Education in Medicine Journal

REVIEW ARTICLE

Title: The variety of undergraduate medical education curricula: an environmental scan of diverse medical school characteristics within Indonesia

Authors: Bayu Prasetya Alfandy, Eti Poncorini Pamungkasari, Lily Aulia Salsabila, Lubna Djafar, Syarifah Islami

Submitted Date: 16-03-2023

Accepted Date: 14-10-2023

To cite this article: Alfandy BP. Pamungkasari EP. Salsabila LA, Djafar L, Islami S. The variety of undergraduate medical education curricula: an environmental scan of diverse medical school characteristics within Indonesia. Education in Medicine Journal. (early view).

ORIGINAL ARTICLE

ARTICLE INFO

Submitted: 16-03-2023
Accepted: 14-10-2023

The Variety of Undergraduate Medical Education Curricula: An Environmental Scan of Diverse Medical School Characteristics within Indonesia

Bayu Prasetya Alfandy[1,2], Eti Poncorini Pamungkasari[3], Lily Aulia Salsabila[1,4], Lubna Djafar[1,5], Syarifah Islami[1,6]

[1]*Center for Indonesian Medical Students' Activitites (CIMSA), Depok, INDONESIA*

[2]*Undergraduate Medical Program, Faculty of Medicine, Universitas Syiah Kuala, Banda Aceh, INDONESIA*

[3]*Medical Education Unit, Faculty of Medicine, Universitas Sebelas Maret, Surakarta, INDONESIA*

[4]*Undergraduate Medical Program, Faculty of Medicine, Universitas Pelita Harapan, Tangerang, INDONESIA*

[5]*Undergraduate Medical Program, Faculty of Medicine, Universitas Indonesia, Jakarta, INDONESIA*

[6]*Undergraduate Medical Program, Faculty of Medicine, Universitas Sebelas Maret, Surakarta, INDONESIA*

To cite this article: Alfandy BP. Pamungkasari EP. Salsabila LA, Djafar L, Islami S. The variety of undergraduate medical education curricula: an environmental scan of diverse medical school characteristics within Indonesia. Education in Medicine Journal. (early view).

ABSTRACT

An educational curriculum is a fundamental component of undergraduate medical education (UME) programmes, and its implementation may differ between medical schools due to multiple factors influencing curriculum development processes, such as medical schools' characteristics, intended outcomes of educational programmes, resources, and cultures. Consequently, the quality of UME programmes and medical graduates may be affected. This study aimed to collect knowledge on the implementation of UME curricula in Indonesia, as a country that has numerous medical schools with diverse characteristics. A nationwide environmental scan with cluster sampling was employed from December 2020 to May 2022. Data were collected from the dean or the staff of medical education units or other relevant stakeholders in medical schools on the curriculum approach, teaching-learning strategy, assessment system, and curriculum evaluation. Data collected were analysed using descriptive statistics and presented using frequency and percentage parameters. Of 74 medical schools invited, 30 agreed to participate in this study. Most medical schools had established outcome-based

UME while employing diverse curricular approaches within the SPICES (student-centred, problem-based, integrated, community-based, elective, and systematic) strategy. Variations were also observed in the teaching-learning processes and assessment systems used. Case-based discussions, lecture-based classes, skills laboratories, laboratory practice, and interprofessional learning were used as teaching-learning methods, while written/computer-based tests, objective structured clinical examinations, and other assessment methods were used to measure student competency. In their policy networks, medical schools involved numerous stakeholders and performed periodic curriculum evaluations using multiple well-established tools to ensure the quality of medical training and graduates. As various strategies of curriculum implementation were reported, it remains critical to establish productive UME curricula. Various potentials, resources, and opportunities in medical education must be optimised to maintain best-practice educational programmes.

Keywords: *Curriculum, Undergraduate, Medical education, Indonesia, Environmental scan*

CORRESPONDING Bayu Prasetya Alfandy, Center for Indonesian Medical Students' Activities, Depok, Indonesia

Email: b.alfandy00@gmail.com

INTRODUCTION

Medical education is a continuous process of training physicians that begins at the undergraduate level and continues through clinical clerkship, residency, and subspecialist programmes to provide quality healthcare to individuals, families, and society (1,2). Consequently, medical education is expected to constantly consider the healthcare requirements for medical doctors, which form the essence of medical education curriculum development (1,2). However, it is widely agreed that medical education cannot solely concern generating medical doctors who meet the current healthcare requirements; it must constantly conform to global developments and be prepared for future challenges (3). Therefore, comprehensive efforts are required to address these circumstances in administering medical education programmes, including at the undergraduate medical education (UME) level.

The novel landscape of global transformation (i.e., Industry 4.0) and the revolution in medical science encourage the presence of high-quality physicians who are often associated with being five-star doctors (4–7). Numerous studies argue that future medical doctors must be adaptive and perform multiple roles in healthcare (i.e., healthcare provider, leader, communicator, researcher, decision-maker, manager, etc.), aside from possessing professionalism, capacity for collaboration, and adequate literacy skills to enable them to perform the main tasks of a physician (i.e., those involving medical knowledge and skills) in delivering quality care and improving patient safety in primary, secondary, and tertiary healthcare systems (4,8,9). Transforming the UME curricula to address current challenges is viewed as an effort by medical schools to ensure medical graduates meet the demands associated with the evolving healthcare landscape and ongoing global transformations, as the primary purpose of UME programmes is to provide medical doctors who can assume appropriate responsibility for patient care (10,11).

Curriculum development in medical education refers to a sustainable activity for adapting educational programmes towards society's demands and global challenges, which could generate future physicians with complex healthcare capabilities (12). The World Federation of Medical Education (WFME) explains that the curriculum for basic medical education should consist of several aspects such as the curriculum concept/model, teaching-learning strategy, assessment system, and relevant

evaluation of the educational provision (12). The UME curricula should adequately define the expected outcomes of medical graduates, as well as the learning outcomes of each course in the educational programme, known as outcome-based medical education (12). Teaching and learning processes in the educational curriculum should accommodate students in achieving relevant competency according to the intended outcomes of the curriculum, which encompasses many options and variants of educational methods and experiences (12). Effective teaching-learning should be accompanied by an adequate assessment system providing opportunities to optimise learning activities and feedback for medical students to identify their strengths and weaknesses and assist them in consolidating their learning, which requires incorporating multiple assessments to achieve the purpose of the educational programme in medical schools (12). Finally, each educational programme in medicine should include a curriculum evaluation mechanism to review the adequacy of numerous course components. Regardless of the recommendation framework of the UME curriculum internationally, the WFME argues that it is essential to align the educational curriculum towards each country's national regulatory standards or government requirements (12).

