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IMAGINARY, CREATIVE, TECHNOLOGICAL, PEDAGOGICAL KNOWLEDGE OF CONTENT – TPACKI AND MATHEMATICAL LEARNING

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ABSTRACT

This article aims to investigate the role of the Imaginary Creative Technological Pedagogical Content Knowledge (TPACKI) in the promotion of meaningful and engaging mathematical learning. TPACKI, a concept that is based on the integration of different knowledge, represents a competency model for teachers who seek to integrate digital technologies, creativity and imagination into teaching practice, transforming mathematics teaching into a dynamic and meaningful experience for students.

Keywords: TPACKI. Mathematical Learning. Meaningful Learning.

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INTRODUCTION

Contemporary society is marked by technological advances and the growing need for individuals capable of dealing with complex information and digital tools. In this context, education has the challenge of preparing students for the future, developing essential skills for the twenty-first century, such as critical thinking, creativity and mastery of digital technologies.

The teaching of mathematics, traditionally based on traditional methods, needs to adapt to this new reality. The integration of digital technologies and the promotion of creative imagination become key elements to make learning more engaging, meaningful, and relevant for students. The present research seeks to analyze the role of the Imaginary, Creative, Technological, Pedagogical Content Knowledge – TPACKI as a tool to promote more effective and engaging mathematical learning.

TPACKI represents a new model of knowledge that combines pedagogical expertise, technological mastery, and the ability to integrate creative imagination into teaching and learning processes (OLIVEIRA FILHO, 2021). It differs from the traditional Pedagogical Technological Knowledge of Content (TPACK) by considering the importance of creativity and the ability to imagine and create innovative solutions (MISHRA, KOEHLER, 2006).

This study will explore the implications of TPACKI for Mathematics Education, investigating how the integration of creative imagination, digital technologies, and pedagogical content knowledge can boost the teaching-learning process of mathematics. The research will delve into the potential of TPACKI to create more dynamic, stimulating and effective learning environments, exploring its potentialities and challenges in teaching practice.

THEORETICAL FOUNDATION

The understanding of TPACKI, as a construct that aims at the integration of pedagogical, technological and content knowledge, is based on several theories and research on teaching and learning. This theoretical-methodological framework is consolidated in a rich history of debates on education and its interaction with digital technologies.

David Ausubel's Theory of Meaningful Learning (1968) highlights the importance of relating new knowledge to previous knowledge, promoting deeper and more lasting

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learning (Ausubel, 1968). TPACKI aligns with this principle by offering an environment conducive to the construction of meaning through the integration of different resources and tools (OLIVEIRA FILHO, 2021).

Constructivism, based on the ideas of Jean Piaget, suggests that knowledge is actively constructed by the subject, through interaction with the environment (PIAGET, 1973). TPACKI encourages the construction of knowledge by the student, providing tools and activities that stimulate autonomy and investigation (OLIVEIRA FILHO, 2021).

Howard Gardner's Theory of Multiple Intelligences (1995) expands the traditional view of intelligence, recognizing different ways of thinking and learning. TPACKI supports the diversification of resources and methodologies to meet multiple intelligences, providing more inclusive and engaging learning (OLIVEIRA FILHO, 2021).

The Theory of Mediation, by Lev Vygotsky (2000), highlights the importance of the social and cultural role in the construction of knowledge. TPACKI recognizes that knowledge is built in interaction with other people, tools, and resources, creating a collaborative and interactive environment.

The theories and research mentioned above provide a solid foundation for understanding TPACKI and its role in mathematical learning. By integrating pedagogical, technological and content knowledge, TPACKI shows itself as a promising model for contemporary education, offering a more meaningful, interactive, inclusive teaching adapted to the needs and characteristics of students.

Pedagogical Content Knowledge (PCK) is a fundamental concept in Mathematics Education, representing the intersection between in-depth knowledge of mathematical content and understanding of the best pedagogical practices to teach it. It encompasses the teacher's ability to transform mathematical content into something meaningful and accessible to students (SHULMAN, 1987; SHULMAN, SHULMAN 2016).

Shulman (1987) defines PCK as the "knowledge that transforms content into something teachable". This knowledge encompasses understanding how students learn mathematics, their difficulties and conceptions, the best strategies for presenting appropriate concepts, activities, and resources, and how to assess learning.

The PCK is not limited to simply knowing mathematics. It requires the teacher to understand how students think and learn math, the difficulties they may face, the common mistakes they make, and how to use that understanding to plan and adapt their lessons.

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A teacher with a well-developed PCK is able to: i) Select and organize mathematical content in a way that is relevant and accessible to students. ii) To develop activities that enable students to build significant mathematical knowledge; iii) Use different representations and didactic resources to explain complex mathematical concepts clearly; iv) Identify and diagnose students' difficulties and offer appropriate support and intervention; v) Evaluate student learning in a fair and meaningful way (SHULMAN, 1987; SHULMAN, SHULMAN 2016).

