17. Students have an important input in educational committees of the institution.	1	2.9375	AM
	18. Student evaluations and feedback are considered important for making changes in the courses.	0.8125	2.75	AM
	19. Student evaluations and feedback are considered for modifying assessments.	0.8125	2.8125	A
	20. Student's input is taken in developing new courses according to their passion and need.	0.625	2.5625	D
	21. Students are encouraged to ask questions during teaching sessions.	1	3	AM
Presence of strong disciplinary cultures	22. Students are fined if they do not adhere to institution policies.	1	2.9375	A
	23. Student committees are strictly monitored by the faculty.	0.6875	2.8125	D
	24. Student presence is strictly monitored through biometric thumb/ attendance.	0.875	2.8125	AM
Lack of social interaction	25. My institution provides opportunities for social interaction between students and teachers.	1	2.9375	A
	26. My institution provides formal opportunities for social interaction among students.	1	3	A
	27. My institution provides interactive online discussion forums	1	2.9375	A
	28. My institution has meeting places for students and teachers for interaction.	0.875	2.8125	D

Appendix 4.3: Response process validity

Participants

Interviews were held with 6 teachers and 3 students. Double the number of teachers were questioned compared to number of students, because the teacher questionnaire had more than twice the number of items as the student questionnaire. The selection criteria for teachers were: (1) more than 10 years of teaching experience, (2) involvement in curriculum development and evaluation, and (3) representation of teachers from basic and clinical sciences. All 3 students were selected from the final-year undergraduate medical program in their clerkship rotations, as it was expected that they would have good knowledge of the whole curriculum of their school as compared to students from the earlier years.

Materials

In version 3, the teacher questionnaire had 53 items measuring 12 constructs and the student questionnaire had 23 items measuring 7 constructs. We used a combination of 'think aloud' and 'verbal probing' techniques (Artino et al., 2014).

Think Aloud Technique

The participants were asked to read the item silently and think aloud what comes to their mind after reading the item (Willis & Artino Jr, 2013). This was explained to them with the help of an example. All participants were asked about the number of windows in their room and then say out loud what they think when they look at the windows. Then they were asked to read the first item silently and explain out loudly what they have understood from it. Further prompts, if required, were: 'Please say out loud what are you thinking' or 'What goes through your mind?' The participants were encouraged by praising them, so they continued to think aloud.

Verbal Probing

In verbal probing, scripted or spontaneous questions were asked by the interviewer, after the participant read an item (Rodrigues et al., 2017). The scripted probes used were: 'What does this term mean to you?', 'Can you explain it more', 'What do you think this item is inquiring?', 'Can you rephrase this item in your own words?' and 'What is the reason for selecting this response for this item?' Examples of spontaneous probes that we used were: 'Can you differentiate between intended learning outcomes and learning objectives?', 'What do you think the term better health professionals mean?' and 'How much time would be enough for preparing your teaching activity?'

We combined verbal probing with the think-aloud technique as 'think aloud' acts as a cue for respondents, to yield additional information on the quality of the items as explained in the procedure section below.

Procedure

Test Interviews (Pilot)

Test interviews were conducted with 1 co-author, 1 teacher, and 1 student using Zoom (zoom.us) to identify possible issues related to combining recorded think-alouds as cues for verbal probing. The time participants needed to answer the items in the questionnaire was also determined.

The average cognitive interview lasted approximately 60 minutes for 27 items in the teacher questionnaire and 50 minutes for 23 items in the student questionnaire. However, in verbal probing, after a few items (5-6), we observed that respondents had difficulty in remembering the think-aloud of the former items as compared to when they were asked a probing question directly after each item. Regarding cued retrospective probing (van Gog et al., 2005), the primary researcher played the recorded think-aloud back to the participant and explored the items with scripted and spontaneous probes. We found that it yielded no extra benefit in providing a cue as compared to the combination technique of verbal probing after each think-aloud item. It was also observed that it required more time and was less feasible as the recording had to be played back to the interviewee on Zoom.

Cognitive Interviews for the study

The cognitive interview requires a sustained concentration on behalf of the participants. Hence protocols regarding these interviews were planned based on the pilot interviews. For the teacher questionnaire, we divided the 53 items in the questionnaire between 2 participants, so that participants 1 and 2 had to address 27 and 26 items each, respectively. Therefore, 6 teachers responded to the teacher's questionnaire, and 3 students responded to the student questionnaire, as it had only 23 items. To increase the credibility of the interview technique and reduce the primary researcher's (RAK) bias, another researcher (UM) was also present during each interview. The participants read the item silently. After reading each item silently, participants were requested to think aloud to express their understanding of the item. Based on the think-aloud and scripted probes, additional questions were asked to clarify the responses.

Data Analysis

Analytic memos (reflections of the researcher on the data) were created based on the think-aloud and verbal responses. These memos were coded into the following categories: (1) items with no problems in understanding, (2) items with minor problems in understanding, and (3) items with major problems in understanding (Haeger et al., 2012). These categories were assigned independently by RAK and UM. Items that required more clarity were reworded and further refined through review from the remaining co-authors (AS, MAL and JVM).

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CHAPTER 5:

A mixed-method study on student and teacher perceptions of curriculum viability inhibitors

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A mixed-method study on student and teacher perceptions of curriculum viability inhibitors.

Abstract

Perceptions of teachers and students about curriculum viability inhibitors are equally important yet may differ. Divergence can lead to destructive friction and adversely affect curriculum viability. Our team aimed to find the perceptions of teachers and students on inhibitors affecting the viability of an implemented medical curriculum, report their convergence or divergence, and explore approaches to reduce divergence. Through a mixed-method approach, using valid and reliable questionnaires, we found the curriculum under review had no inhibitors. However, teachers had more positive perceptions than students regarding educational program inhibitors. Upon qualitative inquiry, using focus group discussion with students and teachers, we found that 'improving the communication gap', 'enhancing the role of faculty and students in curriculum', and 'improving the assessment process' can reduce the friction between teachers and students. This study provides an approach that identifies the curriculum viability inhibitors and solutions to address them.

Keywords: mixed method design, student perceptions, teacher perceptions, curriculum viability, curriculum inhibitors

Introduction

Curriculum, derived from the Latin word *Currere,* meaning 'run the racecourse' is, as Colin explains, "a race to be run, a series of obstacles or hurdles (subjects) to be passed" (Marsh, 2009). A dynamic entity and an ever-changing process, it can develop issues over time that can inhibit achieving quality standards or affect its viability (Khan et al., 2020). Measuring these viability inhibitors in a curriculum is crucial. Perceptions of teachers and students, the two key curriculum stakeholders, can elucidate curriculum viability inhibitors (Chan et al., 2020; Turner et al., 2017). However, they may have varying perceptions about specific aspects of the curriculum (Perera et al., 2008). Convergence occurs when students' and teachers' perceptions are congruent; friction occurs when perceptions differ (Könings et al., 2014). Congruence increases the curriculum's productivity regarding bridging the gap between the taught and learnt curriculum (Pyhältö et al., 2015; Wubbels et al., 1991). Teachers with constructive interactions with their students foster environments conducive to learning, as social interaction plays a vital role in learning (Hurst et al., 2013). Conversely, differing perceptions may decrease curriculum productivity. For example, when a teacher's teaching strategy and student's learning strategy are incompatible, friction results, decreasing learning or thinking skills (Könings et al., 2005; Vermunt & Verloop, 1999). This requires finding the reasons for friction to facilitate remedies.

Curriculum viability is a new concept (Khan et al., 2019). The curriculum's quality is usually evaluated by assessing it against specific standards set by accreditation bodies (Tackett et al., 2015). For instance, the 'World Federation for Medical Education (WFME) basic quality standards' are globally accepted by many institutions and independent curriculum reviewers to evaluate an undergraduate medical curriculum (Sjöström et al., 2019). Their goal is to evaluate whether a curriculum meets the standards, yet this process does not identify responsible viability inhibitors. Real curriculum quality improvement is challenging without identifying and understanding these inhibitors.

This study aims to develop an approach for measuring the presence of curriculum viability inhibitors in a medical college, find the variations of teacher and student perceptions regarding these inhibitors, and explore solutions for disagreement. To do so, this study addressed three research questions: (1) Which curriculum viability inhibitors are present in an undergraduate medical curriculum as measured by teacher and student curriculum viability questionnaires? (2) What are the curriculum viability inhibitors teachers and students converge and/or diverge on? (3) What, according to students and teachers, are approaches to deal with divergence on curriculum viability indicators?

