Narrative Review

Novel teaching–learning and assessment tools to complement competency-based medical education in postgraduate training

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ABSTRACT

Medical and educational techniques and approaches have evolved globally over the past few decades. The modern approach is more learner-centred, with a focus on the acquisition of skills. The recently implemented competency-based medical education (CBME) for the National Medical Commission (NMC) undergraduate course curriculum is also competency-based rather than an outcome-based traditional curriculum. It is vital to embrace innovative teaching–learning and educational strategies to achieve the aspiration of CBME. This article provides a list of some of the newer tools and their perceived advantages and challenges and serves as a guide for using these methods effectively to meet the objectives of CBME as proposed by the NMC. Virtual teaching, learning from digital resources, objective-structured practical and clinical examination, flipped classroom, case-based learning, serious gaming, simulation-based learning and learning from role-plays and portfolios emerged as novel instructional strategies.

Key words: Assessment, Competency-based medical education, curriculum, learning, medical education, teaching, training

INTRODUCTION

Competency-based medical education (CBME) addresses the shortcomings of the traditional medical curriculum, which is subject-centred, teacher-oriented, and time-bound. The thrust is on acquiring knowledge and skills rather than attaining the 'ability to apply the acquired knowledge and skills in appropriate clinical context'. CBME emphasises developing competencies, which is the ability to use knowledge, skills, and attitudes in the proper clinical context to fulfil society's health needs. It is also largely student-centred and considers learners accountable for their learning. Unlike conventional curriculum, the teaching in CBME is flexible and is not time-bound. The training continues till the time the desired competency is attained. To ensure this, the assessments are frequent and formative, where feedback is ingrained in the training process. The assessment is criterion-based, where the students are assessed by pre-defined, measurable standards rather than norm-referencing.[1]

The attainment of competencies is more realistic and relevant to the postgraduate (PG) curriculum as most clinicians practise in society independently without supervision after completion of their PG training. The National Medical Commission (NMC), in the competency-based draft on postgraduate medical education in 2021, has stressed mastering the competencies specific to the speciality required for practising at the secondary and tertiary levels of the health care delivery system.[2] It also has emphasised that a PG student should possess orientation towards research methodologies and have basic skills to teach

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other health-care professionals. While a dissertation may sufficiently impart an orientation to research methodologies, many efforts are required to impart sufficient speciality-related skills and skills related to teaching.

This narrative review aims to appraise the newer teaching-learning (TL) strategies and assessment methodologies that suit the learning needs as per CBME.

METHODS

A literature review was performed on PubMed and Google Scholar databases using keywords' innovative' OR 'novel educational methods' OR 'modern learning techniques' OR 'newer assessment tools' AND 'competency-based medical education'. The articles retrieved included both qualitative and quantitative research. The studies were scrutinised for their relevance and significance in terms of novel educational tools and strategies. The articles on undergraduate medical education, traditional teaching and assessment methods, and similar articles describing the same learning and assessment tools were considered redundant and discarded.

DISCUSSION

For clarity, let us classify the novel teaching–learning and assessment methods into the well-known Bloom's taxonomy of learning domains and contrast them with the more traditional tools [Table 1].

Novel techniques for teaching the cognitive domain

The cognitive domain deals with memory, comprehension, application, and problem-solving skills. For postgraduate students, traditionally, it is taught by didactic methods like large and small group teaching, bedside clinical teaching (teaching in relevant areas like wards, operation theatres, and critical care units), and other activities like seminars and journal clubs. This leaves the opportunity to communicate and exchange information and experience physically with a limited group of learners and teachers during working hours only. Online teaching can surpass this limitation as the classroom can be extended beyond working hours with broader participation and a flexible schedule.

