

Implementation of Problem-Based Learning in Undergraduate Medical Education in Ethiopia: An Exploratory Qualitative Study

Ali Beyene Mohammed¹, Robel Tezera Zegeye¹, Hikma Ali Dawed², Yenuse Molla Tessema¹

¹Department of Medical Radiology Technology, Addis Ababa University, Addis Ababa, Ethiopia; ²Department of Medical Radiology Technology, Arba Minch University, Arba Minch, Ethiopia

Correspondence: Ali Beyene Mohammed, Department of Medical Radiology Technology, Addis Ababa University, Addis Ababa, Ethiopia, Tel +251917431679, Email alibeyene01@gmail.com

Background: The poor quality of health professional education in Ethiopia, which was rooted in a traditional curriculum, has posed significant challenges for graduates in effectively addressing real-life health problems. In response, there has been curricular reform by adopting problem-based learning across Ethiopian medical schools. Given the dearth of literature on the topic and the significance of context in the effective implementation of problem-based learning, it is imperative to provide local institutional evidence to pinpoint critical intervention areas and support the effective implementation of problem-based learning.

Methods: A qualitative design based on in-depth, individual, semi-structured interviews was used to explore medical educators, program coordinators, and educational leader's experiences and perspectives on the problem-based learning implementation in health sciences education. A total of 24 participants recruited from five undergraduate health science programs participated in the study. All sessions were audio recorded and transcribed verbatim. Results were analyzed following a qualitative thematic analysis method.

Results: Analysis of the transcripts revealed three main themes, along with their corresponding subthemes. Within the first main theme, participants discussed the importance of integrating Problem-Based Learning into undergraduate medical programs and the educational benefits it brings to medical education. The second main theme explored issues related to challenges in implementing problem-based learning which include inadequate staff training, deficiencies in curricular design and governance, constraints in educational resources, and a lack of preparedness in the educational environment. The third theme deals with the strategic recommendations to address the challenges that contributed to the poor implementation of problem-based learning in undergraduate medical schools.

Conclusion: Our study has addressed several issues related to the implementation of Problem-Based Learning in Ethiopian Health Sciences Colleges. The study's findings have the potential to provide educational stakeholders and policymakers with essential information to strategize successful problem-based learning implementation in undergraduate medical schools.

Keywords: implementation, problem-based learning, undergraduate, medical education Ethiopia

Background

In the contemporary era of medical education, there is a paradigm shift in instructional strategy from teacher-centered to one that is student-centered. Problem-based learning is one such approach that has been widely adopted in health science education, where students work together in small groups to solve clinical scenarios while learning is guided by a tutor and the curriculum allows for plenty of time for independent study.¹ It is a method of delivering medical education in a self-directed, integrated, contextual, and student-centered active learning environment.² In 1969, McMaster University's medical school introduced problem-based learning (PBL) for the first time, setting a new standard for learning in the field of medicine.³ PBL is now widely used across the globe and has expanded beyond its original use in health sciences disciplines to many other fields.⁴ However, the PBL curriculum and its methodology have been interpreted and conceptualized differently by medical schools and across various disciplines. Accordingly, its variation

might range from one that employs PBL as the primary learning platform to one that is merely cosmetic and uses a few PBL problems or scenarios each academic year.⁵ Importantly, however, there is a growing recognition that PBL may work best when combined with other teaching and learning strategies such as didactic teacher-centered learning or team-based learning, a hybrid form.⁶ The peculiar implementation opportunities and restrictions that exist in various universities are one reason why diverse PBL variations have emerged.⁷ Moreover, it might be due to the contextual nature of PBL when utilized as a learning strategy in different fields. Despite different views on the effectiveness of the PBL, it has been widely used as a curriculum-wide or single-course teaching approach in many medical schools in non-Western nations.⁸ In African countries, there is a growing tendency towards the adoption of PBL in medical education. However, a limited number of Sub-Saharan universities have implemented PBL and conducted research on its efficacy in undergraduate medical education.

Ethiopia is one of the countries in Sub-Saharan Africa with a low physician to population ratio. The poor quality of health professional education in the country which is based on a traditional teacher-centered curriculum led to serious challenges for graduates to deal effectively with real-life health problems.^{9,10} The Traditional teaching approach used a didactic model to deliver instruction both in the classroom and clinical settings and more reliance on content coverage and objective testing. There are well-documented weaknesses in the traditional content-based teaching approach in developing key health professionals' skills like problem-solving, clinical decision making, communications, clinical reasoning, and self-directed learning.^{11,12} To this end, the country introduced and adopted a new curricular approach through shifting the long-held and conventional teacher-centered curricula to student-centered approach using PBL.¹⁰

The concept of PBL was introduced in medical education in Ethiopia in the 2011 New Innovative Medical Curriculum curriculum.¹⁰ Recently, as part of the current curriculum reform, PBL has been incorporated in the competency-based curriculum (CBC) in undergraduate health science programs across Ethiopian medical institutions, indicating a trend towards more broad adoption in Ethiopia.¹³

The introduction of PBL as a teaching strategy for undergraduate medical education at Addis Ababa University's College of Health Science (AAU CHS) commenced in 2019, marking a relatively recent development in its educational practices. Typically, PBL is recognized as one of a teaching strategy within the undergraduate CBC to promote the integration of basic medical science and clinical courses. Its purpose is to provide medical students with early exposure to clinical practice, enabling them to adapt and navigate complex real-life patient scenarios. While there is a growing trend in embracing PBL in the medical curriculum at AAU CHS, there are currently variations in its implementation across disciplines and medical schools.

Also, there exist scant evidence regarding the readiness and implementation of PBL in undergraduate health science programs in Ethiopia in general and in Addis Ababa University in particular. Moreover, given the significance of context in the effective implementation of the PBL, it is imperative to provide local institutional evidence in order to identify critical intervention areas and support the effective implementation of the PBL. Therefore, the purpose of the study is to explore medical educators and educational leaders' experiences and perspectives regarding the implementation of PBL in undergraduate health science programs in AAU.

Methods and Materials

Study Setting

Addis Ababa University, founded in 1950 as the University College of Addis Ababa, stands as the first of its kind and the most expansive institution for higher education and research in Ethiopia. Throughout its existence, the University has consistently held the position of being the foremost hub for teaching, learning, research, and community engagement. The College of Health Sciences (CHS), Addis Ababa University (AAU), is an esteemed institution dedicated to the field of health sciences. It is composed of four schools that encompass the disciplines of medicine, pharmacy, public health, and allied health sciences, and one teaching hospital. The College currently offers eight undergraduate and over 70 postgraduate programs. Tikur Anbessa Specialized Hospital serves as the teaching hospital of the College and is the largest specialized hospital in Ethiopia, boasting over 700 beds. Moreover, the hospital serves as a vital training center for a wide range of medical professionals, including undergraduate and postgraduate medical students, dentists, nurses, midwives, pharmacists, medical laboratory technologists, radiology technologists, and others.