Methods

This is a mixed-method study. For quantitative data, teachers' and students' perceptions were collected through validated, targeted questionnaires measuring viability inhibitors. For qualitative data, a focus group discussion (FGD) among teachers and students explored possible approaches to diverging teachers' and students' perceptions.

Settings

The study was conducted in a medical college established in 1996. The current curriculum consists of two phases spread over five years. It has undergone an external curriculum review based on WFME standards twice in the last eight years and undergoes an internal review every year.

Participants

For quantitative assessment, 87 medical college faculty members involved in teaching and 100 final-year students were asked to participate, as they have maximum experience and knowledge of the curriculum.

For qualitative assessment, five teachers and five students participated in the FGD. Teachers included were actively involved in teaching, three from pre-clinical, and two from clinical sciences.

Materials

Two valid, reliable questionnaires were developed to collect teachers' and students' perceptions. The teacher questionnaire is a 25-item, closed-question questionnaire measuring inhibitors in six constructs: Educational program, Disciplinary Culture, Social Interaction, Institutional policy, Communication practices, and Faculty Involvement. The student questionnaire is a 14-item, closed-question questionnaire with three constructs (Inhibitors): educational program, student requirements, and institutional culture. Eight items for the two questionnaires are identical; measuring educational program and institutional culture. Each item is scored on a Likert scale. Complete teacher and student questionnaires are provided in Tables 5.1 and 5.2, respectively.

Pre-structured questions collected teachers' and students' approaches to reduce the perception divergence regarding curriculum viability inhibitors (Appendix 5.1). These questions explored the individual items encompassing the construct. Based on participant input, further questions were asked that explored the probable approaches to bridge the gap between teachers' and students' perceptions.

Procedure

For the quantitative assessment, questionnaires were developed using Qualtrics (www.qualtrics.com) and distributed to 87 faculty members and 100 medical students through email and social media. Respondents' identities were kept anonymous. They were requested to complete the questionnaire within two weeks, with a reminder sent after one week. Faculty and students who did not fill out questionnaires online were also provided hard copies of the questionnaire, during teaching activities.

For the qualitative part, five teachers and five students were invited to participate in the FGD online on Zoom (www.zoom.us). All had filled out questionnaires earlier and were briefed about the purpose of the FGD regarding the curriculum viability inhibitor about which the teachers and students had different perceptions. The FGD started with introducing participants and establishing understanding of the topic under discussion (primary author, RAK). Questions probed the reasons and their solutions regarding the curriculum viability inhibitor. The FGD closed by soliciting any additional comments. Another author (UM) observed the FGD and took notes for discussion.

Data were transcribed using the Otter online application (otter.ai) that converts speech to text. RAK checked the text for any inaccuracies by listening to the recording and member checking it with the participants. Remaining authors (AS, UM, MAL, JVM) reviewed it to ensure credibility and validity of the data. Ethical approval was obtained from the Ethical Review Committee of the Riphah International University (#Riphah/IRC/20/230).

Data Analysis

Answering our first research question, we calculated the median, interquartile range, and internal consistency (Cronbach's alpha) of all the items using SPSS 26. To measure

the presence of curriculum viability inhibitors, the total score of the inhibitors was calculated (Boone & Boone, 2012). We interpreted the results as (i) absence of the inhibitor when the median was lower than 3; (ii) neutral when the median was 3; and (iii) presence when the median was higher than 3. Cronbach's alpha was considered acceptable between .50 and .70, good between .70 and .90, and excellent if higher than .90 (Altman, 1991; Streiner et al., 2016; Taber, 2018).

Answering our second research question, we compared the total scores of teacher and student questionnaires for the two shared inhibitors, educational program, and institutional culture. Differences between teacher and student scores were tested with the Mann-Whitney *U* test.

Answering our third research question, thematic analysis of the FGD data was done (Braun & Clarke, 2006). RAK performed the manual analysis of the transcribed data. Another author (UM) also examined and reviewed the transcript thoroughly. The raw data were coded to enable interpretation in a meaningful way and analyzed to establish the relationship between them and how they can be combined to form a theme or fitted in a sub-theme. Finally, three themes were generated as being relevant to answering the research question. The coding followed by the formation of sub-themes and main themes was done by RAK and validated by UM.

Results

Questionnaire respondents included 79 of 100 students (79%), and 74 of 87 faculty members (85%), comprising 25 full professors (34%), 11 associate professors (15%), 11 assistant professors (15%), 6 senior lecturers (8%), and 21 lecturers (28%); 49% were from clinical sciences, and 51% from pre-clinical sciences.

Research Question 1: Which Curriculum Viability Inhibitors are Present in an Undergraduate Medical Curriculum as Measured by Teacher and Student Curriculum Viability Questionnaires?

Kolmogorov-Smirnoff and Shapiro-Wilk tests showed that data were not normally distributed (p-value < .05), hence median and IQR are reported (Field, 2018). In the teacher questionnaire, all inhibitors had an average value < 3 (neutral value), so the curriculum

under review had no clear inhibitors according to our criteria. Table 5.1 shows the mean value of the Educational Program (EP) inhibitor was 1; Communication Practices (CP), Social Interaction (SI), Faculty Involvement (FI), and Institutional Policy (IP) was 2; and Disciplinary Culture (DC) was 2.7. Table 5.2 shows that in the student questionnaire, the median value of all inhibitors was 2. The Cronbach's alpha of all the inhibitors (subscales) and Cronbach's alpha if deleted (CAID) for all their items is in Table 5.2.

Table 5.1: Teachers perception on curriculum viability inhibitors (N=74)

		Median	IQR	CAID
1-Educational Program (EP) Inhibitor				
1	The contents I teach to my students are relevant to the intended learning outcomes of the curriculum (e.g., doctor as a professional, leader, communicator, researcher, etc.). *	1	1	.51
2	In my institution, the content taught in one course/module helps the students to understand the related concepts in other courses/modules. *	1	1	.49
3	The curricular content taught in my institution contributes to making students good doctors. *	1	1	.53
4	I use different assessment tools to assess knowledge, skills, and attitude in a course. *	1	1	.55
5	I construct assessment items according to the blueprinting for an exam. *	1	1	.58
6	I provide regular constructive feedback to my students.	1	1	.57
Median of the construct				*1*
Internal consistency (Cronbach a) of the construct				*.58*
2-Disciplinary culture (DC) Inhibitor				
7	The attendance of faculty on campus is strictly monitored through biometric thumb impressions.	3.5	3	-
8	Students are fined if they do not adhere to institution policies. *	2	1	-
Median of the construct				*2.7*
Internal consistency of the construct				*.54*
3-Social interaction (SI) Inhibitor				
9	My institution offers formal opportunities for enhancing social interaction on educational issues among students.	2	1	.62
10	My institution provides interactive online discussion forums. *	2	1	.68
11	My institution has meeting places for students and teachers for interaction. *	2	2	.78
Median of the construct				*2*
Internal consistency of the construct				*.77*

4-Institutional policies (IP) Inhibitor				
12	Faculty can appeal against institutional decisions without any fear.	3	2	.78
13	My institution's decisions are based on defined policies and procedures.	2	1	.75
14	I have been provided with a clear job description.	1	1	.79
15	My institution gives awards for educational innovation (e.g., development of a new assessment tool, teaching method etc.)	2.5	1	.79
16	My teaching and research activities are considered equally important for my promotion.	2	1	.74
Median of the construct				*2*
Internal consistency of the construct				*.81*
5-Communication Practices (CP) Inhibitor				
17	In my institution, there are no restrictions on the use of social media such as YouTube, WhatsApp etc. for educational purposes.	1	1	.85
18	In my institution, regular faculty meetings are held at the departmental level where everyone has the right to voice their concerns.	2	1	.74
19	In my institution, the curriculum managers clearly communicate educational changes to the faculty.	2	1	.74
20	In my institution, the faculty share strategies for effective classroom management among themselves.	2	1	.74
21	In my institution, the faculty share their experiences of various instructional designs (e.g., 4C ID, Gagne 9 events) amongst them.	2	1	.77
22	My institutional management shares the educational courses/modules in the curriculum with the faculty.	1	1	.78
Median of the construct				*2*
Internal consistency of the construct				*.80*
6-Faculty involvement (FI) Inhibitor				
23	I am invited to the meetings in which curricular issues are discussed and decisions are made.	2	1	.76
24	My suggestions to update a course/module are given due consideration by committees that make curricular changes.	2	1	.72
25	I have the authority to update the content of course/module in the curriculum.	2	1	.79
Median of the construct		2		
Internal consistency of the construct		*.82*		

