

Delimitation and Mitigation of Selected Gaps in Learning and Teaching

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ABSTRACT

This paper explores the complex challenges, persistent problems, and unexpected setbacks within the educational ecosystem that inevitably lead to teaching and learning gaps. It analyzes the entire extent of their occurrence chain, examining what causes these weaknesses and what measures can be taken to prevent them. The paper briefly presents learning theories, followed by contributions from major educational thinkers, notably David Paul Ausubel (1918-2008) with his concept of meaningful learning, and some teaching and learning models, with emphasis on William G. Huit's (1995) "A systems framework of the teaching/learning process." On the other hand, it discusses the constructs of teaching, highlighting that the process refers to the flow of knowledge from teacher to student, or broadly, from the educator to the learner. It features John Dewey (1859-1952), the educator who advocated for contextualized teaching tailored to individual student interests. The paper concludes by considering the main drivers of 21st-century education and proposes some initiatives to mitigate the identified problems.

Keywords: teaching and learning gaps; educational ecosystem; meaningful learning.

INTRODUCTION

The process of human development, through which knowledge, values, skills, and attitudes can be acquired, is extensively studied in various areas of knowledge. In the field of education, the groundwork for knowledge acquisition rests on the dynamic interplay of teaching and learning. These processes are inherently interdependent, interconnected, integrated, and inseparable. Teaching, broadly defined, is a key method of facilitating education, encompassing the transmission and dissemination of knowledge. Conversely, learning is the outcome of teaching, signifying an individual's capacity to assimilate and integrate knowledge through the acquisition and comprehension of information.

Teaching and learning complement each other in integrated processes of knowledge transfer, on one hand, and acquisition, assimilation, and use of information for individual knowledge construction, on the other, both referenced and parameterized in many teaching and learning theories. This complex interplay is certainly surrounded by complex challenges, persistent problems, and unexpected setbacks, contained within the educational system or beyond it, but which inevitably lead directly to gaps in teaching and learning.

Addressing these gaps requires a thorough analysis of their entire occurrence chain within the broad educational ecosystem, starting by understanding what these weaknesses are, what causes them, what measures can be taken to prevent them, and if they do occur, how to mitigate the undesirable outcome. From this perspective, the following text aims to provide some insights into the teaching and learning process, highlighting the challenging areas that require attention.

ELEMENTS OF THE THEORETICAL-METHODOLOGICAL IDENTITY OF LEARNING

At the heart of the learning concept is the notion of change, which manifests through the development of new knowledge, acquisition of a skill, understanding of a context, or alteration in attitude. This change is characteristically long-lasting and often results from intentional efforts, though it can also occur incidentally or through experience (Sequeira, 2012). According to Carr (1930), learning is understood as the process of memorization, skill acquisition, retention of what is learned, and how new knowledge can be used in mastering other problems. Vermunt and Verloop (1999) point out that learning is not a passive process, but an active, constructive, and self-directed one in which students construct internal representations of knowledge that are personal interpretations of their learning experiences.

Recent advancements in comprehending this process have given rise to a spectrum of learning theories. These encompass perspectives from behaviorist, neobehaviorist, Gestalt, cognitivist, humanist, and socio-constructivist schools of thought. Behaviorism, a psychological theory focused on the study of observable behaviors and their relationships with environmental stimuli, was developed by John Broadus Watson (1878-1958) and other American psychologists in the early 20th century. It posits that human behavior is determined by environmental stimuli and can be modified through conditioning, a process by which a response is associated with a specific stimulus. Behaviorism has had a significant impact on both psychology and education, with its evidence-based approach being extensively applied to understand and address a range of behavioral issues in children and adolescents.

Critique of behaviorism's reductionist methodology, particularly its oversight of internal motivations and cognitive processes in human behavior, catalyzed the advent of neobehaviorism. This evolved perspective extends beyond the confines of traditional behaviorism by integrating insights from cognitive psychology and neuroscience. Contrasting with classical behaviorism's exclusive focus on observable behavior and environmental stimuli, neobehaviorism acknowledges the significant roles of cognition and perception in processing information and determining behavior.

Neobehaviorism emphasizes the significance of the interaction between environmental information and cognitive processing in shaping behaviors. It highlights the importance of internal motivations, beliefs, and expectations in determining behavior and has been widely used to understand and address various behavioral issues, including anxiety, depression, behavioral disorders, and learning problems.

Psychologists Burrhus Frederic Skinner (1904-1990), Albert Bandura (1925-2021), and Julian B. Rotter (1916-2014) are some of the key figures in neobehaviorism. They integrated concepts from classic behaviorism with cognitive psychology and neuroscience, resulting in this updated form of behaviorism.

The Gestalt school of thought centers on the mechanisms through which individuals process and organize sensory information. This approach posits that people do not simply respond to discrete stimuli; instead, they perceive and process information in an integrated, holistic manner. Proponents of Gestalt psychology argue that the human mind instinctively structures information into coherent, meaningful patterns and relationships, aiding in our understanding of the world. This perspective underscores the significance of overall perception and visual information, focusing on how composite shapes and patterns impact perception, rather than on isolated components.

Cognitivism, a psychological theory centered on the study of cognition – the process of acquiring, processing, and storing information in the mind – emerged as a reaction to behaviorism. This theory places a strong emphasis on understanding mental processes and the mind's internal structures, such as attention, memory, language, intelligence, problem-solving, and learning through mental models. Cognitive theorists propose that individuals are not merely passive recipients of information but are actively and autonomously involved in constructing knowledge from sensory inputs. They suggest that mental representations play a crucial role in processing information and making sense of the world.