Study Period

The study period spanned from December 15, 2022, to May 23, 2023, allowing for a comprehensive assessment of the implementation of PBL in the Addis Ababa University health science college.

Study Design

This research adopted a qualitative approach to address its research questions, recognizing the significant role of participants as key sources of information. An exploratory qualitative study design based on individual interviews was used aiming to delve deeply into the experiences and perspective of medical educators, program coordinators, and educational leader's regarding the PBL implementation in health sciences education.

Study Population

In this comprehensive study, a total of 24 participants (16 males and 8 female), including school deans, department heads, module coordinators, and educators, were actively involved. These participants were selected from five departments, all of which offered undergraduate health science programs ([Supplementary 1](#)).

The study participants consisted of one program coordinator and two faculty members from each department who possessed experience in implementing the PBL within the designated study area. These individuals were selected based on their expertise and direct involvement in the PBL implementation process, ensuring that their insights and perspectives would be valuable in shedding light on the nuances and intricacies associated with PBL implementation in the academic setting. Two volunteer educators who possessed training of trainee (TOT) were interviewed to substantiate the data. In addition, the educational leaders were deliberately chosen as potential participants due to their significant roles as stakeholders in educational governance and administrative decision-making. Key informant interviews were conducted with two school deans and five department heads.

Data Collection Tool and Procedure

The data were gathered through in-depth, individual, face-to-face semi-structured interviews using an audio-recorder. Open-ended and probing questions, guided by the purpose of the study, were used to gain in-depth insight into the perspective and views of medical educators regarding the implementation of PBL in undergraduate health science education ([Supplementary 2](#)). To ensure the validity of the interview guide, it underwent a critical review and refinement process by two experts in the field before the actual data collection phase. YM is a medical educator and currently a PhD student with the relevant skill in conducting qualitative research. While RT is an experienced researcher in the field of medical education, who have completed his PhD recently.

The participants were given the autonomy to determine the date, time, and venue for their interviews, which lasted approximately 18–30 minutes each. The consent process and purpose of the study were explained, and the educators willingly participated in the study. After obtaining informed consent from the participants, a team of four skilled data collectors conducted the interviews using the prepared interview guide. To ensure accuracy and completeness, a voice recorder was used to record the interview process.

Additionally, detailed field notes were taken throughout the data collection process, providing valuable context, and facilitating improvements in subsequent interviews. These field notes served as a reflective tool to enhance the overall data collection process, ensuring that essential insights were comprehensively captured. To ensure data saturation and achieve a comprehensive understanding, the number of interviews conducted was determined based on reaching a point where new information and insights no longer emerged, guaranteeing a thorough exploration of the subject matter.

Data Analysis Technique

The data obtained from the participants was subjected to a thorough transcription process, wherein the exact Amharic interviews were translated into an English transcript. To ensure the reliability and trustworthiness of the data, the transcription and translation procedures were conducted independently by both the principal researcher, AB and an external expert, HA, who holds a master's degree in public health. Any inconsistencies that arose between the two transcriptions were resolved through rigorous discussions.

Throughout the transcription and translation process, the data was thoroughly anonymized to protect the participants' confidentiality and privacy. The data gathered from the in-depth interviews, a systematic approach was employed for analysis, following Jack Caulfield's six-step thematic analysis method.¹⁴

Step 1 (Familiarization): The audio recordings were repeatedly listened to, and the transcripts were thoroughly reviewed to gain a comprehensive understanding of the data.

Step 2 (Coding): Coding was carried out by meticulously describing shorthand levels from the relevant sections of the text, closely aligned with the study's objectives. This enabled the researchers to create concise and meaningful summaries of recurring themes and patterns evident in the data, while eliminating irrelevant or ambiguous coding.

Step 3 (Generating themes): Once patterns and connections were identified in the codes, themes were thoughtfully generated, capturing the essence and key findings of the data.

Step 4 (Reviewing themes): The representativeness and accuracy of the emerged themes were rigorously evaluated by cross-referencing them with the entire data set, ensuring their alignment with participants' perspectives.

Step 5 (Defining and naming themes): Clear and straightforward names were assigned to the themes, ensuring their intelligibility and coherence.

Step 6 (Writing up): The final write-up was meticulously crafted, incorporating the outcomes of each previous step to present a robust and meaningful analysis of the data.

Atlas.ti 23 software was employed to facilitate the analysis of the data.

Reflexivity

Four investigators participated in the study. The three co-authors (AB, RT, and YM) are medical educators who are currently pursuing their PhD education and possess extensive expertise in qualitative research. RT has a strong background in monitoring, evaluation, and research, while AB and YM are recognized for their involvement in curricular design and development programs in collaboration with national educational organizations such as the Ethiopian Federal Ministry of Education. The fourth co-author (HA) is a medical educator who holds a master's degree. Specifically, she contributed to the study as an external expert, assisting with the transcription and translation procedures to ensure the reliability and trustworthiness of the data.

Ethical Considerations

Prior to commencing the study, ethical clearance was obtained from the Institutional Review Board (IRB) of Addis Ababa University, College of Health Science, ensuring that all ethical considerations were meticulously addressed. Both verbal and written consent were obtained from each participant, signifying their voluntary willingness to partake in the study.

To uphold the participants' confidentiality and protect their privacy, the data collection procedures were designed to maintain anonymity. The researchers ensured that no personal identifiers were included in the data collection process or the subsequent analysis, providing a shield of confidentiality for each participant. Prior to data collection, every participant in the study provided their informed consent by signing a document. This document included statements regarding the publication of anonymized responses.

Results

The gathered data was subjected to a rigorous thematic analysis, yielding an extensive dataset comprising 120 distinct codes and 12 categories. These categories represented a diverse range of insights and perspectives on the PBL implementation process. Guided by the research objectives, the emerging data led to the identification of three major overarching themes and 9 refined and condensed sub-themes ([Supplementary 3](#)).

In the first major theme participants engaged in a discussion regarding the imperative that underlies the integration of PBL into undergraduate medical programs, and the learning benefits that it brings to medical education.

Conversely, the second major theme delved into issues related to the implementation of PBL in AAU CHS undergraduate programs which encompass challenges pertaining to lack of adequate staff training, educational resource constraints and insufficient educational environment preparedness. Another recurring theme that emerged during the interview study was strategic recommendations to mitigate the challenges that contributed to poor implementation of

PBL in AAU CHS. These strategies were carefully examined and categorized into sub-themes, representing actionable approaches and recommendations for enhancing the curriculum's successful implementation.

