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NARRATIVE REVIEW

Internal Medicine

Error-based learning. Basic educational strategy for physician training: A narrative review.

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Abstract

Introduction: Error-based learning (EBL) is a teaching strategy that uses errors as a learning platform.

Objective of the review: This article is a narrative review with the primary aim of raising awareness and promoting the application of error-based learning (EBL) in medical education.

Essential points of the review:
Greater engagement: The ABE encourages a stake that is further active and critical of students, making them further responsible for their learning.
Learning deeper: By analyzing and correcting errors, the students acquire knowledge that is further solid and durable.
Competence development: This strategy helps students develop critical competencies such as thinking, problem-solving, and self-evaluation.

Conclusion: This teaching strategy allows students to have active and cooperative learning focused on them. In this experience, students will perceive satisfaction and support in the errors presented by the teacher with the application of the method in their teaching, as well as in the diagnostic procedures and treatment for the errors raised, allowing each student to individualize their learning in the areas of knowledge, which is of interest.

Keywords:

Medical training, Learning, Medicine, Skills, Diagnostic errors, Error.

Abbreviations

ABE: Error-based learning.
ACRA: Acquisition-encoding-retrieval-support.
EDA: Learning strategies.

Supplementary information

No supplementary materials are declared.

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Author contributions

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Introduction

Error-based learning (EBL) is a teaching strategy that uses errors as a learning platform. The term "learn" is a means of acquiring knowledge through experience and study, and it is also related to the ability to remember. Learning has an innate content of one's own and inherited capabilities conditioned by what is learned in individual and collective experiences. The neuronal system participates in this process with specialized areas of the central nervous system, such as the limbic system, which analyzes the signals that come from the body that will later elicit responses conditioned by different factors of social aspects, security, and socioeconomic existence, guaranteeing reactions between the individual and the social environment to which they belong [1]. Rewards or punishments for collaboration, camaraderie, solidarity, guarantees, etc, integrate this learning.

The teaching system applies some learning styles to different subjects directed by the master class supported by virtual resources and individual work [2]. Currently, many strategies are used to improve student-teacher interaction in medical careers, which implies a change in the traditional educational paradigm of using novel teaching methodologies. ABE is a methodology where the teacher includes errors to motivate students to find them and solve their problems [3]. It increases self-appreciation or the feeling of achievement by identifying shortcomings and collaborative communication between multiple individuals, acquiring knowledge and promoting group work, and improving performance, dedication, and camaraderie.

The strategy of this learning motivates learning based on gamification [4]. The experience applied at the Complutense University of Madrid allowed many students to achieve the highest evaluation score. Likewise, it was developed from the meta-cognitive and constructivist field in the written communication of high school students [5]. The detection of errors introduced by the teacher helps the student retain knowledge in the learning process [6]. An explicit correction of the error is optional for the correct response; what is proposed are the beneficial effects of the error that lie in the implicit cognitive processes [7]. Although errors are the first source of learning, many institutions are likely to lose potential because of student complaints about teachers' understanding of organizational deficiencies [8]. This process is essential for improving self-efficacy and student motivation; the technique is observed in errors driven by students [9]. This review aims to present the application of error-based learning in medical education.

Learning strategies

Some research techniques for learning [10], such as the discussion team, motivation of memory, and direct information from the participants, which consensus by the members classify, develop relevant questions in the teacher's practice; members' evaluation (participants' self-evaluations) at the end of each session, the topics are discussed at the beginning of the next meeting; and in a metacognitive intervention, participants express weaknesses and skills, as well as recommendations to improve the curriculum program on the progress, process, direct materials and effects of the metacognitive intervention.

The observation shows methodological examples of improvement in the teaching of students in higher medical training, which allows the development of educational tools for the evaluation of learning and the pedagogical work of teaching, leading to the development of knowledge of scientific skills in the student and the professional.

Different authors define learning skills from the perspective of understanding, such as "behavior," "thoughts," "abilities," "awareness," and "capabilities," among others. Cognitive automation is responsible for student learning, which corresponds to metacognition [11]; for this reason, strategies must fulfill essential functions when evaluating students. In other words, learning strategies lead to learning.

There are tools for immediate application that provide learning skills that students can use, allowing them to reflect on their work [12, 13].

The ACRA questions comprise four cognitive and meta-cognitive tools: acquisition-encoding-retrieval-support [14], scope of double responses, determination of the cognitive and meta-cognitive EDA, and specific determination of the steps that act on the learning. These levels are based on codified theories that allow the recovery of information. The cognitive procedure manages assistance in the psychosocial meta-cognitive environment. According to Lev Vygotsky, the instruments are inspired by cognitive statements to process data and evaluate points of view based on the sociocognitive problem, ABE, etc. [15], attempting to reform the cognitive form. Therefore, it is essential to understand cognitive psychology related to strategic learning, metacognition, and aspects of cognitivist constructivism.

