Bloom's taxonomy and its applicability to collaborative learning in distance learning

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ABSTRACT
This article proposes an analysis of the categories of Bloom's Taxonomy that prove to be more effective in implementing collaborative learning in the context of distance education. Conceived in the 1950s by psychologist and educator Benjamin Bloom, Bloom's Taxonomy serves as a widely used pedagogical tool, playing a fundamental role in guiding the planning and evaluation of the teaching and learning process. This approach divides learning objectives into three distinct domains (cognitive, affective, and psychomotor), establishes a hierarchy outlining a progressive cycle of learning. The structure encourages students to master each level before advancing to subsequent stages, thus creating a progressive learning framework. The integration of collaborative learning with Bloom's Taxonomy provides a conducive framework for planning teaching activities that promote mutual learning, as well as stimulate knowledge construction and the development of social and teamwork skills. The methodology adopted for this study involved a thorough literature review, emphasizing works that highlight the relevance of Bloom's Taxonomy as a tool centered on the learning process. Among the identified advantages, the ability of this taxonomy to effectively guide the cognitive and affective development of students stands out. However, the literature review also exposes some limitations in the use of Bloom's Taxonomy, especially when applied to distance education. The absence of physical contact between teachers and students emerges as a significant challenge, complicating the assessment and monitoring of student performance. Thus, this chapter emphasizes the critical need for educational institutions to consider such amplified disadvantages in the context of remote teaching, emphasizing the strategic importance of implementing adaptive approaches to mitigate these limitations.

Keywords: Teaching methods, Distance education, Learning, Bloom's Taxonomy.

1 INTRODUCTION

Collaborative learning represents a teaching-learning process, conceived under the premise that learning is inherently a social process, in which individuals actively interact to achieve shared educational goals. This concept is aligned with cognitivist theories, which outline the learning process as the acquisition of knowledge, changes in cognitive structures, and the formation of significant relationships between new problems and those previously solved (Sevalho, 2017; Adams, 2015). In this context, the present discussion proposes to explore the interaction between collaborative learning and Bloom's Taxonomy, highlighting how this convergence offers a framework for the promotion of meaningful learning and the construction of knowledge.

Bloom's Taxonomy, developed by Benjamin Bloom in the 1950s, is an essential tool for teaching planning and evaluation, categorizing learning objectives into six distinct cognitive levels. According to Costa *et al.* (2014), the bottom-up classification of these levels, namely: knowledge, understanding, application, analysis, synthesis and evaluation, provides a hierarchical structure that allows educators to identify specific learning objectives and develop activities that engage students in different stages of critical thinking and reflection. This structured approach empowers teachers to guide students' cognitive development progressively and coherently.

Bloom's Taxonomy, also known as the Taxonomy of Educational Objectives, transcends the cognitive domain, incorporating affective and psychomotor dimensions. This educational strategy, originally conceived as a tool to categorize learning objectives, was later revised in 2001 to incorporate changes in education by replacing nouns with verbs in the cognitive domain and including an additional dimension of knowledge. This evolution was crucial to maintain the relevance of the Taxonomy in the face of educational transformations. In 2009, it was updated to adapt to digital methodologies, taking advantage of distance learning technologies to improve the construction of knowledge (Torres *et al.*, 2022; Ferraz; Belhot, 2010).

The synergy between collaborative learning and Bloom's Taxonomy emerges as a promising field of research. The combination of these elements provides a pedagogical structure that fosters not only the acquisition of knowledge, but also the development of social skills and the promotion of mutual learning (Rocha *et al.*, 2023). In the specific context of distance learning, it is crucial to understand which categories of Bloom's Taxonomy demonstrate greater applicability, considering the nuances of the virtual environment and the specific demands of collaborative learning. Thus, the present article aims to analyze and provide insights into the specific categories of Bloom's Taxonomy that stand out in the effectiveness of collaborative learning in distance learning.