In the field of psychology, humanism represents an approach that underscores the importance of comprehending individual perspectives and subjective experiences. This person-centered methodology concentrates on an individual's potential for self-determination and self-realization. It emphasizes the crucial roles of empathy, understanding, respect, and self-expression in fostering emotional and psychological well-being. Prominent figures in humanistic psychology include Carl Rogers (1902-1987), Abraham Maslow (1908-1970), and Rollo Reece May (1909-1994).

Finally, socioconstructivism, both a pedagogical and psychological concept, places a strong emphasis on the role of social and cultural interactions in the development of knowledge and identity. This theory advocates for an interactive approach, underlining the necessity of active participation by individuals in their own knowledge and identity formation. According to socioconstructivist principles, knowledge is not simply transferred from one individual to another in a passive manner. Instead, it is actively constructed through social and cultural exchanges. This perspective underscores the significance of communication, collaboration, and the communal construction of knowledge.

In education, socioconstructivism posits that learning is fundamentally a social construct. It suggests that individuals actively partake in the construction of knowledge through interactive methods like discussions, collaborations, and group problem-solving activities. Prominent figures in socioconstructivist theory include Lev Vygotsky (1896-1934), Jean Piaget (1896-1980), and Ernst von Glasersfeld (1917-2010).

Ultimately, these learning theories serve as foundational guides for the teaching and learning process. They act as the bedrock principles of education, directing educational practices across various levels and modalities of teaching. These theories advocate for numerous educational goals, such as fostering creativity, valuing scientific knowledge, promoting the holistic development of individuals, and encouraging social inclusion. These guiding principles, inherent in different learning theories, are adaptable and can be effectively implemented in diverse educational settings.

Socioconstructivism, as a theory, underscores the vital role of social interaction and dialogue in the construction of knowledge. It posits that learning is a communal process, rooted in the social and cultural experiences of individuals. Within this framework, principles like the valuation of scientific knowledge and holistic individual development are integral. They guide educational practices towards embracing cultural diversity and fostering collaboration among students. Humanism, conversely, champions a student-centered approach to learning, which takes into consideration the unique needs and interests of each student. This philosophy advocates for an educational model that respects individuality, nurturing student creativity and autonomy.

Cognitivism, on the other hand, focuses on the mental processes involved in learning, such as attention, memory, and reasoning. Applying principles like the valuation of scientific knowledge and the encouragement of creativity within this context can lead to educational practices that cater to diverse cognitive processing styles of students.

Gestalt theory, with its emphasis on the role of perception in learning, asserts that stimuli are mentally organized into coherent, meaningful patterns. This theory supports educational approaches that value scientific knowledge and creativity, catering to the varied perceptual perspectives of students.

Lastly, neobehaviorism and behaviorism highlight the influence of environmental stimuli on learning. In these theories, the holistic development of the individual and social inclusion are key principles. They support educational methods that consider the social and cultural environments shaping student experiences.”

In conclusion, the guiding principles of education and learning theories are intrinsically linked, serving as pathways to foster quality education. These principles take into account not only the needs and characteristics of students but also the social and cultural contexts in which they exist.

Lemos *et al.*, (2022) have enriched the discourse on learning theories with a comprehensive analysis of theoretical contributions from a range of influential thinkers. These include Plato (427-347 BC), Vittorino da Feltre (1378-1446), Jan Amos Komensky (Comenius, 1592-1670), Jean-Jacques Rousseau (1712-1778), Johann Heinrich Pestalozzi (1746-1827), Johann Friedrich Herbart (1776-1841), John Dewey (1859-1952), Rudolf Steiner (1861-1925), Maria Montessori (1870-1952), Henry Paul Hyacinthe Wallon (1879-1962), Alexander Neill (1883-1973), Lev Semenovitch Vygotsky (1896-1934), Célestin Freinet (1896-1966), Jean Piaget (1896-1980), Anísio Teixeira (1900-1971), David Paul Ausubel (1918-2008), Paulo Freire (1921-1997), and Edgar Morin (1921). Following extensive analysis and reflection, they proposed a set of guiding principles that are foundational to educational practices and pivotal for successful learning trajectories:

- Guiding Pinciple 1. Meaningful Learning
- Guiding Pinciple 2. Contextualization and Problemization of Knowledge
- Guiding Pinciple 3. Holistic and Civic Formation and Multidimensional Education
- Guiding Pinciple 4. Protagonism, Active Learning, Engagement, and Belonging
- Guiding Pinciple 5. Autonomy and Self-Management
- Guiding Pinciple 6. Interconnection of Knowledge, Inter- and Transdisciplinarity
- Guiding Pinciple 7. Inclusion
- Guiding Pinciple 8. Cooperation and Socialization
- Guiding Pinciple 9. Criticality
- Guiding Pinciple 10. Dialogicality
- Guiding Pinciple 11. Innovation, Creativity, and Curiosity
- Guiding Pinciple 12. Flexibility and Dynamism
- Guiding Pinciple 13. Equity
- Guiding Pinciple 14. Sustainability
- Guiding Pinciple 15. Universal Human Values

According to Dumont, Istance, and Benavides (2010), theoretical concepts do not provide concrete prescriptions for classroom application but can be used flexibly and creatively by teachers in their planning and educational practice.

It is essential to recognize that learning extends beyond the classroom, with a substantial portion occurring in non-formal environments (such as the home, which serves as the primary learning space). Often, learning transpires implicitly and effortlessly, known as incidental learning.

