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DIGITAL PLATFORMS IN SECONDARY EDUCATION: a review study

PLATAFORMAS DIGITAIS NO ENSINO MÉDIO: um estudo de revisão

PLATAFORMAS DIGITALES EN LA EDUCACIÓN SECUNDARIA: un estudio de revisión

Aderson Leite Rodrigues[1]
Derli Juliano Neuenfeldt[2]

Abstract
The aim of this research was to analyze the use of digital platforms in teaching and learning processes in secondary education. It is a qualitative, descriptive, and review study, grounded in the investigation of dissertations and theses published between 2019 and 2024, available in the CAPES and BDTD repositories. In total, nine works were analyzed, presenting different perspectives, ranging from discussions about the return to face-to-face classes after the pandemic period to practices of integrating Digital Information and Communication Technologies (ICT) as mediators of the pedagogical process. The results indicate that digital platforms expand didactic and methodological possibilities, promoting the personalization of teaching and the diversification of learning strategies. However, they also reveal limitations related to technological infrastructure and the need for adequate teacher training for their critical and effective use. The relevance of interdisciplinary planning is highlighted as an essential requirement to ensure the conscious integration of these tools into the school curriculum. Furthermore, gamification, exemplified by the use of the *Nivelamento Online* (NiO) platform in Physics teaching, demonstrated great potential to engage students, increasing motivation and contributing to the improvement of academic performance. Therefore, it is concluded that digital platforms constitute relevant instruments for innovative pedagogical practices in secondary education, provided they are accompanied by continuous evaluation and reflections that enable the optimization of their benefits in the teaching and learning process.

[1] PhD candidate in the Graduate Program in Teaching (PPGEnsino) at Universidade do Vale do Taquari – Univates, Lajeado, RS, Brazil. Pedagogical Supervisor at Secretaria de Estado da Educação do Piauí. E-mail: aderson.rodrigues@universo.univates.br
[2] PhD in Sciences: Environment and Development from Universidade do Vale do Taquari – Univates, Lajeado, RS, Brazil. Full Professor in the Physical Education undergraduate program and in the Graduate Program in Teaching at Universidade do Vale do Taquari – Univates. E-mail: derlijul@univates.br

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Keywords: Digital Platforms. Teaching Processes. Secondary Education. Digital Technologies.

Resumo
Este artigo teve como objetivo analisar a utilização de plataformas digitais nos processos de ensino e aprendizagem efetivados no Ensino Médio. Trata-se de uma pesquisa qualitativa, de caráter descritivo e de revisão, que se fundamentou na investigação de dissertações e teses publicadas entre 2019 e 2024, disponíveis nos repositórios da CAPES e BDTD. No total, foram analisados nove trabalhos, que apresentam diferentes perspectivas, abrangendo desde as discussões sobre o retorno às aulas presenciais após o período de pandemia até as práticas de integração das Tecnologias Digitais de Informação e Comunicação (TDICs) como mediadoras do processo pedagógico. Os resultados apontam que as plataformas digitais ampliam as possibilidades didáticas e metodológicas, favorecendo a personalização do ensino e a diversificação das estratégias de aprendizagem. Entretanto, também revelam limitações quanto à infraestrutura tecnológica e à formação docente adequada para sua utilização crítica e efetiva. Destaca-se a relevância do planejamento interdisciplinar como requisito essencial para garantir a integração consciente dessas ferramentas ao currículo escolar. Além disso, a gamificação, exemplificada pelo uso da plataforma Nivelamento Online (NiO) no ensino de Física, demonstrou grande potencial para engajar os estudantes, aumentando a motivação e contribuindo para a melhoria do desempenho acadêmico. Conclui-se, portanto, que as plataformas digitais se configuram como instrumentos relevantes para as práticas pedagógicas inovadoras no Ensino Médio, desde que acompanhadas de avaliação contínua e de reflexões que possibilitem otimizar seus benefícios no processo de ensino e aprendizagem.

Palavras-chave: Plataformas Digitais. Processos de Ensino. Ensino Médio. Tecnologias Digitais.