2 METHODOLOGY

To meet the proposed demand, a systematic literature review was conducted, conducted in order to analyze and understand the knowledge previously addressed and experienced by researchers specialized in the subject. This analysis was based on the review of scientific articles available in electronic databases, including national and international scientific productions. The systematic approach provided a comprehensive view of the existing academic contributions on the pertinent topics, enabling a critical deepening and a solid foundation for the present discussion.

The literature review was conducted with specific criteria, aiming to identify relevant contributions to the understanding of the relationship between Bloom's taxonomy, distance learning, learning strategies and collaborative learning. The careful selection of key terms, such as "Bloom's taxonomy", "distance learning", "teaching and learning", "learning strategies" and "collaborative learning", allowed a precise delimitation of the scope of the review, ensuring the inclusion of studies that directly address the themes in question. This systematic method of literature search and selection was essential to identify relevant studies and establish the conceptual basis for the subsequent discussion.

In the theoretical basis, we carry out a concise and analytical approach to the main concepts and definitions related to Bloom's taxonomy, distance learning, learning strategies and collaborative learning. This approach allowed for a deeper understanding of the theoretical underpinnings underlying the topics discussed, providing a solid context for the critical and reflective analysis to be conducted in the final conclusions of the chapter.

The final considerations allow not only the synthesis of the main insights extracted from the analyzed studies, but also the identification of gaps in the existing knowledge, indicating possible directions for future research. In this way, Bloom's Taxonomy emerges as a tool of undeniable relevance for distance learning, being able to structure and measure students' skills, thus promoting meaningful learning and aligned with the contemporary demands of education.

3 THEORETICAL BACKGROUND

Collaborative learning, as a pedagogical method, represents an approach in which students converge efforts to achieve a common goal in the learning process. This modality can manifest itself in several configurations, including the formation of small groups for discussion of topics or problem solving, the shared distribution of responsibilities for the execution of tasks or projects, as well as team collaboration in virtual teaching and learning environments (Torres; Ilara, 2014).

Based on the premise that social interaction is intrinsically associated with learning, collaborative learning is supported by a theoretical foundation that recognizes the active role of the student in the construction of knowledge. Unlike the independent learning approach, in which students

act in an individualized way to achieve learning objectives, collaborative learning provides an interactive dynamic that promotes dialogue, the exchange of ideas, and the collective construction of understanding.

Collaborative learning has numerous benefits, including improved social and communication skills, and increased understanding and retention of content. However, it is important to note that one of its main advantages is its ability to increase student motivation (Damiani, 2008). When they work together, they feel more involved in the learning process and more committed to the success of the group. As a result, there is an increase in student participation and involvement, leading to an improvement in academic performance. This situation is quite different from that of independent learning, in which students work individually to achieve learning objectives (Klein; Vosgerau, 2018; Lee; De Paiva, 2010).

By fostering interaction between students, this approach contributes to the development of social and communication skills, fostering an enriching learning environment. In addition, collaborative learning demonstrates the potential to intensify the comprehension and retention of content, which results from the active engagement of students in complex cognitive and social processes.

Among the benefits, the remarkable ability of collaborative learning to enhance student motivation stands out. By working together toward common goals, students experience a significant increase in engagement with the learning process, as well as a more intrinsic commitment to collective success. Such engagement results in a more active participation and a substantial improvement in academic performance, evidencing a differentiated dynamic compared to more individualistic approaches (Lourenço; De Paiva, 2010).

In addition to its central role in the educational context, collaborative learning makes notable contributions to the development of students' social and communication skills. By collaborating together to achieve common learning goals, students are compelled to communicate effectively, promoting the articulation of ideas and the collaborative resolution of problems. This interactive process provides the improvement of crucial skills, such as the ability to listen actively, express oneself clearly, and resolve conflicts efficiently, thus contributing to the integral formation of the individual (Borssoi *et al.*, 2021).

Another advantage of collaborative learning is its remarkable ability of this approach to broaden students' understanding and retention of content. By engaging collectively in the understanding and application of the study material, students evince a greater propensity to internalize and retain knowledge effectively. In addition, collaborative learning, by promoting an interactive and participatory dynamic, presents itself as a facilitator of the development of critical skills, such as

critical thinking and problem solving, which are fundamental for the cognitive and analytical development of learners (Klein; Vosgerau, 2018).