Prominent theorists and educators, including David Ausubel, Jean Piaget, Robert Gagné, John Dewey, and Benjamin Bloom, have identified various types of learning. They have also developed models and strategies to facilitate knowledge and skill acquisition among students. These methods encompass meaningful learning, rote learning, discovery learning, problem-based learning, project-based learning, guided learning, constructive and self-regulated learning, experiential learning, situated learning, and technology-based learning. Each type possesses distinct processes and strategies and is selected based on its suitability for the specific context to optimize the acquisition of knowledge and skills. David Paul Ausubel's (1918-2008) theory of meaningful learning, introduced in 1968 (Ausubel, Novak, & Hanesian, 1968), aligns with the principles of cognitivism and places a strong emphasis on understanding and assimilating new knowledge.

This theory advocates for a learning process that is meaningful and relevant to the student, focusing on the comprehension and practical application of the acquired knowledge. Ausubel posited that effective learning occurs when new information is connected to pre-existing knowledge. The theory underscores the importance of motivation and active engagement in the learning process. At its core, it involves identifying what a student already knows and tailoring the teaching approach accordingly. Learning is deemed meaningful when new information integrates with existing concepts in an individual's memory, thereby creating new, organized knowledge structures.

Ausubel's theory accentuates the critical role of context and meaning in the learning process. Lemos *et al.*, (2022) interpret meaningful learning as experiences that profoundly influence the holistic development of an individual. This begins with valuing and reinterpreting prior knowledge, coupled with the pursuit of new knowledge, thereby infusing learning with sense and relevance specific to an individual's life. This approach to learning acknowledges the active participation of the student in the construction of knowledge, moving beyond a passive role as merely a recipient of information. In line with this, the latest UNESCO (2022) report on educational scenarios emphasizes the necessity of providing children and young people “uma aprendizagem significativa e um senso de propósito e autonomia para agir ou escolher suas ações” (UNESCO, 2022, p. 9)¹, to equip them more effectively for current and future challenges (UNESCO, 2022).

These theoretical frameworks have given rise to diverse learning models that address key questions about student learning processes. For example, determining the most suitable model for a specific context is crucial, such as selecting pedagogical models ideal for children and youth in teacher-centric educational settings, or choosing andragogy² for adult learners. Andragogy emphasizes the needs and interests of adult learners, viewing the teacher more as a collaborator than a director, with the goal of creating a stimulating, meaningful, and relevant learning environment.

¹ Translation: “a meaningful learning and a sense of purpose and autonomy to act or choose their actions” (UNESCO, 2022, p. 9, editorial translation).

² The word ‘andragogic’ means conducted by the man himself.

This approach is commonly implemented in continuing education and professional training for adults. Another alternative is heutagogy³, which positions the learner at the epicenter of the learning journey. In this approach, the teacher's role is that of a facilitator rather than the primary source of knowledge.

Heutagogy's objective is to cultivate in learners the capacity for autonomous learning and self-directed goal setting. In this model, students are encouraged to actively seek information, engage in reflective thinking, and experiment, with the ultimate aim of constructing their own knowledge and honing skills in self-reflection and self-direction.

In these diverse learning models, researchers commonly categorize learning into three principal domains: cognitive, psychomotor, and affective (which includes motivation). Cognitive processing activities are those that result in changes in the students' knowledge base (Dumont, Istance, & Benavides, 2010). This domain encompasses understanding, processing, and acquiring information, knowledge, and mental skills. It also includes higher cognitive functions such as memory, attention, perception, problem-solving, decision-making, creativity, and intelligence. The cognitive domain is crucial for acquiring knowledge, skills, and competencies essential for everyday life and professional settings."

The psychomotor domain of learning pertains to the development of fine motor skills (such as writing, drawing, manipulating small objects) and gross motor skills (like running, jumping, playing sports), motor coordination (such as balance, agility, and dexterity), and reflexes (such as those triggered by automatic stimuli like touch). These skills are developed through practice and repetition over time. This domain is crucial for performing physical tasks and involves integrating sensory information, like vision, hearing, and touch, with precise and coordinated body movements. Developing this domain is vital for everyday tasks and can be directed through practical activities that involve precise and coordinated body movements.

The affective domain encompasses the emotional aspects of learning, including emotions, attitudes, values, and motivations. It involves elements such as interest, motivation, involvement, and satisfaction. The positive development of this domain is pivotal in enhancing students' eagerness to learn, fostering greater engagement and motivation. This, in turn, cultivates a mindset that can significantly influence the efficacy of the learning process.

In their synthesis of various teaching and learning models, McIlrath and Huitt (1995) highlighted contributions from several educators, including John B. Carroll (1963), C. Patrick Proctor (1984), Donald R. Cruickshank (1986), Nathaniel L. Gage and David C. Berliner (1992), and William G. Huitt (1995). Carroll's Model, for instance, emphasizes time as a critical variable in learning, encapsulated in the equation:

$$\text{school learning} = \text{function}(\text{time needed}/\text{time spent}).$$

³ The word 'heutagogic' means led by the knowledge itself.

Among the many variables used to detail the equation, the author includes Bloom's concept of quality education, suggesting that teachers should:

(i) organizar o assunto do ensino em unidades de aprendizagem gerenciáveis, (ii) desenvolver objetivos de aprendizagem específicos para cada unidade, (iii) desenvolver medidas de avaliação formativa e sumativa apropriadas e (iv) planejar e implementar estratégias de ensino em grupo, com alocações de tempo suficientes, prática oportunidades e reinstrução corretiva, para que todos os alunos alcancem o nível desejado de domínio (Mcilrath; Huitt, 1995, p. 2, tradução nossa)⁴.