Virtual teaching

The younger generation is tech-savvy and well-versed in exploring the information on the internet. This attribute of the new-age learners can be used to guide them effectively outside their working hours. This also may ensure the availability of all postgraduates and faculty simultaneously on the same platform, thus enriching the discussion. The online sessions should be planned with clear objectives to make them more efficient. The educational activities conducted out of necessity during the coronavirus 2019 pandemic demonstrated the strength of virtual teaching.[3] Many institutes are continuing such online educational activities after the pandemic. All forms of didactic educational activities can be performed on various digital platforms. Various modifications, like online quizzes and polling during the sessions, ensure student engagement and may enhance the overall educational impact.[4] The advantages of combining the traditional teaching approach with virtual teaching have already been recognised and are termed blended teaching.[5] The use of digital technology has also blurred the geographical boundaries. Renowned experts in the field across the globe can be involved in online educational sessions, and traditional seminars can be converted to webinars for enriched content, more comprehensive outreach, and fruitful discussions.

Domain of learning	Educational tools		Assessment tools	
	Traditional	Novel	Traditional	Novel
Cognitive	Lectures, bedside teaching,	Virtual teaching, blended teaching, flipped classrooms, MOOCs, case-based learning, and serious gaming.	Written examinations, case presentations, viva-voce examination	Patient management problems, script concordance test,
				Structured viva-voce examination, structured case presentations
	Seminars	Webinars, online resources	Logbook	Portfolio
Psychomotor	Observation and imitation	Simulation	No objective assessment tool.	OSCE/OSPE, Mini Clinical Evaluation Exercise (Mini-CEX), Direct Observation of procedural skills (DOPS), simulation-based assessment
Affective	Observation alone (teaching by chance/ hidden curriculum)	Role-play, learning portfolio	No objective assessment tool	Professionalism Mini Evaluation Exercise (P-MEX), Multi-source feedback, Mini peer assessment tool (Mini-PAT)

Table 1: Novel educational and assessment tools for various domains of learning

MOOC=Massive open online courses, OSCE/OSPE=Objective Structured Clinical Examination / Objective Structured Practical Examination

Massive open online courses

Massive open online courses (MOOCs) are courses offered digitally by various educational organisations. As the name suggests, the classes are massive in number of participants and are 'open' to all as they can be accessed free of cost online. Such courses are usually modules with specific learning objectives, relevant content, and self-assessment tools. Although they cannot replace conventional teaching, they may serve as an effective tool for self-learning and assessment. They are being used for continuing medical education (CME), development of soft skills and research-related skills, and faculty development.[6] MOOC platforms can also be used to share experiences and ideas among learners and thus help in collaborative learning. The Study Webs of Active-Learning for Young Aspiring Minds (SWAYAM) and National Program on Technology Enhanced Learning (NPTEL) are portals that offer free online courses on various topics for medical students and faculty.

Learning from digital content

Several digital contents are available that can be used to enhance learning. Some examples are the content on YouTube, Slide Share, Medscape, and UpToDate. Numerous other apps provide problem-based learning and case-based scenarios to promote higher-order thinking. Selecting a credible resource may be challenging and should be guided by a subject expert. A list of good quality and reliable digital teaching tools or links may be supplemented after a learning session. This will ensure learning from reliable sources and promote active learning amongst the faculty and students. With the advent of user-friendly software and the wide availability of content creation and editing, faculty can create educational content to enhance the teaching–learning experience. This will also keep them abreast of technological advances.

Modern flipped classroom

The flipped classroom is a tool for active learning. In a traditional flipped classroom, content for pre-reading (usually in print form) is provided to the students and the classroom is utilised for discussion only, bypassing the didactic teaching. The teacher in a flipped classroom thus acts as a moderator and guides the discussion. The benefit of blended learning may be extended to modern-day flipped classrooms. A link to various pre-reviewed multimedia digital contents (articles, videos, animation, podcasts, modules) may be provided for self-learning, followed by deliberations in subsequent face-to-face teaching.