In a more systemic analysis, it is possible to categorize the benefits of collaborative learning into several dimensions. In the first place, the development of social and communication skills is highlighted, which are fundamental for the formation of full citizens. In addition, the methodology contributes to increasing student motivation and engagement, fostering active and involved participation in the educational process. In addition, there is an expansion of knowledge, since collaborative interaction provides a more comprehensive and contextualized approach to the contents. Although its advantages are visible and easy to observe, it is worth noting that. According to Klein and Vosgerau (2018), this methodology also has some disadvantages, such as:

- No guarantee of active participation of all members of the group, in view of individual characteristics such as shyness;
- Lack of equal conditions in the face of teamwork;
- Tendency for some students to follow the lead of one or more dominant members, rather than making their own decisions by contributing their ideas;
- It is more difficult to assess individual student performance when they are working in groups.

However, even in the face of its obvious advantages, collaborative learning is not without its challenges and disadvantages. Among the limitations identified, the lack of guarantee of active participation of all group members is highlighted, often associated with individual characteristics, such as shyness or reticence. In addition, the lack of a level playing field in teamwork can lead to disparities in enjoying the benefits of collaboration, creating challenges in terms of equity. The tendency for some students to follow the lead of more dominant members, instead of exercising autonomy in their decisions, and the complexity associated with the evaluation of individual performance when inserted in group contexts, stand out as challenges inherent to this pedagogical approach (Borssoi, 2021; Damiani, 2018; Klein; Vosgerau, 2018).

On the other hand, Bloom's Taxonomy represents a classification system that aims to categorize the cognitive abilities involved in learning processes, providing a hierarchical structure for the planning and evaluation of teaching. Composed of six distinct categories, each reflecting a gradual increase in cognitive complexity, Bloom's Taxonomy stands out as a valuable tool to guide pedagogical practices and provide a structured approach to the achievement of educational objectives.

The first category, "Knowledge," focuses on the ability to recall specific information and facts, including the process of storing and retrieving data. For example, memorizing dates, names, and definitions falls under this level of cognitive complexity. This early stage represents the fundamental

foundation for the development of more advanced cognitive abilities, laying the foundation for deeper understanding (Trevisan; Amaral, 2016; Ferraz; Belhot, 2010).

The second category, "Comprehension", according to Trevisan and Amaral (2016), Ferraz and Belhot (2010), transcends the simple retention of information, requiring students to be able to interpret and explain the underlying meaning. In this context, the emphasis is on understanding the relationships between information and its application in different contexts. For example, the ability to explain a complex concept or summarize a text requires effective comprehension, going beyond superficial memorization. In other words, this category is related to the ability to interpret and understand information and concepts, and is fundamental for collaborative learning, since students need to understand the information in order to discuss it and collaborate with their peers. As an example we have: discussing a text, sharing notes, summarizing what was read.

The third category, "Application", is directed to the practical application of information and concepts acquired in new or different situations. Students are challenged to utilize their knowledge in a functional way, demonstrating the ability to solve specific problems or apply scientific principles to real-world contexts. The solving of mathematical problems or the application of scientific theories in concrete situations exemplify this category (Trevisan; Amaral, 2016; Ferraz; Belhot, 2010).

The subsequent category, "Analysis," implies the ability to break down information into smaller parts to understand the interrelationships between them. Analysis demands a critical approach, allowing students to compare, contrast, and identify the constituent parts of a whole, as well as identify parts of a story or a system, for example. The development of this skill provides a deeper and more contextualized understanding of knowledge (Trevisan; Amaral, 2016; Ferraz; Belhot, 2010).