Likert scale used: 1= strongly agree 2=somewhat agree 3= neither agree nor disagree 4= somewhat disagree 5= strongly disagree
IQR = Interquartile range, CAID = Cronbach's alpha if deleted
*Note : Common items between the teacher and student questionnaires are marked by * (asterisk)*

Table 5.2: Students perception on curriculum viability inhibitors (N=79)

		Median	IQR	CAID
1-Educational Program (EP) Inhibitor				
1	The contents taught to me are relevant to the intended learning outcomes of the curriculum (e.g., doctor as a professional, leader, communicator, researcher, etc.). *	2	1	.73
2	In my institution, the content taught to me in one course/module helps me to understand the related concepts in other courses/ modules. *	2	1	.73
3	The curricular content taught in my institution contributes to making students good doctors*	2	1	.74
4	I am assessed according to intended learning outcomes of the course*	2	1	.75
5	My institution uses multiple assessment tools for the assessment of students*	2	1	.78
Median of the construct		*2*		
Internal consistency of the construct		*.76*		
2-Student Requirements (SR) Inhibitor				
6	My institution offers appropriate Information Communications Technology facilities (e.g., the Internet, computers, software, etc.) for students	4	3	.68
7	My institution has an appropriate infrastructure that supports educational activities such as lectures, PBL sessions, skill acquisition, etc.	2	2	.60
8	My institution has adequate support services such as counselling, scholarships, etc. for students	4	3	.58
9	In my institution, student's evaluation of the assessments/ examinations is considered important for making changes in them	2	1	.69
10	In my institution, students are encouraged to ask questions during teaching sessions	2	1	.77
Median of the construct		*2*		
Internal consistency of the construct		*.72*		
3-Institutional Culture (IC) Inhibitor				
11	Students are fined if they do not adhere to institution policies*	2	2	.65
12	Student attendance is strictly monitored through biometric thumb impression in my institution	5	3	.71
13	My institution provides opportunities for social interaction between students and teachers*	2	2	.52
14	My institution provides online interactive discussion groups*	2	3	.53
Median of the construct		*2*		
Internal consistency of the construct		*.68*		

Research Question 2: What are the Curriculum Inhibitors Teachers and Students Converge and/or Diverge on?

Table 5.3 shows teachers had a median of 1 in the Education program inhibitor with an interpretation that teachers strongly agree that the inhibitor was absent, whereas students' median value was 2, indicating they somewhat agree this inhibitor is absent. The *p*-value was found to be < .05, indicating a significant difference between teachers' and students' perceptions.

Table 5.3 also shows the total score under Institutional Culture is 2 for both student and teacher questionnaires, with a *p*-value > .05, indicating no differences between teacher and student perceptions.

Table 5.3: Comparison of perceptions of teacher and student questionnaire based on the common inhibitors in the questionnaire

Educational Program Inhibitor	**Median**	**Likert Scale Value**	**P- value**
Teacher questionnaire	1	Strongly Agree	.00
Student questionnaire	2	Somewhat agree	
Institutional Culture Inhibitor			
Teacher Perception	2	Somewhat agree	.22
Student Perception	2	Somewhat agree	

Research Question 3: What, according to Students and Teachers, are Approaches to Deal with Divergence regarding the Curriculum Viability Inhibitors?

Table 5.4 displays the thematic analysis of the FGD done to further explore the curriculum viability inhibitor and approaches to reduce divergence. Answering our third research question, three main themes and eight sub-themes emerged, including 'bridging the communication gap', 'enhancing the role of faculty and students in the curriculum', and 'improving the assessment process'. Teachers and students agreed that proper communication could bridge the gap in perceptions between them. They suggested that explicit instruction by the teachers regarding delivery of the curriculum and intradepartmental meetings can reduce the teacher and student disconnect. They also emphasized that teachers should guide them more about the contents in the

module books and recognize students' role in developing and revising the learning outcomes and the contents. For example, one student said, 'If we think we (students) have problems with any of the content, we do not tell it properly to the teachers'. Similarly, to address the difference in perceptions regarding learning outcomes, a teacher said, 'They (learning outcomes) need to be laid out in a clearer manner'. Students also affirmed this, illustrated here: 'I think the learning outcomes should be revised and if they are revised, the students should have a say'.

Table 5.4: Thematic analysis of Focus group discussion

Themes	Sub-themes	Quotes
Bridging the Communication gap	Communication gap between teachers and students	• *'Students believe that low stakes assessments are meant for preparing for Combined Block Assessments (CBA is a mid-stake assessment). And we (teachers) believe that low stakes assessment is a component of their (student's) assessment. So, there is a communication gap'.* • *'If we think, we (student's) have problems with any of the content, we do not tell it properly to the teachers.* • *'I think the most important thing in this regard (to bridge the gap between teacher and students) is communication, and more of an interactive session (while teaching)'.*
	Communication gap between departments	• *'Departments should be communicating with each other on the learning outcomes and the curriculum'.* • *'I think there should be intradepartmental meetings to discuss such issues where there is no clarity in assessment'.*
Enhancing the Role of Faculty and Students in curriculum	Teaching by Senior Faculty	• *'(It is)more common in clinical sciences and varies from batch to batch. They (Students) are taught by junior doctors (while) senior faculty is not available'.*
	Faculty development	• *'I feel that those faculty members who have less experience of integrated curriculum or are not CHPE qualified may find it difficult to understand the usage of these different assessment tools.*
	Teacher guidance	• *'The teachers teaching in basic sciences should guide students in preclinical years about the basic (sciences) content that will be required by them (students) in clinical sciences to have better concepts.* • *'Teachers should guide students about what (to) read and learn'.*
	Recognition of the role of Students	• *'(There should be) assessment and curriculum student's committees that interact with the faculties committees, to bring the students viewpoint in sync with the faculty'.* • *'I think the learning outcomes should be revised. and if they are revised the students should have a say'.*
Improving the assessment process	Align Assessment to teaching	• *'If some LO (learning outcome) is to be assessed through MCQ, it should not be asked in OSCE'.* • *I am not taught by the teachers about prioritizing an investigation for a specific disease. But in my assessment, I am expected to answer one (specific) answer (in MCQ), and I'm completely blank 'as I am not assessed the way I am taught*
	Uniform pattern of assessment	• *'Formative (low-stake) assessment should be properly structured and monitored as our faculty members do CBAs (mid-stakes) and professionals (high-stakes assessment)'.*

Discussion

This study provides an approach to measure curriculum viability inhibitors in an undergraduate medical curriculum, to find variations in teachers' and students' perceptions of curriculum viability inhibitors, and to bridge these differences.

On comparison of the inhibitor, 'educational program' , we found divergence between teachers' and students' perceptions. This divergence can possibly cause destructive friction (Vermunt & Verloop, 1999); we further explored it through FGD. Whereas teachers exhibited complete agreement that no educational program inhibitors existed, students did not fully agree. Similarly, Miles et al. (Miles & Leinster, 2009), comparing staff and student perceptions, found that faculty believed students had a more positive learning and teaching environment than students reported.

We found no difference in teacher and student perceptions regarding the institutional-culture inhibitor. This result is dissimilar to Miles and Leinster (2009), who found teaching staff felt unable to comment on the students' social environment. They also reported a limitation in that they used a tool designed for measuring students' perceptions to find teachers' perceptions, which may have led to misinterpretation of teacher perceptions. However, our study used questionnaires designed separately for both teachers and students. Another study compared student and teacher perceptions regarding the curriculum environment using the Dundee Ready Educational Environment Measure (DREEM) questionnaire for both students' and teachers' perceptions, but they did not follow it with qualitative inquiry to probe the perceptions (Shehnaz et al., 2012). We avoided both these limitations by using separate teachers and student questionnaires followed by FGD to find divergence in perceptions and to identify approaches to reduce this gap. We believe this approach might help to improve the curriculum, even when no strong inhibitors are present.

The three suggestions to reduce the friction between teachers and students, that is, improving the communication gap between teachers and students, enhancing the role of faculty and students in curriculum, and improving the assessment process, have also been reported in other studies as approaches to improve curriculum quality (Bland et al., 2000; Huang et al., 2014; Watson et al., 1998). Martens et al. also emphasized the importance of teacher-student partnerships in enhancing educational quality and highlighted the importance of co-creation in which teachers should be open to involving students in improving education quality (Martens et al., 2020).

