

The Impact of Formative Assessment on Medical Students' Learning: A Scoping Review

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ABSTRACT

Introduction: Formative Assessment is integral to medical education, serving the purpose of enhancing learning efficacy, providing feedback to students and faculty, and refining teaching methodologies for student advancement and academic progression. This study was therefore designed with the aim of investigating formative assessment and its impact on the education of students.

Materials and Methods: This study was a scoping review are based on Arksey and O'Malley's framework. Published studies from 2000 to 2024 were retrieved from Web of Science (WOS), Scopus, PubMed/Medline (NLM), and ERIC. The keywords of education, teaching, learning, medical education, Formative Assessment and their English equivalents were used.

Results: A total of 2,433 articles were initially identified, with 53 meeting the inclusion criteria. After screening, 16 key conceptual areas related to the impact of Formative Assessment in medical education were identified. These areas include web-based self-assessment, feedback, longitudinal assessment, classroom interaction, dynamic evaluation, motivation, cumulative learning impact, continuous revision, reflection, OSCE, clinical reasoning, instructor experience, and strategies for student success.

Conclusion: The findings of this review show the impact of Formative Assessment on learning, teaching and introduce some methods of Formative Assessment in medical education and the benefits of using them. By integrating these strategies into your teaching practice, you can generate a dynamic learning environment that supports ongoing student development and fosters a culture of continuous improvement.

Keywords: Formative Assessment, Learning, Medical Education, Scoping Review

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Introduction

Education is a complex process, particularly in medical sciences, where graduates must be prepared to work directly with patients. It is vital that medical students learn effective communication skills, which are fundamental to their education (1, 2). Since 1990, UNESCO has advocated for educational reforms worldwide under the slogan 'Education for All,' aiming to enhance the quality of educational systems (3).

Therefore, human societies must seek to climb the stairs of success and all-round development through focusing on educational development. Several factors and criteria play a role in the development of education, including the assessment system in education (4). An important part of the educational process is assessment and a suitable means to modify the goals, programs and methods of teaching and an fundamental part of the teaching-learning process (5), which is carried out continuously along with education and in close association with it.

Instead of emphasizing on the classification of learners and comparing them with each other, assessment focuses on their educational guidance (4). Therefore, assessment is a comprehensive and necessary process for all higher education organizations and institutions that aim for justice and excellence, as improving the modality of teaching and learning is the most central value of academic institutions in the first place (6).

Basically, student assessment is considered as important pillars of university teaching and learning. effective assessment not only plays a significant role in screening students, but also increases students' motivation and also helps the instructor in evaluating his/her own activities. The goal of properly assessing students is to encourage learning and to inform students, to inform instructors, to improve learning activities, to select students, and to prepare them for promotion. Student assessment methods are different, and depending on their type, they are able to evaluate different areas of learning, so it is better to use tests that are able to measure high-level areas of learning. In other words, in the higher education system, the assessment of academic progress is done with various methods and tools; therefore, the selection of the assessment method and the way of designing the test questions should be in such a way that they specifically evaluate those materials and learnings that have been transferred to the learners during the education process (7).

Assessment is a research that uses quantitative and qualitative methods as well as formal and informal methods in order to understand, judge and improve an educational activity (8). Assessment can be done in relation to the learner, teacher, curriculum, etc. On the other hand, assessment can be used at different levels (9). Of course, there are different methods for assessment, which include: descriptive test, true-false test, oral test, log book, multiple choice questions, structured objective clinical test, etc. (10). The results of some studies indicate that

the use of any assessment methods can be a valid tool for evaluating the course. Also, course assessment has the ability to provide instructors with valuable information about the course curriculum. Students are competent people who provide valuable information about their experience in learning, and many instructors find the students' point of view enlightening and useful when evaluating a course. This is why most universities use their current students for course assessment (11-13).

Since students, as the main target group of education activities, are one of the best options for evaluating the education process and future plans for its improvement, the present study was therefore designed with the aim of investigating formative assessment and its impact on the education of students. Using the results of the present study, formative assessment and its effects on education were revealed. In addition, formative assessment methods adopted in medical education were examined, and most of the uses and benefits of each of these methods were determined. By using the results of this study, we can contribute to the improvement of the students' education process with regard to the correct use of appropriate formative assessment methods in their education.