Resumen
El artículo tuvo como objetivo analizar el uso de plataformas digitales en los procesos de enseñanza y aprendizaje realizados en la Enseñanza Secundaria. Se trata de una investigación cualitativa, de carácter descriptivo y de revisión, basada en la indagación de disertaciones y tesis publicadas entre 2019 y 2024, disponibles en los repositorios de CAPES y BDTD. En total, se analizaron nueve trabajos que presentan diferentes perspectivas, abarcando desde las discusiones sobre el regreso a las clases presenciales después del período de pandemia hasta las prácticas de integración de las Tecnologías Digitales de Información y Comunicación (TDIC) como mediadoras del proceso pedagógico. Los resultados señalan que las plataformas digitales amplían las posibilidades didácticas y metodológicas, favoreciendo la personalización de la enseñanza y la diversificación de estrategias de aprendizaje. Sin embargo, también revelan limitaciones relacionadas con la infraestructura tecnológica y la adecuada formación docente para su utilización crítica y efectiva. Se destaca la relevancia de la planificación interdisciplinaria como requisito esencial para garantizar la integración consciente de estas herramientas al currículo escolar. Además, la gamificación, ejemplificada con el uso de la plataforma Nivelamento Online (NiO) en la enseñanza de Física, demostró un gran potencial para involucrar a los estudiantes, aumentando su motivación y contribuyendo a la mejora del rendimiento académico. Se concluye, por tanto, que las plataformas digitales se configuran como instrumentos relevantes para las prácticas pedagógicas innovadoras en la Educación Secundaria, siempre que estén acompañadas de una evaluación continua y reflexiones que permitan optimizar sus beneficios en el proceso de enseñanza-aprendizaje.

Palabras clave: Plataformas Digitales. Procesos de Enseñanza. Educación Secundaria. Tecnologías Digitales.

Introduction

Currently, technologies occupy an important place in society. With the rise of digital technologies, digital platforms have assumed an increasingly prominent role in education, transforming the way students learn and interact with knowledge. In this regard, Kenski (2012, p. 45) highlights that "the history of education runs parallel to the history of technology; each technological advancement brings with it new possibilities for teaching and learning". This panorama reflects a trajectory of constant transformations, in which technological tools offer opportunities to rethink and reform educational practices.

These tools have the potential to promote access to diverse knowledge resources, personalize teaching, and expand possibilities for interaction between teachers and students. However, the use of digital platforms is not without challenges. According to Kenski (2012), technological mediation requires specific competencies from both teachers and students.

The implementation of these tools, however, requires critical reflection on the challenges and possibilities to ensure that the use of these technologies is effective. According to Moran (2020b), the use of technologies in the school environment should not be merely instrumental; rather, it should be grounded in a pedagogical proposal that promotes meaningful and participatory learning. Furthermore, Kenski (2012) emphasizes that the integration of digital platforms requires continuous teacher training and strategic planning aligned with students' needs and curricular objectives.

Moran (2020a) argues that digital technologies provide significant support to pedagogical practice, enabling the creation of more dynamic and interactive environments. In secondary education, digital platforms can contribute to new teaching formats, such as active methodologies, blended learning, and the flipped classroom. For Moran (2020a), these approaches position the student as the protagonist of the learning process, allowing them to develop at their own pace and

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explore topics according to their interests and needs.

Moran (2020b) argues that, in the Brazilian context, the COVID-19[3] pandemic accelerated the use of these tools, highlighting the importance of innovative and flexible pedagogical practices. Empirical observations in the school context led us to perceive an expansion in the use of different digital platforms, especially during and after the period of remote teaching imposed by the pandemic.

Authors such as Silva, Sousa and Menezes (2024) state that the pandemic required teachers to seek new ways of communicating with their students, who were outside the usual classroom context. In this scenario, teachers were once again compelled to reinvent their teaching practices. Digital technologies became part of the pedagogical routine, with the transposition of face-to-face classes to virtual environments, highlighting the potential of these technologies for teaching and learning.

The emergence of remote teaching during the COVID-19 pandemic brought new challenges to light, requiring careful analysis of strategies mediated by digital platforms in education. In this context, the importance of interdisciplinary planning stands out as a necessary construction for the effective integration of digital technologies in secondary education, promoting innovative pedagogical practices adaptable to the emerging digital culture.

Thus, this article aimed to analyze the use of digital platforms in teaching and learning processes carried out in secondary education. To this end, we relied on the analysis of theses and dissertations that address this topic.

It is understood that the analysis of these works allows us to comprehend the integration of digital platforms into educational practice within the context of Brazilian secondary education. Moreover, considering that the use of digital platforms in education is a constantly evolving field, understanding the current panorama is essential to identify gaps and, thus, seek a solid foundation for future research and the improvement of teaching practices.

[3] Acute respiratory infection caused by the SARS-CoV-2 coronavirus, potentially severe, highly transmissible, and globally distributed.

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Methodology

This research adopts a qualitative approach (Bogdan; Biklen, 2013), is descriptive in terms of its objective (Lakatos; Marconi, 2021), and consists of a bibliographic review regarding its technical procedures (Minayo, 2024). The study sought to identify recent research related to the use of digital platforms in teaching processes in secondary education by consulting scientific research databases, such as the CAPES Theses Catalog and the Brazilian Digital Library of Theses and Dissertations (BDTD).

