CORA Cork Open Research Archive
Cartlann Taighde Oscailte Chorcaí

Title	Feedback and formative assessment—looking backwards to move forward
Authors	McCarthy, Nora;Neville, Karen;Pope, Andrew
Publication date	2025
Original Citation	McCarthy, N., Neville, K. and Pope, A. (2025) 'Feedback and formative assessment—looking backwards to move forward', Discover Education, 4(1), p.25. DOI: 10.1007/s44217-025-00414-9
Type of publication	Article (peer reviewed)
Link to publisher's version	10.1007/s44217-025-00414-9
Rights	© 2025, the Author(s). Open Access - https://creativecommons.org/licenses/by-nc-nd/4.0/
Download date	2026-11-16 11:42:11
Item downloaded from	https://hdl.handle.net/10468/17303



UCC
University College Cork, Ireland
Coláiste na hOllscoile Corcaigh

Discover Education

Perspective

Feedback and formative assessment—looking backwards to move forward

Nora McCarthy[1] · **Karen Neville**[2] · **Andrew Pope**[2]

Received: 20 September 2024 / Accepted: 3 February 2025
Published online: 07 February 2025
© The Author(s) 2025 OPEN

Abstract
The terms 'feedback' and 'formative assessment' are ubiquitous in education, but their conceptual boundaries are ill-defined. This perspective piece explores the meaning of 'feedback' and 'formative assessment', revealing the entanglement and confusion that exists between these two terms. An argument for clarity of terms is made, to avoid ambiguity and to create a common language. A suggestion is made to re-embrace the original definition components of 'feedback', as all of the original parameters of this term, when well established in industry and biology, did not migrate into education. Incorporating the original definition components into the current definition of 'feedback' in education circles may negate the need for the term 'formative assessment' altogether, which carries with it the inevitable negative connotations associated with the word assessment. Words matter. Medical education, with the introduction of competency-based medical education (CBME) and entrustable professional activities offers a timely opportunity to re-visit such terms, with 'feedback' and 'formative assessment' being central to these processes. While we use medical education as an example to explore how looking backwards and incorporating all aspects of the original feedback definition can help us to move forward with clarity of terms, we mainly seek to bring new perspectives and hope to encourage necessary conversations on 'feedback' and 'formative assessment' entanglement.

Keywords Feedback · Formative assessment · Undergraduate medical education · Entrustable professional activities · Definitions

1 Introduction

The US National Research Councilemphasises that assessment and feedback are critical elements for student learning [1, 2]. Yet, what is meant by the terms 'feedback' and 'formative assessment'? While considerable research is published on assessment and feedback, the original meanings of feedback and formative assessment have undergone many changes and crossovers in recent years, with resulting ambiguity. This perspective piece looks at the meaning of feedback, from its origins as a process to how it is currently used in education. It also highlights the similarities that exist between the current use of the term 'formative assessment' and the term 'feedback' as originally conceived. We do not strive to fully synthesise the myriad of articles on these topics; instead, we adopt a perspective review, focussing on highlighting the crossovers and entwinement of the terms 'feedback' and 'formative assessment'. Indeed, a related concept of coaching has been introduced into CBME, to further muddy the murky waters of clarity [3, 4]. This perspective will focus on 'feedback' and

✉ Nora McCarthy, nora.mccarthy@ucc.ie; Karen Neville, KarenNeville@ucc.ie; Andrew Pope, A.Pope@ucc.ie | [1]Lecturer in Medical Education, University College Cork, Cork, Ireland. [2]Department of Business Information Systems, Cork University Business School, University College Cork, Cork, Ireland.

'formative assessment'. We argue that the ambiguities that exist around the terms 'feedback' and 'formative assessment' risk making these terms meaningless [5]. Inconsistent terminology impedes progress [6]. To better support transparent practices, we propose that accuracy and clarity of terms used in research, education and the clinical learning environment is key. Otherwise, we risk adopting Humpty Dumpty's approach in "Through the Looking-Glass, and What Alice Found There" where he states that "When I use a word… it means just what I choose it to mean – neither more nor less [7]." To which Alice replies: "The question is," said Alice, "whether you can make words mean so many different things [7]."