Materials and Methods

This type of review, which is a subset of systematic or systematic review, is defined as Quickly review key concepts in a specific research topic and find definitive sources and types of evidence available (14, 15). A scoping review, like a systematic review, includes a structured process and a systematic search method, but it has not had some of the limitations of a systematic review, such as evaluating the quality of the reviewed articles. As a result, more resources are reviewed and used in less time (16, 17). The steps of this scoping review are based on Arksey and O'Malley's framework for scoping reviews (15) (Figure 1).

1. Identification of research questions

The questions of this research included the following:

- How is formative assessment done in student education?
- What is the impact of formative assessment on students' learning in medical education?
- What is the impact of formative assessment on training in medical education?
- Which of the formative assessment methods is used more in medical education?
- What are the advantages and disadvantages of using each formative assessment method in medical education?

Identifying studies related to the topic

PIAO (P (population), I (Intervention), A (Alternative intervention), O (Outcome)) format (18) The search strategy was used to examine the current range. (Search Syntax S1).

Search Syntax – S1

This term used for search:

Search syntax in PubMed: (15 August 2024: 292)

("formative assessment"[title/abstract] OR "formative evaluation"[title/abstract]) AND ("Medical Education"[title/abstract] OR Education, Medical [title/abstract]) AND 2000/01/01:2024/08/15[dp]

Search syntax in Web of Sciences (15 August 2024: 650)

("formative assessment" OR "formative evaluation") AND ("Medical Education" OR Education, Medical

Search syntax in Scopus (15 August 2024: 1,138)

TITLE-ABS-KEY (("formative assessment" OR "formative evaluation") AND ("Medical Education" OR education, AND medical)) AND (PUBYEAR > 2000 AND PUBYEAR < 2025)

Search syntax in Eric (15 August 2024: 711)

((title :("formative assessment" OR "formative evaluation") OR (abstract :("formative assessment" OR "formative evaluation") AND ((title :("Medical Education" OR education, AND medical OR (abstract :("Medical Education" OR education, AND medical)) AND pubyear: 2000-2025]

Figure 1. Search Syntax S1**1. Licensed Journal Databases**

Z.H. performed electronic searches in the following databases between January 1, 2000, and August 30, 2024: PubMed/Medline (NLM), Scopus, Web of Science (WOS), and ERIC. The syntax of this scoping review (designed by Z.H. and F.K.) is a combination of Medical Subject Headings (MeSH; MEDLINE), Emtree medical (Embase) terms, and free text words in research equations with “OR” and “AND.” Boolean operators were used. Free text words were also selected from the synonyms of all keywords used in the text of relevant studies. The search strategy was initially created in PubMed/MEDLINE (NLM) and then translated into other databases (Search Syntax S1). We did not search ongoing, unpublished studies and gray literature such as books, theses, conference proceedings/abstracts, and news/magazine articles.

2. Hand Searching

Manual searches (performed by F.K. and Z.H. independently) included scanning reference lists of included studies, similar reviews, and three key journals.

2. Retrieving the studies

Published studies that dealt with formative assessment methods in medical education were retrieved from

international medical databases such as Web of Science (WOS), Scopus, PubMed/Medline (NLM), and ERIC. The keywords “formative assessment, medical education OR education, medical”. The first keyword was searched with other keywords and finally with a combination of them. In this regard, AND, and OR operators were used. Quotation mark was used for search. The search strategy in terms of selected keywords was as follows:

("formative assessment"[title/abstract] OR "formative evaluation"[title/abstract]) AND ("Medical Education"[title/abstract] OR Education, Medical [title/abstract])

In order to have high sensitivity, the first step was to search for articles in databases, without applying restrictions such as language and year of publication. To have high specificity, in reviewing the title and summary of articles, articles published in English from 01/01/2000 to 08/30/2024 that is subject to the entry criteria were included in the study, and the high sensitivity and specificity mentioned in systematic reviews were observed. Studies dealing with formative assessment in medical education were reviewed in international search engines based on the research protocol. To minimize possible biases, articles that met the following criteria were included in the study (Table 1).

