REVIEW ARTICLE

STRATEGIES TO IMPROVE LEARNING OUTCOMES AND COMPETENCIES IN UNDERGRADUATE MEDICAL EDUCATION

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Outcome-based education (OBE) is a performance-based approach that identifies educational outcomes, after which curriculum content, teaching methods, assessment processes, and educational environment are defined. The model is based on specific, measurable, achievable, relevant, and time bound learning outcomes stated by Bloom's taxonomy to inform learners and teachers about the content of learning. Based on these outcomes, the desired learning content is delineated, embodied, and integrated into the curriculum with a focus on coherence and logical understanding. The pedagogical approaches are modern teaching aids, including simulators and e-learning are incorporated to promote cognitive and psychomotor skills. Engaging students through standardized patients, virtual, and real cases, coupled with role-playing, serves as a vital affective component within the framework of OBE enhancing emotional and attitudinal preservation in learners. Knowledge retention is employed by spaced strategies, mnemonics, and e-learning. Self-directed learning, peer-teaching are used to promote understanding and improve retention. Psychomotor skills are elicited through motor learning phases. Diverse assessments, including quizzes and work-based evaluations, are aligned with learning outcomes to ensure a comprehensive evaluation of students' understanding and application of acquired knowledge and skills. Early clinical skill development and digital literacy prepare students for evolving healthcare challenges. Therefore, by integrating these strategies in medical education enhances the overall learning experience, equipping students for the complexities of the medical profession in a dynamic healthcare landscape.

Keywords: Competence, Educational outcomes, Learners, Learning environment, Medical education, Outcome-based education

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INTRODUCTION

Outcome-based education (OBE) is a performance-based approach that specifies educational outcomes, after which curriculum content, teaching method, assessment process, and educational environment is defined.[1] This approach has gained prominence in contemporary pedagogy as a departure from traditional methods, emphasizing the end goals of education rather than solely focusing on the means of instruction.

During the last three decades, medical education has strongly emphasized on OBE and learning-centred education (LCE) in order to prepare young doctors to practice in an increasingly complex healthcare conditions with changing patient and public expectations.[2] Outcome based education offers many advantages as it encourages the teachers and the students to share responsibility for learning and emphasizes relevance in curriculum and accountability. Learning-centred education provides a curriculum that includes multiple methodologies to promote interactive, student-centred education and lifelong learning skills.[3]

Learning outcomes (LO) typically state what knowledge should be known at the time of graduation. It includes integration of knowledge, reasoning, critical thinking, abilities and mindful reflection learned in a course more quantitatively; whereas competency is the ability to perform a professional task to a specified standard and is more qualitative. It integrates the relevant cognitive, psychomotor and affective skills required to progress from a novice to an expert as indicated by Miller's pyramid.[4]

Since the information learned by medical students is easily forgotten, it is important to design methodologies that enable longer periods of retention by application of educational strategies, instructional design and cognitive learning science to the field of medical education.[5,6] An ideal curriculum bridges the gap in learning from inception to outcome without being too heavy, with too much depth and information overload.[7] The present integrated PBL-based curriculum in vogue in most of the medical colleges of world proceeds by working backwards from outcome to the other elements such as content, teaching learning strategies etc (Figure-1).[8]

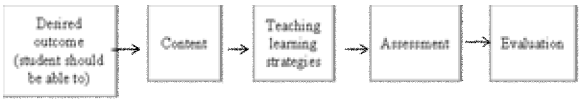

Figure-1: Components of a backward design curriculum framework

In Pakistan, the instructors lack the ability to revise their instructions, devise new learning

experiences or apply active instructional methods to achieve learning goals.[9] In view of this deficiency, strategies are being presented for improving learning outcomes involving the learner, the learning task/ environment and the context of learning being practiced. It is expected to raise awareness among teachers, better training of medical students and upgrade the system of medical education in public and private sector universities.

In a few educational institutions, many instructors lack the capacity to revise instruction, design active learning experiences, or adopt innovative teaching methods. To address this, strategies focusing on learners, learning environments, and contextual relevance are proposed to enhance outcomes and modernize medical education in both public and private sectors. These include setting clear SMART learning outcomes, mapping and reframing curriculum, sequencing the topics, using interactive lectures, simulations, e-learning tools, and promoting early clinical exposure, peer teaching, and feedback. Together, these measures aim to enhance better student engagement, retention, and clinical competence outlined in Figure-2 and discussed below.