2 Illuminating the entanglement of formative assessment and feedback

Table 1 highlights the crossovers and entwinements that occur between 'feedback' and 'formative assessment'. It gives a small sample of the striking similarities in the use of both terms; numerous other examples exist. While supposedly complementary, the strategies mentioned for both 'feedback' and 'formative assessment' are identical. This cannot make sense if they are two distinct entities.

Researchers in Table 1, whether discussing 'formative assessment' or 'feedback', focus on the need to recognise the goals of learning and to know where the student's current performance is at. This creates knowledge of the discrepancy between the existing level of knowledge or performance and the optimum level, thus allowing the development of strategies to help close the gap. This commonality of meaning is represented in the Venn Diagram of Fig. 1.

So, 'feedback' and 'formative assessment' are represented here by the exact same concepts. What elements belong to what term? Conflating the terms has brought ambiguity. Without understanding the parameters under which a term operates, uncertainty and chaos may ensue.

2.1 The changing concepts of feedback

The literature abounds with writing on feedback. The importance of feedback in medical education is well recognised [13], with feedback being essential to the development of clinical skills [14], the advancement of competency-based medical education (CBME) [15–19] and entrustable professional activities (EPA) [20–24].

Feedback is a very powerful tool when it comes to teaching and learning and was adopted into education as a concept in the mid-twentieth century, having already established itself in industry and biology [11]. It is positioned as a key

Table 1 Entanglement of Formative Assessment and Feedback

Concept referred to—FEEDBACK	Concept referred to—FORMATIVE ASSESSMENT
Feedback [8] "Effective feedback must answer three major questions asked by a teacher and/or by a student: Where am I going? (what are the goals) How am I going? (what progress is being made toward the goal?) Where to next? (What activities need to be undertaken to make better progress?)"	Formative assessment [9] "We need some way of defining formative assessment in a way that is useful for classroom practice. The way that I have found most useful is to think of three key processes in learning: 1. Where the learner is right now 2. Where the learner needs to be 3. How to get there."
Feedback [6] Feedback is: Specific information about the comparison between a trainee's observed performance and a standard, given with the intent to improve the trainee's performance"	Formative assessment [10] "From the student's point of view, the formative assessment "script" reads like this: "What knowledge or skills do I aim to develop? How close am I now? What do I need to do next?"
Feedback [11] 'Feedback is a process whereby learners obtain information about their work in order to appreciate the similarities and differences between the appropriate standards for any given work, and the qualities of the work itself, in order to generate improved work'	Formative assessment [12] "All the best uses of formative assessment ….are consistent with the teacher helping the student operate within a framework of three guiding questions: Where are you trying to go? (identify and communicate the learning and performance goals) Where are you now? (assess, or help the student to self-assess, current levels of understanding) How can you get there? (help the student with strategies and skills to reach the goal)"

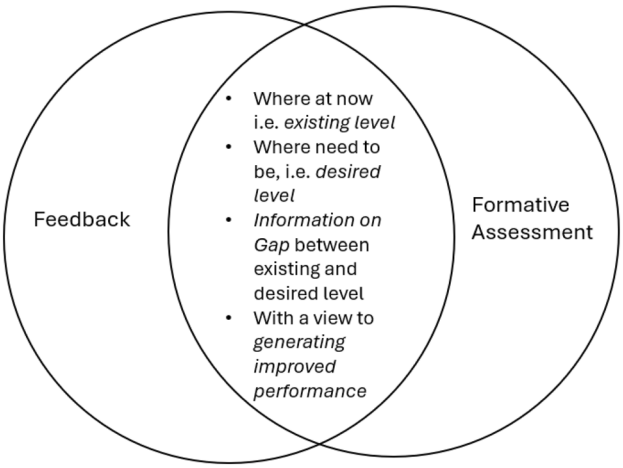


Fig. 1 Commonality between 'Feedback' and 'Formative Assessment' in various definitions