For UME programmes in Indonesia, the educational curriculum is arranged according to the same standard, the Indonesia Medical Doctor Competency Standard (IMDCS), which forms the primary reference in the curriculum development process besides the other governmental regulations in the national or local contexts (i.e., regulations of the Ministry of Education and Indonesian Medical Council) (13). However, each medical school in the country has different academic objectives and intended outcomes for medical graduates. These are coupled with multiple aspects, such as medical school characteristics, resources, facilities, cultures, and contexts of the schools, which may affect the educational process, including the curriculum development process (13–15). Consequently, the UME programme curriculum implementation varies. The WFME has mentioned the possibility of curriculum variation in the UME programme, although the national curriculum and its related regulations are specified (12). Unfortunately, curriculum variation has created significant concern regarding the quality of medical graduates, as the curriculum is the foundation of educational programmes, and the quality of the educational curriculum may determine the profile of its graduates (16). Therefore, it is essential to constantly recognise the best practices of the UME curriculum, such as through quality assurance processes and performing continuous study on the educational curriculum of the UME programme.

To date, no study has comprehensively investigated the implementation of UME curricula in Indonesian medical schools. Available information on this topic is limited, as the most recent report from Mustika et al. (17) in 2019 involved investigating medical education as a whole in Indonesia and not the UME curricula specifically. Therefore, we argue that an environmental scan of curriculum implementation in UME programmes is significant to ensure medical graduates in Indonesia fulfil the expected standards and have demonstrated proficiency in delivering healthcare, which may be influenced by the implementation of the medical curriculum. Using the framework of the global standard for basic medical education by the WFME (12), we aim to collect knowledge on the curricular concepts, teaching-learning methods (including interprofessional education [IPE]), assessment systems, and curriculum evaluation strategies of Indonesian medical schools. Information collected in this study is expected to be an empirical finding to improve understanding of the different emphases of UME curricula in Indonesia. Accordingly, the opportunity for advancing UME programmes could arise. Although this study appears relatively local, we argue that it would disseminate empirical ideas related to the best practices of the UME curriculum for international readers. As this study also highlighted the essence of collaborative work with multiple stakeholders in policymaking and curriculum development, these findings may stimulate medical schools to establish collaborative work in numerous critical activities in medical schools to embody the sustainability of medical education, particularly with students as the largest stakeholder in medical schools. This study will assist medical teachers in identifying the recent requirements for educational programmes in medicine and translating such requirements into appropriate delivery methods in teaching and

learning activities. Finally, these findings may provide insights for policymakers and medical schools in a global context regarding advancing medical education and supporting best-practice curriculum implementation within medical schools to achieve a productive UME programme.

METHODS

Context

Indonesia is the largest archipelago country in the world, comprising more than 16,000 islands and having a population of over 270 million (17). At the time this study was conducted, Indonesia had 91 medical schools, which differ in their capabilities, setting/demographic locations (spread over the eight main islands in the country and six administrative regions based on the classification of the Indonesian Association of Medical Education Institutions [IAMEI]), accreditation level (A/B/not-accredited), ownership status (public or private), student body (active or passive), and length of existence (old or new) (13). The UME programme in the country is divided into two stages: the pre-clinical stage and the clinical clerkship programme. Overall, the UME programme lasts for at least 11 semesters (seven semesters for the pre-clinical stage and the rest for the clinical clerkship rotation stage). After completing the pre-clinical stage, medical students are granted a bachelor of medicine (BMed). After completing the clinical clerkship rotation and passing the medical licensing examination (MLE), medical students are awarded a medical doctor (MD) degree and should then participate in a national internship programme for approximately 1 year to receive a practising licence as a clinical physician.

Study Design

This study employed a nationwide environmental scan using an active approach – a data collection tool was constructed to investigate the tacit knowledge of the educational curriculum at the pre-clinical stage of UME programmes in Indonesia directly from the research respondents. The study was conducted from December 2020 to May 2022. Ethical clearance was granted by the Health Research Ethics Committee of the Faculty of Medicine, Universitas Sebelas Maret (No. 179/UN27.06.6.1/KEPK/EC/2020).

Participant and Recruitment

The study population comprised 91 medical schools spread over the islands of Sumatra, Java, Bali, Nusa Tenggara, Kalimantan, Sulawesi, Maluku, and Papua. Based on the sample size calculation, which used Slovin's formula with a 5% error margin, 74 medical schools were required to participate. A cluster sampling technique was used, with some clusters randomly selected based on natural geographic location to ensure that each cluster comprised medical schools with diverse characteristics. Conversely, clustering the study population based on accreditation level was avoided since medical schools at the same level of accreditation tend to have similar characteristics, particularly those at the lowest level of accreditation, which were mainly new medical schools with a passive student body and limited resources, which may affect the validity of the clustering process. Thus, medical schools in Sumatra, Java, Bali, Kalimantan, and Sulawesi were included. The schools were recruited primarily through an invitation letter distributed by the authors to representatives from each medical school. Email invitations were also distributed to medical education experts in some medical schools through the alumni network of the Masters of Medical Education Program, Faculty of Medicine, Universitas

Indonesia.

Instrument

The authors formulated the questionnaire used in Bahasa Indonesia as the primary language for all respondents in this study. Key domains were discussed and formed by the authors according to several regulations of the UME curriculum, nationally and internationally (i.e., the Global Standard for Basic Medical Education by the WFME, the IMDSC of 2012, the Medical Education Law No. 20 of 2013, the Regulation of the Indonesian Medical Council No. 10 of 2012, and the National Standards for Higher Education). Based on these, several questions were drafted. After several refinement rounds, a set of questions was presented to six medical education experts (who had graduated from the Master of Medical Education programme and/or were actively involved in medical education research) in Indonesia for evaluation and input related to the ability of each item to assess the implementation of UME curricula, as well as assessment of the extent to which each item in the questionnaire could be comprehended by responders. Based on this, the questionnaire domains and their associated questions were identified. The domains used were the curriculum concept, curricular approach, curriculum decision-making, teaching and learning method (including IPE), assessment, and curriculum evaluation. Further details on the research questionnaire are available in the appendix. Once the questionnaire was finalised, it was distributed to the respondents.

Data Collection and Analysis

Data were obtained from those actively involved in the curriculum development and administration of educational programmes in medical schools: the dean or staff of a medical education unit, department, or centre or a relevant stakeholder in medical schools with approval from the dean. The purpose of this study was explained to the respondents before they were asked to provide consent as confirmation of their voluntary participation. Since our respondents were medical educationalists, scepticism towards misconceptions about several terminologies in medical education could be eliminated. Furthermore, we anticipated the occurrence of such events earlier; thus, the questionnaire contained minimal difficult-to-understand terminology, including restricted use of abbreviations. When the data collection was complete, the research variables and medical school characteristics were analysed using descriptive statistics and presented using frequency and percentage parameters.

RESULTS

Study Respondents

Of the 74 medical schools invited to participate, 30 medical schools with varying demographics, institutional ownership status, and levels of accreditation agreed to be investigated regarding the implementation of the educational curriculum at the pre-clinical stage of UME programmes, giving a response rate of 40.5%. Medical schools participating in this study were then grouped according to the administrative region classification of the IAMEI. Table 1 indicates that the majority of respondents represented government medical schools (60.0%), were in Java (60.0%), and were accredited as A or the highest accreditation level in the country (63.3%). In each of the regions, it was found that medical schools were mainly government schools, except for Region 2 (33.3%). Additionally, more than half of the schools in each region were A-accredited, other than in Region 1 (37.5%). Unfortunately, Region 6 had only one medical school participating in this study. All medical schools participating in this study had a medical education unit, centre, or department.