Our study was limited to one medical college, running an integrated outcomes-

based curriculum, so it only provides insight into curriculum viability inhibitors of this type of curriculum. Expanding the study would enable determining viability inhibitors in other curricula. Another limitation was that two subscales had internal consistencies < .7: educational program (EP) with internal consistency of .58 and disciplinary culture (DC) with internal consistency of .54, both for the teacher questionnaire. This low value was still in the acceptable range of internal consistency (Cortina, 1993; Field, 2018; Schmitt, 1996; Sijtsma, 2009). Our findings on the divergence between teachers and students on the educational program scale must thus be interpreted with care, because of the relatively low internal consistency.

Questionnaires measuring curriculum viability inhibitors can be used stand-alone or as part of the curriculum evaluation process. Used stand-alone, questionnaires measure the presence of curriculum inhibitors; help curriculum evaluators focus on relevant areas and see how inhibitors affect the curriculum's quality; and help find remedies for curriculum weaknesses. Used as part of curriculum evaluation, they can help determine reasons for not meeting quality standards, the curriculum's weaknesses, and their causes.

We measured curriculum viability inhibitors; to determine curriculum viability, defined as the degree to which quality standards have been met combined with inhibitors affecting attainment of those standards (Khan et al., 2019), requires evaluating the quality standards of a curriculum. Further studies can pair questionnaires measuring curriculum standards (e.g., DREEM, Assessment Implementation Measure (AIM), HELES, or JHLES) with teacher and student curriculum viability questionnaires to determine curriculum viability (McAleer & Roff, 2016; Rusticus et al., 2019; Sajjad et al., 2018).

Conclusion

In conclusion, teacher and student questionnaires can determine viability inhibitors and perception variations in a medical curriculum. Further exploring divergence can help to reduce the friction between teacher and student perceptions and help find approaches to reduce them and improve curriculum.

Appendix 5.1: Questions for Focus Group Discussion among Teachers and Students

1. What do you understand by curriculum viability and curriculum viability inhibitors?
2. Regarding the educational program inhibitor, what is your understanding of irrelevant curriculum content and low-quality assessment?
3. Regarding the educational program inhibitor, what are the reasons for difference in perceptions of teachers and students?
4. The results of the survey indicate that there is difference in perceptions regarding the relevance of the content. What do you think is the reason and how can we bridge this gap?
5. The results of the survey show that there is difference in perceptions regarding the quality of assessment such as alignment of assessment to the intended learning outcomes and use of multiple assessment tools in the examinations. What do you think is the reason for this and how can we reduce this gap?
6. Do you have any additional comments?

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CHAPTER 6:

General Discussion

This thesis described, investigated, and used the concept of curriculum viability in medical education. It was needed to introduce this concept because the routine evaluation of a curriculum seemed to ignore the inhibitors that impede the attainment of quality standards; it was generally done by benchmarking a curriculum against national or global accreditation standards (Bharvad, 2010; Ruhe & Boudreau, 2013). To the best of the authors' knowledge, no accreditation body lists inhibitors alongside quality standards. The inhibitors may be explored only if desired by the institution. Evaluating a curriculum against the quality standards is like diagnosing a disease without knowing its underlying cause. Hence, to fill this gap, we have defined the new concept of curriculum viability. Curriculum viability is determined based on the attainment of quality standards in a curriculum and the presence of inhibitors impeding their achievement.

To achieve our project goal, we designed four research questions that led to four studies. The research questions, along with their brief answers, are given in Table 6.1.

Table 6.1: Research studies, research questions, and their brief outcomes

Study	Chapter	Research Question	Brief Outcomes
1	2	What standards and inhibitors of curriculum quality have been reported in the literature?	The scoping review on curriculum viability found 13 studies that reported standards of quality, whereas only two studies described both standards and inhibitors of quality, thus addressing curriculum viability. These standards and inhibitors were related to educational content and strategy, students, faculty, assessment, educational/work environment, communication, technology, and leadership.
2	3	Which standards and inhibitors addressing curriculum viability in an undergraduate medical education program do education experts agree upon, and how do they rank them according to their importance?	Based on a consensus study using a Modified Delphi Technique, the experts agreed on 40 out of 44 items. These included 27 standards and 13 inhibitors. Experts rank-ordered the curriculum viability indicators according to their relative importance in areas of educational content and strategies, faculty, leadership, assessment, students, educational/ working environment, communication, and technology.
3	4	What are valid and reliable teacher and student questionnaires that can measure curriculum viability inhibitors in an undergraduate medical curriculum?	Valid and reliable teacher and student questionnaires were developed with 25 and 14 items, measuring 6 and 3 constructs, respectively. We used qualitative expert validation, measured content validity index, and content clarity ratio, and conducted cognitive interviews and factor analysis.
4	5	Which curriculum viability inhibitors are present in an undergraduate medical curriculum and what is the divergence and/or convergence of teachers' and students' perceptions about them?	Through a mixed-methods approach, we found that the curriculum under review had no inhibitors. However, teachers had more positive perceptions than students for the educational program inhibitor. On qualitative inquiry using focus group discussion with students and teachers, we found that 'improving the communication gap', 'enhancing the role of faculty and students in the curriculum', and 'improving the assessment process' can reduce frictions between teachers and students.

This general discussion chapter elaborates on: (1) the findings of the four studies and how they contribute to achieving the overall goal of this project, (2) theoretical implications and suggestions for future research, (3) strengths and limitations of this project, (4) practical implications, and (5) conclusion.

Main Findings of the Studies

In Study 1 (Chapter 2), a scoping review study was conducted to find curriculum viability indicators that have already been reported in the literature. To find what was already reported in the literature, our first research question was aimed towards finding the indicators of curriculum viability by performing a literature search on standards and inhibitors of curriculum quality. As curriculum viability was a new concept, we searched for its determinants, that is, curriculum quality standards and inhibitors. After a rigorous systematic search of the literature, 13 articles were selected for the scoping review. Out of these, 11 articles focused on standards of curriculum quality, and only two articles discussed both standards and inhibitors of curriculum quality. Consequently, the thematic analysis of the literature produced two main themes: standards of curriculum quality and inhibitors of curriculum quality, which were further divided into eight sub-themes, namely: (1) educational strategy/content, (2) students, (3) faculty, (4) assessment, (5) educational/work environment, (6) curriculum communication, (7) technology, and (8) leadership. Based on these results, we introduced a framework for evaluating curriculum viability which can assess the standards as well as the inhibitors of a curriculum. This framework provides a holistic approach that can help detect problems affecting the well-being of an undergraduate medical curriculum, thereby contributing to its improvement.

In Study 2 (Chapter 3), we conducted a modified Delphi technique to establish the agreement of experts on the curriculum viability indicators and asked them to rank them according to their importance. The study was done in two phases. In the first phase, after two Delphi rounds, curriculum experts reached a consensus on 40 out of the 44 items that were shared with them. Out of these items, 24 were standards, and 13 were inhibitors. This addressed the research question of establishing an agreement on standards and inhibitors of curriculum viability indicators. The second research question in the study dealt with the importance of the indicators of curriculum viability. Seventy-two percent of the experts responded, and they ranked 40 indicators in

eight categories, namely (1) educational strategy/content, (2) students, (3) faculty, (4) assessment, (5) educational/work environment, (6) curriculum communication, (7) technology, and (8) leadership. This study established the importance of inhibitors in relation to the corresponding standards.

In Study 3 (Chapter 4), we developed two valid and reliable questionnaires that can measure the curriculum viability inhibitors. During the developmental process of the questionnaires, the relevance of the items was tested, after which 60 items remained in the teacher questionnaire and 28 items in the student questionnaire. While establishing the validity and reliability of the instrument, several items were again either deleted or modified, leaving 53 items in the teacher questionnaire and 23 items in the student questionnaire. For construct validity and reliability of the questionnaire, KMO and Bartlett's tests were applied. After confirmatory factor analysis, reliability indices of .941 and .870 for the teacher and the student questionnaire were obtained, respectively. Following the modifications, after the application of good-for-fit models, the resulting teacher questionnaire had 25 items measuring 6 constructs, and the student questionnaire had 14 items measuring 3 constructs. As a result of this rigorous methodology, valid and reliable teacher and student questionnaires were developed that can measure the curriculum viability inhibitors in the domains of educational program, disciplinary culture, social interaction, institutional policies, communication practices, faculty involvement, and student requirements.

In Study 4 (Chapter 5), through a mixed-methods approach using valid and reliable questionnaires, we found the curriculum under review had no inhibitors. This could be because the curriculum under review was a good quality curriculum or our questionnaires were not able to detect the inhibitors in this curriculum. This indicates that future studies are needed using these questionnaires in other institutions with different curricula to further determine their practical use and ability to measure curriculum inhibitors. However, teachers had more positive perceptions than students for one educational program inhibitor. On qualitative inquiry using focus group discussion with students and teachers, we found that 'improving the communication gap', 'enhancing the role of faculty and students in curriculum', and 'improving the assessment process' can reduce the friction between teachers and students. Through this study, we have developed an approach that identifies the curriculum viability inhibitors using questionnaires and conducting a focus group discussion among teachers and students to find solutions to these inhibitors.