"Synthesis," the fifth category, focuses on the creative ability to combine information in a creative way in order to generate something new. Synthesis demands a high level of cognitive ability, encouraging students to design scientific experiments or create narratives from fragmented concepts, for example. This internship represents a breakthrough in the practical application of the knowledge acquired. And finally, the sixth and final category, "Evaluation," requires students to be able to judge the quality and value of information, as well as make decisions based on it. This category includes the critical discussion of the relevance of a text, the analysis of the veracity of the information presented, and the appreciation of the quality of a project, demonstrating a high level of cognitive maturity (Trevisan; Amaral, 2016; Ferraz; Belhot, 2010).

In summary, Bloom's Taxonomy provides a rigorous and hierarchical framework for the understanding and application of cognitive skills, being an essential reference for the design of pedagogical and evaluative strategies. This tool continues to be a substantial contribution to the educational field, guiding the design of learning objectives and enriching the educational experience.

Thus, Bloom's Taxonomy is a widely used tool for categorizing and describing learning objectives and teaching activities.

In Distance Education, Bloom's Taxonomy is often used in the development of online courses, programs, and teaching activities, and also in the evaluation of student performance. For Sevalho (2017), some of the most common uses of Bloom's Taxonomy in distance education include:

- Reference educational materials in order to assist in the definition of goals, objectives, and learning objects.
- Guide curriculum planning, teaching, and assessment.
- Establish performance standards for students in certain competencies.
- Develop teaching activities, assisting teachers in the selection of the content to be taught, as well as in improving the way of teaching.
- Establish criteria for evaluating the quality of educational material and distance learning.
- Develop teaching material, creating specific activities to facilitate the development of critical and creative thinking skills in students.
- Assist students in developing self-assessment skills in order to determine if learning objectives have been met.
- Identify areas where students need more guidance.

The Ministry of Education determines Distance Education as an educational modality. In addition,

> presented distance education as a form of teaching that enables self-learning, with the mediation of systematically organized didactic resources, presented in different information supports, used alone or combined, and conveyed by the various media. This is a reflection of a process of change in educational public policies in favor of the improvement of educational practices (Garcia, 2013. p. 92).

It is important to emphasize that, according to the author:

> The educational methods used in the distance modality need to take into account the existing technologies to provide an adequate education for learning. In the school environment, learning is influenced by students' individual characteristics, such as skills, competencies, ease of understanding and absorbing knowledge, and ability to concentrate, and is therefore affected by intellectual differences in students' ability (Garcia, 2013, p. 5).

Overall, Bloom's Taxonomy is a valuable tool for teachers developing distance learning courses and programs. It allows teachers to identify learning objectives and develop activities that engage students at different levels of critical thinking and reflection. Group work can be considered a collaborative learning practice. In this method, students are divided into small groups and work together to achieve a common goal. Each member of the group takes on specific roles and

responsibilities while working together with the other members to achieve the goal (Sevalho, 2017; Ferraz; Belhot, 2010).

With Bloom's Taxonomy, students have a frame of reference to help them learn collaboratively and develop critical thinking and reasoning skills. Thus, there are numerous advantages in the use of Bloom's Taxonomy, and Ferraz and Belhot (2010, p. 422) point out two of these advantages in the educational context:

1. Providing a basis for the development of assessment instruments and the use of differentiated strategies in order to enable, evaluate and stimulate the performance of students at different levels of knowledge acquisition;
2. Stimulus for educators, in a conscious and structured way, to help their students in the acquisition of specific skills from the perception of the need to master simpler skills (facts) in order to later master more complex ones (concepts).

Despite all the advantages listed, the biggest challenge faced in collaborative learning in distance learning is to create an online environment that encourages engagement and connection among students. This requires teachers to develop strategies that allow students to share, collaborate, and discuss effectively. In addition, it is also necessary for teachers to have enough knowledge to use these tools efficiently so that all students can reach their maximum learning potential.

4 FINAL THOUGHTS

The research undertaken in this investigation revealed Bloom's Taxonomy as a pedagogical tool intrinsically dedicated to the planning and evaluation of educational processes. Composed of six distinct cognitive categories, taxonomy plays a crucial role in identifying and delineating learning objectives, offering a conceptual framework for understanding how these objectives can be effectively achieved.