Table 1: Characteristics of the participant medical schools

Variable	R1		R2		R3		R4		R5		R6		TOTAL	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Demographic Location														
Sumatra	8	100.0	0	0.0	1	33.3	0	0.0	0	0.0	0	0.0	9	30.0
Java	0	0.0	6	100.0	2	66.7	4	80.0	6	85.7	0	0.0	18	60.0
Bali	0	0.0	0	0.0	0	0.0	0	0.0	1	14.3	0	0.0	1	3.3
Sulawesi	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	100.0	1	3.3
Kalimantan	0	0.0	0	0.0	0	0.0	1	20.0	0	0.0	0	0.0	1	3.3
Ownership status														
Government	6	75.0	2	33.3	2	66.7	3	60.0	4	57.1	1	100.0	18	60.0
Private	2	25.0	4	66.7	1	33.3	2	40.0	3	42.9	0	0.0	12	40.0
Accreditation level														
A	3	37.5	4	66.7	3	100.0	3	60.0	5	71.4	1	100.0	19	63.3
B	5	62.5	2	33.3	0	0.0	2	40.0	2	28.6	0	0.0	11	36.7
Not-accredited	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Existence of medical education unit/department/center														
Yes	8	100.0	6	100.0	3	100.0	5	100.0	7	100.0	1	100.0	30	100.0
No	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0

R: Region, N: Frequency/number of medical schools, %: Percentage

Undergraduate Medical Education Curricula

Most medical schools implemented the outcome-based medical education (OBME) concept (93.3%), with the majority of these established before 2016 (53.3%), especially for medical schools in Region 2 (Table 2). The remaining schools used a competency-based medical education concept based on the IMDCS (6.7%). Curriculum approaches varied: medical schools used the SPICES (student-centred, problem-based, integrated, community-based, elective, and systematic) approach, with variations in the use of student-centred (33.3%), problem-based (40.0%), integrated (56.7%), community-based (40.0%), elective (36.7%), and systematic (60.0%) approaches. Besides, some medical schools used less specific approaches, between the student-centred and teacher-centred approaches (66.7%) and the problem-based and information-gathering approaches (56.7%). When comparing regions, it was found that Region 2 had many medical schools with the closest applicability of the SPICES approach, whereas medical schools in Regions 1, 3, and 6 still used a less specific approach to the UME curriculum.

Table 2: Undergraduate medical education curriculum variations

Variable	R1		R2		R3		R4		R5		R6		TOTAL	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%
What type of curriculum does your institution use?														
Outcome-based medical education	8	100.0	5	83.3	2	66.7	5	100.0	7	100.0	1	100.0	28	93.3
Non-outcome-based medical education (please specify)	0	0.0	1	16.7	1	33.3	0	0.0	0	0.0	0	0.0	2	6.7
When did your institution first establish an outcome-based medical education?														
Before 2016	4	50.0	5	83.3	2	66.7	2	40.0	2	28.6	1	100.0	16	53.3
2016	1	12.5	0	0.0	0	0.0	0	0.0	2	28.6	0	0.0	3	10.0
2017	2	25.0	0	0.0	0	0.0	2	40.0	1	14.3	0	0.0	5	16.7
2018	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2019	1	12.5	0	0.0	0	0.0	1	20.0	1	14.3	0	0.0	3	10.0
2020	0	0.0	0	0.0	0	0.0	0	0.0	1	14.3	0	0.0	1	3.3
Not applied yet	0	0.0	1	16.7	1	33.3	0	0.0	0	0.0	0	0.0	2	6.7
Which curricular approach does your institution use?														
Student-centered	1	12.5	4	66.7	1	33.3	2	40.0	2	28.6	0	0.0	10	33.3
In between (not specific)	7	87.5	2	33.3	2	66.7	3	60.0	5	71.4	1	100.0	20	66.7
Teacher-centered	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Problem-based	2	25.0	3	50.0	1	33.3	2	40.0	4	57.1	0	0.0	12	40.0
In between (not specific)	6	75.0	3	50.0	2	66.7	3	60.0	2	28.6	1	100.0	17	56.7
Information gathering	0	0.0	0	0.0	0	0.0	0	0.0	1	14.3	0	0.0	1	3.3
Integrated	3	37.5	4	66.7	1	33.3	3	60.0	6	85.7	0	0.0	17	56.7
In between (not specific)	5	62.5	2	33.3	2	66.7	2	40.0	1	14.3	1	100.0	13	43.3
Discipline-based	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Community-based	3	37.5	3	50.0	1	33.3	3	60.0	2	28.6	0	0.0	12	40.0

In between (not specific)	5	62.5	3	50.0	2	66.7	2	40.0	5	71.4	1	100.0	18	60.0
Hospital-based	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Elective	2	25.0	4	66.7	0	0.0	2	40.0	3	42.9	0	0.0	11	36.7
In between (not specific)	4	50.0	1	16.7	2	66.7	3	60.0	3	42.9	1	100.0	14	46.7
Standard	2	25.0	1	16.7	1	33.3	0	0.0	1	14.3	0	0.0	5	16.7
Systematic	2	25.0	6	100.0	0	0.0	3	60.0	7	100.0	0	0.0	18	60.0
In between (not specific)	6	75.0	0	0.0	3	100.0	2	40.0	0	0.0	1	100.0	12	40.0
Opportunistic	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Did your institution perform a comparative and/or literature study before implementing the current curriculum?														
Yes	7	87.5	6	100.0	3	100.0	4	80.0	7	100.0	1	100.0	28	93.3
No	1	12.5	0	0.0	0	0.0	1	20.0	0	0.0	0	0.0	2	6.7
Which of the following stakeholders does your institution engage in curriculum decision-making? (You may choose more than one)														
University stakeholder	6	75.0	5	83.3	3	100.0	3	60.0	5	71.4	0	0.0	22	73.3
Medical education unit	8	100.0	6	100.0	3	100.0	5	100.0	7	100.0	1	100.0	30	100.0
The dean and staff	8	100.0	6	100.0	3	100.0	5	100.0	7	100.0	1	100.0	30	100.0
Medical teachers	7	87.5	6	100.0	3	100.0	5	100.0	7	100.0	1	100.0	29	96.7
Student representatives	4	50.0	4	66.7	2	66.7	4	80.0	7	100.0	0	0.0	21	70.0
Alumni	5	62.5	4	66.7	2	66.7	4	80.0	7	100.0	0	0.0	22	73.3
External stakeholders (i.e., hospital managers, teaching hospital representatives, public health office representatives, and other medical schools)	5	62.5	6	100.0	3	100.0	4	80.0	7	100.0	0	0.0	25	83.3
Administrative staff	5	62.5	4	66.7	1	33.3	4	80.0	5	71.4	0	0.0	19	63.3
Other (please specify)	1	12.5	1	16.7	1	33.3	1	20.0	4	57.1	0	0.0	8	26.7