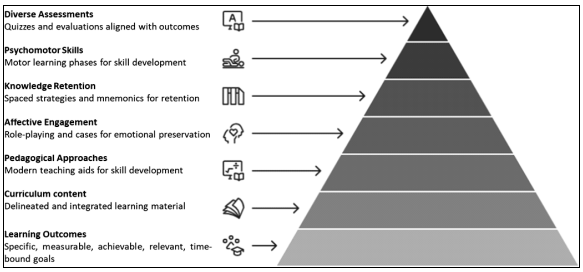

Figure-2: Framework of outcome based education

METHODOLOGY

A comprehensive literature review was conducted on Google Scholar, PubMed, Scopus, and Web of Science, Education Resources Information Center and official website of Association of Medical Education in Europe for best practice guidelines using the keywords: Outcome-based education, undergraduate medical education, educational outcomes, learning environment, and learners. Snowball searching techniques was applied from the references harvested using the keywords like, simulation in medical education, self-directed learning, mentorship and problem based learning and clinical exposure. Only English-language articles addressing undergraduate medical education and the strategies to achieve defined learning outcomes or develop specific competencies were recruited. Research articles (original studies, reviews), conceptual papers, opinion pieces, and authoritative guidelines from relevant organizations were used to propose the suggestions. While not strictly limited, preference was given more to recent literature to reflect current trends, alongside seminal works and potentially with some attention to the context of local literature available. Articles not in English, studies focusing solely on postgraduate medical education or allied health sciences, clinical research without an educational component and low-impact studies on well-established concepts, unless they offered a unique perspective were excluded for this review paper. For each selected article, the strategy, key outcomes and its practical implementation with limitation were briefly discussed in this paper. A detailed flowchart using PRISMA diagram showing the number of articles search and refined is given in Figure-3.

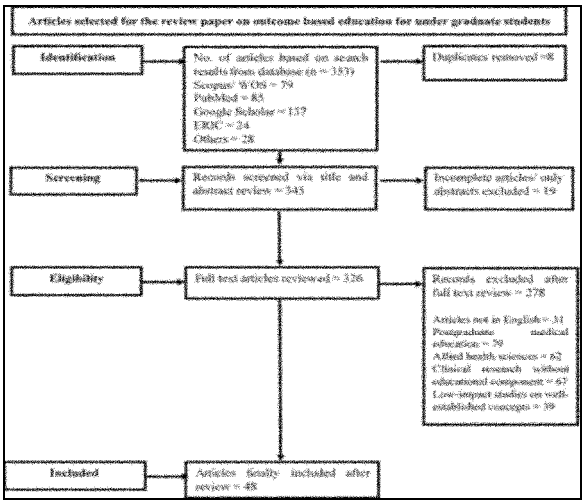

Figure-3: Prisma flowchart showing how the articles for the review paper on outcome-based education for under graduate students

1: Setting clear learning outcomes

Outcome based education places paramount importance on clearly defined and measurable learning outcomes. These outcomes articulate what students should know, understand, and be able to do by the end of a particular educational program. These outcomes serve as foundation upon which the entire educational process is built.[10]

Setting LOs is a central activity for both basic and clinical teachers. The concept of predetermined intended outcomes reinforces all teaching, learning and assessment activities like lectures, tutorials, demonstrations and case-based learning etc.[11]

Learning outcomes should be written either following the three domains of Bloom's taxonomy or ABCD model (audience, behaviour, conditions, degree of mastery needed) and should be SMART, i.e., specific, measurable, achievable, relevant, and time bound. They inform learners what they should achieve and inform teachers about what they should help learners to achieve. Before writing the objectives, it is important to determine the level of learner and the most effective learning approach to attain it.[10]

2: Design Curriculum and Plan a comprehensive, interactive lecture to enhance learning

Curriculum development in OBE is an iterative process that starts with the identification of desired outcomes. The curriculum is then structured to align with these outcomes, ensuring that every aspect, from content selection to instructional strategies, contributes to the achievement of the predefined goals.[1,2]

Faculty should be trained in proper formatting and designing of power point presentations with emphasis on important points. Mechanisms and processes should be explained by animations and videos. Start the lecture by stimulating recall of prior learning and knowledge, stop in the middle of lecture and ask questions and again at the end of lecture summarize and clarify with an enhanced level of understanding of the teaching-learning relationship, Students should be motivated to take notes during lectures. Teacher should know if the students have learned by asking questions and taking feedback, enhancing level of understanding of the teaching-learning relationship.[12]