standard in education in Australia [16, 17]. Feedback exerts a powerful influence on learning [8, 25] and is considered integral to clinical education [18, 26–29]. The original feedback definition related to system control and involved a cycle [11, 30, 31], where information on the gap in performance was recorded and inputted back into the system, affecting the next outcome. This cyclical process continued until the desired effect was achieved. In terms of the use of the concept feedback in education, this classic definition has seldom translated into the field of education, with the meaning of feedback in education, including medical education, shifting over the last few decades, often coming to mean the one-way telling of information to a student [6, 8, 11, 32–34]. While there is no doubt that information is given to students with the intent of improving performance, very few education feedback definitions speak about the need to provide opportunities to close the gap, with even less mentioning demonstration of closure of the gap as a necessary component of feedback. This contrasts with the original meaning and use of the term 'feedback' [31]. Without a student showing that they have learned from information given to them, the feedback loop cannot be said to have been closed [34], it is only *"dangling data"* [35]. This is not meant in any sense to lessen the value of the information given to the student, it is merely acknowledging that giving information, in and of itself, is not feedback. Whether successful learning has occurred or not based on this information depends on the involved student's understanding and acting on the information provided. Good information should encourage students to improve on their learning, and this is the importance of giving accurate, understandable information. Further confusion relating to the term 'feedback' emerges due to its fusion with other terminologies, such as informal, formal, directive, facilitative, corrective, formative, summative, intentional, unintentional, direct, indirect, descriptive, evaluative, ipsative, diagnostic, feed-up, feed-forward [8, 32, 36–38]. These terms use feedback to denote different meanings, which is confusing and misleading.

2.2 To be or not to be—formative assessment re-visited

The term 'assessment' encompasses many meanings [39–44]. As a concept it has developed a tremendous vocabulary, including terms such as formative and summative [9, 35, 43, 45–61]. 'Formative assessment' is often seen as one side of the dichotomy with summative assessment. The terms 'formative' and 'summative' were initially used in education circles to describe evaluation by administrators on adopting a curriculum. Formative addressed the "ongoing improvement of the curriculum" [62], with summative evaluation occurring at the end of the curriculum, "a final evaluation of the project or person" [62] (p. 42) to see if continuing with it was justified. These terms migrated into education, with formative being applied to the student's learning evaluation [38], or assessment as it is often called today. Many researchers specifically state that the point at which the assessment occurs distinguishes between formative and summative assessment [47, 53, 54, 56, 58]. While formative assessment generally refers to assessment occurring during the learning, the timing of a summative assessment is one of its defining features, with most concurring that a summative assessment occurs at the end of learning [35, 45, 47, 56, 59, 60, 63].

A great number of different definitions for formative assessment exist in the literature, with Table 2 presenting some examples.

Table 2 highlights some examples of 'formative assessment' definitions, with elements that refer to the original 'feedback' definition shown in italics. What is obvious is that 'formative assessment' definitions often encapsulate what was

Table 2 Definitions of Formative Assessment

"Formative assessment is a planned, ongoing process used by all students and teachers during learning and teaching *to elicit and use evidence of student learning to improve student understanding of intended disciplinary learning outcomes* and support students to become self-directed learners…… • *Clarifying learning goals and success criteria within a broader progression of learning;* • *Eliciting and analyzing evidence of student thinking;* • Engaging in self-assessment and peer feedback; • *Providing actionable feedback;* • *Using evidence and feedback to move learning forward by adjusting learning strategies, goals, or next instructional steps"* [48]
"An assessment activity can help learning if it *provides information* to *be used as feedback* by teachers, and by their pupils in *assessing* themselves and each other, to *modify the teaching and learning activities in which they are engaged. Such assessment becomes 'formative assessment' when the evidence is actually used to adapt teaching work to meet learning needs"* [41]
"Using everyday language, the formative-assessment process involves teachers' *and/or students' use of assessment evidence to make adjustments in what they're doing……This process revolves around the use of assessments to collect evidence, and then the employment of such evidence by teachers and/or students to decide whether they need to adjust what they are doing"* [64]

originally referred to, as 'feedback'. If all of the original elements of 'feedback' had migrated into education circles, it could potentially have stopped the muddying of waters between the terms 'formative assessment' and 'feedback'. Perhaps, if 'feedback', with all of its original definition components, including the gathering of information on the gap in current performance, is fully embraced, the term 'formative assessment' is no longer needed? Indeed, the word 'assessment' brings with it many negative associations [65, 66]; thus, moving away from the word 'assessment' in favour of terms such as 'observation' or 'review' as part of the feedback cycle, might have more favourable connotations for the students. This approach was adopted for EPAs in Ireland where observation and review tools are the terms proposed instead of assessment tools [23].