R: Region, N: Frequency/number of medical schools, %: Percentage

Regarding the decision-making processes used prior to implementing UME curricula, most medical schools performed a literature study or comparative study on other medical schools (93.3%). However, one medical school in Region 1 and one in Region 4 had not yet practised this. Furthermore, several stakeholders were involved in the decision-making processes of medical

education curricula, including university stakeholders (73.3%), medical education units (100.0%), the dean and their staff (100.0%), medical teachers (96.7%), student representatives (70.0%), alumni (73.3%), external stakeholders (83.3%), administration staff (63.3%), and other stakeholders (26.7%), such as government agencies, parents of students, professional associations, and graduate consumers. All the medical schools in every region involved the medical education unit and the dean and staff in this process, while many of them also diversely included other stakeholders, except for one medical school in Region 6, which excluded several parties such as university stakeholders, student representatives, alumni, external stakeholders, and administrative staff.

Teaching, Learning and Assessment

Medical schools use numerous teaching and learning methods (Table 3), with case-based discussions (100.0%), lecture-based classes (100.0%), skills laboratories (100.0%), and laboratory practice (100.0%) as compulsory methods used equally in all regions. Some medical schools (63.3%) used other teaching-learning methods such as project-based learning, team-based learning, simulation-based learning/role play, field studies, panel discussions, and self-directed learning. The majority of medical schools also used interprofessional learning in their curricula (60.0%). However, this study found that several medical schools have not yet established interprofessional learning, particularly in Region 3 (66.7%).

Table 3: The teaching and learning methods and assessment strategies used by medical schools

Variable	R1		R2		R3		R4		R5		R6		TOTAL	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Which of the following methods does your institution use for teaching and learning? (You may choose more than one)														
Case-based discussions	8	100.0	6	100.0	3	100.0	5	100.0	7	100.0	1	100.0	30	100.0
Lecture-based classes	8	100.0	6	100.0	3	100.0	5	100.0	7	100.0	1	100.0	30	100.0
Skills laboratories	8	100.0	6	100.0	3	100.0	5	100.0	7	100.0	1	100.0	30	100.0
Laboratory practice	8	100.0	6	100.0	3	100.0	5	100.0	7	100.0	1	100.0	30	100.0
Other (please specify)	4	50.0	2	33.3	3	100.0	5	100.0	5	71.4	0	0.0	19	63.3
Does your institution use interprofessional learning?														
Yes	4	50.0	3	50.0	1	33.3	5	100.0	4	57.1	1	100.0	18	60.0
No	4	50.0	3	50.0	2	66.7	0	0.0	3	42.9	0	0.0	12	40.0
Which of the following methods does your institution use to measure students' competency? (You may choose more than one)														
Written/computer-based tests	8	100.0	6	100.0	3	100.0	5	100.0	7	100.0	1	100.0	30	100.0
Objective structured clinical examinations (OSCEs)	7	87.5	6	100.0	3	100.0	5	100.0	7	100.0	1	100.0	29	96.7
Student oral case analysis (SOCA)	1	12.5	3	50.0	2	66.7	0	0.0	3	42.9	0	0.0	9	30.0
Laboratory examinations	8	100.0	6	100.0	2	66.7	5	100.0	6	85.7	1	100.0	28	93.3
Other (please specify)	3	37.5	2	33.3	2	66.7	2	40.0	2	28.6	0	0.0	11	36.7

R: Region, N: Frequency/number of medical schools, %: Percentage

To measure students' competency and provide feedback on teaching-learning activities, medical schools use multiple assessment systems, with written/computer-based tests (100.0%), objective structured clinical examinations (OSCEs; 96.7%), and laboratory examinations (93.3%), as the most common assessment tools. Less than half of the schools used student oral case analysis (SOCA; 30.0%). Furthermore, few medical schools (36.7%) used observation reports, assignments, portfolios, progress tests, and work-based assessments. Comparing medical schools across regions indicated that OSCEs are not used by all medical schools in Region 1 (87.5%). Similarly, some medical schools in Region 3 (66.7%) and Region 5 (85.7%) do not use laboratory examinations as an assessment tool. SOCA was commonly used in Region 2 (50.0%), Region 3 (66.7%), and Region 5 (42.9%).

Curriculum Evaluation

Medical schools performed curriculum evaluations related to the course programme within medical curricula to improve the quality of medical training and as part of their curriculum development process (Table 4). Various methods were used for curriculum evaluation, including written testimonials (96.7%), interviews (36.7%), focus group discussions (63.3%), and open discussion (33.3%), which also varied between regions, with more than half of medical schools in each region using written testimonials and focus group discussions, except for Regions 1 and 6. Curriculum evaluations were typically conducted periodically at the end of the implementation period for a learning module (53.3%). Medical schools in all regions mainly performed curriculum evaluation at the end of semesters or every year, except for one medical school in Region 2 (3.3%), where this was performed incidentally. A medical school in Region 5 (3.3%) performed curriculum evaluation whenever a new dean was appointed.

Table 4: The curriculum evaluation strategies used by medical schools

Variable	R1		R2		R3		R4		R5		R6		TOTAL	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Which of the following methods does your institution use for curriculum evaluation? (You may choose more than one)														
Questionnaire/written testimony	7	87.5	6	100.0	3	100.0	5	100.0	7	100.0	1	100.0	29	96.7
Interview/oral testimony	2	25.0	3	50.0	2	66.7	2	40.0	2	28.6	0	0.0	11	36.7
Focus group discussion	3	37.5	5	83.3	3	100.0	4	80.0	4	57.1	0	0.0	19	63.3
Open discussion	2	25.0	2	33.3	2	66.7	2	40.0	2	28.6	0	0.0	10	33.3
Other (please specify)	1	12.5	1	16.7	1	33.3	1	20.0	0	0.0	0	0.0	4	13.3
How many times does your institution perform a curriculum evaluation?														
Every module	3	37.5	3	50.0	1	33.3	4	80.0	5	71.4	0	0.0	16	53.3
Every semester	3	37.5	1	16.7	2	66.7	1	20.0	1	14.3	0	0.0	8	26.7
Every year	2	25.0	1	16.7	0	0.0	0	0.0	0	0.0	1	100.0	4	13.3