Table 1. Inclusion and Exclusion Criteria

Criterion	Inclusion	Exclusion
Study design	All articles related to program evaluation methods will be reviewed.	All articles unrelated to program evaluation methods will be included in the review.
Participant	Medical or Paramedical Medical Students	Non-medical or non-paramedical students
Language	English	Other languages
Date of publication	01/01/2000: 08/30/2024	Before 01/01/2000 and after 08/30/2024
Context	Eny medical or paramedical setting, and medical classroom	Any non-medical or non-paramedical setting and non-medical classroom

3. Study selection

Data Extraction & Data Synthesis

At first, the data extraction tool was piloted with three articles of varied methodological approaches to ensure it would collect correct and effective information. This process was verified by one researcher (Z.S.). Then, two reviewers (Z.H. and F.K.) independently extracted data from primary articles by extraction form. Any discrepancies were resolved same as screening stage. Data charted and reported based on Arksey and O'Malley's framework for scoping reviews (21).

Level of Evidence

Two reviewers (Z.H. and F.K.) assessed the level of data classification for studies. Conflicts were resolved by discussion to reach a consensus. A third reviewer (Z.S.) acted as an arbitrator when consensus was not attained.

4. Abstract or diagram

The data of the selected studies were organized in a figure 2.

Ways to improve students' success
The effect of instructor experience on formative assessment
Web-based assessment
Improving clinical reasoning and internship skills
OSCE
Reflection
Continuous review and revision
Learning assessment
Effect of formative assessment on summative assessment
Motivation
Convergent and divergent assessment
Interactive and evolving formative assessment
Classroom interaction (discussion, question, test and observation)
Confirmation of longitudinal formative assessment
Feedback
Web-based self-assessment

Figure 2. The data of the selected studies

5. Presentation of results

Data extraction was done in a narrative and is descriptive.

Ethical Consideration

Ethical concerns included acquiring the ethics code (IR.IUMS.FMD.REC.1400.395), ensuring integrity in library collection and data reporting.

Results

2433 articles were found as a result of searching databases, and considering the inclusion criteria, 53 articles were finally included in this study. The reviewed articles were screened and reviewed according to the PRISMA Flow Figure and finally the articles were selected according to the inclusion criteria (Figure 3).

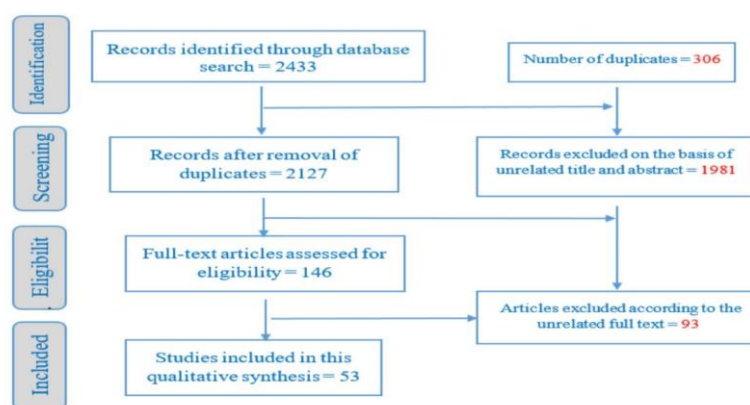


Figure 3. Searching steps in the study

The findings are organized in a table and in 16 areas: web-based self-assessment, feedback, confirmation of longitudinal formative assessment, classroom interaction, dynamic, interactive and evolving formative assessment, convergent and divergent assessment, motivation, effect of formative assessment on

summative assessment, learning assessment, continuous review and revision, reflection, OSCE, improving clinical reasoning and internship skills, web-based assessment, the effect of instructor experience on formative assessment, and ways to improve students' success (Table 2 and 3).