For the development of this investigation, descriptors related to the research problem and objective were defined. The descriptors used in the search included the Boolean operator "plataformas digitais" AND "Ensino Médio". These descriptors were applied in both aforementioned databases. The time frame considered encompassed the last five years, corresponding to the period from January 2019 to May 2024. The search was limited to works written in Portuguese that, in some way, addressed the use of digital platforms in teaching and learning processes specifically directed to regular secondary education.

After applying these filters, 3 master's dissertations were found in the CAPES Theses and Dissertations Catalog, and 192 results were identified in the Brazilian Digital Library of Theses and Dissertations (BDTD). Of the 192 results from BDTD, 154 were dissertations and 38 were doctoral theses. Altogether, 195 works were identified across CAPES and BDTD. For analysis, 8 master's dissertations and 1 doctoral thesis were selected. The selection process initially involved reading the abstracts and keywords, followed by a more detailed examination of the research context, methodologies, and results analysis. Based on the reading of abstracts and keywords, 153 works were excluded. Subsequently, after analyzing the textual elements of the works, an additional 33 works were excluded. These works were excluded because they were not directly related to the use of digital platforms in teaching and learning processes in regular secondary education; instead, they focused on other contexts, levels, and modalities of education, such as Early Childhood Education, Elementary Education, Higher Education, or Technical Secondary Education, which did not meet the inclusion criteria of this study.

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Based on this process, it is observed that the selection of works enabled the construction of a consistent analytical *corpus* aligned with the research objectives, ensuring greater precision in analyzing the use of digital platforms in the context of secondary education. The exclusion of works that did not meet the established criteria reinforces the reliability of the analyzed data, while also highlighting the specificity of the investigated topic. In this sense, once the set of studies that underpin this investigation was defined, the next section presents the results and discussion, in which the contributions of the selected works are presented and analyzed, highlighting their approaches, findings, and implications for the integration of digital platforms in teaching and learning processes.

Results and Discussion

Regarding the selected works, both the master's dissertations and the doctoral thesis presented important reflections on the use of digital platforms, addressing a range of relevant topics for the integration of digital platforms in contemporary education. From the analysis of the return to face-to-face classes in the post-COVID-19 pandemic period and the use of Digital Information and Communication Technologies (DICT) in secondary education, to pedagogical mediation through the Google Classroom platform, the reflections highlight both the possibilities and limitations of these tools. Furthermore, they investigate the role of DICT in the teaching of specific subjects and content areas, such as Mendelian Genetics and Biology, through educational platforms such as "*Trilha do Conhecimento*" (Knowledge Path). Below, we present a descriptive overview of the works corresponding to the aforementioned time frame, which address the use of digital platforms in teaching and learning processes, specifically within the context of regular secondary education.

To facilitate the analysis of the selected works and the understanding of their relationship with the present research, Table 1 was developed with the following specifications: authors, title, institution, year, and type of publication.

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Table 1: Dissertations and Thesis Selected for the Study

Author/Year	Title	Institution/Publication
01 - FERREIRA, E. dos S. (2023)	Challenges in Remote Mathematics Teaching During the COVID-19 Pandemic: An Analysis of Strategies Mediated by Digital Platforms	Universidade Federal do Oeste do Pará (UFOPA) (Master's Dissertation)
02 - COSTA, T. R. P. da (2019)	Interdisciplinary Planning in Secondary Education: A Possible Construction through Digital Platforms	Universidade Federal do Tocantins (UFT) (Master's Dissertation)
03 - NEVES, M. A. S. das (2023)	Gamified Educational Platforms and Physics Teaching: The Case of Online Leveling	Universidade Estadual do Centro - Oeste, UNICENTRO – PR (Master's Dissertation)
04 - FREIRE, J. A. (2019)	Digital Platform "Knowledge Trail": The Use of Information and Communication Technologies for the Creation and Application of Educational Objects in Biology Teaching	Universidade Federal de Minas Gerais (UFMG) (Master's Dissertation)
05 - OLIVEIRA, M. D. S. de (2020)	The Use of Google Classroom as a Pedagogical Mediation Tool	Universidade Federal de Juiz de Fora (UFJF) (Master's Dissertation)
06 - SILVA, A. K. R. F. da (2023)	Digital Technologies, Emergency Remote Teaching, and Pedagogical Practice in High School Biology: Reflections on Teachers' Practice	Universidade Estadual de Feira de Santana (UEFS) (Master's Dissertation)
07 - SOUZA, P. V. da S. e (2019)	Didactic Use of Mobile Phones in Biology Classes through the Google Classroom Tool	Universidade do Estado do Rio de Janeiro (UERJ) (Master's Dissertation)
08 - NICANDIDO FILHO, A. dos S. (2019)	Mendelian Genetics Teaching and Learning Mediated by Digital Information and Communication Technologies	Universidade Federal de Alagoas (UFAL) (Master's Dissertation)
09 - VANZ, G. (2023)	The Use of the Google Classroom Platform in the Teaching Practice of Geography Teachers in Southwestern Paraná during the COVID-19 Pandemic	Universidade Estadual do Oeste do Paraná (UNIOESTE) (Doctoral Thesis)

Source: Prepared by the authors (2024).