The Pedagogical Technological Knowledge of Content (TPACK) is a model that highlights the importance of integrating technological, pedagogical and content knowledge for effective teaching and learning. TPACK recognizes that teaching in a digital world requires educators to not only master technology, but also understand how it can be used to promote learning in meaningful and relevant ways (MISHRA, KOEHLER, 2006; OLIVEIRA FILHO, 2021).

It expands the concept of Pedagogical Content Knowledge (PCK), incorporating the technological dimension. (Almeida, 2015). TPACK emphasizes the need for teachers to be able to: i) Understand how technology can be used to teach and learn specific content; ii) Select and use appropriate technologies to achieve specific learning objectives; iii) Integrate technology naturally and effectively into pedagogical practices; iv) Assess the impact of technology on learning and adapt teaching strategies as needed (OLIVEIRA FILHO, 2021).

TPACK is instrumental in promoting innovative and relevant education, preparing students for the demands of the twenty-first century. The satisfactory use of technology in teaching requires teachers to become proficient in integrating technological, pedagogical and content knowledge, promoting meaningful learning and preparing students for the future.

IMAGINARY, CREATIVE, TECHNOLOGICAL, PEDAGOGICAL KNOWLEDGE OF CONTENT (TPACKI)

TPACKI (Technological Pedagogical Content Knowledge Imaginative Creative) is a knowledge model that expands the concept of TPACK, including the dimension of creative imagination in the integration of digital technologies in pedagogical practice. It is configured as a comprehensive framework that seeks to strengthen the teacher's ability to integrate

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technology in the classroom in a creative and innovative way, taking into account the specific content of the discipline and the needs of students (OLIVEIRA FILHO, 2021).

TPACKI differs from other models by emphasizing the role of imagination and creativity in teaching practice. He recognizes that the teacher, in addition to mastering the content, technologies and pedagogical strategies, needs to be able to think outside the box, generate innovative ideas and adapt digital tools in a personalized way to each teaching context. This means integrating technology in a way that enhances learning, stimulates creativity, the development of twenty-first century skills, in addition to promoting a more engaging and meaningful experience for students (OLIVEIRA FILHO, 2021).

The integration of creative imagination into TPACK offers a new look at the use of technology in education. It is not limited to presenting digital tools as isolated resources, but rather to exploring their potential to create dynamic, interactive learning environments that enable the construction of knowledge in a deeper and more meaningful way.

TPACKI offers a fundamental framework for contemporary mathematics education, as it integrates creativity, technology and pedagogical knowledge of the content, decisive elements for meaningful learning. The TPACKI model encourages the development of essential skills for the mathematics teacher, such as: i) Creating innovative and engaging learning environments, using digital resources and creative methods to make mathematics teaching more dynamic and interactive; ii) Develop activities that stimulate creativity, problem-solving, critical thinking and collaboration, providing more authentic and meaningful learning; iii) Select and integrate digital tools appropriate to the age group, level of knowledge and learning objectives of the students, promoting the responsible and critical use of technology in the school context; iv) Adapt mathematical content to the different needs and learning styles of students, using multimodal resources and digital technologies to make mathematics more accessible and understandable (OLIVEIRA FILHO, 2021).

TPACKI contributes to the construction of a more engaging, relevant learning environment connected to the demands of the twenty-first century, preparing students for the future and for an increasingly technological and complex society.

CREATIVE IMAGINATION IN MATHEMATICAL LEARNING

Creative imagination plays a key role in mathematical learning, promoting a deeper and more meaningful understanding of mathematical concepts and skills. By stimulating

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their imagination, students can explore different perspectives, build mental representations, and develop innovative solutions to mathematical problems (OLIVEIRA FILHO, 2021).

Creative imagination allows students to transform mathematical abstractions into tangible realities, using creativity to visualize, manipulate, and interact with mathematical concepts. Through imagination, they can create analogies, metaphors, and visual representations that facilitate the understanding of complex concepts (ALMEIDA, 2015).

The use of creative imagination in mathematical learning also contributes to the development of cognitive flexibility, the ability to think outside the box, and more efficient problem-solving. Imagination allows students to explore different solutions, identify patterns, and establish connections between seemingly distinct concepts (OLIVEIRA FILHO, 2021).

The integration of creative imagination into pedagogical practice can be accomplished through activities such as games, role-plays, stories, open-ended problem solving, model building, and mathematical projects. These activities encourage experimentation, investigation, and the search for creative solutions, promoting autonomy and the development of essential skills for mathematical learning.