Table 2. Characteristic s of included articles

Name of the journal	year of publication	Name of the author
Medical Teacher	2001	S. Khan (19)
Medical Teacher	2005	Rushton (20)
The National Medical Journal of India	2005	Taradi SK (21)
South African Medical Journal	2006	Burch V (22)
Advances in Physiology Education	2006	Hudson JN (23)
Advances in Health Sciences Education	2006	Krasne S (24)
Education for Health	2007	Mkony CA (25)
Academic emergency medicine	2008	Rudolph JW (26)
BMC Medical Education	2008	Velan GM (27)
Advances in health sciences education	2009	Carrillo-De-La-Peña MT (28)
Learning, Media and Technology	2009	Hatzipanagos S (29)
The 33rd International Convention MIPRO	2010	Gamulin J (30)
The National medical journal of India	2010	Singh T (31)
Teaching Learning in Medicine	2011	Kibble JD (32)
Journal of dental education	2011	Lele SM (33)
Innovations in Education Teaching International	2011	López-Pastor VM (34)
Assessment & Evaluation in Higher Education	2011	Nestel D (35)
International Journal of Collaborative Research on Internal Medicine Public Health	2012	Hashim Z (36)
Journal of Ayub Medical College Abbottabad	2012	Jain V (37)
Kathmandu University Medical Journal	2012	Mondal R (38)
Assessment Evaluation in Higher Education	2012	Weurlander M (39)
Education for primary care	2012	Wiener-Ogilvie S (40)
Medical teacher	2013	De Kleijn RA (41)

Journal of Education Health promotion	2013	Malhotra SD (42)
Medical Teacher	2013	Pelgrim E (43)
Ann Acad Med Singapore	2013	Tham KYJAAMS (44)
Journal of anatomy	2014	Evans DJ (45)
BMC Medical Education	2014	Palmer E (46)
J Pak Med Assoc	2014	Rauf A (47)
Medical Teacher	2014	Schlegel EF (48)
Gerontology & geriatrics education	2014	Williams BR (49)
Medical education online	2015	Bijol V (50)
BMC medical education	2015	Deane RP (51)
The Clinical Teacher	2015	Hadley L (52)
BMC Medical Education	2015	Holden CA (53)
BMC Medical Education	2015	G Ingham (54)
Universitas Médica	2015	Lüdeke AKJUM M (55)
National Journal of Physiology	2015	Srivastava TK (56)
Journal of Clinical and Diagnostic Research	2018	KeSavan KP (57)
International Journal of Emerging Technologies in Learning (iJET)	2020	Lajane H (58)
Assessment & Evaluation in Higher Education	2020	Page M (59)
Journal of Education and Health Promotion	2021	Mondal H (60)
Nurse Education Today	2021	Msosa A (61)
BMC Medical Education	2021	Fernández Ros N (62)
Advances in physiology education	2021	Snekalatha S (63)
Pakistan Journal of Medical Sciences	2022	Alam L (64)
Journal of Datta Meghe Institute of Medical Sciences University	2022	Pathak S (65)
Quarterly journal of research and planning in higher education	2023	Li OK (66)
European Journal of Clinical Pharmacology	2023	Kalfsvel L (67)
BMC Medical Education	2024	Lin H-J (68)
Academic Psychiatry	2024	Celano M (69)
Advances in Medical Education and Practice	2024	Atwa HS (70)
Medical Forum Monthly	2024	Anjum S (71)

Table 3. Areas of impact of formative assessment in medical education based on reviewed studies

[illegible]

*														*		Mkony C – 2007 (25)
			*			*				*				*		Rudolph JW – 2008 (26)
*			*			*								*		Velan GM – 2008 (27)
*																Carrillo-De-La-Peña MT – 2009 (28)
		*														Hatzipanagos S – 2009 (29)
*																Gamulin J – 2010 (30)
			*													Singh T – 2010 (31)
*		*						*								Kibble JD – 2011 (32)
				*										*		Lele SMJode – 2011 (33)
*						*										López-Pastor VM – 2011 (34)
				*										*		Nestel D – 2011 (35)
				*				*								Hashim Z – 2012 (36)
*														*		Jain V – 2012 (37)
				*												Mondal R – 2012 (38)
										*						Weurlander M – 2012 (39)
			*													Wiener-Ogilvie S – 2012 (40)
*		*														De Kleijn RA – 2013 (41)
				*												Malhotra SD – 2013 (42)
			*		*									*		Pelgrim E – 2013 (43)
			*													Tham KYJAAMS – 2013 (44)
*									*			*		*		Evans DJ – 2014 (45)
*	*	*												*		Palmer E - 2014(46)
														*		Rauf A, Shamim MS – 2014 (47)
								*			*					Schlegel EF – 2014 (48)
*																Williams BR – 2014 (49)
*								*								Bijol V – 2015 (50)
			*											*		Deane RP – 2015 (51)
					*									*		Hadley L – 2015 (52)
*																Holden CA – 2015 (53)
*			*						*					*		G Ingham – 2015 (54)
*														*		Lüdeke AKJUM – 2015 (55)
						*										Srivastava TK – 2015 (56)
*			*				*									KeSavan KP – 2018 (57)
*		*						*						*	*	Lajane H – 2020 (58)
*			*											*		Page M – 2020 (59)
*		*										*		*	*	Mondal H -2021- (60)
*			*											*		Msosa A – 2021 (61)
*		*	*					*						*		Fernández Ros N – 2021 (62)
*		*												*		Snekalatha S– 2021 (63)
							*	*						*		Alam L – 2022 (64)
			*													Pathak S – 2022 (65)
											*					Li OK – 2023 (66)
							*							*		Kalfsvel L – 2023 (67)
														*		Lin H-J – 2024 (68)
														*		Celano M – 2024 (69)
								*						*		Atwa HS – 2024 (70)
							*							*		Anjum S – 2024 (71)