The presentation of the results begins with the study by Ferreira (2023), entitled "*Challenges in Remote Mathematics Teaching During the COVID-19 Pandemic: An Analysis of Strategies Mediated by Digital Platforms*", which provides relevant reflections on the adaptation of teachers and students to a new educational scenario. The investigation was conducted in the western region of Pará, involving 23

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Mathematics teachers from public and private schools, distributed across several cities in the region, such as Santarém, Alenquer, Almeirim, Belterra, Itaituba, Mojuí dos Campos, Monte Alegre, Óbidos, and Senador José Porfírio.

Ferreira (2023) states that teachers played a fundamental role in maintaining the continuity of Mathematics teaching and in seeking effective strategies to ensure the quality of education during the pandemic. However, it became evident that teachers, in many cases, felt insecure regarding technological adaptation, requiring them to quickly adjust to the use of digital platforms such as Google Meet, Google Classroom, Zoom, and Skype. Thus, the results of the study indicate that investing in technological qualification and teacher training can have positive impacts on teaching.

In addition to these technical difficulties, the study conducted by Ferreira (2023) highlights the emotional challenges faced by teachers, such as the lack of personal interaction with students, the impersonality of remote teaching, and the difficulty in assessing content assimilation without visual feedback. The study points out that the emergence of the pandemic required teachers to reinvent their teaching practices, leading them to explore new pedagogical strategies and seek creative alternatives to ensure the continuity of student learning. During this period, greater importance was given to digital platforms. They played a crucial role in remote Mathematics teaching by enabling access to educational content, fostering interaction between teachers and students, and contributing to the construction of mathematical knowledge. The study also emphasizes the need for continuous teacher training in educational technologies and virtual learning environments in order to improve pedagogical practices and ensure the quality of education (Ferreira, 2023).

These results highlight the challenges, transformations, and opportunities generated by remote Mathematics teaching during the pandemic, emphasizing the importance of adaptation, innovation, and mutual support among teachers, students, and educational institutions. In this sense, it is evident that digital platforms are tools that significantly contribute to improving the quality of education, promoting digital inclusion, expanding access to education, and fostering the development and consolidation of essential skills for the 21st century.

Costa (2019), who investigated "*Interdisciplinary Planning in Secondary Education: A Possible Construction Through Digital Platforms*", examined whether the School Management System (SGE) enables the development of interdisciplinary planning as a digital platform for collaborative work within the State Education Network of Tocantins. The study addresses the importance of interdisciplinarity in secondary education and the use of digital platforms for the development of interdisciplinary planning. Costa (2019) conducted the research in different phases, ranging from the analysis of practical experiences reported by teachers, virtual communication channels on platforms such as Eproinfo and Moodle, course and lesson plans, as well as a comparison between the planning model of the School Management System and that of the Ministry of Education (MEC) Teacher Portal.

The author highlights the need to overcome the fragmentation of school knowledge and to promote an interdisciplinary approach, using Information and Communication Technologies (ICT) as enabling tools. Interdisciplinarity is seen as a way to foster more meaningful and autonomous learning for students, as well as to support the understanding of content required in assessments such as the Brazil's National Secondary Education Examination (Exame Nacional do Ensino Médio - ENEM).

However, Costa's (2019) study identified that the planning module of the School Management System (SGE) does not provide the necessary tools for the development of interdisciplinary planning, unlike the Teacher Portal of the Ministry of Education (MEC), which offers resources for the development of collaborative work among teachers. The lack of collaborative and cooperative elements in the SGE was identified as an obstacle to the effective implementation of interdisciplinarity.

In light of this, Costa (2019) suggests the reformulation of the SGE planning space, with the inclusion of resources aimed at fostering collaborative work among teachers, in order to address both the pedagogical and technological aspects required for an effective interdisciplinary approach. The study emphasizes the importance of strategically integrating digital technologies into the educational environment to enhance interdisciplinary work and promote more meaningful and contextualized learning for secondary education students.

The possibility of strategically integrating digital technologies into the

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educational environment fosters and enhances interdisciplinary work and promotes more meaningful and contextualized learning for secondary education students. By using resources such as digital platforms, virtual learning environments, and multimedia tools, teachers can create learning situations that stimulate critical thinking, problem-solving, and student autonomy.