DIGITAL TECHNOLOGIES IN MATHEMATICAL LEARNING

The integration of digital technologies into mathematical learning offers a range of possibilities to make learning more interactive, engaging, and meaningful. Tools such as educational software, online platforms, applications, and multimedia resources allow you to create innovative and personalized educational experiences that adapt to different needs and learning styles (BISPO, 2017).

Digital technologies can assist in visualizing abstract mathematical concepts, solving complex problems, and conducting experiments and simulations. Through educational games, students can develop logical reasoning skills, problem-solving strategies and work collaboratively with their peers (BORBA, PENTEADO, 2012). The use of online platforms allows access to high-quality educational resources, such as explanatory videos, interactive exercises, and digital teaching materials, in addition to facilitating communication and collaboration between students and teachers.

Technology can help create a more dynamic and stimulating learning environment, making math lessons more engaging and relevant. Digital resources can be used to personalize learning, allowing students to advance at their own pace and explore specific

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areas of interest. Digital technologies can also facilitate the assessment of learning by providing teachers with more complete information about students' progress and difficulties (BISPO, 2017).

However, it is essential that the use of technology is intentionally planned and integrated into the curriculum, ensuring that digital tools are used effectively and pedagogically. The teacher plays an irrefutable role in mediating the use of technology, guiding students in the use of tools and in the application of mathematical concepts.

THE ROLE OF THE TEACHER IN THE INTEGRATION OF TPACKI

The teacher plays a crucial role in the integration of TPACKI (Imaginary, Creative, Technological, Pedagogical Content Knowledge) into teaching practice. He needs to be a mediator and facilitator of the learning process, using creative imagination as a tool to promote the construction of mathematical knowledge, exploring digital technologies in a meaningful and innovative way.

The teacher needs to create a learning environment that fosters creativity and imagination, allowing students to explore ideas, experiment with different solutions, and express themselves freely. The teacher needs to master the digital technologies and teaching tools available, using them effectively to create interactive activities, educational games and digital resources that promote meaningful learning (CURY, SILVA, 2016). The teacher should encourage students to collaborate in projects and activities that involve the use of TPACKI, promoting teamwork, the exchange of ideas and the joint construction of knowledge. The teacher should encourage research and investigation, using digital technologies to access information, conduct experiments, and analyze data, stimulating students' critical thinking and autonomy (OLIVEIRA FILHO, 2021).

The teacher needs to be in constant development, seeking to improve their skills and knowledge to integrate TPACKI satisfactorily into their classes, making mathematical learning more engaging, creative and meaningful for students.

RESEARCH METHODOLOGY AND CONTEXT

The present research, of a qualitative and exploratory nature, aimed to investigate the impact of the Imaginary Creative Creative Technological Pedagogical Content Knowledge – TPACKI on mathematical learning. The method used was the case study,

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focusing on an elementary school class, with a student aged 12 to 14 years, in a public school in the city of Caxias - Maranhão.

Data collection was carried out through different instruments, including: (a) participant observation of classes, with registration in a field diary, (b) semi-structured interviews with teachers and students, (c) analysis of documents such as lesson plans, teaching materials and activities carried out in the classroom, and (d) online questionnaires for students about their perceptions in relation to the use of technologies and digital tools in mathematics classes (LUDKE, ANDRÉ , 2014; GONZÁLEZ, 2017).

For data analysis, the content analysis technique was used, seeking to identify patterns, trends and relationships between the information collected (BARDIN, 2011; SANTOS, 2024). The analysis of the data allowed us to understand the different ways in which TPACKI was implemented in the classroom, as well as the impact on mathematical learning.

This research is inserted in the context of the growing need to integrate digital technologies into mathematics education, seeking to improve the teaching and learning processes. With the advancement of information and communication technologies (ICTs), the educational scenario is transformed, and the teacher needs to adapt to this new reality, using digital resources efficiently and creatively (BORBA, PENTEADO, 2012).

In this context, TPACKI (Imaginary Creative Technological Pedagogical Content Knowledge) knowledge emerges as a powerful tool for the development of innovative pedagogical practices, capable of promoting mathematical learning in a meaningful way (OLIVEIRA FILHO, 2021). The exploratory and qualitative research of this study aimed to investigate how TPACKI influences teaching practice in the classroom, analyzing the integration of digital tools, creativity and imagination in mathematics teaching.

The research builds on previous studies on TPACK, creative imagination, and digital technologies in mathematics education, seeking to deepen understanding of TPACKI's role in developing mathematical skills and creating engaging and challenging learning environments.

The research involved elementary school mathematics teachers from public schools. These teachers were selected through a convenience sampling process, seeking to ensure the diversity of experiences and pedagogical contexts.