Discussion

This study was therefore designed with the aim of investigating formative assessment and its impact on the education of students. Based on the findings of the scoping review regarding the effect of formative assessment on medical education, 16 conceptual areas were identified, including web-based self-assessment, feedback, confirmation of longitudinal formative assessment, classroom interaction, dynamic, interactive and evolving formative assessment, convergent and divergent assessment, motivation, effect of formative assessment on summative assessment, learning assessment, continuous review and revision, rethinking, OSCE, improving clinical and internship reasoning skills, web-based assessment, the effect of instructor experience on formative assessment, and ways to improve students' success. The highlights of these areas are illustrated below.

Web-based self-assessment is a tool for evaluating knowledge and interpreting it. In the S. Khan DAD et al.'s study aimed at evaluating web-based development based on seven knowledge-based questions for eight weeks, students could easily evaluate in educational environments or on PCs or focus on the computer site of the Medical College. To give feedback, the answers were provided immediately, and evaluation was used as an educational tool, the results of these tests are for self-assessment only and have no effect on the final evaluation (19). These results indicate the importance of using the web in student evaluation, including developmental evaluation.

Feedback is one of the main components of developmental evaluation and is defined as "information provided to the agent." Feedback enables students to progress over the course of training sites, provides students with feedback on educational effectiveness, identifies educational environments where students have not performed well, and timely corrective measures. And it does before the final evaluation (19). Accordingly, the focus of feedback for developmental evaluation relies on a combination of transmitters that create feedback, the most powerful unit effect on success (20-22). Experiences by various researchers confirm the importance of using evaluation to provide feedback to teachers and students during the course of training, which makes students aware of their knowledge and increases the motivation for learning.

The important thing in the developmental evaluation is its longitudinal during a training course. In low -income areas such as developing countries, the usefulness of educational innovations is largely determined by the balance between needs and the benefits of evaluation. The results of Burch et al. showed that longitudinal evaluation of the course, with urgent feedback, can be successfully implemented in low -income areas, which increases the awareness of their capable students (22). Obviously, the use of multiple exposure to a real patient in the workplace is an increasing developmental evaluation strategy in the developed world that improves clinical reasoning skills in the face of patients.

One of the essential components of education that is highly emphasized is the interaction of the class between the lecturers and the learners. There are many aspects of classroom interaction such as discourse, questioning, testing, and observation that contribute to developmental evaluation (20). Based on the results of revision studies as developmental evaluation, it is a very interactive process in which skills and

understanding are not simply evaluated by the trainer, but on new insights in the conversation between the trainer and the students (26). Although the origin of revision and evaluation is different, they pursue the same goals.

Evaluation has always been a dynamic process. Schlegel et al. In their study, they used a game race as a useful tool for the developmental evaluation of large groups of students who competed in teams. The technology allowed students to take possession of their knowledge while interacting with teammates and assessing their test readiness. The elements of the game increased the pleasure and dynamics of the evaluation. This collaborative evaluation also provided feedback to the professors of the contest questions that helped provide a two-way evaluation for students and professors alike and deepen the learning and teaching processes. Improving the average academic performance scores in microbiology, pharmacology, pathology, and clinical medicine and increased student satisfaction data supports the fact that this game competition is a useful concept and tool for the developmental evaluation of large groups of students (48). Accordingly, developmental evaluation can be considered as a dynamic, interactive, and evolving process by emphasizing its complexity and the existence of a lecturer as facilitator.