Theoretical Implications and Future Research

Regular evaluations to check the quality of curriculum should be a standard procedure (Ahmed & Alneel, 2017). This process, however, often does not consider the reasons behind the failure to attain the quality standards (Khan et al., 2020; Khan et al., 2019). In routine practice of curriculum evaluation, the strengths and weaknesses of a curriculum become evident (Walsh, 2014). Strengths of a curriculum are the standards that are met when the curriculum is benchmarked against the accreditation standards, and the weaknesses are the standards that are not achieved (Tackett et al., 2015). For instance, an undergraduate medical curriculum, when evaluated against globally accepted basic quality standards provided by the World Federation for Medical Education (WFME), can reveal its strengths and weaknesses (Sethi & Javaid, 2017; Sjöström et al., 2019), but not the reasons (inhibitors) behind it (Khan et al., 2020; Khan et al., 2019). This is true for other accreditation standards as given by the Liaison Committee for medical education in the USA (Muller et al., 2008; Zehra & Sadaf, 2013). The aim of the four studies in the PhD project was to fill this gap in the literature. Hence, we defined the concept of curriculum viability, which not only considers the quality standards but also looks for the issues or the inhibitors that are responsible for them.

In our first study, we developed a curriculum viability framework that combines quality standards with inhibitors in different areas of the curriculum, hence providing a new lens to assess the curriculum. This can be compared with the framework that was developed by Tackett et al. (2015) to evaluate an undergraduate medical curriculum based on WFME standards. Though this framework offers a very detailed analysis of the curriculum containing items based on standards, it lacks the inhibitors that impede the curriculum quality.

To the best of our knowledge, no single tool, instrument, or questionnaire has been reported in medical education literature that measures (curriculum viability) inhibitors explicitly and at the same time covers all the areas of the curriculum. The available tools measure only a few aspects of the curriculum. Some instruments such as DREEM (Patil & Chaudhari, 2016), HELES (Rusticus et al., 2020), and PHEEM (Chan et al., 2016) measure aspects of the educational environment; others such as AIM measure aspects of the implementation of assessments in a medical school (Sajjad et al., 2018). Also, these tools measure only student perceptions. Though another tool, namely, AMEET measures teacher perceptions about the educational environment, its construct validity has not been established (Shahid et al., 2019; Shehnaz et al.,

2015). We have bridged this gap by developing valid and reliable questionnaires that measure teacher and student perceptions, which complement each other in the areas of educational program and institutional culture.

The evaluation of a curriculum is a tedious process (Tackett et al., 2015) and requires expertise to benchmark the curriculum against the quality standards. The curriculum viability framework is a rather systematic approach to evaluate the curriculum. It provides a holistic picture of the curriculum covering all nine areas – addressing both standards and inhibitors. In addition to the framework, the curriculum viability inhibitor measuring questionnaires (CVIM-Q) also provide medical educationists and, especially, curriculum reviewers a straightforward and systematic approach to determine the inhibitors of the curriculum. The CVIM-Q can also be combined with currently available tools such as DREEM, PHEEM, HELES, and AIM, where these tools provide comprehensive information specifically about the educational environment (Chan et al., 2016; Patil & Chaudhari, 2016; Rusticus et al., 2020; Sajjad et al., 2018).

Teachers and students are the main stakeholders of the curriculum (Muller et al., 2008). Their perceptions about the curriculum are important for improving it. Convergence in their perceptions can improve the outcomes of the curriculum whereas divergence can affect the curricular outcomes negatively (Brok et al., 2006). We have devised an approach in our project combining quantitative measurements of curriculum viability inhibitors through CVIM-Q with qualitative focus group discussion among teachers and students to probe the reasons for divergence between their perceptions. This approach can generate solutions to address divergence between the two main stakeholder groups and, eventually, improve the quality of the curriculum.

There are a few gaps in our project that may be filled through future research. We have defined curriculum viability as a combination of quality standards and the inhibitors that impede their achievement. However, there is room to also investigate the *enablers* of the curriculum quality in relation to curriculum viability. Some of the enablers reported in the literature include strategies of continuous improvement, flexible people-oriented cultures, ability to perform multiple roles, and clear tasks requirements and responsibilities. (Bendermacher et al., 2016; Korndorffer Jr et al., 2013; Regmi & Jones, 2020; Rudhumbu, 2016; Tun, 2019). It would be interesting to investigate how combining enablers with inhibitors and standards enhances the outcomes of the curriculum viability framework, which was reported in our first study. Lack of enablers in combination with the presence of inhibitors may predict a weak

curriculum with more conviction than a combination of enablers and inhibitors.

Further expanding on the concept of curriculum viability, accreditation bodies can also consider re-writing standards to include curriculum inhibitors. Currently, the WFME and LCME only provide quality standards (van Zanten et al., 2012). However, if relevant inhibitors and enablers are also listed alongside the quality standards, they will help to gauge the curriculum viability.

While developing the questionnaires, we have considered only the perceptions of teachers and students in measuring curriculum inhibitors. However, a significant role in the implementation of a curriculum is played by curriculum managers (Casiro & Regehr, 2018; Changiz et al., 2019), who may not be a part of the teaching faculty. Their perceptions regarding the challenges faced while implementing the curriculum in medical education will be useful in measuring the inhibitors that impede the achievement of the curriculum quality standards. Also, the issues faced by curriculum managers may be more of an administrative nature, such as management and organization of coursework, internal examinations, moderation, and teacher assessment, which may not be precisely reported by teachers and students.

Strengths and Limitations

This PhD project has particular strengths with respect to the research process and its main product, that is, the theory, questionnaires, and an approach for curriculum viability. Regarding the process, we have followed rigorous and robust methods in all our studies. First, we have used Arksey O'Malley's framework, PRISMA, and Qualsyst criteria for the scoping review. For the development of questionnaires, content validity indices and content clarity averages, response process validity, and construct validity were established. Second, the teacher respondents in our study belonged to 77 medical colleges with varied experience, from junior to senior academic positions and involved in teaching different curricula.

Regarding the product of our project, that is, our theory of curriculum viability and the instruments to measure it, we devised a complete approach to measure curriculum viability inhibitors and suggested approaches to address them. This was done by developing and using teacher and student questionnaires and conducting a focus group discussion to gather suggestions to bridge the gap between the divergent perceptions of teachers and students regarding the inhibitors.

Our PhD project also had its limitations. We have broadly described inhibitors for relevant areas of the curriculum, but we were unable to find inhibitors for every single quality standard. This is because work on inhibitors is still scant in several areas of the curriculum. While developing expert consensus on the quality standards and inhibitors of the curriculum, our source of data was limited to the literature search and experts from seven countries only. It was also observed that non-participants in the second round were from the non-home countries of the authors, and due to the distant nature of the Delphi study, it was difficult to convince them to participate in subsequent rounds despite multiple requests.

Two of the constructs, 'disciplinary culture' (teacher questionnaire) and 'institutional culture' (student questionnaire), had low internal consistencies determined by Cronbach's alpha. We decided to retain these constructs as low values of Cronbach's alpha can be common for one-dimensional constructs with less than 10 items and have been justified in the literature. In addition, regarding both these sub-scales in our study, they were an important measure of discipline and social activities regarding the institutional culture. Hence, another reason to retain the items in these subscales was to maintain the content validity. Also, the relevance of these items to the construct had been established through expert validation, content validity index, and confirmatory factor analysis earlier in the study.

Our Study 4 was limited to one medical college only, running an integrated outcomes-based curriculum, so it only provided insight into curriculum viability inhibitors of a particular curriculum. In future studies, teacher and student questionnaires should also be used in curricula which are not meeting the curriculum quality standards. This would help in determining the inhibitors that are impeding the achievement of the quality standards and provide additional evidence for the usefulness of the developed questionnaires

Practical Implications

Implications for Accreditation bodies

Global and national accreditation bodies have accreditation standards for evaluation of medical school curricula. To determine the quality of the curriculum, these accreditation standards either have quality standards (basic and excellent) such as provided by the WFME or both standards and qualitative open questions such as

provided by some national accreditation bodies. Our curriculum viability framework can be used by these accreditation bodies to rewrite their accreditation standards and to include inhibitors in the relevant areas, so that the aim of the accreditation should not only be based on the achievement of the quality standards but to also identify the inhibitors which make the curriculum less viable or weak.