3 Where to next in education and assessment?

Recent researchers in education are re-embracing the original meaning of feedback, where demonstration of improvement in performance is a necessity [26, 67]. It is difficult in traditional classroom education settings to offer students the opportunity for re-appraisal. This is understandable given existing hurdles, such as the large volume of students and the constraints on resources. However, without this step, information given to students remains just that—information [11, 34]. This is not to lessen the worth of this information, it is merely attempting to be accurate in the use and meaning of the various terminologies used, as focussing on only one aspect of feedback weakens the entire meaning of the term [26]. Technologies such as in-lecture audience engagement tools for live student polling and quizzing may allow opportunities to see where students are at in their in-class learning. Subsequent re-visiting of the necessary information to reduce the gap in performance can be followed by re-evaluation on the same topic, with regular re-evaluation as necessary occurring over the course of a class. This allows for accurate engagement in the process of feedback. Successful growth in learning requires the use of information on the identified gap to improve performance. Creating the necessary time for feedback is difficult when a course needs to cover breath as well as depth, but educators are renowned for being innovative, and simple small regular steps may inspire more innovative approaches.

While traditional classroom-based education may struggle with feedback implementation where time-limited exposure is the norm, the set-up of undergraduate medical education often lends itself well to re-evaluation after highlighting the performance gap. In the preclinical course-based education setting, small-group learning sessions and simulations can afford opportunities to engage in accurate feedback practice. In the clinical phase of medical education, bed-side tutorials, hospital and general practitioner attachments, potentially provide regular opportunities to see students closing the gap following receipt of information on their initial discrepancies. The essence of CBME in postgraduate medical education is that competence is seen to be achieved [16, 17]. Due to the regularity in performance of tasks while working as a doctor, a subsequent performance following receipt of information on current discrepancies is going to be the norm, thus allowing for re-review and performance improvement. Thus, medical education can lead the way in re-embracing feedback as originally conceived. This is not to say that it will be easy. Barriers are evident [27], such as changing supervisors, changing teams, changing hospitals; it will require time, dedication, effort, on the part of the student and the supervisors/educators.



Fig. 2 The cyclical process of feedback

The move to EPAs and entrustment in PGME is complex, with many countries still being at an early implementation phase [15, 23, 68]. In those countries where EPA has already been adopted as a strategy, there are visible challenges and hurdles, with variations in EPA design existing between different countries [69]. Other countries are still in the early stages of EPA adoption and implementation. Therefore, now might be a good time to encourage and recommend that research on EPA implementation is performed with clarity of terms from the outset. Feedback will inevitably emerge as a core element in attainment of EPAs, but what will be meant by feedback? We position that this is a good time in medical education to revisit and underline the importance of an explicit definition of feedback, and its potential future implications.

4 Conclusion—divide and conquer—'feedback' and 'formative'

Inconsistent definitions of 'feedback' and 'formative assessment' are rife, with robust definitions being required if both terms are to co-exist and remain useful entities. This paper advocates for clarity of terms. We seek to shift the perspective on 'feedback' back to its original conception, why re-invent the wheel? Feedback, to be properly fulfilled, requires numerous elements; it requires an observation or review, with resulting generation of information about the gap between the actual and desired reference parameter level; this information should then be used to alter the gap with a subsequent re-review occurring. The successful use of this information by the student depends on many elements including student understanding and willingness to use the information, guidance on use of the information etc., but this is not the focus of the definition of feedback, which simply describes the cyclical process, represented in Fig. 2.

The original definition for feedback emphasises this cyclical nature. The process repeats, thus repetitive observations may be required, until the desired state is reached. The observation/review element is the assessment component that inherently and integrally lies in feedback. This cyclical process subsumes assessment, renamed observation/review, into its core, rendering the term 'formative assessment' redundant. Words are powerful, the word 'feedback' encompasses many powerful elements, perhaps we should pay it extra: "When I make a word do a lot of work like that,' said Humpty Dumpty, 'I always pay it extra" [7]. If this shift backwards to embracing the original meaning of the term 'feedback' occurred in order to move forward with clarity, the term 'formative assessment' may no longer be required?

We believe that accurate definitions, while complex and difficult to achieve, are important, because educators and researchers look to fulfil the required parameters of accepted definitions. Clearly defining a construct is difficult, gaining universal acceptance of a definition may be well-nigh impossible; at a minimum we hope to encourage necessary conversations about the accuracy and conceptual boundaries of terms. "The question is," said Humpty Dumpty, "which is to be master—that's all" [7].