The results of the studies indicate convergence and divergent evaluation. This means that developmental evaluation can be a "convergence" test, if a particular purpose is recognized or "divergent" and examine what is unknown. One of the key features of developmental evaluation in both class and empirical fields is that it gives students feedback to improve their current performance (26). Convergence evaluation evaluates whether the trainee can achieve predetermined goals. The divergent developmental evaluation deeply examines what the trainee thinks and how he creates specific behaviors in a scenario (37).

Examination of texts and experiences shows that having sufficient motivation can be a stimulus for learning and its effectiveness. Although motivation is influenced by several factors, the results of studies show that developmental evaluation plays an important role in motivating learners. Weurlander et al (39). Evans et al. acknowledge that developmental evaluations are important tools for students' learning in three areas: motivation to study, awareness of their learning, and impacts on learning, both in processes and consequences. Technical evaluation in different ways affects students' motivation to study. For many students, developmental evaluations act as external stimuli. In addition to the impact on motivation, developmental evaluation can give students feedback on their progress, which in turn informs them of their learning (45). According to the results of these studies, it can be said that, if well -designed, they can improve students' motivation and interest in learning.

Technical evaluation is specifically intended to provide feedback on performance in order to improve and accelerate learning. The results of developmental evaluation are valuable not in terms of completing a course, but in terms of students' understanding of the curriculum. Therefore, it can help students plan for future learning activities (41). And improve performance in the final evaluation (24). In fact, it can be said that the developmental evaluation of a hidden variable helps performance in compressing evaluations.

The results of other researchers' studies also confirm that the purpose of the developmental evaluation is to provide information that enhances students' learning and accelerates competence (32, 36). Learning evaluation is one of the other concepts that are repeated in the texts, which means that evaluation has sufficient impacts of removal so that the curriculum is actual. The results of the studies also show that the developmental evaluation with timely, relevant and supportive feedback (not just scores) can help improve learning results, and if the evaluation is better to enhance learning results, it can be argued that developmental evaluation is the most important action. Is the evaluation (27, 34, 55). While compressing evaluation is "learning" and it does not reflect on learning in itself, because it focuses on getting better scores and thinking regardless of "learning gaps". The developmental evaluation is "for learning" and enriches the learner's experience and ultimately improves them (57). In a study of first -year medical students, online technical evaluations along with online classes are valuable learning activities that provide them with feedback on learning and encourage them to study further. Students wanted to take optional anonymous tests and thought that the online test could be an alternative to the face -to -face assessment test (60). Finally, what should be evaluated in a classroom is the number of learners who help with the developmental evaluation of this learning. Continuous review and review of the basic concepts extracted in this study means that their importance is not hidden. A review of educational goals during and ending a class or training requires evaluation. The results of the studies also show that the focus of revision as a developmental evaluation is to study frameworks that cause the functional gap. This approach is like a convergent developmental evaluation that evaluates whether the trainee can achieve predetermined goals. It is like a divergent developmental evaluation that deeply examines what the trainee thinks and how he creates specific behaviors in a scenario. As part of a developmental assessment, the reaction stage provides valuable insights into what was more exciting or painful for trainees, allowing the instructor to focus on his goals and inclusive goals (27, 34). Developmental assessment is an effective way to enhance students' learning and develop their skills and competencies and must form part of the new educational performance.

The conceptual reflection is almost unknown and, of course, important in evaluation. Pelgrims et al. Define rethinking in the developmental evaluation of two rethinks in the developmental evaluation: reflection on performance and reflection on feedback. Recipients reflect their performance by monitoring their performance before receiving external feedback. Whereas, after receiving feedback, they reflect on the feedback to make a comment on that feedback (43). And the General Medicine Council (GMC) has acknowledged that it is a key component of rethinking based on structured feedback (52). According to the results of these studies, it can be said that developmental evaluation and feedback are powerful tools to change the behavior of trainees when they are associated with intellect.