Implications for Medical Institutions

Institutional self-evaluations are conducted to determine the strengths and weaknesses of the curriculum. These self-evaluations serve to determine the strengths and weaknesses of the curriculum against specific quality standards set by accrediting bodies. The use of teacher and student questionnaires in combination with the curriculum viability framework can provide institutions with information not only about the strengths and weaknesses of the curriculum, but also about the issues that hamper the achievement of quality standards. This will help the institutions find the inhibitors. In addition to this, using our approach of conducting focus group discussion, institutions can devise solutions to address divergence between teachers' and students' perceptions. This will avoid pitfalls in the curriculum and improve its quality.

Implications for Curriculum Developers and Evaluators

Curriculum developers can use the curriculum viability framework, the ranked viability indicators, and the curriculum viability inhibitors in developing a curriculum. The curriculum viability framework can guide the developers regarding quality standards and the inhibitors that may affect the achievement of the standards. Using this framework, curriculum developers can (re)design the curriculum that meets the quality criteria but at the same time ensure that the curriculum is designed in a manner that inhibitors that can likely affect the achievement of these standards are also addressed. Table 3.2 shows curriculum viability indicators and methods to measure these indicators for both, curriculum on paper and implemented curriculum. For example, while designing a curriculum, the developer should ensure that it does not contain irrelevant curriculum content, which is an inhibitor and may affect the achievement of curriculum's objectives which is a quality standard.

Implications for Teachers and Students

The teacher and student questionnaires provide in-depth detail of possible inhibitors. Using these questionnaires, teachers, and students can become aware of the curriculum areas where they share similar or differing perceptions. This would also add to their knowledge of criteria and inhibitors important for functioning of the curriculum. Wherever there are differing perceptions, the reasons and solutions can be found after discussion among teachers and students. This can be achieved by conducting focus group discussions among teachers and students regarding disagreement in their perceptions about the inhibitors and finding common solutions to achieve a higher quality of the curriculum.

Implications for Educational Managers

Educational managers play a profound role in the implementation of the curriculum. Though our questionnaires lacked the perceptions of educational managers, the information gathered about the presence or absence of inhibitors in the curriculum can help educational managers ensure the smooth implementation of the curriculum. Educational managers can plan certain activities based on the information gathered through the questionnaires. For example, they can design faculty development workshops in the areas where teachers require training.

Conclusion

This research project introduced the new concept of curriculum viability and emphasized the importance of measuring curriculum viability inhibitors in an undergraduate medical curriculum in order to have a pragmatic and straightforward approach to determine the wellbeing of a curriculum.

The research project resulted in the development of a theoretical framework for curriculum viability, valid and reliable teacher and student questionnaires measuring curriculum viability inhibitors, and an approach to address the inhibitors that are present in an undergraduate medical curriculum. The curriculum viability indicators enable curriculum developers to consider both quality standards and inhibitors while

developing and implementing a curriculum, whereas by using the teacher and student CVIM-Q, curriculum reviewers can identify inhibitors that impede the achievement of quality standards. The findings from these questionnaires will also help curriculum managers in the effective implementation of the curriculum. The qualitative approach to bridge divergence between teachers' and students' perceptions can further help to find solutions that address the inhibitors.

In a nutshell, curriculum viability determines the health of the curriculum by determining the inhibitors that make the curriculum diseased. An explicit identification of these inhibitors through valid and reliable questionnaires and an approach to bridge the differences in perceptions of teachers and students can improve the quality of the curriculum and hence have a positive impact on society.

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English Summary

This dissertation describes four studies conducted to assess curriculum viability. In the first chapter (General Introduction), we have described the evolution of curriculum, explaining the different definitions of curriculum reported in the literature, and how it has evolved from the 1950s onwards. Then we have described the curriculum quality standards and their importance in the evaluation of a curriculum. We explained these standards and how they are used in the accreditation of a medical institution. Following this, we introduced the new term *curriculum viability,* and explained the importance of this new method of evaluation, which establishes the reasons behind non-achievement of quality standards. In the end, we explained why we need to design valid questionnaires to evaluate the curriculum viability and how the questionnaires will add to the process of evaluation.

To assess curriculum viability, four studies were conducted, guided by the following four research questions:

RQ1 What standards and inhibitors of curriculum quality have been reported in the literature? (Study 1 – Chapter 2)

RQ2 Which standards and inhibitors addressing curriculum viability in an undergraduate medical education program do educational experts agree upon and how do they rank them according to their importance? (Study 2 – Chapter 3)

RQ3 What are valid and reliable teacher and student questionnaires that can measure curriculum viability inhibitors in an undergraduate medical curriculum? (Study 3 – Chapter 4)

RQ4 Which curriculum viability inhibitors are present in an undergraduate medical curriculum and what is the divergence and/or convergence of teachers' and students' perceptions about them? (Study 4 – Chapter 5)

In Chapter 2, Study 1, we have performed a scoping review to find the curriculum viability inhibitors already reported in the literature. To identify curriculum viability indicators in the literature, we searched for the key terms, curriculum quality standards and inhibitors, as we described curriculum viability as a combination of the degree to which a curriculum meets the quality standards, and the presence of curricular inhibitors, which impede the attainment of these standards. We found 1233 articles after a meticulous search, based on keywords and their combinations, through eight databases. Using our inclusion criteria, we filtered 36 articles. These 36 articles were evaluated for their quality and eventually, only 13 articles were considered suitable for analysis. Based on the data analysis, we found that only 2 out of 13 articles reported

quality standards and inhibitors together. These articles reported curriculum viability indicators (quality standards and inhibitors) for both on-campus and online programs. After analyzing the data, we found 37 quality standards and 19 inhibitors reported in the literature. Based on these findings, we developed a curriculum viability framework that can be used by educational institutions for assessing curriculum viability.

When identifying curriculum viability indicators in the literature, our focus was on assessing curriculum viability for an on-campus program in a medical institution. Therefore, we established the agreement of educational experts on the quality standards and inhibitors found through the scoping review. Through this, we finalized the list of indicators, based on which questionnaires could be developed in our subsequent study. Hence, in our second study (Chapter 3), we shared a questionnaire comprising of relevant standards and inhibitors with the educational experts for their agreement. After two Delphi rounds, an agreement was reached on 40 out of 44 items. These items were further ranked by the experts according to their importance related to assessing curriculum viability. These items were grouped under eight categories as follows: (1) educational strategy/content, (2) students, (3) faculty, (4) assessment, (5) educational/work environment, (6) curriculum communication (for teachers and students), (7) (Use of) technology, and (8) (Medical) leadership. Based on the results of the expert agreement, we revised the previously devised framework.

To the best of our knowledge, we could not find any literature that reported valid and reliable instruments or questionnaires for measuring curriculum viability inhibitors. However, instruments or questionnaires were available in the literature to measure quality standards. Therefore, in our third study (Chapter 4), we describe the development of a valid and reliable questionnaire. Using a meticulous and robust process of developing a questionnaire, we established that the content of the questionnaire was valid. Then we ensured that the items in the questionnaires had similar meanings for the participants as developed and understood by the researchers. This was established through interviews with teachers and students, a process known as 'cognitive interviews.' Following this, a pilot study was conducted with 20 teachers and 15 students. A total of 575 teachers and 275 students filled out the questionnaires. This data enabled us to develop a final version of the questionnaire that was valid and reliable. The final teacher and student questionnaire had 26 items under 7 constructs, and 14 items under 3 constructs, respectively.

In our fourth study (Chapter 5), we used the teacher and student questionnaires to measure curriculum viability inhibitors and conducted a focus group discussion

between teachers and students to develop approaches to address the divergence in perceptions of teachers and students about these inhibitors. This was done as divergence among teachers and students may negatively affect the quality of the curriculum. We found that the curriculum under review had no strong inhibitors, but there was a divergence of perception between teachers and students regarding educational program and institutional culture inhibitors. We further explored this divergence by conducting a focus group discussion between teachers and students. This enabled us to suggest solutions to bridge the gap between teachers and students and to resolve such issues.

In Chapter 6, the general discussion, the research problem, and how it has been addressed through the four research questions has been discussed. It provides an insight into what our study has added to the already existing literature about curriculum evaluation. Strengths and weaknesses of the study have been described. The gaps that still exist have been discussed and avenues for future research have been suggested. These included developing a questionnaire to gather perceptions of educational managers and to use the questionnaires in medical institutions with different curricula. The project concluded by introducing the new concept of curriculum viability and highlighting the importance of measuring both standards and inhibitors to determine the curriculum viability, and through it, improving the quality of the curriculum.