Using diverse learning tools enhances the learning experience compared to the traditional flipped classroom. This methodology does not require additional tools or resources and is feasible for postgraduate training. Various authors have asserted better student engagement, improved teacher–student interaction, and improved learning experience.[7-9]

Case-based learning

Case-based learning (CBL) is an effective active learning strategy that helps to relate theory with practice. It is a form of small group teaching where a group of students are assigned a case vignette or medical record of a patient. The group worked on the assigned focused task and discussed it with the moderator. The moderator is an experienced subject expert who guides the students on the assigned task. Although this learning strategy sounds similar to problem-based learning (PBL), it is much more distinct. PBL is primarily aimed at novice learners who focus on acquiring knowledge on a particular matter. CBL is for advanced learners (those with background information and understanding of the subject) and focuses on problem-solving rather than mere knowledge acquisition.

Conducting CBL online to harness the advantages of blended learning is possible.[10] In addition to fulfilling one of the conditions of the newly implemented competency-based postgraduate curriculum of self-directed and assisted learning, CBL can also be used as an effective tool for early clinical exposure in the undergraduate curriculum.

Serious gaming

The present generation is exposed to various digital games for enjoyment and fun. Specifically, designed computer games can be used as an effective tool to make learning more effective. Digital health games have been reported to increase engagement and make the learning environment more interactive.[11,12] They also offer to improve problem-solving and other higher-order cognitive skills, which are translatable to the real world. Their repetitive nature is ideal for learning. Such games can also provide immediate feedback, which highly benefits the learner. Apart from enjoyment while learning, using games for teaching and training reinforces the importance of time in critical decision-making in emergency scenarios, thus filling the gap in traditional teaching and training. Such tools can be developed in collaboration with Information Technology professionals. Once developed, they can be available in the simulation laboratories for training and assessment.

Novel techniques for teaching the psychomotor domain

Simulation-based learning

The heart and soul of the CBME curriculum is the development of competencies. Although the importance of competencies in cognitive and affective domains cannot be undermined, psychomotor or procedural skills are most pertinent for postgraduate students.

The increasing role of simulation in teaching and training medical graduates and postgraduates has been appreciated and is being used in a non-uniform way across the country.[13] A variety of simulators can be used to impart basic and advanced skills. Although a high-fidelity simulator may mimic a real-patient encounter, the initial procurement and upkeeping cost of such simulators may be prohibitive. It is well-known that a relatively low-fidelity simulator can also impart high-fidelity simulation by appropriately building realism in the scenario.[14] Various simulators, from simple to more complex that can be used to impart postgraduate training include:

- Abstract partial task trainers: These are the simplest of all simulators. An example is a board for teaching suturing or knot-tying skills. These are inexpensive and can even be issued to the learners for repetitive practice of a simple task at their own pace and convenience.
- Physical anatomic trainers are replicas of a part or whole of the human body to train a particular skill like endotracheal intubation, peripheral and central venous line insertion, nasogastric tube insertion, or urethral catheterisation.
- Human simulators: These may be partially or fully computerised and impart training on more complex procedural skills. They may also be used to train non-technical skills like communication, teamwork, and decision-making.[15] They may impart a more immersive experience and learner engagement; however, they are expensive and require regular updating and maintenance.
- Animal tissue models: Models made from animal tissues can also serve as effective simulators for more realistic experience on specific procedural skills. These have been used extensively in teaching various psychomotor skills and are cheaper than high-fidelity simulators.[16,17] A facility for procuring, retaining, and discarding animal organs and a trained workforce to handle them is an essential prerequisite.
- Cadavers: Training on human cadavers has been used and appreciated as one of the most realistic ones, as the anatomy is similar to that in living patients. They can be used effectively in in-house workshops on various subject-related procedures in postgraduate training. Advancements in embalming procedures have further improved the realism of cadaver-based training.[18,19]
- Simulation using virtual reality (VR) and augmented reality (AR): Several simulators using VR and AR are commercially available, providing a more immersive experience in training technical and non-technical skills. The cost of acquiring and maintaining such equipment is high and may indeed be prohibitive. Still, with technological advancement and growing market competition, they may become more affordable.[20]