Author contributions All authors (Nora McCarthy, Karen Neville, Andrew Pope) contributed to the conception of the work; the writing and revising of the work. All authors (Nora McCarthy, Karen Neville, Andrew Pope) commented on previous versions of the manuscript. All authors (Nora McCarthy, Karen Neville, Andrew Pope) read and approved the final manuscript.

Funding No funds, grants, or other support was received.

Data availability No datasets were generated or analysed during the current study.

Declarations

Competing interests The authors declare no competing interests.

Open Access This article is licensed under a Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License, which permits any non-commercial use, sharing, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if you modified the licensed material. You do not have permission under this licence to share adapted material derived from this article or parts of it. The images or other third party material in this article are included in the article's Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit http://creativecommons.org/licenses/by-nc-nd/4.0/.

References

1. Guerrero-Roldán AE, Noguera I. A model for aligning assessment with competences and learning activities in online courses. Internet Higher Educ. 2018;38(April):36–46. https://doi.org/10.1016/j.iheduc.2018.04.005.
2. National Research Council T. How people learn: brain, mind, experience, and school. How people learn: brain, mind, experience, and school. Washington DC: National Academic Press; 2000. p. 31–50.
3. Richardson D, Landreville JM, Trier J, Cheung WJ, Bhanji F, Hall AK, et al. Coaching in competence by design: a new model of coaching in the moment and coaching over time to support large scale implementation. Perspect Med Educ. 2024;13(1):33–43.
4. Frank JR, Karpinski J, Sherbino J, Snell LS, Atkinson A, Oswald A, et al. Competence By design: a transformational national model of time-variable competency-based postgraduate medical education. Perspect Med Educ. 2024;13(1):201–23.
5. Ajjawi R, Regehr G. When I say … feedback. Med Educ. 2019;53(7):652–4.
6. Van De Ridder JMM, Stokking KM, McGaghie WC, Ten Cate OTJ. What is feedback in clinical education? Med Educ. 2008;42(2):189–97.
7. Carroll L. Alice's adventures in Wonderland; and Through the looking-glass and what Alice found there. Oxford English Novels. 1971;1:277.
8. Hattie J, Timperley H. The power of feedback. Rev Educ Res. 2007;77(1):81–112.
9. Wiliam D. Assessment: the bridge between teaching and learning. Voices Middle. 2013;21(2):15–20.
10. Brookhart SM. How to give effective feedback to your students. 2nd ed. Education for primary care : an official publication of the Association of Course Organisers, National Association of GP Tutors, World Organisation of Family Doctors. ASCD. 2017. http://www.ncbi.nlm.nih.gov/pubmed/20836932.
11. Boud D, Molloy E. Rethinking models of feedback for learning: the challenge of design. Assess Eval High Educ. 2013;38(6):698–712.
12. Atkin JM, Black P, Coffey J, Assessment C, Education S, Behavioral D et al. Classroom Assessment and the National Science Education Standards Classroom Assessment and the National Science Education Standards. National Academies Press, Washington, DC. 2001.
13. Brand PLP, Jaarsma ADC, van der Vleuten CPM. Driving lesson or driving test?: A metaphor to help faculty separate feedback from assessment. Perspect Med Educ. 2021;10(1):50–6.
14. Schmidt CN, Abdullahi A, Kryzhanovskaya IV. Giving and receiving feedback: a student-informed curriculum. Med Educ. 2021;55(5):638.
15. Shorey S, Lau TC, Lau ST, Ang E. Entrustable professional activities in health care education: a scoping review. Med Educ. 2019;53(8):766–77.
16. Englander R, Frank JR, Carraccio C, Sherbino J, Ross S, Snell L. Toward a shared language for competency-based medical education. Med Teach. 2017;39(6):582–7.
17. Pack R, Lingard L, Watling C, Cristancho S. Beyond summative decision making: Illuminating the broader roles of competence committees. Med Educ. 2020;54(6):517–27.
18. Kogan JR, Hatala R, Hauer KE, Holmboe E. Guidelines: The do's, don'ts and don't knows of direct observation of clinical skills in medical education. Perspect Med Educ. 2017;6(5):286–305.
19. Dijkstra IS, Pols J, Remmelts P, Rietzschel EF, Cohen-Schotanus J, Brand PLP. How educational innovations and attention to competencies in postgraduate medical education relate to preparedness for practice: the key role of the learning environment. Perspect Med Educ. 2015;4(6):300–7.
20. Carraccio C, Englander R, Holmboe ES, Kogan JR. Driving care quality: aligning trainee assessment and supervision through practical application of entrustable professional activities, competencies, and milestones. Acad Med. 2016;91(2):199–203.
21. Kappy B, Herrmann LE, Schumacher DJ, Statile AM. Building a doctor, one skill at a time: Rethinking clinical training through a new skills-based feedback modality. Perspect Med Educ. 2021;10(5):304–11.
22. Duijn CCMA, Welink LS, Mandoki M, ten Cate OTJ, Kremer WDJ, Bok HGJ. Am I ready for it? Students' perceptions of meaningful feedback on entrustable professional activities. Perspect Med Educ. 2017;6(4):256–64.
23. Byrne D, Lydon S, Madden C, O'Dowd E, Boland J, O'Connor P. The development of entrustable professional activities for the Irish intern year. 2018.
24. Powell DE, Carraccio C. Toward competency-based medical education. N Engl J Med. 2018;378(1):3–5.
25. Mattick K, Gallen D. Judging competence, providing feedback and changing organisations. Med Educ. 2020;54(6):497–9.
26. van de Ridder JMM, Mcgaghie WC, Stokking KM, ten Cate OTJ. Variables that affect the process and outcome of feedback, relevant for medical training: a meta-review. Med Educ. 2015;49(7):658–73.
27. Harrison CJ, Könings KD, Dannefer EF, Schuwirth LWT, Wass V, van der Vleuten CPM. Factors influencing students' receptivity to formative feedback emerging from different assessment cultures. Perspect Med Educ. 2016;5(5):276–84.
28. Lefroy J, Watling C, Teunissen PW, Brand P. Guidelines: the do's, don'ts and don't knows of feedback for clinical education. Perspect Med Educ. 2015;4(6):284–99.