Theme I: PBL Opportunities

Under this theme, the participants engaged in a discussion regarding the imperative that underlies the integration of PBL into undergraduate medical programs, and the learning benefits that it brings to medical education. According to the participants' perspective, PBL has been incorporated into the current undergraduate medical education program as a constituent of the new CBC. PBL has been identified as one of the primary teaching and learning methodologies in the implementation of the CBC. Its main objective was to improve the competency of medical students by facilitating their acquisition of the basic sciences of medicine and promote the development of the reasoning processes utilized by physicians and other healthcare professionals in their clinical practice, thereby facilitating the holistic growth of students. Regarding the integration of PBL curriculum one participant witnessed:

The PBL was incorporated into the current undergraduate Anaesthesia program in the new curriculum with the purpose of improving the students' learning outcome (improving their knowledge, skills and attitude). P2

Furthermore, the participants stated that adequate time was allotted for PBL session on the curriculum. Accordingly, eight PBL sessions each lasting four hours running over 16 weeks were assumed to be conducted during the 2nd year of the academic calendar.

Another participant compliments the statement by claiming:

Yes, adequate time was allocated for the PBL in the curriculum. In our program, four hours per week were allotted for the PBL session. P5

Moreover, from the findings of the interview study, the participants acknowledged the significance of PBL as a pedagogical approach and well recognized the learning benefits it brings to the medical education. With respect to students, the PBL holds the potential to augment learning outcomes by facilitating the integration of basic sciences of medicine and clinical knowledge throughout the learning process.

One participant conveyed the following regarding the possible learning benefits the PBL can bring to medical education:

For instance, students should go to the Cadaver room to boost their knowledge of Anatomy and Physiology. Similarly, the students need to visit the laboratory in order to integrate their basic -clinical knowledge to understand the problem; and correlate the findings from the laboratory with the clinical scenario P1

The participants believed that compared to the traditional content-based instruction, PBL involves an active learning process, which encourages learners to engage actively, inquire further, and retain knowledge. Additionally, PBL enhances the educational outcomes of self-directed and reflective learning while also enabling the educators to continuously monitor and evaluate the students' learning progress.

As a learning instruction, PBL has various teaching and learning benefits. In traditional lecture-based learning, the teacher delivers the contents, and the students follow the lecture which is passive in engaging the students. But in PBL the clinical problem is usually used as a trigger to solve certain clinical scenarios through a gradual learning process, where the students actively engage in the learning process P15

Moreover, PBL typically involves small group collaboration thereby improving the students' soft skills such as interpersonal, communication and teamwork. These skills are integral components of health professionalism.

Furthermore, in addition to enhancing the student's knowledge and skills, the PBL can improve the students' soft skills such as interpersonal and communication skills. However, the PBL alone cannot be a learning methodology by itself P9

Regarding its advantage for the community, the participants asserted that PBL has the potential to improve students' problem-solving skills in a clinical setting because it exposes students to real-world clinical problems. This in turn improves the provision of the health care system for the community.

During the PBL process, the students face real clinical cases, in their effort to solve the clinical problem, they have the opportunity to improve their knowledge, skills, and attitudes in diagnosing and treating real patient cases P12

Theme 2: PBL Implementation Challenges

Even though PBL is integrated in the undergraduate medical curricula as one of the teaching approaches, its implementation is far from sufficient. The poor execution of PBL is associated with concerns regarding curricular design and governance, as well as implementation challenges such as inadequate training and awareness among educators and learners, and a dearth of resources to facilitate PBL implementation. PBL, being a demanding instructional approach that requires a significant investment of time and resources, its implementation is further hindered and complicated by the unpreparedness of the educational environment in the context of AAU CHS.

One key informant provided the following commentary in support of the statement:

The curriculum designers too are cognizant of the learning benefits of the PBL and adapted it to the undergraduate medical curriculum in recent times. However, various departments are struggling to accommodate the new PBL integrated curriculum in their part still now P6

Most participants indicated that PBL implementation is haphazard and currently only in the pilot stage in their respective departments.

Another participant concurred the above statement by commenting the following:

The PBL integrated competency-based curriculum has been used in our college for four years; nevertheless, its implementation has not yet fully begun. P13

Subtheme 1: Issues Related to PBL Curricular Design and Governance

The participants questioned the appropriateness of PBL adoption into the curriculum asserting that the integration process did not consider the context of Ethiopian health science colleges.

From my experience in Switzerland, I had the opportunity to observe the learning process of the PBL. There exists a significant variation: PBL model in Switzerland is totally different, it never goes with the Ethiopian context. For instance, in the former (Switzerland) the curriculum entirely focuses on the nursing practice; in the later (Ethiopia) there is little opportunity to blend the interactive lecture with clinical practice session since the clinics are managed by the clinical site preceptors. Consequently, there is little opportunity for educators to teach nursing practice P11

Another participant concurred the statement by pointing out that the curriculum lacks proper strategy and plan to conduct the PBL sessions which makes it difficult for the learners to gain the desired educational outcomes.

The following is a description of the issue by one undergraduate program module coordinator:

What is important is not the time allotted for PBL as stated in the curriculum document. In the first place, there is no clear strategy on how to implement the PBL session each week. For example, the curriculum included PBL to be implemented in the 2nd year of our undergraduate program during which the basic science courses are taught. It would have been better if the PBL session was assigned during the 3rd and 4th year academic calendar since the extensive clinical courses and practical sessions were present during these critical learning periods. This indicates the adoption of PBL for our program context can be questionable P15

Furthermore, the respondents disclosed that the inadequate presence of a strong administrative body within the college, dedicated to overseeing the implementation of PBL has resulted in subpar execution of PBL in CHS. The participants asserted it is imperative to establish a central office within the college that is accountable for monitoring the appropriate execution of PBL. In addition, the participants suggested the formation of PBL implementation committees at the departmental level.

One educator witnessed the case as:

There is motivation among those who understand the teaching benefits of PBL such as the department heads, program coordinators, and trained educators to implement PBL on their part. But that alone is not enough to fully realize the PBL implementation. It is imperative that educational administrators become involved in monitoring the progress of curricular implementation, evaluating programs, and providing support for the improvement of PBL implementation P14

Subtheme 2: Issue Related to Staff Training and Awareness Creation

One of the prominent challenges hindering the successful implementation of PBL, as voiced by the participants, revolves around issues related to lack of trained manpower. Participants identified concerns relating to staff training as one of the major obstacles hindering the proper implementation of PBL. Participants disclosed that there were no formal training programs and workshops designed expressly to give educators the necessary knowledge and skills required for PBL implementation.

When asked about their difficulties in successfully implementing the PBL, educators expressed their concerns about a lack of adequate training.

In addition to what I have mentioned earlier, PBL is not implemented in our department because there was no adequate number of trained staff to conduct the PBL sessions and there is a lack of awareness about the new curriculum in general and the PBL in particular P7

Participants also recommended that since PBL implementation necessitates a cross-disciplinary cooperation and collaboration among health professionals, training of staff members for basic science and clinical educators as well as raising awareness of the PBL concept among clinical site preceptors are prerequisites for successful PBL implementation.