Information theory suggests that students must know certain prerequisite information and that new information should be presented in a way that facilitate encoding and fills the gap between knowledge and outcome. In addition to lectures, interactive methods of learning include brief writing exercises, Think-pair-share, flipped class room, gamification, small group discussion, and debates etc.[12] Cognitive functions can be enhanced by use of pre- and post-test assessments before, during or after the sessions, incorporation of pop-up quizzes, mnemonics, trigger questions and spaced repetition.[12]

3: Sequencing of topics within and between subjects

OBE emphasizes integration between subjects and in the curriculum. Boundaries between subjects are barrier to understanding; thus, students are unable to derive a coherent understanding from a list of disjointed courses.[1,2]

The theory of 'Constructivism' explains that knowledge is actively constructed by the learner and not passively received from an outside source. Moreover, brain has limited capacity for cognitive load and working memory should not be overloaded. This can be achieved by determining a theme for every week and proper sequencing of topics of different subjects. All the tutors involved in teaching should discuss the content of their lectures and identify the fundamental link that is missing in sequence between the same and different disciplines. They should filter out the irrelevant material so that important points are learned only.[13]

Teachers of different disciplines should coordinate their efforts for developing strategies useful for building educational blocks step by step, logically organizing chunks of information, with increasing difficulty, complexity, clinical application, exposure and readiness for practice. These constructive pedagogical approaches bridge the gap in learning from inception to outcome.[14]

4: Use modern teaching aids, and e-learning resources

Cognitive learning can be improved by modern teaching aids such as simulators, skills lab, audiovisual material in smart labs, while psychomotor skills and learning can be enhanced by demonstrations and practice on models, mannequins and simulators. Practice on simulators provide effective learning especially in clinical years if it is associated with proper feedback, repetitive practice with clinical variations, increasing level of difficulty and integration of overall curriculum. A study documented that simulation program in skill labs enhanced the experience of students in clinical settings and helped them to develop critical thinking, decision making and clinical competency.[15]

E-learning is the use of new electronic technologies and internet to facilitate learning and is certainly one of the most important developments in the delivery of medical education. It includes offline (CDs, DVDs) and online resources, video links on bulletin boards, discussion forums, instant chats, online tutoring, mentoring and assessment and online delivery of course content, lectures, quizzes etc.[16] Visualization of a process or mechanism by 3-D smart lab enhances semantic learning. Students prefer to learn by watching animations to have clear concepts. Availability of medical dictionary in tablets or mobile phones of learners for quick referral during discussion is also very useful.[15]

E-learning help improves retention qualities and reinforcement of knowledge as it can be repeated on demand. Well-designed e-learning content has high level of interactivity and cognitive engagements, increased recall and application.[17] Learners using computer-based instructions generally learn in less time with the help of images, videos and flow charts etc. Video links with presentation and explanation of a procedure with in a clinical case seem to help students learn in context to understand its clinical importance.[18] However, transition to e-learning models for course delivery requires an effective change in strategy with establishment of an appropriate learning culture.[19]

5: Arrange standardized, virtual and real patients and organize role play

History taking and examinations of real or standardized patients should be routinely practiced during small group discussions as it promotes long term retention of knowledge. Standardized patients help in understanding the clinical presentations of various diseases while virtual patients with addition of a video clip on multimedia to illustrate patient's findings or procedures

performed is a unique way of learning.[20] Bed-side teaching with history and examination of real patients in clinical settings motivates learners and enhances learning by its relevance and through active participation. It is the only setting where clinical reasoning, decision making, empathy and professionalism can be taught.[21]

Affective and attitude retention can be influenced by history taking, reflective writing and role play. Role modelling where learner takes the role of healthcare professional and interactively diagnoses and treats the patient is also very important because if a teacher respects a patient, the student also learn to respect him. Professional thinking, behaviour and attitudes are 'modelled' by teachers.[21]

6: Enhance retention and transfer of knowledge: Spaced retention

The term 'Spaced retention' describes educational interventions that are built in order to make use of spacing effect to enhance retention.[5] A meta-analysis confirmed that educational interventions that are distributed and repeated over time results in more efficient learning and retention; recall of previous information and linking it to new concept during lectures is highly advantageous.[5]

The interventions include spaced education games, delivery of content by e-mail, blended approaches composed of face-to-face sessions and spaced contacts with online materials.[22] Long term retention can also be achieved by developing mnemonics for a list of causes, microorganisms, differential diagnosis because during encoding of mnemonics, information is transferred from working memory to long term memory with an organized mental representation. Students should be taught to make concept or mind maps in which one schema represents a concept and two schema containing concepts are linked together.[23]

7: Elicit performance for psychomotor skills

Three phases of motor learning skills have been identified; the early cognitive phase in which learner attempts to understand the executive routine; an intermediate phase during which learner practice sub-skill alternately with practice of total skill and final autonomous phase in which skill performance becomes automatic.[24]

During practical, tutorial, or demonstration sessions, learners should actively perform clinical skills like examination of pulse, elicitation of reflex, measurement of blood pressure so that corrections in the performance are carried out at the spot.