Every time a new dean begins	0	0.0	0	0.0	0	0.0	0	0.0	1	14.3	0	0.0	1	3.3
Incidental	0	0.0	1	16.7	0	0.0	0	0.0	0	0.0	0	0.0	1	3.3
Never	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Which of the following stakeholders are involved in curriculum evaluation? (You may choose more than one)														
University stakeholders	2	25.0	0	0.0	1	33.3	0	0.0	2	28.6	0	0.0	5	16.7
Medical education unit	8	100.0	6	100.0	2	66.7	5	100.0	6	85.7	1	100.0	28	93.3
The dean and staff	4	50.0	4	66.7	2	66.7	4	80.0	5	71.4	0	0.0	19	63.3
Medical teachers	7	87.5	5	83.3	3	100.0	5	100.0	6	85.7	0	0.0	26	86.7
Students	5	62.5	5	83.3	2	66.7	4	80.0	6	85.7	0	0.0	22	73.3
Alumni	1	12.5	2	33.3	1	33.3	1	20.0	2	28.6	0	0.0	7	23.3
External stakeholders (i.e., hospital managers, teaching hospital representatives, public health office representatives, and other medical schools)	3	37.5	5	83.3	1	33.3	0	0.0	2	28.6	0	0.0	11	36.7
Administrative staff	2	25.0	1	16.7	1	33.3	4	80.0	5	71.4	0	0.0	13	43.3
Other (please specify)	1	12.5	2	33.3	0	0.0	0	0.0	2	28.6	0	0.0	5	16.7

R: Region, N: Frequency/number of medical schools, %: Percentage

Implementing curriculum evaluation involved certain stakeholders, including predominantly medical education units (93.3%), medical teachers (86.7%), and students (73.3%). Moreover, other parties (16.7%), such as the quality assurance body, were involved in this process at some medical schools. The distribution of stakeholders involved in this process varies by region. For instance, medical schools in Region 3 did not include external stakeholders in curriculum evaluation, while one medical school in Region 6 only involved the medical education unit in this process.

Throughout the evaluation process, various challenges related to implementing the UME curriculum were identified by the medical education unit, centre, or department of each school. As shown in Figure 1, common student complaints concerned mental health problems. Such problems among medical students were more prevalent at some medical schools with tighter and stricter curriculum structures. Other student complaints concerned the medical school's support facilities (i.e., classrooms, laboratory materials, places of worship, etc.), which were considered inadequate to support teaching and learning activities.

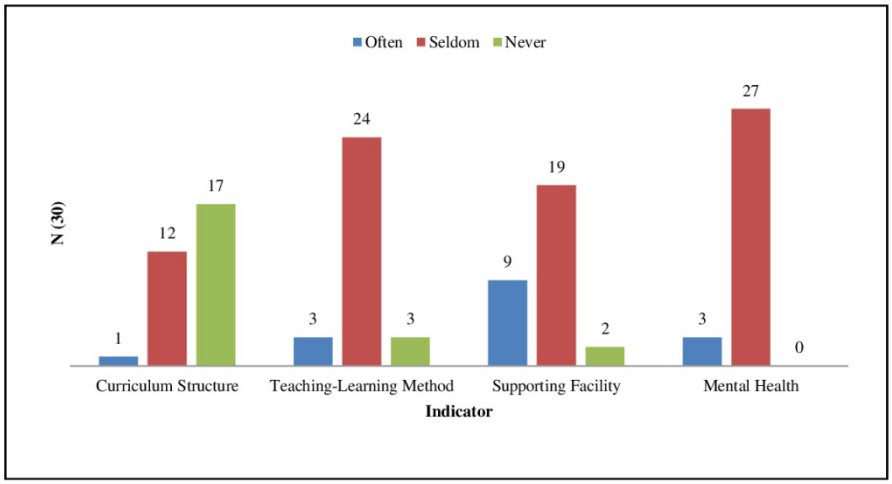

Figure 1: Complaint related to the implementation of UME program

DISCUSSION

The curriculum is a fundamental component of educational programmes and guides in formulating numerous critical activities in medical education, such as student admission processes, teaching and learning, assessment, faculty development, and evaluation of educational programmes (12). Despite numerous discussions on curricula in medicine, studies highlighting the variation in educational curricula remain limited. To the best of our knowledge, this is the first environmental scan of the UME curricula, particularly in Indonesia, a populous country with numerous medical schools having diverse characteristics. This study involved 30 medical schools, which were then classified into six administrative regions of the IAMEI since each IAMEI region often performed capacity development activities for medical schools, including those related to the curriculum development process; thus, each region may have specific contextual dimensions of educational approaches in medicine. Conversely, grouping the study results based on the accreditation level and ownership status was avoided to anticipate any negative perceptions about the educational quality due to the accreditation level or ownership status of medical schools. To some extent, we argue that connecting the accreditation level to the quality of the educational curriculum appears inappropriate, particularly for new medical schools with no graduates and limited resources, as these are included as an accreditation indicator for medical schools in Indonesia; thus, this may significantly affect their accreditation status. Using the curriculum framework of the WFME (12), we investigated the variety of UME curricula at the pre-clinical stage, particularly regarding the curriculum concept, teaching and learning activities, assessment system, and curriculum evaluation mechanism.

The UME curriculum of Indonesian medical schools is developed according to several regulations from the government and several related parties, including the IMDCS of 2012, the Medical Education Law No. 20 of 2013, and the National Standards for Higher Education (18–20). Seven areas of competency must be mastered: noble professionalism, self-awareness and self-development, effective communication, information management, scientific foundations of medical science, clinical skills, and management of health problems (20). However, debate occurs regarding the best-practice curricular approaches of education in medicine to address global and health transformation, as these depend on multiple aspects influencing curriculum development and implementation, including academic objectives, demographic characteristics, stakeholder support, available resources, and leadership (21,22). Such factors may explain why medical schools in Indonesia are granted the autonomy to define their educational curricula, contributing to the variety observed in the

implementation of UME programmes. This study found that medical schools have established diverse educational approaches at the pre-clinical stage of the UME programme, although most used a similar curricular concept for reference, OBME. The application of OBME as an educational curriculum is consistent with the international recommendation of the WFME and national instruction from the Indonesian Ministry of Education stated in the National Standards for Higher Education that educational curriculum for higher education, including UME programmes, should be developed according to the principles of outcome-based education (12,19). As the educational approaches of medical schools vary, they may experience diverse outcomes despite implementing the same curricular concept. This possibility is mentioned by Er et al. (23), who state that the benefits of outcome-based education strongly depend on the implementation approaches used. Therefore, concerns regarding the quality of medical graduates due to variations in UME curricula are valid. Accordingly, medical schools are expected to optimise efforts in medical education to ensure that MD graduates can meet the demands associated with the current healthcare and global health transformation.

Regarding the decision-making process associated with UME curricula, this study found that medical schools engage students, teachers, external stakeholders, and other stakeholders in medical education. This engagement is essential. Mejicano et al. (21) argue that medical schools should understand the ideal balance of compromising with stakeholders in the policymaking process to ensure that stakeholders' input and perspectives are valued, improving the outcome of this process. Furthermore, engagement-based decision-making may provide practical ideas and solutions for curricular transformation, making the curriculum more evidence-based (24). Accordingly, we strongly urge that medical schools in wider contexts adopt this framework. This study also found that most medical schools initially performed a comparative study with the other schools or conducted literature studies before implementing the curricula. We assumed that this strategy was used to understand previous learning regarding the curricular approaches; thus, it may amplify the outcome of the curriculum. Therefore, we argue that this approach could be used in a wider setting to employ every resource and opportunity in medical education to achieve the most relevant and productive UME curricula according to the context of medical schools (25).