Novel techniques for teaching the affective domain

A professional must possess humanistic qualities like effective communication skills, empathy, punctuality, altruism, and compassion. Unfortunately, a structured and planned approach has never been used to teach these essential attributes. Traditionally, they are considered part of a 'hidden curriculum' where students learn these traits from their mentors. It is aptly said that the characteristics in the affective domain are instead 'caught than taught'. For the first time, an effort has been made by NMC to provide a framework for elaborating, teaching, and assessing these humanistic qualities by giving the AETCOM (Attitude, Ethics, and Communication) module. Despite this effort, teaching and assessing the affective domain remains a challenge.[21] The following tools can be used to impart professionalism:

Roleplays: Roleplays can effectively observe, analyse, and reflect on various activities intended to educate on humanistic qualities. This tool has been used effectively to educate on effective communication, empathy, and team building.[22,23] Short films focusing on a specific objective for more sustainable use can be recorded. It makes the learning more engaging and relevant. The faculty needs to be trained in role-playing and in providing effective debriefing.

Portfolios: Learning portfolios allow pupils to reflect on a learning experience. A portfolio is a collection of papers or electronic material to document learning. It has also been called a 'learning journal' or 'learning

diary'.[24,25] This sounds similar to logbooks, as a logbook is a record that reflects learning. Portfolios, however, are different and must not be confused with a logbook. While a trainee records the learning experiences in a logbook, the portfolio also includes 'critical reflection' on such learning experiences in the learner's own words. This self-reflection component is the soul of a portfolio and differentiates it from a logbook. Reflection refers to thinking and writing on one's experience and inspecting it rather than just experiencing it. This exercise imparts deeper learning, which is impossible by merely recording the learning experience in a logbook. The reflections can be unstructured or structured. Instructions on how to record reflections may be provided to the students. Various models and frameworks are available for recording reflections, such as Gibbs's model of reflection and Kolb's reflective cycle.[26,27] Portfolios can be used effectively to teach and assess various attributes of professionalism.[28,29]

Portfolios can be seamlessly integrated into the existing postgraduate training programmes. As logbooks are used widely, a column on reflections can be added to the current framework of the logbook. The students can record reflections on their learning experiences in this modified portfolio draft.

Novel assessment tools

Implementing and using novel teaching methods also entails using innovative assessment tools to measure the learner's performance. A whole toolbox is available for evaluating the competencies in major learning domains [Table 1].[30] It is essential to pick the right tool to make valid judgments regarding the student's performance. This again reinforces the need for faculty training and development.

Challenges in implementing novel T-L and assessment methods and the way ahead

The biggest challenges to implementing the T-L and assessment methods mentioned above are a lack of awareness and resistance to change.[31] Despite being cognizant of the changing learning needs over time, teachers and faculty are equally content with the traditional techniques of teaching–learning and assessment.

Logistic factors also hamper the implementation of these newer methods. The number of students in sub-specialities is increasing with a disproportionate increase in resources. The faculty are also burdened with multiple administrative and clinical obligations apart from teaching responsibilities.[31,32] The policymakers and administrators must address these issues to implement CBME better.

ROLE OF FACULTY DEVELOPMENT

The role of faculty development in adopting and effectively utilising novel tools for learning and assessment cannot be overemphasised.[33,34] The science of medical education is evolving rapidly, and medical teachers need to be apprised of its advancements. Faculty development and training of trainer programmes should be conducted regularly as modern-day medical educators need to develop new competencies and methodologies that they never experienced or were taught during their training. NMC conducts Basic and Advanced courses in medical education for faculty development in various nodal and regional centres. The onus also lies on teachers for self-development, and they can get enrolled in multiple programmes for advancement in medical education like the Foundation for Advancement of International Medical Education and Research (FAIMER) or Masters in Health Professions education.

CONCLUSION

Several novel TL and assessment tools are available, which have the potential to make medical education more effective and aligned with the objectives of CBME. There is a need to embrace these newer tools. Faculty awareness, willingness to change and adopt more unique methodologies, regular faculty development programmes, and administrative support are crucial for implementing these novel educational methods.

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