In this sense, technologies should not be seen merely as support tools, but as mediators of the educational process, capable of reshaping methodologies and making teaching more engaging, participatory, and aligned with contemporary demands.

Neves' (2023) dissertation investigated the effectiveness of gamification through the gamified educational platform *Nivelamento Online* (NiO) in Physics teaching in secondary education. The study, which involved 66 students from Colégio Estadual Alto da Glória, located in the municipality of Palmas, Paraná, evaluated evidence of learning provided by gamification by correlating students' learning outcomes before and after the implementation of the activity sequence. It also analyzed students' experiences with gamification, as well as the platform's ability to motivate them to learn, and produced a guide to assist teachers in implementing gamification in their classes.

According to Neves (2023), gamification through the NiO platform significantly contributed to student engagement, improving their academic performance in Physics. The platform's personalized approach, adapting to students' individual needs, promoted a more engaging and effective learning experience. In addition, gamification encouraged active student participation, making the teaching process more dynamic and motivating (Neves, 2023).

The analysis of pre- and post-test data in Neves' (2023) study revealed a higher learning gain in the Experimental Group (EG) compared to the Control Group (CG), demonstrating the effectiveness of gamification in Physics teaching. The results also indicated a significant improvement in the academic performance of students in the EG, highlighting the importance of the gamified approach in promoting learning.

In light of the above, the findings indicate that gamification through *Nivelamento Online* is an effective strategy to motivate students, improve their

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academic performance, and promote a more engaging and personalized learning experience in Physics. The study reinforces the importance of gamified educational platforms as innovative tools in teaching and learning processes in Natural Sciences and Mathematics.

Freire's (2019) study, entitled "*Digital Platform "Knowledge Trail": The Use of Information and Communication Technologies for the Creation and Application of Educational Objects in Biology Teaching"*, addresses the use of Information and Communication Technologies (ICT) for the creation and application of educational objects in Biology teaching. The study was developed in five stages, beginning with the creation of the digital platform "Knowledge Trail", based on QR code scanning via smartphones. Subsequently, educational objects such as the "Trail Games" and the "Crossing Simulator" were developed.

The research focused on verifying the applicability of these educational objects with second- and third- year secondary education students in relation to Biology content. Freire (2019) used questionnaires as data collection instruments to identify students' profiles regarding smartphone and internet use, as well as to assess their perceptions of the pedagogical experience with the educational objects. The participants were selected by convenience sampling and consisted of students from a public state school in Belo Horizonte, Minas Gerais, during the years 2018 and 2019.

Freire's (2019) study highlights the importance of ICT as a mediator of the teaching and learning process, aiming to improve the educational process. The research contributes to pedagogical innovation by using technologies to make Biology teaching more dynamic and engaging, with the goal of improving students' understanding of and interest in the content. Therefore, this study demonstrates the relevance of using ICT-based educational objects as a complementary strategy in Biology teaching, providing a more interactive and engaging learning experience for students.

In summary, Freire's (2019) study reaffirms that the effective integration of digital technologies in Biology teaching lies in the adoption of innovative tools and the development of intentionally mediated pedagogical practices capable of engaging with students' experiences and technological repertoires. The use of the "Knowledge Trail" platform and interactive educational objects shows that ICT, when well aligned

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with the curriculum, enhances engagement, fosters active learning, and expands the possibilities for understanding complex content.

However, the study also raises reflections about the challenges surrounding this integration, particularly regarding teacher training, school infrastructure, and the critical use of technologies. Thus, rather than merely a complementary resource, ICT emerges as a structuring element of contemporary pedagogical practice, requiring teachers to adopt a reflective and innovative stance capable of transforming teaching into a meaningful, contextualized experience aligned with the demands of the digital society.

Oliveira (2020), in turn, focused on analyzing the use of the Google Classroom platform as a pedagogical mediation tool in Biology classes in secondary education. The study aimed to investigate how the integration of Information and Communication Technologies (ICT) could contribute to Biology teaching, empowering students and promoting their active role through an inquiry-based approach.

Oliveira's (2020) research provided technical instruction to students on the use of Google Classroom, examined Biology teachers' use of ICT, identified students' profiles regarding access to ICT, developed and implemented an inquiry-based instructional sequence, and evaluated potential difficulties faced by teachers in using ICT. The study was conducted at Colégio Estadual de Cândido Sales, in the southwest of Bahia, with the participation of 27 second-year secondary education students and five Biology teachers. Ultimately, the research offers significant contributions to the field of Biology teaching, highlighting the importance of Google Classroom as a relevant pedagogical mediation tool. Oliveira (2020) emphasized the importance of appropriately integrating ICT into the teaching and learning process in order to improve the quality of education and promote students' active participation in their own learning.