...During the PBL process, there is little room for the students to inquire knowledge outside the classroom because the educators lack the PBL facilitation skills; the clinical site preceptors are less supportive due to lack of awareness about the PBL. P17

Subtheme 3: Issues Related to the Demanding Nature of the PBL Instruction (Time and Resource Intensive Nature of the PBL Instruction)

Another factor that impeded the successful implementation of PBL in undergraduate medical education pertains to the arduous nature of PBL as an instructional approach, particularly in terms of time and infrastructure. The participants assert that PBL is a resource and time-intensive method of instruction that is challenging to implement in resource-limited settings, such as Ethiopian health science colleges.

The above statement was supported by the following quotation from one educational leader:

The stakeholders who designed the curriculum did not consider the context of our country; I think. Since PBL is resource-intensive instruction, it necessitates adequate preparation in terms of teaching facilities to effectively implement it. The PBL should have been integrated into the curriculum considering the existing infrastructural resources of the country. It became very problematic to implement PBL with the existing resources in our college context P14

Moreover, the implementation of PBL was impeded by a rigorous academic schedule, resulting from the aftermath of both the post-war and post-pandemic crises, as well as the inclusion of supplementary courses that required a lengthier duration under the new CBC reform. These necessitated educators to expedite the completion of the major courses within a limited timeframe, leading to an overwhelming teaching workload. As a result, the ongoing crisis in the country, stemming from the COVID-19 pandemic and the war, has had a detrimental impact on medical education, and the curricular implementation including the PBL approach.

One participant stated the condition as:

During these years' Ethiopian medical education has faced a learning crisis which led to a shortage of time to properly cover the curriculum contents. We are obliged to complete each semester of the academic year within a short period of time with overlapping and overburdened learning activities. This makes it challenging to implement PBL, which requires at least eleven months per year in order to properly and fully implement it P13

Subtheme 4: The Educational Environment Readiness to Implement PBL in CHS

Another subtheme that emerged during the study regarding the implementation of PBL pertains to the readiness of the educational climate of the AAU CHS to execute the instructional approach. The participants conveyed that the general preparedness to implement PBL was unsatisfactory. This is attributed to the inadequacy of teaching materials and resources that can facilitate PBL and the scarcity of trained manpower to conduct PBL sessions.

The participants expressed that there is lack of syndicate rooms available for PBL sessions. In addition, there are no adequate resources for PBL facilitation such as, learning guides, flipcharts, sufficient reference materials to facilitate the learner's self-study.

One educator elaborated the condition as:

In our department, there is lack of specifically designed room for PBL sessions equipped with the necessary teaching materials such as flip charts, worksheets, and LCDs to facilitate the PBL sessions. There is no suitable room for group discussions to conduct the PBL. As a result, we introduce the instruction in the classroom and usually ended in the classroom P22

Additionally, the participants emphasized that the successful implementation of PBL necessitates the presence of academicians who are adequately trained to facilitate PBL sessions. Unfortunately, there is a dearth of qualified personnel who can serve as PBL tutors in undergraduate medical programs. The participants indicated that the educators lack essential qualities of an effective PBL tutor, such as the skills to design well-structured PBL cases, facilitate group discussions within the framework of PBL objectives, and provide tailored feedback and assessment of the PBL session. These factors are critical to the success of PBL implementation.

PBL needs the preparation of a syllabus, learning objective, learning plan, and assessment. However, there is a lack of awareness among educators about the PBL. Most of the educators did not know the concept of PBL, how to implement it, how to conduct PBL sessions, and how to make assessments of PBL. P21

Another participant concurred the statements by saying:

... PBL has not been implemented within our department due to insufficient numbers of adequately trained staff to conduct PBL sessions, as well as a general lack of awareness regarding the new curriculum and PBL specifically. It is worth mentioning that only two out of the twenty-one staff members within our department have received training on PBL instruction. As a result, no PBL sessions have been prepared, and neither PBL cases nor assessment tools have been made available within our department. P8

Theme 3: Strategies for Effective Implementation of the PBL in CHS

Another recurring theme that emerged during the interview study was strategic recommendations to mitigate the challenges that contributed to poor implementation of PBL in AAU CHS.

Subtheme I: Contextualized Adoption of the PBL Considering the Local Context of Ethiopian CHS

The participants expressed dissatisfaction with the integration of PBL into undergraduate medical education, citing a lack of consideration for the Ethiopian College of Health Sciences' local context. While PBL has demonstrated educational advantages, its adoption and integration into medical education necessitates meticulous planning that accounts for local contextual factors, including institutional infrastructure, educational trends, and educational climate preparedness, rather than simply replicating the foreign PBL model. Therefore, to ensure the successful implementation of PBL, curriculum designers should prioritize the alignment of any educational strategy with the local context.

In our country, there is a long existing trend of importing educational programs without considering the local context. A program that works somewhere may not work here. Or if it is to work here, it should be customized to the local context and tailored to the undergraduate CHS programs. P4

Another participant reflected on the statements as follows:

From my experience in Switzerland, I had the opportunity to observe the learning process of the PBL and I have noticed the educational benefits it brings to health sciences education. However, the PBL model in Switzerland is different, it never goes with the Ethiopian context. It is time and resource intensive. P11

Furthermore, the participants have recommended the involvement of educators in the curriculum design process, stating that their program expertise is crucial for the successful implementation of the curriculum. In relation to this matter, the participants have expressed concern regarding the appropriateness of the course contents, structures, and organizations within the curriculum to effectively facilitate learning through PBL instruction. To address these challenges, the participants have proposed several strategies. While certain educators have proposed the rescheduling of academic periods with the aim of providing additional time for major courses that are specific to a particular program, others have recommended a revision of the curriculum to rectify the suitability of course content and organization.

Regarding the course content, one educator reflected as:

The health science disciplines are considered to be of a specialized nature, with the expectation that students will attain the necessary competencies to practice within their respective disciplines. However, a significant portion of the students' time (25–30%) is devoted to the acquisition of common/supportive courses. In light of this, it is recommended that a compromise be reached with regards to these common courses, and that greater emphasis and time be allocated towards the major courses. P1

Another educator shares her perspective regarding course content organization in the curriculum so that the PBL would yield integration of the basic sciences with the clinical and clerkship sessions to improve the student's competence.

...the undergraduate program needs to be evaluated and require revision by the respective stakeholders if the PBL is to be successfully implemented. This is important to rearrange the course content sequences in the way that integrate the basic science and clinical knowledge, thereby aligning PBL content with the students' knowledge levels. This approach will foster integrated discussions and broaden students' horizons, enabling them to learn from multiple disciplines. P2

Subtheme 2: Providing Tailored Capacity-Building Training for Educators

The role of PBL tutor is very critical for effective implementation of PBL. The participants indicated that the boosting of the educator's skill in planning PBL session, constructing PBL cases, facilitating PBL group discussion and providing feedback and assessment of PBL session are important elements to facilitate successful implementation of PBL in the CHS context.