8: Utilize self-directed learning (SDL) and peer-teaching effectively

Self-Directed Learning can be very effectively utilized for enhancing retention of knowledge. For that learners should be motivated to develop self-directed traits, which include ability to be disciplined, logical, analytical, collaborative and independent. The students should plan their own learning by developing and applying strategies and appropriately using learning resources.[23] Students learn best not only by receiving knowledge but also by interpreting it. They learn by discovering the queries themselves and this involvement in learning leads to experiential learning which is retained for longer periods. Learners should be given opportunity and support to use self-direction as they become active contributors to the educational process.

Thus, involving students in teaching sessions would definitely lead to long term retention of knowledge. It has been documented that when students assume the role of peer educator for small group sessions, they require a deep learning, improvement in knowledge acquisition as they become aware of their knowledge deficits.[25] By interacting with their peers in class rooms, they can accurately assess their own knowledge and retention as well as gain insight into which concept they need to study further.[26]

9: Assess learning by a suitable format of questions

Assessment in OBE is closely linked to the identified learning outcomes. Assessment methods are designed to evaluate not only the students' knowledge but also their ability to apply that knowledge in real-world scenarios.[27]

Assessment drives students' learning and facilitates continuous rather than episodic learning with better memory retention. A study suggested that after an initial contact with the learning material, it is more beneficial to test rather than re-study the material.[28] Traditionally, assessment has focused on testing acquisition of knowledge or the demonstration of certain competencies in controlled settings.[29] With OBE comes a shift to work-based assessment, that take into account the impact of students' competence on the quality of care provided to the patient.[30] The meaningful impact of competency-based assessment can only be accomplished by the use of right assessment at the right time for the right purpose, using multiple assessors, involving active participation of learners.[31]

Assessment measures learning outcomes, provide direction and motivation for further learning, and promote and reward successful students. However, choosing the most appropriate type of written exam for a certain purpose is often difficult. Various methods can be used at different occasions including quizzes, multiple choice questions with one correct option, multiple true and false, short answer open ended questions, short essays and extended matching questions.[32] Many online examination tools are available for quick assessment of students along with spontaneous checking and analysis of answers. Medical students are expected to develop a broad range of skills and educators must use diverse and frequent

assessments to accurately evaluate their ability to function as clinicians.[33]

10: Provide a constant and informative feedback to learners

Feedback (FB) is a process in which part or whole of the learner's performance is provided to the learner in order to enhance and facilitate the future performance. Feedback helps learners to evaluate their own knowledge, identify their strengths and weaknesses, to understand the expectations of teachers and to plan to improve performance. It also improves clinical performance by reinforcing positive behaviour and correcting undesirable behavior.[34]

The FB also benefits teachers by allowing them to recognize a student's progress, modify teaching methods, encourage their interactions with students, and build a productive working and learning relationship. Quantitative FB is provided in the form of grades gained after any exam. It is advisable to discuss the results of test papers with students so that they learn by their mistakes and have notion about effectiveness of their strategic efforts for better understanding.[34]

A study reported three formats of FB given to students on their performance after formative and summative Objective Structured Clinical Examination (OSCE). The FB includes: Domain FB based on knowledge (quantitative); Hot FB written by examiner about indicator of performance and Cohort FB for the whole year focusing on performance trends across all students (qualitative).[35] Another study demonstrated that providing additional FB using qualitative analysis is beneficial for both students and educators as students receive adequate tool to improve on their skills through self-reflection.[36]

11: Develop effective problem based and case-based skills

Problem Based Learning (PBL) and Case Based Learning (CBL) should be constructed in such a way that provides the learners with tangible goals of applying their knowledge to solve a concrete problem. During the session's students should be allowed to discuss all the aspects of a case, activating their prior learning, generating hypothesis with simultaneous construction of their knowledge. They should be motivated to gather information from a wide range of sources.[37]