29. Ryan A, Judd T, Swanson D, Larsen DP, Elliott S, Tzanetos K, et al. Beyond right or wrong: more effective feedback for formative multiple-choice tests. Perspect Med Educ. 2020;9(5):307–13.
30. Ramaprasad A. On the definition of feedback. Behav Sci. 1983;28(January):4–13.
31. Molloy E, Ajjawi R, Bearman M, Noble C, Rudland J, Ryan A. Challenging feedback myths: values, learner involvement and promoting effects beyond the immediate task. Med Educ. 2020;54(1):33–9.
32. Shute VJ. Focus on formative feedback. Rev Educ Res. 2008;78(1):153–89.
33. Tokode OM, Dennick R. A qualitative study of foundation doctors 'experiences with mini-CEX in the UK. Int J Med Educ. 2013;4:83–92.
34. Molloy E, Boud D, Henderson M. Developing a learning-centred framework for feedback literacy. Assess Eval High Educ. 2020;45(4):527–40.
35. Sadler D. Formative assessment and the design of instructional systems. Instr Sci. 1989;18:119–44.
36. Goldin I, Narciss S, Foltz P, Bauer M. New directions in formative feedback in interactive learning environments. Int J Artif Intell Educ. 2017;27(3):385–92.
37. Wingate U. The impact of formative feedback on the development of academic writing. Assess Eval High Educ. 2010;35(5):519–33.
38. Bloom BS. The Two Sigma problem: the search for methods of group instruction as effective as one-to-one tutoring. Educ Res. 1984;13(6):4–16.
39. Brown GTL, Hirschfeld GHF. Students 'conceptions of assessment: links to outcomes. Assess Educ Princ Policy Pract ISSN. 2008;15(1):3–17.
40. Earl LM. Assessment as learning using classroom assessment to maximise student learning. 2nd ed. Cheltenham: Hawker Brownlow Education; 2014.
41. Gipps CV. Beyond testing: towards a theory of educational assessment. Abingdon: The Falmer Press Taylor & Francis e-library; 2003.
42. Norcini J, Anderson B, Bollela V, Burch V. Criteria for good assessment: consensus statement and recommendations from the Ottawa. Conference. 2010;2011:206–14.
43. Sadler DR. Formative assessment: revisiting the territory. Assess Educ. 1998;5(1):77–84.
44. American Educational Research Association. American psychological association, national council on measurement in education, joint committee on standards for educational & PT (US). The standards for educational and psychological testing. Washington, DC: American Educational Research Association; 2014.
45. Taras M, Molina I, Gallardo K, Morales-Piñero JC. Beliefs and understandings of assessment theories and terminologies by university lecturers. Lond Rev Educ. 2023. https://doi.org/10.14324/LRE.21.1.41.
46. Allal L. Assessment and the regulation of learning.
47. Bell B, Cowie B. The characteristics of formative assessment in science education. Sci Educ. 2001;85:536–53.
48. Black P, Wiliam D. Inside the Black box: raising standards through classroom assessment. Phi Delta Kappan. 1998;80(2):139–44.
49. Black P, Wiliam D. Developing the theory of formative assessment. Educ Assess Eval Account. 2009;21(1):5–31.