In the model of C. Patrick Proctor (1984), the author underscores the social nature of teaching, extending beyond the teacher-student relationship to encompass the broader social climate of the school. This climate is shaped by various factors including student demographics (such as race, gender, economic status, and previous academic performance) and school policies that address learning time and necessary support systems. This can include, in addition to the quality of education (or instruction), the teacher's behavior in the classroom (also addressed in the model of Donald R. Cruickshank, 1986).

William G. Huitt's 1995 model expands the educational framework to include not just the school, classroom, teacher, and student, but also additional contextual factors such as family, home, and community environments. This model seeks to categorize and organize the myriad variables that influence why some students learn more effectively than others. It introduces the concepts of input (what students and teachers contribute to the classroom) and output (learning measures taken outside the classroom). This model revises and broadens the 1983 model by David A. Squires, William G. Huitt, and John K. Segars, which focused solely on educator-controlled variables.

Huitt (1995) emphasizes the need to consider significant contextual variables in an information-rich society. He posits that learners, as members of a complex society, are influenced and shaped by their surroundings, which in turn affects their learning processes and defines the knowledge and competencies deemed important.

This approach prompts a reflection on the multitude of specific conditions that the learning process hinges upon, including physical and psychological states, environmental factors, and learning methods. Understanding the impact of these varied conditions on the rate of learning helps to identify and address the most pressing learning gaps in today's educational landscape.

⁴ Original: "(1) organize subject matter into manageable learning units, (2) develop specific learning objectives for each unit, (3) develop appropriate formative and summative assessment measures, and (4) plan and implement group teaching strategies, with sufficient time allocations, practice opportunities, and corrective reinstruction for all students to reach the desired level of mastery" (Mcilrath; Huitt, 1995, p. 2).

LEARNING GAPS

Learning gaps refer to specific areas where students have not met the expected standards in assimilating knowledge. These gaps can arise from a variety of factors, including psychosocial difficulties, learning disabilities, and a lack of motivation. Conversely, teaching gaps pertain to deficiencies in the educational process itself, where content has not been effectively or appropriately imparted at the necessary level. Causes of teaching gaps may include insufficiently prepared educators, resource limitations, inadequate lesson planning, and challenges in delivering education to certain regions, among other factors. Essentially, while learning gaps are student-centric, teaching gaps are rooted in the broader educational ecosystem. Both types of gaps, however, can significantly impede a student's academic progress.

A prominent learning gap is the lack of student motivation, which may manifest as disinterest in learning, difficulties in absorbing new information, and low engagement in classroom activities. Other common learning gaps include insufficient access to necessary resources, inadequate development of learning skills, errors in teaching methods, and limited opportunities for students to apply the knowledge they have acquired. This list below highlights some of the more apparent challenges that need to be addressed in order to devise effective solutions.

Learning Gap 1. Limited access to educational resources: Often constrained by factors like cost and location, which can hinder learning.

Learning Gap 2. Lack of motivation: One of the primary factors limiting learning.

Learning Gap 3. Lack of time: One of the biggest challenges to learning, as people may not have enough time to study and keep up with classes.

Learning Gap 4. Psychosocial difficulties: Emotional and social barriers that affect an individual's ability to learn, which can include emotional problems (such as anxiety, depression, low self-esteem, difficulty in emotional regulation, among others), social issues (such as bullying, family conflicts, lack of social support, and lack of social skills), and behavioral problems (such as hyperactivity, impulsivity, lack of concentration, attention difficulties, among others). These difficulties can negatively affect motivation, attention, and an individual's participation in the learning process and can be especially problematic for children and young people of school age. To address these difficulties, it is important to identify and address the underlying causes, as well as to work together with the education team and other health professionals to provide appropriate support and treatment.

In a simplified manner, learning gaps present themselves in the following situations:

Situation 1. Family vulnerability

Situation 2. Financial vulnerability

- Situation 3. Lack of time for dedication to studies
- Situation 4. Individuals with learning disorders
- Situation 5. Compromised mental health
- Situation 6. Vision impairments
- Situation 7. Hearing problems
- Situation 8. Lack of motivation and purpose
- Situation 9. Lack of access to adequate resources
- Situation 10. Difficulties in commuting to school
- Situation 11. Diversion from study time due to daily urgencies

Finally, identifying and addressing learning gaps present an ongoing challenge for both educators and students. While these gaps can be sources of frustration, it is crucial to recognize them as inherent components of the learning journey. As such, they should not be perceived as insurmountable barriers. Instead, the educational ecosystem must remain vigilant and proactive in minimizing the occurrence and impact of these gaps. This requires a concerted effort to support and facilitate the learning process, ensuring that these challenges are addressed effectively and constructively.

THEORETICAL-METHODOLOGICAL TRAITS OF TEACHING

Teaching comprises a series of events specifically orchestrated to facilitate the learning process. Unlike learning, which is an individual and internal process, teaching occurs within the broader context of the educational ecosystem. It involves the transmission of knowledge from teacher to student, or more broadly, from educator to learner. Teaching serves as the conduit through which the acquisition and assimilation of knowledge become possible. However, it is important to note that the act of teaching does not automatically guarantee learning.

Teaching is a multi-stage process, encompassing planning, implementation, and evaluation. Each stage is crucial in ensuring the effectiveness, quality, and alignment of the teaching with both student needs and established learning objectives. The first stage, planning, involves defining learning objectives, formulating teaching strategies, selecting methodologies, and choosing appropriate teaching materials. The second stage, implementation, is the active phase of teaching. During this stage, students are encouraged to engage dynamically in the learning process through activities such as questioning, discussion, collaboration, and the practical application of acquired knowledge. The final stage, evaluation, provides an opportunity for the teacher to assess whether the learning objectives have been met and if the students have developed meaningful skills and knowledge.