Consistent with the implementation of UME curricula, medical schools in the present study established teaching and learning methods using the andragogical approach and student-centred learning (i.e., case-based discussions, laboratory practice, skills practice, and self-directed learning). However, pedagogical approaches, such as lecture-based classes, were also reported as these emphasise students' understanding by directly transferring knowledge from the expert (26). Collaborative learning, known as IPE, was also established in many Indonesian medical schools. This teaching-learning strategy aims to foster the collaborative competency of students and improve the provision of quality care and patient safety (27–30). The World Health Organization states that effective collaboration among health workers will only be achieved by implementing IPE within medical and health professional institutions (31). Unfortunately, IPE has not been implemented in many schools. The primary reason for this is thought to be the limited availability of health professional programmes within each institution, as well as the requirement for a meticulous development process, adequate resources, and rigorous planning to establish this teaching-learning strategy (27,29).

Teaching and learning in UME transcend transferring medical knowledge and skills. They are expected to be a platform to cultivate the soft skills associated with the profession, such as altruism, communication, critical thinking, problem-solving, and negotiation (32). Consequently, teaching and learning activities are not limited to the classroom or hospital setting but can also occur in the community (32). These may be the underlying factors where medical schools reported using other teaching and learning methods such as project-based learning, field study, and simulation-based learning. Despite the variation in teaching and learning activities, we argue that medical schools are

expected to constructively align learning goals with teaching-learning activities, use relevant assessment methods, strengthen the fundamental theory and practice of students, and optimise the faculty's role in monitoring the teaching-learning process (12). Such recommendations aim to optimise the teaching-learning process, enlarge learning outcomes, and embody a productive UME curriculum.

The present study has demonstrated medical schools' strategy to measure students' competency through the application of several assessment methods, both formative (i.e., written/computer-based tests, objective structured clinical examinations, and laboratory examinations) and summative (i.e., observation reports, assignments, portfolios, progress tests, and work-based assessments), which is known as a multi-method assessment system (33). Such a strategy is required to appear simultaneously in educational processes as assessments should be viewed as a strategy to not only assess the learning outcomes but also support the teaching and learning process, including assisting students in their mastery of some courses (34,35). Feedback in numerous teaching and learning activities is the most common application of formative assessment in Indonesian medical schools. As an illustration, a session is allocated for supervisors to provide feedback to students during clinical skill practices and case discussions. Couto et al. (36) mentioned that formative assessment significantly correlated with the results of summative assessments, such as OSCEs and progress test scores. Syukri et al. (37) also proposed the same result for the Indonesian setting, where formative assessment might contribute to students' achievement in summative assessment. Accordingly, we argue that feedback in medical education is critical, as argued by Lee et al. (38), and that effective assessment should include continuous and constructive feedback to assist students in identifying their strengths and areas for improvement. Therefore, the application of formative assessment, including feedback in medical curricula, is expected to be frequent, timely, non-threatening, specific, and supportive of self-assessment to improve the productivity of teaching and learning activities and their outcomes (38).

Moreover, assessment is often considered during curriculum development and is used to identify an area for future improvement regarding the teaching and learning process (39). Therefore, we argue that comprehensive and constructive assessment is required to optimise the implementation of UME curricula and improve the quality of medical graduates (39). In medical education, it is known that assessment should be conducted using multiple methods. The application of assessment tools that potentially quantify student performance is strongly recommended by the OBME framework (40). Previous study has identified the application of outcome-based student assessment, such as multiple choice questions (MCQs), direct observation of procedural skills (DOPS), and mini-experimental evaluation exercises (40). In 1990, George Miller introduced a student assessment system for clinical competence called the Miller pyramid, starting from the lowest level to measure knowledge (MCQs). The second level is the application of knowledge (essays, clinical problem exercises, and extended MCQs); the next level measures clinical competence through standardised patients, simulations, and clinical examinations; and the top level measures clinical performance in real settings (41). OSCEs or DOPS are an example of widely used student assessments that measure students' performance and competency. Thus, it is necessary to design an evaluation mechanism that ensures the measurability of students' clinical or diagnostic reasoning (41).

Medical schools evaluate the educational processes within the curriculum development process to establish the most relevant and productive UME programme (42). This study revealed that medical schools perform periodic curriculum evaluations using multiple well-established methods, where the findings of this evaluation will greatly aid the updating of the study plans. Prior study has highlighted that the evaluation method is essential to the evaluation process, and medical schools must ensure that they use proper methods to optimise the evaluation performance and outcome (43). Additionally, this study found that medical schools engage several stakeholders during curriculum evaluation as mandated by the regulation of the Indonesian Medical Council. However, not all schools involved

students in this process. Bilodeau et al. (44) reported that medical students might be excluded from policy projects, such as curriculum development, due to concerns that they may be unable to maintain the confidentiality of sensitive materials, have hidden motivations, or lack appropriate knowledge. Such circumstances are regrettable since medical students experience curricula directly (24); therefore, they may be able to provide evidence and suggestions for making curricula more realistic and student-centred (45,46).

This study has identified the variations in educational curricula regarding the pre-clinical stage in UME programmes and emphasised the need for comprehensive efforts to actualise the best practice of educational activities and maintain the productivity of UME curricula since curricular variations often impact the quality of medical education programmes and profiles of medical graduates. According to our country's experiences, such efforts were embodied through a massive periodic quality assurance activity, which included implementing at least a MLE and accreditation process. Rahayu et al. (13) reported that the MLE in Indonesia provides reassurance regarding medical graduates' competency and enables medical schools to monitor the ability of their educational programme to generate qualified medical graduates. This promotes the improvement of UME programmes, including their curricula (13). In addition to the MLE, the quality of UME programmes in Indonesia is monitored through the accreditation process (17). This process allows medical schools to identify their weaknesses and propose potential solutions to improve the quality of their medical training (17). Indeed, accreditation has often stimulated medical schools to adapt their curricula to meet the current healthcare requirements and quality indicators set by the assurance body to achieve the highest accreditation level (17). We finally argue that the above experiences could offer lessons for medical schools in the global context, as well as convey recognition that variety in medical education curricula is inevitability and unavoidable, despite various efforts to standardise them through multiple regulations and recommendations at national and international levels. Therefore, optimising various potentials, resources, and opportunities in medical education is critical to ensuring that the educational programmes are aligned with the dynamic transformation of medicine, resulting in medical graduates who are competent and able to provide adequate health services to society in a healthcare context.