Nederlandse Samenvatting

(DUTCH SUMMARY)

In dit proefschrift worden vier studies beschreven die ten doel hadden om de uitvoerbaarheid van curricula te beoordelen. In Hoofdstuk 1 (de algemene inleiding) beschreven we de evolutie van het curriculum, waarbij we uitlegden welke verschillende definities van "curriculum" er in de literatuur worden vermeld en hoe het curriculum zich vanaf de jaren 50 uit de vorige eeuw heeft ontwikkeld. Vervolgens beschreven we de kwaliteitseisen die aan curricula worden gesteld en de belangrijke rol die zij spelen in de evaluatie van een curriculum. We lichtten deze eisen nader toe en legden uit hoe zij bij de accreditatie van een medische onderwijsinstelling worden gehanteerd. Hierna introduceerden we de nieuwe term "uitvoerbaarheid van curricula" en legden we uit wat het belang is van deze nieuwe evaluatiemethode die de redenen achter het niet voldoen aan bepaalde kwaliteitseisen in kaart brengt. Ten slotte legden we uit waarom het noodzakelijk is dat we voor het evalueren van curriculumuitvoerbaarheid valide vragenlijsten ontwerpen en hoe dergelijke vragenlijsten een bijdrage leveren aan het evaluatieproces.

Om de uitvoerbaarheid van curricula te kunnen beoordelen, werden er vier studies verricht waarin de volgende vier onderzoeksvragen (OV's) leidend waren:

OV 1: Welke kwaliteitseisen en -bedreigingen worden er in de literatuur vermeld? (Studie 1 – Hoofdstuk 2);

OV 2: Over welke eisen en bedreigingen die samen de curriculumuitvoerbaarheid van een bacheloropleiding Geneeskunde bepalen zijn onderwijsdeskundigen het eens en welke volgorde van belangrijkheid kennen zij daaraan toe? (Studie 2 – Hoofdstuk 3);

OV 3: Wat zijn valide en betrouwbare vragenlijsten voor docenten en studenten die de bestaande bedreigingen voor de uitvoerbaarheid van een bachelorcurriculum Geneeskunde kunnen meten? (Studie 3 – Hoofdstuk 4);

OV 4: Welke bedreigingen voor de curriculumuitvoerbaarheid doen zich voor in een bacheloropleiding Geneeskunde en hoe verschillen en/of concorderen docenten en studenten in hun perceptie hiervan? (Studie 4 – Hoofdstuk 5).

In Hoofdstuk 2, Studie 1, hebben we een verkennende literatuurstudie (*scoping review*) uitgevoerd om te achterhalen welke bedreigingen voor de uitvoerbaarheid van curricula er al in de literatuur zijn vermeld. Om in de literatuur indicatoren voor curriculumuitvoerbaarheid te vinden, zochten we op de trefwoorden "kwaliteitseisen voor curricula" en "bedreigingen", daar we curriculumuitvoerbaarheid omschreven als een combinatie van de mate waarin een curriculum aan de kwaliteitseisen voldoet

en de aanwezigheid van bedreigingen voor het curriculum die verhinderen dat aan deze eisen wordt voldaan. Na een zorgvuldige zoektocht in acht databases, welke gebaseerd was op trefwoorden en combinaties daarvan, vonden we 1233 artikelen. Hieruit filterden we na toepassing van onze inclusiecriteria 36 artikelen. Vervolgens werden deze 36 artikelen op hun kwaliteit beoordeeld, en uiteindelijk werden er slechts 13 artikelen geschikt bevonden voor nadere analyse. Op basis van onze data-analyse constateerden we dat slechts twee van deze 13 artikelen kwaliteitseisen en -bedreigingen samen beschreven. In deze artikelen werden indicatoren beschreven voor de curriculumuitvoerbaarheid (i.e. kwaliteitseisen en -bedreigingen) van zowel het reguliere campusonderwijs als van online opleidingen. Nadat we de data hadden geanalyseerd, stelden we vast dat er in de literatuur 37 kwaliteitseisen en 19 kwaliteitsbedreigingen werden vermeld. Op basis van deze bevindingen ontwikkelden we een kader waarmee onderwijsinstellingen de uitvoerbaarheid van hun curricula kunnen beoordelen.

Bij het inzichtelijk maken van de in de literatuur vermelde indicatoren voor curriculumuitvoerbaarheid, lag onze focus op het beoordelen van de curriculumuitvoerbaarheid ten behoeve van het reguliere campusonderwijs aan een medische onderwijsinstelling. Daarom hebben we vastgesteld over welke kwaliteitseisen en -bedreigingen die uit de scoping review naar voren waren gekomen onderwijsdeskundigen overeenstemming bereikten. Deze methode stelde ons in staat om de laatste hand te leggen aan de lijst met indicatoren waarmee we in onze vervolgstudie vragenlijsten konden ontwikkelen. In onze tweede studie (Hoofdstuk 3) legden we daarom een vragenlijst met relevante eisen en bedreigingen ter instemming voor aan de onderwijsdeskundigen. Na twee Delphi-rondes werd over 40 van de 44 items overeenstemming bereikt. De deskundigen rangschikten deze items verder op volgorde van relevantie voor de beoordeling van curriculumuitvoerbaarheid. Deze items werden in de volgende acht categorieën onderverdeeld: 1) onderwijsstrategie/inhoud, 2) studenten, 3) stafleden, 4) toetsing, 5) onderwijs/werkomgeving, 6) communicatie over het curriculum (voor docenten en studenten), 7) (gebruik van) technologie en 8) (medisch) leiderschap. Op basis van de aldus bereikte overeenstemming tussen deskundigen stelden we ons eerder ontwikkelde kader bij.

Voor zover ons bekend, is er geen literatuur beschikbaar waarin valide en betrouwbare instrumenten of vragenlijsten voor het meten van bedreigingen voor de uitvoerbaarheid van curricula worden beschreven. Wel waren er instrumenten of vragenlijsten beschikbaar voor het meten van kwaliteitseisen. Met die insteek

hebben we in onze derde studie (Hoofdstuk 4) de ontwikkeling van een valide en betrouwbare vragenlijst beschreven. Aan de hand van een zorgvuldige en gedegen procedure ontwikkelden we een vragenlijst en stelden we vast dat de inhoud ervan valide was. Vervolgens verzekerden we ons ervan dat de items in de vragenlijst voor de participanten dezelfde betekenis hadden als zoals de onderzoekers deze ontwikkeld en bedoeld hadden. Dit deden we door interviews af te nemen met docenten en studenten, een proces dat bekend staat als "cognitieve interviews". Aansluitend verrichtten we een proefmeting met 20 docenten en 15 studenten. In totaal vulden 575 docenten en 275 studenten de vragenlijsten in. De aldus verkregen gegevens stelden ons in staat om een definitieve versie van de vragenlijst te ontwikkelen die valide en betrouwbaar was. De uiteindelijke vragenlijst voor docenten en studenten bestond uit respectievelijk 26 items vallend onder zeven constructen en 14 items vallend onder drie constructen.

In onze vierde studie (Hoofdstuk 5) gebruikten we de vragenlijsten voor docenten en studenten om bedreigingen voor de uitvoerbaarheid van curricula te meten en hielden we focusgroepgesprekken tussen docenten en studenten om erachter te komen hoe de verschillen tussen docenten en studenten in hun perceptie van deze bedreigingen het beste kunnen worden aangepakt. Dit deden we omdat verschillen in perceptie tussen docenten en studenten een negatieve uitwerking kunnen hebben op de kwaliteit van het curriculum. We constateerden dat er in het onderzochte curriculum geen sprake was van ernstige bedreigingen, maar dat er een verschil in perceptie was tussen docenten en studenten ten aanzien van de bestaande bedreigingen voor het onderwijsprogramma en voor de onderwijsinstellingscultuur. Door focusgroepgesprekken te houden tussen docenten en studenten probeerden we dit verschil nader te onderzoeken. Dit stelde ons in staat om met oplossingen te komen waarmee de kloof tussen docenten en studenten overbrugd konden worden en zodoende dergelijke kwesties konden worden opgelost.