John Dewey (1859-1952) is often revered as a preeminent figure in the discourse on teaching and learning. As a philosopher, educator, and author, Dewey was a proponent of contextualized teaching that is tailored to the individual interests of students. He held the conviction that all learning should be meaningful and foster an interactive dynamic between the student and teacher. In a similar vein, Paulo Freire (1921-1997) of Brazil made significant strides in educational theory. He developed a model of teaching and learning anchored in critical consciousness. Freire emphasized that teaching should revolve around the active participation of students, fostering decision-making and the cultivation of critical thinking skills. He was a staunch advocate for the right to education as fundamental and unalienable, viewing it as a potent instrument for emancipating individuals from oppression and social injustice.

Cross and Conner (1993) observe that while learning can have various objectives, teaching has a singular, unequivocal goal: to enable, facilitate, and promote learning. They argue that if teaching does not lead to learning, it fails in its primary purpose. Complementing this view, Lemos et al. (2022) delineate the foundations for coherent and effective educational practices. These practices are designed to resonate with the diverse realities and core values of human coexistence. To facilitate learning and development, they identify several pertinent educational strategies, which include:

- Educational Strategy 1. Educational intentionality
- Educational Strategy 2. Active methodologies
- Educational Strategy 3. Active and interactive mediation
- Educational Strategy 4. Playfulness
- Educational Strategy 5. Entertainment
- Educational Strategy 6. Entrepreneurship
- Educational Strategy 7. Theory-practice relationship
- Educational Strategy 8. Experimentation and research
- Educational Strategy 9. Learning communities
- Educational Strategy 10. Empathic and compassionate communication
- Educational Strategy 11. Formative assessment and procedural monitoring
- Educational Strategy 12. Technology-mediated experiences

TEACHING GAPS

The awareness and proactive involvement of all participants in the educational ecosystem are crucial for identifying and resolving teaching gaps. To mitigate the various challenges encountered, such as deficiencies in physical and operational infrastructure of educational institutions, disparities in teacher qualifications, the intricacy of curriculum content, and the limited availability of necessary technological tools, several strategies can be employed. Addressing these gaps effectively requires tailored solutions, which include:

- Teaching gap 1. Lack of financial resources for structural and technological improvements in educational establishments.
- Teaching gap 2. Lack of teacher training to handle the diversity of students.
- Teaching gap 3. Lack of preparation of students for professional life
- Teaching gap 4. Insufficient use of educational technologies
- Teaching gap 5. Inequality of opportunities among students from different social classes.
- Teaching gap 6. Lack of encouragement for research and innovation.
- Teaching gap 7. Low quality of teaching materials.
- Teaching gap 8. Lack of continuous and objective assessment.
- Teaching gap 9. Teaching content irrelevant to everyday life.
- Teaching gap 10. Lack of stimulus for student participation.

In a simplified way, the teaching gaps present themselves in the following situations:

- Situation 1. Inequalities in the offer, characterized mainly by the susceptibility of poorer regions
- Situation 2. Inadequate models of planning and logistics
- Situation 3. Absence of course offerings due to a lack of available teachers
- Situation 4. Adequate computational resources
- Situation 5. Unavailability of internet access
- Situation 6. Inadequate pedagogical models
- Situation 7. Partial fulfillment of competencies established in the Base Nacional Comum Curricular (BNCC)
- Situation 8. Unavailability of teaching oriented to short and medium-term horizons
- Situation 9. Unavailability of models to encourage reading
- Situation 10. Unavailability of models to encourage environmental awareness
- Situation 11. Unavailability of models to encourage positive behavior on social networks

Addressing teaching gaps is an urgent priority for all stakeholders within the educational ecosystem. These gaps present considerable challenges, yet they also call for identifiable and implementable solutions. The absence of quality education deprives children, youths, and adults of critical opportunities, leading to far-reaching consequences for society as a whole. It is imperative to recognize and tackle these gaps to ensure equitable and effective learning experiences for all.

HORIZONS AND GUIDING PATHS

Today's global landscape presents a striking variance in the quality of education across different countries. There is a significant disparity in achieving the necessary standards of quality education. While some nations boast high levels of educational access, others face considerable challenges in making schooling available across their geographical extents. Additionally, educational curricula vary widely: some countries offer programs that equip students with essential life skills, whereas others lag behind with outdated or inadequate educational frameworks, leaving students underprepared for future challenges.

The state of education in Brazil is a topic of considerable debate, characterized by its status as one of the most unequal educational systems globally. This inequality manifests in significant disparities in quality, access, and opportunities across different states and regions, with some enjoying advanced educational infrastructures while others lag considerably. A key issue is the chronic underinvestment in educational infrastructure, compounded by low teacher salaries and limited access to technology. To catalyze transformative changes in Brazilian education, a multi-faceted approach is necessary. This includes increasing investment in infrastructure, enhancing access to technology and contemporary educational materials, and encouraging active student participation to promote meaningful learning. A sustained commitment from all stakeholders—government, schools, educators, parents, and students—is crucial for the progressive development of the nation's education system.

One notable initiative aimed at addressing these challenges is the implementation of the National Common Curricular Base (BNCC). This landmark document, established for the first time in Brazil, delineates the fundamental learning rights and objectives for children and youth in early childhood, primary, and secondary education. It details the competencies, skills, and essential knowledge across all curricular areas. The BNCC, developed through a collaborative and pluralistic process from 2014 to 2018, is grounded in several foundational legal and policy frameworks, including the Citizen Constitution, the Law of Guidelines and Bases of Education, the National Curricular Guidelines, and the National Plan of Education.