In summary, each cognitive category of Bloom's Taxonomy outlines specific goals that transcend the mere acquisition of knowledge. The category of critical thinking, exemplified by analysis, aims at identifying and understanding complex problems through discussion and collaboration among peers. Application, another category of critical thinking, proposes the practical use of the knowledge acquired in problem solving, evidencing the applicability of the categories in the promotion of more sophisticated skills.

The communication category, addressed in both the interpersonal and technological spheres, highlights the importance of developing communication and teamwork skills, as well as the use of technologies to access, evaluate, and share relevant information. This multidimensional approach aligns with the contemporary demands of digital education, incorporating collaborative and technological aspects into the learning process.

The category of metacognition, represented by self-regulation, emphasizes reflection on the learning process and the application of lessons learned in future situations. This approach not only enriches the educational experience, but also prepares students for self-regulation of their own learning, an essential competency in the context of collaborative learning.

Thus, Bloom's Taxonomy can be applied in a variety of ways in the context of collaborative learning in distance learning. Teachers can use it to plan collaborative activities that involve different levels of cognitive skills, as well as analysis, assessment, and creation. In addition, teachers can divide students into working groups based on the learning objectives and cognitive skills they want to develop. It can also be used to assess students' performance in group work and online discussions, allowing teachers to identify areas of strength for improvement by students, providing specific feedback to help them in their educational progress. It can also be used as a way to develop the ability to evaluate and judge one's own learning, which is fundamental for collaborative learning. For example, when working in groups, students can be encouraged to reflect on their own contributions and learning and how they can be improved.

The practical application of Bloom's Taxonomy in collaborative learning in distance learning emerges as a multifaceted challenge. The absence of physical contact between participants can be a barrier to effective collaboration and assessment of learning. In this context, it is essential to adapt pedagogical strategies, fully capitalizing on the potential of the technological resources available to mitigate such challenges.

In the collaborative learning landscape, Bloom's Taxonomy provides a valuable conceptual framework for the planning, execution, and evaluation of educational activities. Applying taxonomy allows teachers to strategically direct collaborative activities, incorporating different levels of cognitive skills, from analysis to assessment to creation. In addition, the formation of work groups based on learning objectives and desired cognitive skills represents an effective strategy to optimize collaboration and promote students' cognitive development.

The assessment of student performance in group work and online discussions, mediated by Bloom's Taxonomy, provides a systematic and insightful approach to identifying areas of strength and improvement. The use of taxonomy as an instrument for self-assessment by students, encouraging reflection on their own contributions and learning, represents an innovative application that promotes metacognition and self-knowledge, fundamental aspects in contemporary education.

However, even in the face of its undeniable benefits, the application of Bloom's Taxonomy to collaborative learning in distance learning requires careful adaptations and careful consideration of the challenges inherent in this particular context. Overcoming these challenges requires flexible pedagogical strategies, taking full advantage of the available technological resources and promoting

effective integration among participants. The effectiveness of this adaptation is crucial to ensure the effectiveness of the collaborative learning process in the virtual environment.

In view of the above, it was possible to verify that, despite all the benefits listed, applying Bloom's Taxonomy in collaborative learning in distance learning can be a challenge. The lack of physical contact between participants can hinder collaboration and assessment of learning. For this reason, it is important to adapt the strategy to ensure the effectiveness of learning and to make the most of the potential of the technological resources available.

Finally, the continued need for research, discussions, and in-depth study remains undisputed. These elements are fundamental to analyze the application of Bloom's Taxonomy in collaborative learning in distance learning and to evaluate its results in a comprehensive and reliable manner. Only through a careful and continuous analysis, supported by a solid basis of research and discussion, will it be possible to sustain and justify the adoption of Bloom's Taxonomy in collaborative learning, giving it credibility and reliability. This evidence-based approach represents a significant step towards an in-depth understanding of the effectiveness of this innovative strategy, aligned with the positive purposes and demands of 21st century digital culture.

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