Oliveira (2020), within this context, within this context, found positive acceptance of the Google Classroom application among students, suggesting the feasibility of its adoption as a pedagogical platform in everyday school practices. On the other hand, teachers faced difficulties in integrating Information and Communication Technologies (ICT) into their pedagogical practices, highlighting the

need for teacher training in this area. The study also emphasizes the importance of promoting student agency through an inquiry-based approach using ICT, with the aim of improving the quality of Biology teaching.

Thus, it became evident that Oliveira's (2020) research contributed to expanding knowledge about the use of Google Classroom as a pedagogical mediation tool, highlighting its relevance in the contemporary educational context and pointing to pathways for the effective integration of ICT in Biology teaching.

The analysis of Oliveira's (2020) study shows that the integration of ICT in Biology teaching constitutes a process that requires pedagogical intentionality, planning, and continuous teacher training. In this sense, the results indicate that the use of Google Classroom supported pedagogical mediation and expanded the possibilities for inquiry-based learning, promoting greater student engagement and agency.

However, the difficulties faced by teachers in using ICT reveal one of the main obstacles to consolidating these practices: insufficient preparation to meaningfully integrate technologies into the curriculum. This finding aligns with the discussions proposed by Moran (2020a; 2020b), as it shows that the potential of technologies is directly related to the adoption of active methodologies and the reorganization of pedagogical practices. Thus, the study reinforces that, although there is acceptance and feasibility in the use of digital platforms in everyday school contexts, their effectiveness depends on a coordinated effort involving infrastructure, teacher training, and innovative pedagogical approaches capable of transforming students into active participants in the learning process.

Silva's (2023) study, entitled "*Digital Technologies, Emergency Remote Teaching, and Pedagogical Practice in Biology in Secondary Education: Reflections on Teaching Practice*", addresses the integration of digital technologies and emergency remote teaching in Biology pedagogical practices in secondary education. The study promotes reflection on the role of the teacher in this context, highlighting the importance of continuous professional development and adaptation to new educational demands. It aimed to understand how pedagogical practices were conducted and mediated by digital technologies during synchronous activities in Emergency Remote Teaching (ERT) from March to July 2021.

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The research was conducted at the Centro Integrado de Educação Assis Chateaubriand, in Feira de Santana, with the initial participation of four secondary education Biology teachers. Online questionnaires and discussion groups were used as data collection instruments. The results revealed both contributions and challenges associated with the use of digital technologies in synchronous class contexts, impacting pedagogical planning and the selection of digital interfaces for teaching during ERT. Furthermore, the study provided an opportunity for reflection on the teacher's role during the pandemic period, encouraging critical examination of the use of digital technologies in Biology teaching.

The dissertation also highlights the importance of continuous teacher education and their adaptation to new educational demands, emphasizing the need to develop digital competencies and innovate in teaching strategies. In summary, Silva's (2023) study provides important insights into the impact of digital technologies and emergency remote teaching on pedagogical practices in Biology in secondary education, contributing to the understanding of the challenges and opportunities offered by these tools in the contemporary educational context.

Souza's (2019) study, entitled "*Didactic Use of Mobile Phones in Biology Classes Through the Google Classroom Tool*", also addresses the integration of digital technologies, specifically mobile phones and the Google Classroom platform, into Biology teaching in secondary education. The study explores the educational potential of these technologies to enhance student engagement. It aimed to develop an instructional sequence to support teachers and students in the teaching and learning process of Biology using the Google Classroom (GC) platform, with the intention of creating a more interactive and engaging learning environment.

The research was conducted using a participatory action research model, involving collaboration among participants to develop solutions to collectively identified problems. The study was carried out in a public state school in Rio de Janeiro, with approximately 90 evening secondary education students, aged between 15 and 25 years old.

In the first semester of 2018, the school was registered on the Google Suite for Education platform, creating accounts for students and virtual classrooms.

Throughout the academic year, lecture-based classes were combined with various activities on the Google Classroom platform, exploring functionalities such as integration with other digital platforms, including YouTube, Google Drive, Google Docs, and Google Forms. The activities included the use of photography and video recording, online social interaction, and the creation of multimedia content, such as mini-documentaries and video lessons.

Students responded to diagnostic questionnaires at the beginning and end of the academic year to evaluate the effectiveness of the activities. The proposed activities were observed, recorded, analyzed, and adjusted as necessary. Student participation and academic performance were monitored to assess the quality of the educational process. The Google Classroom platform proved to be a simple and practical tool, with a wide range of features, allowing for greater student interaction and engagement (Souza, 2019).