If PBL is to be implemented properly desirable features of the PBL session tutor such preparing well designed PBL cases, the skill to facilitate the PBL session to monitor the group discussion within the scope of PBL objective and to provide tailored feedback and PBL session assessment evaluation are very crucial. P3

Moreover, since PBL involves a significant shift from the traditional teacher-centred to student-centred educational system, awareness creation about the conceptual underpinnings and educational benefits of the PBL instruction among educators as well as the learners is essential.

...since problem-based learning requires collaboration across various health science disciplines both vertically and horizontally, awareness creation about the PBL instruction and its potential benefit will enhance the students learning gain through the PBL. P18

Another participant added by stating:

...Then the educators should be well informed about the PBL as well as awareness should be created among the students about the objective, purpose, the learning process of PBL and the learning benefits it brings. Instead of dumping the PBL program on to the students, the learners should understand its significance first. P24

Furthermore, the participants engaged in a discussion regarding the significance of collaboration and partnership with other institutions, which they deemed as a crucial attribute for the successful implementation of the PBL program in the field of study.

The following extract from the data have brought attention to the matter stating:

...in addition, experience sharing and collaboration with other organizations such as Ministry of health, national and international professional organization is crucial. P6

Subtheme 3: Strategies to Address the Resource Demanding Nature of the PBL

In this particular category, it has been emphasized by the participants that the implementation of PBL is a process that requires a significant number of resources. Therefore, it is imperative to ensure the provision of essential infrastructural, logistical, technical, and technological support to sustain the implementation of PBL in the context of Ethiopian CHS. This encompasses the availability of tutors who are well-trained and dedicated. In terms of physical and technical support, it is necessary to consider the availability of appropriate tutorial rooms, especially when there is a large number of students, as well as the availability of suitable technological resources such as internet facilities.

One participant discussed the issue as:

...any attempt to implement such a teaching method as PBL without adequate capacity-building training and infrastructural resources would be a freak. It is imperative that the College of Health Science trains an adequate number of personnel and provides additional learning facilities, such as well-equipped classrooms suitable for PBL sessions, reading materials, and internet access for self-study, to ensure the successful implementation of PBL. P9

Furthermore, the participants revealed that the successful execution of PBL necessitates the engagement of educational leaders and administrative support to meticulously strategize its feasibility and viability, considering the existing time and resources. This entails the establishment of a central office to monitor the implementation of the program, the arrangement of capacity-building training workshops and seminars, and the provision of logistical and budgetary support to surmount facility and infrastructure-related limitations.

...The implementation of PBL necessitates the involvement of all relevant stakeholders, including administrators, in the mobilization of requisite learning resources and facilities. This includes the organization of customized training and experience-sharing programs, the establishment of a central educational office, as well as PBL program coordinators at the departmental level. Additionally, it is imperative to provide the necessary logistical and budgetary support, tailored to the specific needs of medical schools and departments. P18

Discussion

The findings revealed that PBL was integrated into the undergraduate medical education programs and has a potential to bring new educational opportunities. However, its implementation in Ethiopian medical schools faced significant challenges pertaining inadequate staff training, deficiencies in curricular design and governance, constraints in educational resources, and a lack of preparedness in the educational environment to facilitate PBL.

Systematic review studies conducted on the effectiveness of PBL methodology in undergraduate medical education have consistently demonstrated that it surpasses traditional methods, primarily reliant on lectures, in enhancing social and communication skills, problem-solving abilities, and self-directed learning skills.^{15–17}

In the current study, the participants held the belief that PBL introduced a novel dimension to medical education, characterized by a student-centered approach that facilitates the integration of basic science and clinical knowledge. Additionally, the participants expressed that PBL possesses the potential to foster student engagement, empowering learners to reflect on their learning experiences from diverse sources, while also enabling educators to evaluate and track student progress.

In this regard, the current study's findings align with previous investigations, indicating that medical students, educators, and academic leaders share the belief that the utilization of PBL is effective in fostering the development of knowledge, problem-solving skills, self-directed learning skills, and collaboration competencies.^{13,18–20}

Furthermore, the implementation of PBL has the potential to enhance students' proficiency in resolving intricate real-life scenarios within clinical setting.²¹ Through the utilization of PBL, students are exposed to real-life clinical cases, providing them the opportunity to augment their understanding, abilities, and attitudes in the diagnosis and treatment of

actual patients.²² Consequently, this approach serves to bolster the provision of healthcare services for the community.²³ Furthermore, the implementation of PBL can enhance students' soft skills, including teamwork, collaboration, and communication abilities, all of which hold significant value for healthcare professionals.²⁴⁻²⁶

However, the findings of the current study revealed that the implementation of PBL in AAU is far from sufficient. The poor execution of PBL is associated with concerns regarding curricular design and governance, as well as implementation challenges pertaining to inadequate training and awareness among educators and learners, insufficient educational environment readiness and a dearth of resources to facilitate PBL implementation. The results of the current study are consistent with the study conducted in Ghana, wherein the implementation of PBL in a medical school encountered difficulties stemming from curriculum design, resource constraints, faculty development, and PBL scenarios development.²⁷

The results of the current study indicate that the undergraduate CBC medical curriculum incorporates designated time for PBL session, which is utilized in conjunction with other traditional pedagogical approaches, including lectures, clinical practice, clerkship, and community service work, as a complimentary instruction. It implied that a curriculum that remains fundamentally traditional in nature, with PBL elements serving merely as supplementary pedagogical aids.

However, the available evidence strongly suggests that educational institutions intending to integrate PBL their educational framework should avoid the pitfall of adopting a superficial PBL approach contending that PBL is not merely a pedagogical approach, but rather a comprehensive curriculum.^{27,28} Furthermore, the amalgamation of two dichotomous educational philosophies in the form of hybrid PBL raises concerns that it may result in a dysfunctional curriculum that is even more detrimental than the conventional approach particularly in schools that lack the necessary expertise in medical education.⁷

Furthermore, the present study showed that implementation of PBL as a teaching methodology is deficient in terms of strategies for conducting PBL sessions at the academic program level. Nevertheless, the execution of PBL surpasses the mere inclusion of "PBL-like" activities within a conventional curriculum and does not warrant a successful implementation.²⁷ Hence, careful and deliberate planning is imperative for the successful execution of PBL, particularly in institutions that have long been firmly rooted and confined to a conventional curriculum.^{8,29} This necessitates a thorough comprehension of the fundamental principles of PBL, encompassing both its practical application and underlying philosophy.²⁹