Limitations

This study had several limitations, one of which was related to the study respondents' inability to satisfy the sample size requirements. The majority of medical schools did not respond to the authors' invitation to participate in this study, and we could not compel them to participate due to the ethical values of this study. As this study was performed during the COVID-19 pandemic, we argue that such situations occurred because the pandemic affected numerous organisational routines and forced medical schools to adapt their educational activities towards the new norm in many aspects, trapping them in the overwhelming circumstances and requiring them to primarily prioritise such adaptations over participating in this study. However, we also argue that the number of respondents was sufficient to demonstrate the breadth of UME curriculum variation in Indonesia as each administrative region of medical schools was represented in this study. Accordingly, we realise that this study may not represent every region well, particularly for Region 6, which only included one medical school; thus, we may be unable to generalise to all the medical schools in this region. Furthermore, this study cannot represent not-accredited medical schools as none participated in this study, although we invited them. Although this study provided comprehensive information about curricular concepts, teaching and learning activities, assessment systems, and evaluation strategies of the pre-clinical stage of UME programmes, other aspects of educational curricula, such as student admission and faculty development, are understudied. Therefore, future studies are expected to concern these aspects. Another limitation is that this study did not explore the underlying factors influencing medical schools' strategies for performing medical training (qualitative data). Thus, further research is expected to provide more comprehensive information on the complex circumstances medical schools experience in providing medical training.

CONCLUSION

EDM is not only a form of entertainment but also a tool with the potential to improve medical students' academic abilities and performance. This is an entirely untapped field. The current study adds to the small but growing literature that demonstrates how well EDM listening can be transferred to the routine practices of medical students in order to boost their learning outcomes. This research offers insights into EDM listening and medical students' study and revision by using a plan that combines realistic audio-cognitive stimuli and positive cognitive feedback, which is crucial for the scholarly development of these students. It also presents an accessible and efficient method for academic enhancement based on EDM listening. In future studies, we want to compare the efficacy of EDM listening among medical students and learners of other health-related sciences.

ACKNOWLEDGEMENTS

This study was presented at the 13th Jakarta Meeting on Medical Education (JAKMED) on October 23 and 24, 2021 and was financially supported by CIMSA and An International Association for Medical Education (AMEE) through Students Initiatives Grant 2020. The authors express our gratitude to Prof. dr. Diantha Soemantri, M.Med.Ed., PhD. for assisting the recruitment of study respondent and providing input during the manuscript writing process. The authors would like to acknowledge dr. Amandha Boy Timor Randita, M.Med.Ed., Prof. dr. Ardi Findyartini, PhD., dr. Astrid Pratidina Susilo, Sp.An., MPH., PhD., dr. Fundhy Sinar Ikrar Prihatanto, M.Med.Ed., dr. Iswandy Janetputra Turu' Allo, M.Med.Sci., and dr. Rhendy Wijayanto, M.Med.Ed. who have provided feedback and advice during the development of research questionnaire. We are grateful to the Local Officer on Medical Education (LOME) of CIMSA for the effort in recruiting the study respondents. We also acknowledge Dr. Rina Suryani Oktari, S.Kep., M.Si. for providing input during the manuscript writing process.

REFERENCES

1. Reis T, Faria I, Serra H, Xavier M. Barriers and facilitators to implementing a continuing medical education intervention in a primary health care setting. BMC Health Serv Res. 2022;22(1):638. https://doi.org/10.1186/s12913-022-08019-w
2. Vinas EK, Schroedl CJ, Rayburn WF. Advancing academic continuing medical education/continuing professional development: adapting a classical framework to address contemporary challenges. J Contin Educ Health Prof. 2020;40(2):120–4. https://doi.org/10.1097/ceh.0000000000000286
3. Gonzalo JD, Wolpaw T, Wolpaw D. Curricular transformation in health systems science: the need for global change. Acad Med. 2018;93(10):1431–3. https://doi.org/10.1097/acm.0000000000002284
4. Otaki F, Naidoo N, Al Heialy S, John-Baptiste AM, Davis D, Senok A. Shaping the future-ready doctor: a first-aid kit to address a gap in medical education. Int J Med Educ. 2020;11:248–9. https://doi.org/10.5116/ijme.5fad.2d3a
5. Jung M. Digital health care and the fourth industrial revolution. Health Care Manag (Frederick). 2019;38(3):253–7. https://doi.org/10.1097/HCM.0000000000000273
6. Patel M. Changes to postgraduate medical education in the 21st century. Clin Med J R Coll Physicians London. 2016;16(4):311–4. https://doi.org/10.7861/clinmedicine.16-4-311
7. E Melo JAG de M e. C, Araújo NMF. Impact of the fourth industrial revolution on the health

sector: a qualitative study. Healthc Inform Res. 2020;26(4):328–34. https://doi.org/10.4258/hir.2020.26.4.328
8. Findyartini A, Sudarsono NC. Remediating lapses in professionalism among undergraduate pre-clinical medical students in an Asian Institution: a multimodal approach. BMC Med Educ. 2018;18. https://doi.org/10.1186/s12909-018-1206-2
9. Diño MJS, Ong IL. Research, technology, education & scholarship in the fourth industrial revolution [4IR]: influences in nursing and the health sciences. J Med Investig. 2019;66(1.2):3–7. https://doi.org/10.2152/jmi.66.3
10. Pope L, Dubras L. Delivering medical education for future healthcare needs: a community-focused challenge. Educ Prim Care. 2020;31(5):266–9.
11. Khay-Guan Y. The future of medical education. Singapore Med J. 2019;60(1):3–8. https://doi.org/10.11622/smedj.2019003
12. World Federation for Medical Education. Basic medical education WFME global standards for quality improvement the 2020 revision. WFME; 2020. 9–18 p.
13. Rahayu GR, Findyartini A, Riskiyana R, Thadeus MS, Meidianawaty V, Sari SM, et al. Stakeholders' views and confidence towards indonesian medical doctor national competency examination: a qualitative study. J Multidiscip Healthc. 2021;14:3411–3420. https://doi.org/10.2147/jmdh.s336965
14. Buja LM. Medical education today: all that glitters is not gold. BMC Med Educ. 2019 Apr 16;19(1). https://doi.org/10.1186/s12909-019-1535-9
15. O'Sullivan BG, McGrail MR, Russell D, Chambers H, Major L. A review of characteristics and outcomes of Australia's undergraduate medical education rural immersion programs. Hum Resour Heal 16. 8(2018). https://doi.org/10.1186/s12960-018-0271-2
16. Changiz T, Yamani N, Tofighi S, Zoubin F, Eghbali B. Curriculum management/monitoring in undergraduate medical education: a systematized review. BMC Med Educ. 2019 Feb 19;60(2019). https://doi.org/10.1186/s12909-019-1495-0
17. Mustika R, Nishigori H, Ronokusumo S, Scherpbier A. The odyssey of medical education in indonesia. Asia Pacific Sch. 2019;4(1):4–8. http://doi.org/10.29060/TAPS.2019-4-1/GP1077
18. Indonesian Government. Undang-undang pendidikan kedokteran no. 20 (The medical education law no. 20). 2013 p. 19.
19. Junaidi A. Panduan penyusunan kurikulum pendidikan tinggi di era industri 4.0 untuk mendukung merdeka belajar-kampus merdeka (Guidelines for preparing higher education curricula in the industrial era 4.0 to support independent learning - independent campuses). Jakarta: Indonesian Ministry of Education and Culture; 2020. 11 p.
20. Indonesian Medical Council. Standar kompetensi dokter indonesia (The Indonesia medical doctor competency standard). 2012 p. 1.
21. Mejicano GC, Bumsted TN. Describing the journey and lessons learned implementing a competency-based, time-variable undergraduate medical education curriculum. Acad Med. 2018;93(3):S42–8. https://doi.org/10.1097/acm.0000000000002068
22. Rosenberg ME. An Outcomes-based approach across the medical education continuum. Trans Am Clin Climatol Assoc. 2018;129:325–40.
23. Er HM, Nadarajah VD, Chen YS, Misra S, Perera J, Ravindranath S, et al. Twelve tips for institutional approach to outcome-based education in health professions programmes. Med Teach. 2021;43(sup1):S12–7. https://doi.org/10.1080/0142159x.2019.1659942
24. Gheihman G, Callahan DGDG, Onyango J, Gooding HCHC, Hirsh DADA. Coproducing clinical curricula in undergraduate medical education: student and faculty experiences in longitudinal integrated clerkships. Med Teach. 2021 Nov;43(11):1267–77. https://doi.org/10.1080/0142159x.2021.1935825
25. Galvis ÁH. Supporting decision-making processes on blended learning in higher education: literature and good practices review. Int J Educ Technol High Educ. 2018;25(2018). https://doi.org/10.1186/s41239-018-0106-1
26. Bansal A, Jain S, Sharma L, Sharma N, Jain C, Madaan M. Students' perception regarding