Grounded in the pedagogical principles of the BNCC (Brazilian National Common Curricular Base), which emphasizes the cultivation of competencies⁵ and dedication to holistic education, the following competencies are anticipated outcomes of basic education. This encompasses early childhood education, elementary, and high school levels:

- i. Value and use the historically built knowledge about the physical, social, cultural, and digital world to understand and explain reality, continue learning, and collaborate in building a just, democratic, and inclusive society.
- ii. Foster intellectual curiosity and apply a scientific approach, characterized by investigation, reflection, critical analysis, imagination, and creativity. This approach is essential for exploring causes, developing and testing hypotheses, formulating and solving problems, and innovating solutions (including technological ones), drawing upon knowledge from diverse fields.
- iii. Value and benefit from various artistic and cultural expressions, from local to global, and also participate in diverse artistic-cultural production practices. Employ various languages – including verbal (both oral and visual-motor, such as sign language), written, bodily, visual, auditory, and digital – along with an understanding of artistic, mathematical, and scientific lexicons. This multifaceted linguistic proficiency is essential for expressing and sharing information, experiences, ideas, and emotions in diverse contexts. It also facilitates the production of meanings that foster mutual understanding.
- iv. Understand, use, and create digital information and communication technologies in a critical, meaningful, reflective, and ethical way in various social practices (including school-related ones) to communicate, access and disseminate information, produce knowledge, solve problems, and exercise leadership and authorship in personal and collective life.
- v. Appreciate the diversity of knowledge and cultural experiences, and assimilate knowledge and experiences that facilitate an understanding of the workplace. This process aids in making choices that are in harmony with the practice of citizenship and personal life projects, characterized by freedom, autonomy, critical awareness, and responsibility.
- vi. Construct arguments grounded in facts, data, and trustworthy information, to articulate, negotiate, and advocate for ideas, perspectives, and collective decisions that honor and advance human rights, socio-environmental awareness, and responsible consumption at local, regional, and global scales. This approach should reflect an ethical commitment to self-care, the well-being of others, and the health of the planet.

⁵ No documento, competência é definida como a “mobilização de conhecimentos (conceitos e procedimentos), habilidades (práticas, cognitivas e socioemocionais), atitudes e valores para resolver demandas complexas da vida cotidiana, do pleno exercício da cidadania e do mundo do trabalho” (p. 10).

- vii. Cultivate self-awareness and self-appreciation, and take care of one's physical and emotional well-being. This includes understanding oneself within the spectrum of human diversity and recognizing both one's own emotions and those of others, coupled with self-critique and the capacity to manage these emotions effectively.
- viii. Practice empathy, dialogue, conflict resolution, and cooperation, asserting oneself while fostering respect for others and human rights. This entails embracing and valuing the diversity of individuals and social groups, their knowledge, identities, cultures, and abilities, free from any form of prejudice.
- ix. Act both individually and collectively with autonomy, responsibility, flexibility, resilience, and determination. Decision-making should be guided by principles that are ethical, democratic, inclusive, sustainable, and community-oriented." (Ministry of Education, 2018)

According to the MEC (Ministry of Education):

a BNCC por si só não alterará o quadro de desigualdade ainda presente na Educação Básica do Brasil, mas é essencial para que a mudança tenha início porque, além dos currículos, influenciará a formação inicial e continuada dos educadores, a produção de materiais didáticos, as matrizes de avaliações e os exames nacionais que serão revistos à luz do texto homologado da Base (Ministério da Educação, 2018, *online*)⁶.

In this context, while the path forward is lengthy, it is also filled with opportunities to seek educational solutions that contribute to the common good. This involves a form of solidarity where individuals consider the needs of others as their own, thereby refusing to overlook the unique circumstances of each member of society.

Such an approach is essential to avoid undermining this concerned solidarity and prevent the imposition of debilitating conditions upon some citizens. Chomsky (2014) emphasizes that a deep-seated commitment to the common good is the catalyst that drives individuals to discover ways to foster human development in its fullest diversity. This leads to social structures that support rights, well-being, and the realization of legitimate aspirations.

DRIVERS OF 21ST CENTURY EDUCATION

From any perspective through which one examines education in Brazil, at least four 21st-century guiding principles must be acknowledged. The first is the realm of information and communication technologies (ICTs). These technologies have evolved rapidly, exerting a profound and far-reaching impact across all human activities.

⁶ Translation: "The BNCC (Base Nacional Comum Curricular) alone may not be sufficient to transform the existing inequalities in Brazil's Basic Education system. However, it is a critical starting point for initiating change. This is because its impact extends beyond just curricula. It significantly influences the initial and ongoing education of educators, the creation of teaching materials, the frameworks for evaluations, and the national exams, all of which will be re-evaluated in the context of the BNCC text that has been ratified." (Ministério da Educação, 2018, online, editorial translation).

They continually reshape the nature of society and economies, affecting everything from individual lives to global interactions (Dumont; Istance; Benavides, 2010).

The second principle is the central role of knowledge in driving economic activity. This shift signifies that knowledge and information now surpass traditional factors like capital or labor in terms of value and importance in the production process. Indeed,

O conhecimento é a característica distintiva da Sociedade da Informação. Não apenas o conhecimento científico e tecnológico é responsável pelas inovações em todas as áreas do saber, mas o conhecimento que está em todos os aspectos da vida cotidiana, desde a decoração de interiores até as cidades inteligentes; do entendimento das artes à demografia, tudo é permeado pelo avanço do conhecimento. (Alvares, 2021, p. 24)⁷.