Moreover, the findings of the present study showed that the adoption of PBL curriculum was inappropriate because it lacks the consideration of the Ethiopian College of Health Sciences' local context. The replication of PBL methods from Western contexts presents difficulties due to education, culture, and healthcare variations.^{8,30,31} Therefore, the adoption of a customized PBL methodology, which considers the local contextual elements such as institutional infrastructure, educational trends, and preparedness for educational transformation, is imperative to effectively equip medical graduates with the necessary skills to cater to the healthcare requirements of the community.⁸

The implementation of PBL is further hindered by the unpreparedness of the educational environment in the context of AAU CHS. Our research study showed that unfavorable educational climate attributed to the inadequacy of teaching materials and resources that can facilitate PBL, the scarcity of trained manpower to conduct PBL sessions, and the absence of a strong educational administrative body that is particularly dedicated to monitoring the effective implementation of the PBL curriculum. In line with the findings of our study, a study conducted in West Africa showed issues such as lack of supporting educational technology, high startup costs requirement and relative lack of medical school managers with appropriate medical education background impede PBL implementation.³²

However, several studies conducted locally and internationally indicated that it is possible to implement PBL in a resource limited settings through strategic overcoming of the resource limitations, providing early faculty development and fostering inter-institutional cooperation along with the presence of a robust PBL implementation monitoring mechanism.^{13,33,34} This evidence highlighted the need for AAU, CHS to work further and undertake additional measures in order to realize successful implementation of PBL in undergraduate medical education.

Implication for Medical Education in AAU CHS: Possible Strategies and Recommendations to Overcome the PBL Implementation Challenges

The current study identified key intervention areas that needs to be worked upon in order to ensure sustained and effective implementation of PBL in AAU, CHS.

The initial step towards the implementation of PBL is the establishment of a comprehensive curriculum document specifying the type of PBL curriculum. This is because the curriculum serves as a contractual agreement between the institutions, administrators, educators, and students to frame its implementation. Nevertheless, it is imperative to acknowledge that PBL does not adhere to a universal instructional model. Therefore, leaders in medical education and policymakers ought to adapt a customized and deliberately planned curriculum that prioritize the alignment of any educational strategy with the local context.⁴

Consequently, it may even be essential to integrate PBL with interactive lectures and didactic sessions, creating a hybrid approach that aligns with the economic and socio-cultural circumstances of the implementing institution. Notwithstanding concerns associated with the hybrid PBL, various literatures have suggested that this approach is proven to work in medical schools with limited resource settings.^{35–37}

To address the constraints posed by limited resources, it is imperative to have adequately equipped PBL tutorial rooms for the successful implementation of a PBL curriculum. The current study conducted within the context of AAU CHS reveals a dearth of purpose-built PBL tutorial rooms. Consequently, it is suggested that instead of waiting for the availability of such facilities, existing resources should be mobilized to initiate pilot PBL sessions at the departmental level. Simultaneously, long-term planning for the provision of dedicated PBL tutorial rooms is strongly advised. These strategies are in alignment with the findings of studies conducted in other developing nations, which underscore the importance of the utilization of available resources and faculty development programs in planning the implementation of problem-based learning.³⁴

Moreover, in settings with limited resources such as AAU CHS, essential factors for the successful implementation of a new PBL curriculum include sufficient budgetary resources to establish well-equipped rooms and libraries, the provision of necessary logistics such as flip charts, markers, and projectors, the availability of hospitals and community care centers for practical sessions, and an adequate number of trained professionals from diverse disciplines to facilitate the integrated learning approach of PBL.^{27,38} Henceforth, it is imperative for educational administrators and leaders to consider these essential components that are indispensable for the efficient implementation of a novel PBL curriculum.

In addition, drawing from the experiences of other countries and institutions, collaborative development is encouraged to ensure the successful delivery of PBL as evidenced in these studies. For instance, the introduction of PBL has been well-received by medical educators, students, and leaders, and its implementation through a hybrid approach has proven to be effective in local higher education institutions.^{13,39} Moreover, evidence from other African countries supports the notion that collaboration and partnership with other institutions and organizations is a crucial factor in successfully implementing PBL in settings with limited human resources.³³

Beside that, the utmost crucial prerequisite for the effective implementation of PBL is the faculty development at all stages of its adoption, implementation, and progression.^{40,41} It is imperative to involve faculty members from the basic and behavioral sciences, as well as clinical professionals, in the process of designing the curriculum. Their expertise is vital in ensuring the appropriate sequencing, integration, and organization of learning modules.

Additionally, meticulous training of both faculty members and students emerges as a crucial element in guaranteeing the effective execution of PBL. In this regard, organizing PBL trainings and workshops, providing in-service PBL case development and PBL session facilitation skills training would serve to introduce and align the educators and student's mindset with the purpose of PBL.^{42–44} Particularly in relation to faculty development, implementing best practices in PBL tutor training along with the incorporation of a simulated tutorial and provision of a comprehensive PBL tutor guide proved to be a valuable experience.⁴⁵ Moreover, it is crucial to adopt innovative training approaches, such as interactive film scenes, to address challenging scenarios related to group dynamics and individual intervention strategies in PBL.⁴⁶

Ultimately, effective implementation of PBL necessitates not only the provision of requisite material and manpower resources, but also a robust program governance and monitoring system. The introduction of PBL into the medical school's curriculum is greatly facilitated by the robust endorsement from academic administrators, including the dean and other staff responsible for curriculum implementation.^{47,48}

The present study has revealed that PBL constitutes an integral component of the CBC that has been in place in undergraduate medical school programs at AAU for nearly five years. However, given this extended period, it appears that inadequate implementation of PBL instruction may be attributed, at least in part, to a lack of governance and a deficit

in regular curricular evaluation. Therefore, it is imperative for AAU CHS to establish a proper curriculum governance framework to ensure proper implementation of the curriculum. In this regard, it is crucial to establish a central office as well as PBL implementation committee at all undergraduate department levels that collaborates with other academic committees to ensure adherence to the curriculum's objectives.

Strengths and Limitations

This study has addressed several issues related to the implementation and readiness of PBL at AAU CHS. The study provides essential information for medical educators, educational leaders, and policy makers, with implications for successful execution. Furthermore, the paper offers practical solutions and recommendations to strategize successful PBL implementation.

However, it is important to acknowledge the study's limitations. The research was conducted within a relatively short period of time, which may have limited the depth and breadth of data collection. Methodologically, a qualitative design was used due to the lack of large data extraction from the entire CHS community for quantitative design. This is because the majority of undergraduate medical programs were in the early stages of PBL implementation, which might have impacted the study's ability to assess the curriculum's overall success.

Conclusion

When implemented effectively, PBL has the potential to introduce a new dimension of learning benefits to undergraduate medical education. PBL can enhance learning outcomes by facilitating the integration of basic scientific concepts and clinical knowledge throughout the learning process. Collaborative learning in small groups through PBL can also improve students' soft skills, including interpersonal, communication, and teamwork abilities, which are integral components of healthcare professionalism. Additionally, PBL enables educators to evaluate and track student progress. In terms of its benefits for the community, PBL has the potential to enhance students' problem-solving skills in analyzing real-world clinical problems, creating opportunities to improve their knowledge, skills, and attitudes in diagnosing and treating real patient cases. This, in turn, can improve the provision of the healthcare system for the community.