Various tools are used to evaluate development and compression, one of the most practical and reliable (OSCE) or objective structured clinical examinations that have been

widely used in medical and non -medical fields for more than three decades (35, 42). Studies of texts and experiences show that despite these benefits, this type of evaluation also has disadvantages, including time-consuming and not being used in some cases, including pediatric medicine (36, 38). The study of the texts and results of the studies shows the importance of the role of developmental evaluation in improving clinical and internship reasoning skills. Burch et al. based on the results of their study, most students attribute improvement of clinical reasoning skills to the use of patients, which is the basis of developmental evaluation strategy, and clinical educators also acknowledged the educational value of longitudinal structural evaluation. And they approved the use of exposure to patients as a valid way to monitor student progress during the internship (22). Rudolph et al. Also states that the developmental evaluation of the trainees in two ways: 1) form skills and knowledge through feedback. 2) Helps develop professional identity through social interaction of learning conversations. While both educators and students often understand the main curriculum (26). It can be said that, despite existing limitations, OSCE is a valuable evaluation method for improving skills of clinical reasoning.

Today, the development and development of technology -based educational technologies encourages lecturers and students to use and use them in education and evaluation. So, web -based developmental evaluation tools have emerged as valuable resources to improve academic performance and enhance motivation and self -learning among the new generation of learners (50). Khalid S and colleagues are on general medical clinical courses where students work in various educational environments. A web -based developmental evaluation system allows students to oversee their academic achievement. Course managers also monitor the performance of student groups in different educational environments compared to the entire group. The analysis of the test enables measuring correct awareness and identifies incorrect information (19). The use of web -based developmental evaluation through clinical cases helps improve knowledge acquisition. Students with previous average performance appear to be more profitable from this learning tool (62).

Having experience plays an important role in a person's success and performance. In developmental evaluation, instructional experience is also an important factor. Ruston says an experienced lecturer has skills, knowledge, attitudes, standards and expertise in evaluation skills that help his / her professional knowledge. It also creates self-efficacy in the key aspects of the profession. The trainer can spend more time providing feedback to students (20). Accordingly, educational institutions should strive to increase the experience of instructors in the developmental evaluation to get better learning results. The success and learning of learners is influenced by several factors. Over the past few decades, educational researchers have argued that one way to improve students' success is to increase exams. This has a significant impact on the student's motivation and helps them develop the skills needed to become lifelong learners (21). In confirmation of this case, Velan et al. Have stated that Using new methods of evaluation requires more responsibility in the process of developing appropriate learning strategies for continuous

development. However, success in this requires the use of professors to review and adapt to the new teaching and evaluation method (27, 55).

Strengths and Limitations

The study successfully identifies 16 conceptual areas related to formative assessment, such as web-based self-assessment, feedback mechanisms, and classroom interaction. This categorization provides valuable insights into how formative assessment can be effectively implemented in medical education. The study addresses ethical concerns related to data collection and reporting, ensuring that the research adheres to ethical standards in educational research.

This study it has limitations that should be considered when interpreting its findings and implications for practice.

Conclusion

This study is the result of a scoping review regarding formative assessment in medical education. Based on the findings of this review, formative assessment and student education have mutual effects. In such a way that the instructors' experience is effective on formative assessment and formative assessment is effective on the quality of education by providing mutual feedback to students and instructors. Formative assessment is an assessment for learning and enriches the learner's experience. Among the methods of formative assessment in medical education, we can mention web-based self-assessment, competitive games, feedback, continuous revision and review, rethinking, OSCE, and web-based assessment. The advantages of using formative assessment include dynamic and evolutionary assessment, interaction in the classroom, creating motivation for students, positive impact on summative assessment, performing divergent and convergent assessment, improving student success and improving clinical and internship reasoning skills. By integrating these strategies into your teaching practice, you can create a dynamic learning environment that supports ongoing student development and fosters a culture of continuous improvement.

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Conflict of interest

There was no conflict of interest.

Author Contributions

Conceptualization, Investigation, Writing – original draft, Writing – review & editing: ZS, ZH, FK, Visualization, Data curation, Formal analysis, Project administration: FK, Funding acquisition, Supervision, Validation: ZS, Methodology: ZH, Resources, Software: FK, ZH

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