In Hoofdstuk 6, de algemene discussie, wordt het vraagstuk dat in dit werk centraal stond besproken, alsmede hoe dit door middel van de vier onderzoeksvragen werd beantwoord. Het biedt inzicht in de bijdrage die ons onderzoek heeft geleverd aan de reeds bestaande literatuur over curriculumevaluatie. Eveneens werden de sterke en zwakke punten van het onderzoek beschreven. De nog aanwezige lacunes werden besproken en er werden lijnen voor toekomstig onderzoek uitgezet, waaronder het ontwikkelen van een vragenlijst voor het verzamelen van de percepties van onderwijsmanagers en het toepassen van de vragenlijsten in medische

onderwijsinstellingen met verschillende curricula. Het project werd afgesloten met een introductie van het nieuwe begrip "curriculumuitvoerbaarheid" waarbij we erop wezen dat het voor het bepalen van de uitvoerbaarheid van een curriculum, en daarmee het verbeteren van de kwaliteit van het curriculum, belangrijk is om zowel kwaliteitseisen als -bedreigingen te meten.

Impact Paragraph

In this impact paragraph, we briefly explain the rationale, objectives, and findings of this PhD project, briefly including summaries of the findings of each study, followed by the practical implications of the project.

Project Rationale, Objectives, and Findings

A curriculum provides a roadmap for the implementation of an educational program. A faulty curriculum may thus affect the program negatively, producing undesirable results. Educational institutions routinely evaluate their curricula to determine their strengths and weaknesses but in routine do not explore the issues that inhibit the attainment of the quality standards (so-called inhibitors).

Keeping in view both the standards and the inhibitors to assess the quality of the curriculum, we have coined a new term, *curriculum viability*. We define it as '*The current state of a curriculum determined by the degree to which particular quality standards have or have not been met, and the inhibitors affecting the attainment of those standards*'. The objective of our research was to assess curriculum viability by developing an approach that can determine curriculum viability indicators and provide solutions to address curriculum viability inhibitors. For this purpose, we conducted four studies, including one scoping review and three empirical studies. In the first study, we identified 37 standards and 19 inhibitors for both on-campus and online curriculum. Based on these curriculum viability indicators, we proposed a curriculum viability framework to measure curriculum viability. However, these viability indicators did not have an expert agreement; hence we conducted a modified Delphi technique, after which experts agreed on 40 out of 44 indicators (relevant to the on-campus curriculum, excluding the ones related to online curriculum). These 40 indicators included 27 standards and 13 inhibitors in the areas of: (1) educational strategy/content, (2) students, (3) faculty, (4) assessment, (5) educational/work environment, (6) curriculum communication, (7) technology, and (8) leadership. In our third study, we focused on measuring curriculum viability inhibitors only, and developed teacher and student questionnaires to measure the curriculum viability inhibitors. The final teacher and student questionnaires had 7 and 3 constructs, respectively, containing 25 and 14 items each. Lastly, in the fourth study, we used teacher and student questionnaires to measure the curriculum viability inhibitors in an undergraduate medical curriculum and to find the divergence or convergence of teachers' and

students' perceptions about these inhibitors. We found that the curriculum under review had no inhibitors, but teachers and students had diverging perceptions about the educational program and institutional culture inhibitors. This divergence was further explored through a focus group discussion among teachers and students to find solutions to bridge this divergence.

Scientific Impact

This project contributes to the scientific domains of assessing curriculum viability, identifying curriculum inhibitors, developing valid and reliable questionnaires, and explaining convergence and divergence of teachers' and students' perceptions on curriculum inhibitors. This project provides (1) a curriculum viability framework to evaluate a curriculum based on quality standards and inhibitors, (2) valid and reliable student and teacher questionnaires to measure curriculum viability inhibitors and, (3) an approach to address the divergence in perceptions of teachers and students.

The curriculum viability framework provides a skeleton comprised of curriculum viability indicators and its relevant measuring methods for the official and implemented curriculum. The framework is composed of standards and inhibitors reported in the literature, which have been sorted according to the areas of the curriculum. Medical educationists can use this framework to evaluate the official and implemented curriculum. They can compare the curriculum viability framework with curriculum evaluation to explore the benefits of using this framework. This framework can also act as an impetus for future research work on the development of tools, instruments, or approaches for evaluating the curriculum viability.

The valid and reliable teacher and student questionnaires have 6 and 3 constructs, respectively. The teacher questionnaire has 25 items, and student questionnaire has 14 items. Through these questionnaires, the issues or problems in a curriculum that hinder the achievement of curriculum quality standards can be determined.

An approach using focus group discussion among teachers and students helps in exploring the diverging perceptions of teachers and students about the curriculum viability inhibitors. Through this common forum, the gap between these two main stakeholders can be bridged by finding solutions that can address the diverging perceptions.

Practical Implications

As a practical outcome of this PhD project, we foresee an impact of this project for curriculum developers, evaluators, accreditors, managers, teachers, and students, as detailed below.

Impact on Curriculum Developers, Evaluators, and Accreditors

Curriculum developers can utilize the curriculum viability framework reported in our second study in Chapter 3, containing 37 indicators. Curriculum developers can use this framework in the development phase of a curriculum, to ensure that it meets the quality standards and avoids the inhibitors pertaining to those standards. This can serve to avoid curricular issues in the implementation phase. For curriculum evaluators, this framework provides a set of already identified inhibitors that can affect a curriculum, and they can use it to identify these issues in an implemented curriculum. Curriculum evaluators can use the teacher and student questionnaires, stand-alone to identify the curriculum inhibitors, and to gather both teacher and student perceptions regarding it. They can also use these questionnaires in combination with tools, instruments, or questionnaires that measure the quality of a curriculum. Through this approach, they can determine the viability of the curriculum, as both the achievement or non-achievement of standards and the presence of curriculum inhibitors will be determined. Accreditation bodies can also consider rewriting the standards to include the relevant inhibitors to provide a comprehensive approach to evaluate a curriculum.

Impact on Curriculum Managers

Curriculum managers can also use the teacher and student questionnaires to find the issues that may affect the curriculum negatively. They can devise solutions to ensure the smooth running of the implemented curriculum depending on the presence of curriculum inhibitors. This may include faculty development workshops in the areas where faculty needs training for smooth running of the curriculum as identified through the questionnaires. One such example can be training of faculty in developing good quality multiple-choice questions if ‘low quality assessment inhibitor’ is present in a particular curriculum.

Impact on Teachers and Students

Teachers and students can use the results of the questionnaires to become aware of the issues in the curriculum and to know the convergence or divergence of opinions between themselves regarding these issues. These issues can be further explored through focus group discussions among the teachers and students to discuss the gaps in their perceptions and find approaches to bridge this gap. This will help to reduce the gap between the perceptions of teachers and students, which may affect the curriculum negatively. It will thus reduce the dis-satisfaction between teachers and students.

Societal Impact

A curriculum provides a roadmap for the educational program. A poor-quality program in medical education may result in producing inferior quality doctors. Curriculum developers, accreditors, evaluators, managers, educational leaders, and teachers all have a responsibility towards society to develop and implement a curriculum that produces doctors that can provide diligent care to society.

Deans and directors can utilize the results of the questionnaires to resolve the issues identified in a curriculum. The questionnaires will inform the specific areas of curriculum and the extent of the presence of inhibitors in these areas. This will serve to identify the reasons behind a weak or poor curriculum and provide an opportunity to address these inhibitors before the evaluation from an accreditation body. Deans of the medical schools can bring changes or make modifications in policies for the smooth running of the curriculum. Directors of the medical education departments can suggest changes/modifications in curriculum and faculty development workshops in areas of need, based on the inhibitors identified.

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Dedications

I heartily dedicate my thesis…

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Curriculum Vitae

Rehan Ahmed Khan is a Professor of Surgery, Assistant Dean Medical Education and heads the Assessment Committee at Riphah International University, Pakistan.. He is also visiting Professor of Medical Education at University of Lahore. He is actively involved in teaching surgery to undergraduate and postgraduate students. He also teaches in 03 master's in health professions education programs in Pakistan and has supervised many master's students since 2014. He has been instrumental in bringing curricular reforms in undergraduate medical curriculum in two medical schools in Pakistan. He has been a member of the medical education committee of the national regulatory body and in this capacity has been an active member to develop the national accreditation standards. He has several national and international publications in medical education.

Dr Rehan graduated from Rawalpindi Medical College, Punjab University in 1997. He did his fellowships in General surgery from Pakistan (FCSP) and Ireland (FRCS) in 2003. His interests in medical education led to his joint master's in health professions education from Maastricht University (Netherlands) and Suez Canal University (Egypt) in 2010. He then did Master of Science in Health Professions Education from University of Glasgow (United Kingdom) in 2014. Currently his thesis has been accepted for defense of PhD in medical education at Maastricht University.

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