However, in order to gain benefit of the PBL, its adaption requires careful and deliberate planning taking into account local contextual factors such as institutional infrastructure, educational trends, and preparedness of the educational environment. PBL is not a one size fit all instruction, thus it is imperative to identify factors that impede and enable its implementation peculiar to the health science college context where it is implemented. Therefore, health science colleges should consistently monitor and identify practical resolutions, which may vary among institutions, to alleviate the inevitable challenges related to the execution of PBL.

The successful implementation of PBL in AAU CHS necessitates the collaboration of medical educators, students, educational leaders, and the broader university community both vertically and horizontally. Furthermore, due to the resource and time-intensive nature of PBL, it is imperative to effectively utilize and mobilize existing resources, provide supplementary budgetary and logistical support, and implement targeted faculty development programs to ensure the sustainability of PBL implementation in AAU CHS.

Abbreviations

AAU, Addis Ababa University; CHS, College of Health Sciences; CBC, Competency Based Curriculum; PBL, Problem-Based Learning; TOT, Training of Trainee.

Data Sharing Statement

The datasets generated and analyzed during the current study are not publicly available due to privacy and ethical concerns. However, they are available from the corresponding author upon reasonable request.

Ethical Approval and Informed Consent

Prior to commencing the study, ethical clearance was obtained from the Institutional Review Board (IRB) of Addis Ababa University, College of Health Science, ensuring that all ethical considerations were meticulously addressed. Both

verbal and written consent were obtained from each participant, signifying their voluntary willingness to partake in the study. Each study participant signed informed consent prior to data collection, which included statements about publication of anonymized responses, and measures were taken to ensure privacy and confidentiality.

Acknowledgments

We want to thank Addis Ababa University, College of Health Sciences, and the department chairpersons of undergraduate medical education programs for their support. We would like to thank all data collectors and participants contributing to this research work.

Author Contributions

All the authors have made a noteworthy contribution to the work presented, encompassing the conception, design, execution, data acquisition, analysis and interpretation, or a combination of these aspects. Additionally, they have participated in the drafting, revision, or critical review of the article, and have granted their final approval for the version to be published. The authors have also reached a consensus on the journal to which the article has been submitted and have committed to being responsible for all aspects of the work.

Disclosure

The authors declare that they have no competing interests in this work.

References

- Schmidt HG, Rotgans JI, Yew EH. The process of problem-based learning: what works and why. *Med Educ*. 2011;45(8):792–806. doi:10.1111/j.1365-2923.2011.04035.x
- Barrows HS. A taxonomy of problem-based learning methods. *Med Educ*. 1986;20(6):481–486. doi:10.1111/j.1365-2923.1986.tb01386.x
- Neufeld VR, Woodward CA, MacLeod SM. The McMaster MD program: a case study of renewal in medical education. *Acad Med*. 1989;64(8):423–432. doi:10.1097/00001888-198908000-00001
- Taylor D, Mifflin B. Problem-based learning: where are we now? *Med Teach*. 2008;30(8):742–763. doi:10.1080/01421590802217199
- Kwan C-Y, Tam L. Commentary: hybrid PBL-what is in a name? 醫學教育 [medical education]. 2009;13(3):216–223.
- Koh GCH. Revisiting the ‘Essentials of problem-based learning’. *Med Educ*. 2016;50(6):596–599. doi:10.1111/medu.12794
- Lim WK. Dysfunctional problem-based learning curricula: resolving the problem. *BMC Med Educ*. 2012;12(1):1–7. doi:10.1186/1472-6920-12-89
- Chan SCC, Gondhalekar AR, Choa G, Rashid MA. Adoption of problem-based learning in medical schools in non-western countries: a systematic review. *Teach Learn Med*. 2022;1–12. doi:10.1080/10401334.2022.2142795
- Berhan Y. Medical doctors profile in Ethiopia: production, attrition and retention. In memory of 100-years Ethiopian modern medicine & the new Ethiopian millennium. *Ethiopian Med J*. 2008;46:1–77.
- Abraham Y, Azaje A. The new innovative medical education system in Ethiopia: background and development. *Ethiop J Health Dev*. 2013;27(1):36–40.
- Frenk J, Chen L, Bhutta ZA, et al. Health professionals for a new century: transforming education to strengthen health systems in an interdependent world. *Lancet*. 2010;376(9756):1923–1958. doi:10.1016/S0140-6736(10)61854-5
- Afzal M, Cometto G, Roskam E, Sheikh M. Global health workforce alliance: increasing the momentum for health workforce development. *Rev Peru Med Exp Salud Publica*. 2011;28(2):298–307. doi:10.1590/S1726-46342011000200018
- Wondie A, Yigzaw T, Worku S. Effectiveness and key success factors for implementation of problem-based learning in Debre Tabor University: a mixed methods study. *Ethiop J Health Sci*. 2020;30(5). doi:10.4314/ejhs.v30i5.21
- Caulfield J. How to do thematic analysis. A step-by-step guide & examples. *Scribbr*. 2019;2019:1.
- Trullàs JC, Blay C, Sarri E, Pujol R. Effectiveness of problem-based learning methodology in undergraduate medical education: a scoping review. *BMC Med Educ*. 2022;22(1):104. doi:10.1186/s12909-022-03154-8
- Arruzza E, Chau M, Kilgour A. Problem-based learning in medical radiation science education: a scoping review. *Radiography*. 2023;29(3):564–572. doi:10.1016/j.radi.2023.03.008
- Applin H, Williams B, Day R, Buro K. A comparison of competencies between problem-based learning and non-problem-based graduate nurses. *Nurse Educ Today*. 2011;31(2):129–134. doi:10.1016/j.nedt.2010.05.003
- Choi E, Lindquist R, Song Y. Effects of problem-based learning vs. traditional lecture on Korean nursing students’ critical thinking, problem-solving, and self-directed learning. *Nurse Educ Today*. 2014;34(1):52–56. doi:10.1016/j.nedt.2013.02.012
- Bruce JC, Lack M, Bomvana NM, Qamata-Mtshali N. Problem-based Learning: nursing students’ attitude, self-reported competence, tutorial performance and self-directed learning readiness. *J Nurs Educ Pract*. 2018;8(11). doi:10.5430/jnep.v8n6p77
- Wong FM, Kan CW. Online problem-based learning intervention on self-directed learning and problem-solving through group work: a waitlist controlled trial. *Int J Environ Res Public Health*. 2022;19(2):720. doi:10.3390/ijerph19020720
- Li X, Xie F, Li X, et al. Development, application, and evaluation of a problem-based learning method in clinical laboratory education. *Clin Chim Acta*. 2020;510:681–684. doi:10.1016/j.cca.2020.08.037
- Lee M-N, Nam K-D, Kim H-Y. Effects of simulation with problem-based learning program on metacognition, team efficacy, and learning attitude in nursing students: nursing care with increased intracranial pressure patient. *Comput Inform Nurs*. 2017;35(3):145–151.