The results of this study indicated that the use of the Google Classroom platform, combined with students' mobile phones, can facilitate the implementation of active and inquiry-based teaching methodologies. According to the findings, the platform helped make Biology classes more dynamic and interactive, promoting more meaningful learning. The study concludes that the integration of digital platforms can be a viable pathway to modernize and improve Biology teaching in secondary education.

Nicandido Filho's (2019) study, entitled "*Teaching and Learning of Mendelian Genetics Mediated by Information and Communication Technologies (ICT)*", examines the relationship between the Meaningful Learning Theory and the teaching of Mendelian Genetics. It investigated how the teaching and learning of Mendelian Genetics can be mediated by ICT, based on the Meaningful Learning Theory to support the construction of systematized knowledge.

The results of the research were presented in two articles. The first analyzed elements such as public policies for the integration and use of ICT in Brazilian education and how these technologies can foster teaching and learning about Mendelian principles. The second article addressed the use of information and communication technology resources that can be applied to improve the quality of teaching in lessons on genetic traits. This research culminated in the educational

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product "*Virtual Classroom on Mendelian Genetics*", entitled "*Genética Fácil*" (Easy Genetics), aimed at the general public interested in learning basic concepts of heredity through a set of digital tools integrated into a single free online platform called Edmodo, developed by Google, to create a strategic virtual learning environment. The study involved two groups of students from a public school in northeastern Brazil, totaling 23 third-year secondary education students and eight Biology teachers.

According to Nicandido Filho (2019), the use of a digital platform such as Edmodo supports practical teaching and dynamic learning experiences, developed through explanatory videos and animations. In addition, the study observed the development and assimilation of Mendelian Genetics concepts by the research participants. The application of Meaningful Learning Theory proved to be effective in teaching and learning processes, as it enabled participants to assimilate and organize Mendelian genetics concepts into a broader and more meaningful cognitive structure, with 82% achieving or exceeding the required term average. Furthermore, students demonstrated interest in activities such as simulations, games, videos, and other content within the Virtual Learning Environment (VLE).

Finally, the doctoral thesis by Vanz (2023), entitled "*The Use of the Google Classroom Platform in the Teaching Practices of Geography Teachers in Southwestern Paraná During the COVID-19 Pandemic*", analyzes the implementation and impact of Information and Communication Technologies (ICT) in the educational system of Paraná, with a specific focus on the use of the Google Classroom platform during the COVID-19 pandemic. The study provides a historical overview of the main federal and state public policies that have supported the implementation of ICT in education.

Vanz's (2023) analysis indicates that, despite various initiatives, many federal programs produced unsatisfactory results due to issues in their implementation and policy discontinuity. However, some state-level projects, such as *Conectados 2.0*, proved to be more aligned with emerging needs, especially during the pandemic.

The thesis explores how the COVID-19 pandemic accelerated the adoption of remote teaching, using Google Classroom as the primary platform for interaction. It examines the challenges faced by teachers in adapting to online teaching, including

the need for specific training for the effective use of ICT.

One of the main challenges identified by the author is the inequality in access to the internet and technological devices among students. The study highlights that, despite efforts to promote digital inclusion, the lack of adequate infrastructure and socioeconomic disparities compromise the effectiveness of ICT in education.

The research also raises a critical discussion about the growing influence of large corporations, such as Google, Microsoft, and Facebook, in the educational sector. It is argued that the rapid adoption of digital platforms may be aligned with a neoliberal project of education privatization, with the aim of increasing economic efficiency at the expense of quality and equity in education.

Therefore, the results indicate that, although the Google Classroom platform provided a rapid and accessible solution for the continuity of classes during the pandemic, its effectiveness was limited by infrastructure problems, insufficient teacher training, and unequal access among students. The study concludes that the integration of ICT in education requires not only technological investment but also robust public policies that ensure continuous teacher training and equitable access to technologies.

In summary, Vanz' (2023) research offers an analysis of the challenges and opportunities in the implementation of ICT in education in Paraná, highlighting the importance of inclusive and effective public policies for the success of this integration.

Considering the readings and analyses of the dissertations and thesis used in this study, we highlight the key points emphasized by the authors based on their reflections on the digital platforms used by teachers, in addition to those mentioned in the text (such as Google Classroom), which may contribute to improving infrastructure, enhancing connectivity, and expanding access to technological devices for all students; as well as digital inclusion policies, with the adoption of measures that promote understanding of teachers' technological choices.

The results highlight the relevance of digital platforms in education, reinforcing the need for a structured pedagogical approach for their effective integration. Kenski (2012) emphasizes that technology, when incorporated into the school context, becomes a natural extension of teaching and learning processes, requiring

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continuous updating and adaptation from teachers. From this perspective, Moran (2020a) complements this view by arguing that the use of these tools should go beyond a simple transposition of traditional teaching to digital formats, requiring active methodologies that engage students and promote personalized learning.