pedagogy, andragogy, and heutagogy as teaching-learning methods in undergraduate medical education. J Educ Health Promot. 2020;9(301). https://doi.org/10.4103/jehp.jehp_221_20
27. Guraya SY, Barr H. The effectiveness of interprofessional education in healthcare: A systematic review and meta-analysis. Kaohsiung J Med Sci. 2018;34(3):160–5. https://doi.org/10.1016/j.kjms.2017.12.009
28. van Diggele C, Roberts C, Burgess A, Mellis C. Interprofessional education: tips for design and implementation. BMC Med Educ. 2020;20(Suppl 2):455. https://doi.org/10.1186/s12909-020-02286-z
29. Ahmady S, Mirmoghtadaie Z, Rasouli D. Challenges to the implementation of interprofessional education in health profession education in Iran. Adv Med Educ Pract. 2020;11:227–36. https://doi.org/10.2147/AMEP.S236645
30. Homeyer S, Hoffmann W, Hingst P, Oppermann RF, Dreier-Wolfgramm A. Effects of interprofessional education for medical and nursing students: enablers, barriers and expectations for optimizing future interprofessional collaboration - a qualitative study. BMC Nurs. 2018;17(13). https://doi.org/10.1186/s12912-018-0279-x
31. World Health Organization. Framework for action on interprofessional education & collaborative practice. Hopkins D, editor. Geneva, Switzerland: Health Professions Network Nursing and Midwifery Office within the Department of Human Resources for Health; 2010. 26 p. http://www.who.int/hrh/nursing_midwifery/en/
32. Claramita M, Setiawati EP, Kristina TN, Emilia O, van der Vleuten C. Community-based educational design for undergraduate medical education: a grounded theory study. BMC Med Educ. 2019 Jul 11;19(1):258. https://doi.org/10.1186/s12909-019-1643-6
33. Ulrich LD, Weißenfels M, Russer L, Perels F. Multimethod assessment of self-regulated learning in college students: diferent methods for diferent components? Instr Sci. 2021;(49):137–163. https://doi.org/10.1007/s11251-020-09533-2
34. Lim YS. Students' perception of formative assessment as an instructional tool in medical education. Med Sci Educ. 2019;29:255–63. https://doi.org/10.1007/s40670-018-00687-w
35. Danilovich N, Kitto S, Price DW, Campbell C, Hodgson A, Hendry P. Implementing competency-based medical education in family medicine: A narrative review of current trends in assessment. Fam Med. 2021;53(1):9–22. https://doi.org/10.22454/FamMed.2021.453158
36. Couto LB, Durand MT, Wolff ACD, Restini CBA, Faria M Jr, Romão GS, et al. Formative assessment scores in tutorial sessions correlates with OSCE and progress testing scores in a PBL medical curriculum. Med Educ Online. 2019;24(1):1560862. https://doi.org/10.1080/10872981.2018.1560862
37. Syukri NRM, Pratiwi YS, Ariyanto EF, Bashari MH, Achadiyani A, Ghozali M, et al. Correlation between weekly formative and summative assessment of medical students in multidisciplinary examination and oral examination reproductive system block. Indones J Med Educ. 2021;10(3):298–305.
38. Lee GB, Chiu AM. Assessment and feedback methods in competency-based medical education. Ann Allergy, Asthma Immunol. 2022;128(3):256–62. https://doi.org/10.1016/j.anai.2021.12.010
39. Lockyer J, Carraccio C, Chan MK, Hart D, Smee S, Touchie C, et al. Core principles of assessment in competency-based medical education. Med Teach. 2017;37(6):609–16. https://doi.org/10.1080/0142159X.2017.1315082
40. Li KF, Liu BZ, Wu FF, Sun XC, Tian F, Wu YS, et al. Outcome-based student assessment enhances academic performance in basic medical laboratory course. Adv Physiol Educ. 2021;45(2):269–75. https://doi.org/10.1152/advan.00157.2020
41. Witheridge A, Ferns G, Scott-Smith W. Revisiting Miller's pyramid in medical education: the gap between traditional assessment and diagnostic reasoning. Int J Med Educ. 2019;10:191–2. https://doi.org/10.5116/ijme.5d9b.0c37
42. Deis N, Koch C, Dreimüller N, Gaitzsch E, Weißkircher J, Jünger J, et al. Development, implementation, and evaluation of a curriculum for medical students on conflicts of interest

and communicating risk. GMS J Med Educ. 2020;37(1):Doc3. https://doi.org/10.3205/zma001296
43. Toosi M, Modarres M, Amini M, Geranmayeh M. Context, input, process, and product evaluation model in medical education: a systematic review. J Educ Health Promot. 2021;10(1):199. https://doi.org/10.4103/jehp.jehp_1115_20
44. Bilodeau PA, Liu XMXM, Cummings BAB-A. Partnered educational governance: rethinking student agency in undergraduate medical education. Acad Med. 2019;94(10):1443–7. https://doi.org/10.1097/ACM.0000000000002777
45. Peters H, Zdravkovic M, João Costa M, Celenza A, Ghias K, Klamen D, et al. Twelve tips for enhancing student engagement. Med Teach. 2018; https://doi.org/10.1080/0142159X.2018.1459530
46. Burk-Rafel J, Harris KB, Heath J, Milliron A, Savage DJ, Skochelak SE. Students as catalysts for curricular innovation: A change management framework. Med Teach. 2020 May;42(5):572–7. https://doi.org/10.1080/0142159x.2020.1718070