23. Tamblyn R, Abrahamowicz M, Dauphinee D, et al. Effect of a community oriented problem based learning curriculum on quality of primary care delivered by graduates: historical cohort comparison study. *BMJ*. 2005;331(7523):1002. doi:10.1136/bmj.38636.582546.7C
24. Morales-Mann ET, Kaitell CA. Problem-based learning in a new Canadian curriculum. *J Adv Nurs*. 2001;33(1):13–19. doi:10.1046/j.1365-2648.2001.01633.x
25. Deep S, Salleh BM, Othman H. Study on problem-based learning towards improving soft skills of students in effective communication class. *Int J Innov Learn*. 2019;25(1):17–34. doi:10.1504/IJIL.2019.096512
26. Elsie K-M, Francis B, Gonzaga MA. Attitudes and perceptions of students and teachers about problem based learning in the radiography curriculum at Makerere University, Uganda. *Eur J Radiol*. 2009;1(4):156–162. doi:10.1016/j.ejradi.2010.05.001
27. Amoako-Sakyi D, Amonoo-Kuofi H. Problem-based learning in resource-poor settings: lessons from a medical school in Ghana. *BMC Med Educ*. 2015;15:1–8. doi:10.1186/s12909-015-0501-4
28. Barrows HS, Tamblyn RM. *Problem-Based Learning: An Approach to Medical Education*. Vol. 1. Springer Publishing Company; 1980.
29. Gwee MCE. Problem-based learning: a strategic learning system design for the education of healthcare professionals in the 21st century. *Kaohsiung J Med Sci*. 2009;25(5):231–239. doi:10.1016/S1607-551X(09)70067-1
30. Nasr ZG, Wilby KJ. Introducing problem-based learning into a Canadian-accredited middle eastern educational setting. *Curr Pharm Teach Learn*. 2017;9(4):719–722. doi:10.1016/j.cptl.2017.03.027
31. Frambach JM, Talaat W, Wasenitz S, Martimianakis MA. The case for plural PBL: an analysis of dominant and marginalized perspectives in the globalization of problem-based learning. *Adv Health Sci Educ*. 2019;24:931–942. doi:10.1007/s10459-019-09930-4
32. Gukas I. Problem-based learning in undergraduate medical education: can we really implement it in the West African subregion? *West Afr J Med*. 2007;26(2):87–92.
33. Giva KR, Duma SE. Characteristics and critical success factors for implementing problem-based learning in a human resource-constrained country. *Curationis*. 2015;38(1):1–11. doi:10.4102/curationis.v38i1.1283
34. Solano J, Gutierrez MZ, Pínel-Guzmán E, Henriquez G, Henriquez GS. Barriers and solutions to successful problem-based learning delivery in developing countries—a literature review. *Cureus*. 2023;15(8):1.
35. Armstrong EG. *A Hybrid Model of Problem-Based Learning. The Challenge of Problem-Based Learning*. Routledge; 2013:145–158.
36. Carrió M, Agell L, Baños JE, Moyano E, Larramona P, Pérez J. Benefits of using a hybrid problem-based learning curriculum to improve long-term learning acquisition in undergraduate biology education. *FEMS Microbiol Lett*. 2016;363(15):fnw159. doi:10.1093/femsle/fnw159
37. Yeo S, Chang BH. Implementation of problem-based learning in medical education in Korea. *Korean J Med Educ*. 2017;29(4):271. doi:10.3946/kjme.2017.73
38. Carrera LI, Tellez TE, D'Ottavio AE. Implementing a problem-based learning curriculum in an Argentinean medical school: implications for developing countries. *Acad Med*. 2003;78(8):798–801. doi:10.1097/00001888-200308000-00010
39. Tadesse SG, Tadesse DG, Dagnaw EH. Problem based learning approach increases the academic satisfaction of health science students in Ethiopian universities: a comparative cross sectional study. *BMC Med Educ*. 2022;22(1):334. doi:10.1186/s12909-022-03397-5
40. Farmer EA. Faculty development for problem-based learning. *Eur J Dent Educ*. 2004;8(2):59–66. doi:10.1111/j.1600-0579.2003.00337.x
41. Murray I, Savin-Baden M. Staff development in problem-based learning. *Teach Higher Educ*. 2000;5(1):107–126. doi:10.1080/135625100114993
42. Hitchcock MA, Mylona Z-HE. Teaching faculty to conduct problem-based learning. *Teach Learn Med*. 2000;12(1):52–57. doi:10.1207/S15328015TLM1201_8
43. Dalrymple KR, Wuenschell C, Rosenblum A, et al. PBL core skills faculty development workshop 1: an experiential exercise with the PBL process. *J Dent Educ*. 2007;71(2):249–259. doi:10.1002/j.0022-0337.2007.71.2.tb04273.x
44. Dalrymple KR, Wuenschell C, Shuler CF. Development and implementation of a comprehensive faculty development program in PBL core skills. *J Dent Educ*. 2006;70(9):948–955. doi:10.1002/j.0022-0337.2006.70.9.tb04165.x
45. Johnson J. implementing best practice in training problem-based learning tutors. *J Probl Based Learn*. 2021;8(1):24–34. doi:10.24313/jpbl.2021.00017
46. Bosse HM, Huwendiek S, Skelin S, Kirschfink M, Nikendei C. Interactive film scenes for tutor training in problem-based learning (PBL): dealing with difficult situations. *BMC Med Educ*. 2010;10(1):1–14. doi:10.1186/1472-6920-10-52
47. Khoo HE. Implementation of problem-based learning in Asian medical schools and students' perceptions of their experience. *Med Educ*. 2003;37(5):401–409. doi:10.1046/j.1365-2923.2003.01489.x
48. Azer SA. Introducing a problem-based learning program: 12 tips for success. *Med Teach*. 2011;33(10):808–813. doi:10.3109/0142159X.2011.558137

Advances in Medical Education and Practice

Dovepress

Publish your work in this journal

Advances in Medical Education and Practice is an international, peer-reviewed, open access journal that aims to present and publish research on Medical Education covering medical, dental, nursing and allied health care professional education. The journal covers undergraduate education, postgraduate training and continuing medical education including emerging trends and innovative models linking education, research, and health care services. The manuscript management system is completely online and includes a very quick and fair peer-review system. Visit <http://www.dovepress.com/testimonials.php> to read real quotes from published authors.

Submit your manuscript here: <http://www.dovepress.com/advances-in-medical-education-and-practice-journal>