Learning is a previous step, not a final product, which is oriented to cognitive systems in which the subject establishes relationships with knowledge with a perception of levels, characters, care, evocation, and reasoning [16]; therefore, this current method handles the mind–computer analogy, with a processing system that encodes, records and executes with signs and characters [16, 17]. Thus, the teacher's objective is

to obtain dynamic, independent students who decipher and manage learning strategies that improve their learning level. Therefore, the student, in his metacognition, is firm in his learning as the teacher does, which is to sensitize the practices, stimulating and strengthening the critical reflection and autonomous learning of the students.

Several reflections in educational psychology gave rise to cognitivist constructivism, including Piaget J [18], Lev Vygotsky [19], Ausubel D [20], and Jerome Bruner [21], which allowed changing the object of study of the mind and its techniques [22]; for example, Jean Piaget proposed that individuals build their knowledge through their experience and reflection on their own. Therefore, learning occurs when there is an imbalance or a cognitive conflict. In other words, there is a mental change that a student perceives with their methodological training from the educator and the origin of a new methodological practice adjusted for the student [23, 24]. The result is the transmission and progress in the social, educational, and historical justifications of each person in the formation of mental structures and responsibilities [19].

One of the skills that can be achieved with these postulates is the individual's ability to create cognitive scaffolding. Some programs of higher education institutions in North America and South America operate in their plans for education and teaching processes, such as education aimed at cooperative education, organized education in sociocognitive conflict, problem-based learning, and error-based learning. ., seeking to "transform the cognitive organization" [25- 27].

Teaching in university institutions, according to the Bologna project, focuses on the work of students, valuing the training they acquire. In this way, higher education is focused on prioritizing strategic learning optimizing systematizations and skills that allow continuous teaching by the student. For this reason, the strategic student will have scientific instruments to develop in the present context, such as the medical profession [26- 28].

Many authors look for a better strategy for medical education in different fields, such as problem-based learning and error-based learning, which shows an exchange with students, awaken scientific interest and thus understand the reasoning and scope of the topics covered. This allows better interaction with their tutors in the outpatient clinic, ward, and operating field [29].

Discussion

Error-based learning is a strategy through which the teacher includes errors to motivate the student to find and provide a solution to an issue [3, 4, 30]. Historically, the teacher has played the exclusive role of a mediator of knowledge; currently, with the advancement of technology, new strategies, and teaching systems are promoted [2, 31- 34], which allows the student to increase their participation in teaching, enhancing the interaction with the teacher. However, the student manages their learning [35- 39]. This learning strategy encourages the search for information and resolving errors presented by the teacher within the study classroom. These results are related to the experience applied in other subjects, such as the practical methodology at the Complutense University of Madrid, which caused many students to obtain high grades [40].

The clinical review of the resolution of errors can be similar to those carried out in the study program, such as the applied dietetics subject, which included texts and practical seminars with errors with the use of the Kahoot® platform, which is a valuable tool for teachers and students, allowing learning in a very entertaining way and overcoming the student's fear of participating in public [35, 36]. With classroom intervention through questions and answers, collaborative teaching is more effective than traditional methods that do not identify errors but are similar to the evidence found in evaluating errors with the impulse technique [9, 37]. This process is essential for improving student self-efficacy and motivation [38].

Students will be able to develop an efficient and effective capacity to resolve errors in clinical reasoning, as well as skills, clinical skills, self-learning, and teamwork [38 - 39]. Therefore, this experience gives rise to teachers and tutors with different roles to promote this practice necessary to develop this methodology, contributing to the growth of organizational education and supporting the principles of responsibility, innovation, reinforcement, participation, and individual and collective reflection [41]. There is a degree of difficulty for the teacher due to deficiencies in the mastery of coherence, communication, and competency interactions, which will be overcome with the development of their experience [42]. The good academic performance of students depends on the strategies and resources used to obtain information. Academic performance is affected by multiple variables that interact with each other [43]. The exciting aspect of this research is that teachers and students build knowledge, and they do so based on the space of action that medical action establishes [44].

Conclusions

This teaching strategy allows the student to have active and cooperative learning focused on them. In this experience, students will perceive satisfaction and support in the errors presented by the teacher with the application of the method

in their teaching, as well as in the diagnostic procedures and treatment for the errors raised, allowing each student to individualize their learning in the areas of interest.

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The authors declare that they have no conflicts of interest.

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