Knowledge and education are intimately related concepts. Education is one of the main ways of transmitting knowledge, involving the acquisition of competencies, skills, values, and attitudes through various methods, such as formal, informal, experiential, situated, and self-directed learning, among others. The goal of education is to develop in students the abilities and competencies to apply the knowledge acquired in their personal and professional lives, contributing to individual and collective development. Education is one of the main means through which knowledge is transmitted from generation to generation and disseminated in society.

The third is lifelong learning, the capacity to continuously learn, apply, and integrate new knowledge and skills in a constantly changing world that demands greater cognitive capacity. People must become lifelong self-directed learners, especially as they prepare for jobs that do not yet exist, to use technologies that have not been invented, and to solve problems that have not yet arisen. It is the concept that education and skill development do not occur only during formal education but is a continuous and dynamic process throughout life.

This includes formal and informal training, in a flexible and creative manner, in a variety of contexts and situations, as well as autonomous learning and practical experience. It is crucial for maintaining competencies and skills that are relevant and up-to-date, not just in workplaces but in everyday life. In general, this includes the abilities to (i) generate, process, and classify complex information; (ii) think systematically and critically, weigh different forms of evidence in decision-making; (iii) ask meaningful questions about various subjects, be adaptable and flexible to new information, be creative; and (iv) justify and solve real-world problems, acquire a deep understanding of complex concepts, media literacy, teamwork, and social and communication skills (Dumont; Istance; Benavides, 2010).

⁷ Translation: "Knowledge stands as the hallmark of the Information Society. It's not only scientific and technological knowledge that drives innovation across all fields, but knowledge also infuses every facet of daily life, from interior decoration to smart cities, and from appreciating the arts to understanding demography. Every aspect is imbued with the advancement of knowledge." (Alvares, 2021, p. 24, editorial translation).

The fourth is the environmental issue, a guiding principle of the 21st century and likely the dominant concern going forward. The focus on the environment and sustainable development has economic, political, social, and cultural implications worldwide and across all segments of society. It cannot be minimized despite some controversial decisions by the productive sector: economic activities often use natural resources and generate significant environmental impacts, potentially leading to resource scarcity, pollution, global warming, and climate change.

The intersection of the environmental issue with education occurs in various ways, from early childhood education to the training of specialists and researchers. The most relevant form of this intersection is the interdisciplinary formation of critical and active environmental awareness, which can be addressed through education, in a broad and deep understanding of interconnections and consequences, and of technical, scientific, social, and cultural aspects.

EDUCATIONAL TECHNOLOGIES

The interplay between technology and education has gained increasing prominence in recent years, driven by technological advancements and greater accessibility to technological tools. This intersection notably enriches the educational experience, enhancing the interaction between students and teachers and diversifying access to knowledge.

Virtual Learning Environments (VLEs) exemplify this trend by facilitating remote access to educational content through virtual classrooms, discussion forums, and videoconferences. VLEs can form the core of distance education programs or supplement traditional classroom teaching. Designed to mimic the face-to-face learning experience, they enable students to engage with content and interact with educators and peers from any location, at any time, either synchronously or asynchronously, provided they have Internet access.

These VLEs are part of a broader category known as computer-mediated education (CME), a subset of technology-mediated education (TME). CME extends beyond virtual environments to include the integration of technology in all aspects of teaching and learning.

It encompasses various technologies like social networks, educational games, and applications that facilitate communication, interaction, and the construction of knowledge through technological means, applicable across different educational levels and fields.

In summary, computer-mediated education (CME) is a form of distance education that uses computational resources and telecommunications for communication between teachers and students, through a digital learning platform.

It presents some challenges, such as the need for training teachers and students in the use of technological tools and ensuring the quality of the education offered. Educators, of course, need to be prepared to use technology efficiently and creatively, exploring its full potential to improve the quality of education. It is important to consider the need for adequate infrastructure for carrying out activities, such as access to the internet and technological equipment.

The concept of Technology-Mediated Education (TME) is expansive, encompassing all forms of using technology to enhance the quality of teaching and learning. This includes a range of technologies beyond computers, like mobile devices. Within the TME framework, Computer-Mediated Education (CME) is a subset, focusing specifically on computer-related technologies, while TME represents a broader spectrum that includes various other technological forms in education.

In this semantic mapping, it's pertinent to introduce the concept of a Learning Management System (LMS). An LMS is a platform providing a multitude of resources for managing the learning process, whether in educational institutions or other organizations. It serves multiple functions: creating and managing educational content, tracking student progress, offering feedback and assessments, generating performance reports, and monitoring student development.

The LMS can accommodate digital learning objects (DLOs), independent units of digital content, usually stored in digital repositories, that can be used in the teaching and learning process. They are considered as small teaching units that can be integrated into different educational contexts to provide information and learning activities. They can be composed of different types of media, such as text, images, audio, animations, videos, and simulations, and are designed to be flexible and reusable in different teaching and learning contexts.

It's important to differentiate between a Learning Management System (LMS) and a Virtual Learning Environment (VLE). While a VLE primarily focuses on creating a virtual space for student-teacher interaction and communication, an LMS is oriented more towards course management and administration, offering a range of functionalities depending on its intended use and audience. However, both are often integrated to provide a comprehensive distance learning experience.

Among emerging technologies is the metaverse, closely linked to web 3.0. The evolution of the web can be categorized into three phases: web 1.0, characterized by information consumption; web 2.0, enabling both consumption and production of information; and web 3.0 or the semantic web, which supports consumption, production, and interactive execution. Web 3.0, emerging around 2010, is underpinned by artificial intelligence and machine learning.