50. Black P, Wiliam D. Assessment and classroom learning. Assess Educ. 1998;5(1):54.
51. Darling-Hammond L, Herman J, Pellegrino J, Abedi J, Aber JL, Baker E, et al. Criteria for high quality assessment. Stafford Center Oppor Policy Educ. 2013;2:171–92.
52. Gikandi JW, Morrow D, Davis NE. Computers & education online formative assessment in higher education: a review of the literature. Comput Educ. 2011;57(4):2333–51. https://doi.org/10.1016/j.compedu.2011.06.004.
53. Lin JW, Lai YC. Harnessing collaborative annotations on online formative assessments. Educ Technol Soc. 2013;16(1):263–74.
54. Pikhart J. Towards formative assessment: feedback and grades. 2015;104–11.
55. Shepard LA. Linking formative assessment to scaffolding. Educ Leadership. 2005;2(November):66–70.
56. Singh T. Formative assessment: assessment for learning. In: Seven strategies of assessment for learning. 2012;1–14.
57. Slavin R, Heritage M. Formative Assessment: An Enabler of Learning. Proven Programs in Education: Classroom Management & Assessment. 2016;35–8.
58. Stull JC, Varnum SJ, Ducette J, Schiller J, Bernacki ML. The many faces of formative assessment. Int J Teach Learn Higher Educ. 2011;23(1):30–9.
59. Taras M. Back to basics: definitions and processes of assessments. Práxis Educativa Ponta Grossa. 2010;5(2):123–30.
60. Taras M. Summative assessment: the missing link for formative assessment. J Furth High Educ. 2009;33(1):57–69.
61. Wiliam D. Formative assessment and contingency in the regulation of learning processes. Philadelphia: The American Educational Research Association; 2014. p. 1–13.
62. Scriven M. 1967. The methodology of evaluation. Tyler RW, Gagné RM, Scriven M, Editors. Vol 1. Perspectives of curriculum evaluation. Chicago: Rand McNally. 39–83 p.
63. Taras M. Assessment—summative and formative—some theoretical reflections. Br J Educ Stud ISSN. 2005;53(4):466–78.
64. Popham WJ. Formative assessment—a process, Not a Test. Educ Week. 2011;30(21):35.
65. Ferguson PC, Caverzagie KJ, Nousiainen MT, Snell L. Changing the culture of medical training: an important step toward the implementation of competency-based medical education. Med Teach. 2017;39(6):599–602.
66. Stobart G. Testing times: the uses and abuses of assessment testing times: the uses and abuses of assessment. Abingdon: Routledge; 2008. p. 1–218.
67. Dawson P, Henderson M, Mahoney P, Phillips M, Ryan T, Boud D, et al. What makes for effective feedback: staff and student perspectives. Assess Eval High Educ. 2019;44(1):25–36.
68. Lee AS, Ross S. Continuity of supervision: does it mean what we think it means? Med Educ. 2021;55(4):448–54.
69. Paternotte E, Dijksterhuis M, Goverde A, Ezzat H, Scheele F. Comparison of OBGYN postgraduate curricula and assessment methods between Canada and the Netherlands: an auto-ethnographic study. Front Med (Lausanne). 2024. https://doi.org/10.3389/fmed.2024.1363222.

Publisher's Note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.