Digital platforms not only enable access to knowledge but also foster innovative practices, such as gamification and blended learning, which encourage student autonomy and agency. However, both Kenski and Moran warn that the adoption of these technologies must be linked to continuous teacher education and to educational policies that ensure equity in access to digital tools. Thus, the advancement of the use of platforms in secondary education depends on the articulation between pedagogical innovation, adequate infrastructure, and teacher training, essential elements for these technologies to become truly transformative in the educational context.

In this regard, investigating whether teachers explore other options, the criteria used to select these platforms, and the importance of interfaces with mobile devices, such as smartphones, can provide greater clarity about the diversity of available tools and their suitability to students' needs. However, the studies also point to certain difficulties in using platforms as pedagogical resources, as well as the need for continuous teacher training and digital literacy.

It can be observed, therefore, that based on the gaps identified here, there is a need for a more in-depth approach to the continuity of digital platform use in the post-pandemic context, the diversification of the areas of knowledge studied, the expansion of discussions on the platforms used and on the criteria for their selection, as well as the inclusion of reflections on the importance of interfaces with mobile devices. These improvements may enrich the analysis and provide new insights for future research in the field of secondary education and educational technologies.

In light of the above, it is evident that digital platforms have gained increasing importance in education, especially during and following the COVID-19 pandemic. Tools such as Google Classroom, Edmodo, and other gamified platforms can facilitate the continuity of learning and interaction between teachers and students. These tools also underscore the need for teacher training in the use of these technologies and for

rapid adaptation to new educational demands. Furthermore, digital platforms have enabled innovative and interactive teaching methods, increasing student engagement and improving academic performance. However, the effectiveness of these tools also depends on public policies that ensure digital inclusion and equitable access for all students, promoting a more equitable and efficient educational environment.

The adoption of digital platforms in education has emerged as a relevant strategy for maintaining educational activities during the pandemic, offering new, more interactive, and engaging forms of learning. The success of these tools depends on continuous investment in teacher training and technological infrastructure to ensure equitable access for all students. In this way, digital platforms have the potential to modernize and enrich education in an inclusive and sustainable manner.

Thus, through the use of digital platforms, it is possible to develop innovative practices in teaching processes to the point that they are "[...] no longer even considered technologies" (Kenski, 2012, p. 44), as they become incorporated into practice and develop naturally, based on the needs and possibilities present in each context.

In this context, the consolidation of digital platforms in the educational landscape points to the need for a paradigmatic shift that goes beyond the emergency nature observed during the pandemic and becomes a structuring element of contemporary pedagogical practices. The incorporation of these tools, such as Google Classroom and other digital solutions, demonstrates that their effectiveness is directly linked to pedagogical intentionality, effective teacher mediation, and the ability to adapt to different school realities.

As discussed by Moran (2020b), the transformative potential of technologies is realized when articulated with active methodologies and personalized learning, while Kenski (2012) reinforces that their integration tends to become naturalized as they become an organic part of pedagogical practice. Thus, rather than merely expanding the use of platforms, it is essential to rethink practices, strengthen public policies, and invest in continuous teacher education to ensure that these technologies not only modernize teaching but also promote equity, engagement, and meaningful learning. In this way, future research in this area should consider not only the

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diversity of available tools but, above all, the pedagogical impacts of their critical and contextualized use, contributing to the construction of a more innovative and inclusive educational model.

Final Considerations

Based on this review study on the use of digital platforms in education, it can be noted that the analyzed research primarily focuses on the pandemic period. This raises the question of whether, and how, digital platforms have been incorporated into the post-pandemic context.

It was also found that the studies mentioned address the use of digital platforms in specific subject areas, such as Biology, Physics, Mathematics, and Geography. One possible explanation is that, with the exception of Geography, the other studies originate from professional master's programs in these fields, such as PROFBIO, PROFMAT, and MNPEF (Professional Master's in Biology, Professional Master's in Mathematics, and Professional Master's in Physics Teaching). In light of these findings, it becomes evident that there is a need to expand research on the use of digital platforms in secondary education, especially in areas that remain underexplored, such as Languages and Humanities, thereby broadening the scope of research and identifying potential benefits and challenges specific to other fields.

Furthermore, it is essential to understand how these technologies have been incorporated into the post-pandemic period, considering not only their presence in the school environment but also their effectiveness in promoting active and meaningful learning. Future studies may deepen the analysis of the challenges faced by teachers in adapting to digital platforms, the influence of these tools on the development of student autonomy, and the relationship between available technological infrastructure and equity in access to educational technologies. In this way, further research can contribute to a more comprehensive and up-to-date understanding of the role of digital platforms in promoting personalized education and transforming pedagogical practices.

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