The PBLs and CBLs are focused on experiential learning organized around the presenting complaints, investigations, explanations and resolution of meaningful problems. Students reflection on the case helps them to correlate their new knowledge to their prior understanding and to identify gaps in their awareness and to develop a more coherent understanding.[38] Since PBL and CBL sessions are marked by numbers so students are motivated to gather every bit of information related to the problem and become more confident in their presentation. Psychological research theory suggests that when students learn through the experience of solving problems they can learn both content and thinking strategies. Unfortunately, due to lack of resources and dearth of faculty these sessions are not conducted properly in most of the medical colleges.[39]

12: Arrange (offer) mentoring

During the past decade, mentoring programs have become an integral part of medical education where the role of mentor is to provide motivation, psychological support, professional and personal development. Mentoring creates a relationship between an experienced, highly regarded, neutral empathic person (the mentor) and another individual (the mentee) who receives individual personal and professional guidance with continuity throughout the educational program.[40]

As a novice in medical school, the students have no idea about competencies they have to acquire as a medical graduate. Mentoring as well as early clinical exposure allows them to imagine their future life as a physician and give meaning to theoretical studies. The students understanding of professional competence and behaviour evolves during the mentorship and they progress towards understanding the wholeness of the profession.[36] Mentoring provides longitudinal guidance in context of tips for learning, adjustments in college environment, handling different situations, understanding the demands of profession and to find a balance between life and profession. A successful mentoring program not only enhances learning abilities but also an early and directed focus on the non-medical aspects of the professional role.[41]

13: Impart clinical skills in pre-clinical years

The term 'clinical skills' encompasses history taking, physical examination, using diagnostic reasoning, effective communication, and teamwork.[42] Early introduction of these skills using automated manikins, simulators, role play, 3D animation and various artificial intelligence (AI) tools would facilitate the integration of clinical and basic science knowledge and in the development of clinical competence.[43] Previously, medical education was primarily based on rotations in different wards during the clinical years to train clinical skills, while the preclinical period was mainly used to teach the basic sciences. Because of the limited clinical exposure in clinical years, students face difficulties in handling a simple case of diarrhoea when they are posted in emergency or clinics during their house job. As a result, their confidence and decision-making skills as a consultant shatter.[44]

The literature also supports that students feel more prepared when clinical skills are introduced early in their curriculum.[45] It increases their confidence, improves performance, makes them 'feel' like doctors,

and also helps them to best prepare for their clerkship phase. Thus, there is a need of advanced technologies to bridge the gap between traditional teaching based on lectures, and laboratory session in pre-clinical years and bed side consultation during clinical years.[46]

14: Familiarize students with digitalization of medical education

One of the main domains of OBE is to master the medical students with current trends in technology to enable them to meet the ever-evolving challenges of medical field when they professionally start their career.[47] Despite rapid evolution in medical education in last few years, little time is spent on familiarizing medical students with new technologies in clinical training such as AI, mobile healthcare applications and telemedicine.[48]

Artificial intelligence is a scientific discipline that is gaining alarming momentum in healthcare and focuses on understanding and creating computer algorithms which can perform tasks that are usually characteristics of humans. It is currently being used in health care for quick and precise diagnosis, reducing human errors, minimizing medical cost and assisting in radiology and minimal invasive surgeries.[49] However, as AI and its applications become mainstream in healthcare, medical students, need to have knowledge of AI, data sciences, ethical and legal issues concerning AI to become a competent doctor of the future. Thus, it is suggested that medical schools need to include them as part of the curriculum; otherwise, the integration of AI into routine clinical practice is going to be a challenge if it remains untouched by medical educationists.

CONCLUSION

Outcome-Based Education represents a paradigm shift in the field of education, emphasizing the importance of clearly defined outcomes, student-centred approaches, and continuous improvement. While facing challenges, the benefits and potential for positive transformation make OBE a compelling framework for educators and institutions seeking to prepare students for success in the 21st century. As the educational landscape continues to evolve, OBE stands as a dynamic and adaptable approach that holds promise for the future of learning. Healthcare faculty should adopt active learning strategies and novel teaching techniques to improve educational outcome. Faculty training programs should be continued to enable clinicians to think innovatively and create technology enabled training of medical students. This proactive approach will contribute significantly to comply with international academic equivalency and accreditation standards.

AI Disclaimer:

Napkin AI was used for some guidance and language formatting.

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RR: Designed and supervised the article
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