The metaverse is fundamentally about how individuals will interact within web 3.0 environments, utilizing virtual reality technology to access the internet and navigate through various virtual worlds. It represents a three-dimensional virtual space that mirrors the real world, enabling people to connect and interact with each other and with virtual entities. This digital realm offers vast opportunities for exploration and creation, positioning itself as a harbinger of future developments, particularly in the field of education.

Indeed, educational technologies are a means to enhance the quality of teaching, make education more accessible and inclusive, expand learning opportunities inside and outside the classroom, stimulate student engagement and participation, personalize learning according to each student's needs, promote collaboration and teamwork, foster creativity and innovation among students, support the development of essential digital skills for today's world, expand the reach and impact of teaching, and optimize the time and learning process, allowing students to learn more efficiently and productively.

OPEN ISSUES IN EDUCATION

Taking into account particular elements of teaching and learning processes, along with the contemporary educational landscape, it becomes feasible to associate certain gaps in teaching and learning with these identified challenges within the educational ecosystem:

Educational Challenge 1. Develop more inclusive educational programs that can meet the educational needs of all students.

Educational Challenge 2. Implement new educational technologies and advance distance education.

Educational Challenge 3. Encourage collaboration between teachers and students to promote learning.

Educational Challenge 4. Adapt educational programs to the changing competencies required by the job market.

Educational Challenge 5. Increase student motivation and interest through interdisciplinary educational projects.

Educational Challenge 6. Provide students with quality educational resources to assist them in their learning.

Educational Challenge 7. Use modern and interactive teaching methodologies to stimulate student participation.

Educational Challenge 8. Promote activities that reinforce learning, such as lectures, simulations, games, etc.

Educational Challenge 9. Apply assessment tools to monitor student performance and learning gaps.

Educational Challenge 10. Conduct guidance activities for students in difficulty, so that they can improve their performance.

EXAMPLES OF FITIGATION INITIATIVES THROUGH TECHNOLOGICAL TRAJECTORIES

Educational institutions seeking to surmount the challenges inherent in both regular and supplementary education can find invaluable aid in a variety of educational technologies. These technologies span a broad spectrum, from basic tools such as digital books and learning management software, to more sophisticated solutions like virtual teaching platforms, virtual reality simulators, and artificial intelligence systems tailored for mapping out individualized learning pathways.

Impact Reduction Measure 5. Utilization of Technology-Mediated Education (TME) resources.

Impact Reduction Measure 6. Adoption of a pedagogical model adapted to TME.

Impact Reduction Measure 7. Selection of content appropriate for TME.

Impact Reduction Measure 8. Ensuring the necessary infrastructure for content transmission and reception.

Impact Reduction Measure 9. Safeguarding the conditions of the ecosystem for adopting TME.

Impact Reduction Measure 10. Provision of a technological laboratory for the introduction and learning of new technologies, for the transition of technological environments, and for training and formation in strategic areas of information and communication technology.

Impact Reduction Measure 11. Ideation, experimentation, and prototyping of educational financial ecosystems.

Impact Reduction Measure 12. Ideation, experimentation, and prototyping of educational solutions in the metaverse.

Impact Reduction Measure 13. Ideation, experimentation, and prototyping of virtual museums in education.

FINAL CONSIDERATIONS

The processes of teaching and learning are enmeshed in complex challenges within the educational ecosystem. A nuanced understanding of this intricate interplay necessitates a deep dive into the theoretical and methodological identities of both processes. Such an analysis is vital to fully grasp the spectrum of existing gaps.

This paper has explored various learning theories, considering both pedagogical perspectives – which focus on education as a holistic process of shaping individuals across social, cultural, cognitive, and affective dimensions – and psychological viewpoints, which delve into how individuals learn, develop skills, and evolve in thought, emotion, and behavior. Theories such as behaviorism, neobehaviorism, Gestalt, cognitivism, humanism, and socioconstructivism were discussed, alongside notable contributions from leading educators like David Paul Ausubel (1918-2008) and his theory of meaningful learning.

The discussion then moved to models of teaching and learning, with particular emphasis on William G. Huitt's 1995 model *A systems framework of the teaching/learning process*. This model integrates context and environment into the educational equation, acknowledging that as society immerses in information, learners, as members of this complex society, adapt and evolve in their learning processes.

The paper also outlined the three domains of learning – cognitive, psychomotor, and affective – as proposed by Claudia Farache Lemos, Janine Mattar Pereira de Castro, Miriam Lúcia Herrera Masotti Dusi, and Sandra Maria Borba Pereira (Lemos et al., 2022) in their research report for the Institute of Nutech Applied Research. These domains serve as foundational pillars for educational practices.

Conversely, the constructs of teaching were examined, highlighting that teaching is the conduit of knowledge transfer but does not guarantee learning. John Dewey (1859-1952), who championed the need for contextualized and individual-centric teaching, was a focal point in this section.

In tying these elements together, the text referenced Lemos et al. (2022) again, presenting *educational strategies that align with diverse realities and fundamental values of human coexistence to achieve effective educational outcomes*.

This comprehensive yet succinct exploration has identified key gaps in teaching and learning within the educational ecosystem. It has also underscored the driving forces of 21st-century education, such as information and communication technologies, the central role of information and knowledge, lifelong learning, and environmental considerations. In addressing these challenges and prospects, the text culminates in identifying primary obstacles within the educational ecosystem and suggests mitigative strategies, particularly emphasizing the role of educational technologies in enhancing teaching quality, increasing accessibility and inclusivity in education, and broadening learning opportunities.

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