The students participating in the research belonged to different grades of elementary school, covering different age groups. Data collection was carried out through a qualitative

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case study, focusing on an elementary school class II (6th grade) of a municipal public school in the municipality of Caxias, (MA), Brazil. The choice of this approach is justified by the search for understanding, in depth, the application of TPACKI in a real context of mathematical learning. To ensure the richness and depth of the analysis, several instruments were used, such as: i) Classroom observation: The classes were observed and recorded in detail, including the interaction between teachers and students, the use of technological resources, the proposed activities and the teaching strategies employed. The observations allowed us to identify the moments in which the teacher demonstrated integration of TPACKI in class, such as using creative imagination to propose mathematical challenges, explore digital resources for the visualization of concepts and integrate different technological tools to promote collaboration among students; ii) Document analysis: The teacher's lesson plans, the activities developed during the classes, the evaluations applied and the students' productions (notebooks, group work, etc.) were analyzed. The analysis of the documents provided important information about the learning objectives, the methodologies used, the materials used and the level of engagement of the students in the activities; iii) Interviews: After the observations, semi-structured interviews were conducted with the teacher and with some students in the class (LUDKE, ANDRÉ, 2014; GONZÁLEZ, 2017). The interviews allowed to deepen the understanding of the teacher's perception of TPACKI, the difficulties and challenges faced in its implementation, the teaching strategies used and the impact of mathematical learning on the students' perspective.

Data collection was carried out over a period of four months, with two weekly visits to the school. The analysis of the collected data was carried out through content analysis (BARDIN, 2011), seeking to identify patterns, recurring themes and relevant insights for understanding the application of TPACKI in the mathematics classroom.

DATA ANALYSIS AND DISCUSSION OF RESULTS

The analysis of the collected data followed a qualitative approach, seeking to interpret and understand the meanings attributed by the participants to the learning experience with TPACKI.

Content analysis techniques were used, focusing on the identification of patterns, recurring themes and emerging meanings in the teachers' speeches and classroom observations. The stages of content analysis included: i) Floating reading of the data to familiarize with the content; ii) Initial coding of the data, seeking to identify relevant units of

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meaning; iii) Categorization of the units of meaning into broader categories, based on their similarity; iv) Interpretation of the data, seeking to understand the relationships between the categories and the global meaning of the data; Validation of the results with the participants, through a triangulation process (BARDIN, 2011).

The data analysis aimed to answer the following research questions: i) How does TPACKI manifest itself in the pedagogical practices of mathematics teachers? ii) What are the potentialities and challenges of TPACKI for mathematical learning? iii) What are the educational implications of TPACKI for teacher training and for the development of innovative practices?

The results of the research demonstrated that the integration of TPACKI into mathematics pedagogical practices provided a significant increase in student engagement, understanding of mathematical concepts and problem-solving ability. The students reported feeling more motivated and interested in mathematics classes, demonstrating greater creativity in the application of the knowledge acquired in different contexts.

An improvement was observed in the students' ability to reason abstractly, to visualize mathematical concepts and to make connections between different areas of knowledge. The use of digital technologies and creation tools, such as 3D modeling software, augmented reality tools, and gamification platforms, provided a more interactive and engaging learning experience. Digital tools such as 3D modeling software, augmented reality tools, and gamification platforms have helped to make learning more interactive and engaging.

The analysis of data collected during the research showed that the development of TPACKI in mathematics teachers positively influenced their pedagogical practices. Teachers demonstrated greater mastery in integrating creative imagination and digital technologies into lessons, utilizing multimodal resources and differentiated strategies to meet the needs of different learning styles.

The survey also revealed some challenges in implementing TPACKI. The lack of access to technology and adequate infrastructure in some schools, the need for specific training for teachers on the use of digital technologies, and the difficulty of integrating TPACKI into traditional curricula were some of the obstacles encountered.

TPACKI drives the integration of digital technologies in a creative and innovative way in mathematics classes. The teacher, by mastering TPACKI, can use digital tools to

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create simulations, games and interactive activities that engage students and facilitate the understanding of abstract concepts.

TPACKI encourages the creation of interactive learning environments, using online platforms, educational applications, and virtual reality tools. These tools allow students to explore mathematical concepts in a practical and dynamic way, making learning more meaningful and engaging.

TPACKI allows teachers to customize activities according to the needs and interests of students. Through adaptive learning tools, the teacher can monitor the individual progress of each student and adjust the pace and level of complexity of the activities.

DEVELOPMENT OF CREATIVE IMAGINATION AND POTENTIAL OF TPACKI

TPACKI stimulates the development of creative imagination in solving mathematical problems. The teacher, by using TPACKI, can challenge students to think creatively and innovatively, using digital resources to create their own mathematical solutions and representations.

TPACKI, by integrating creative imagination, technology and pedagogical knowledge of the content, opens up a range of opportunities for mathematics education, boosting students' learning and creativity. TPACKI allows the creation of more engaging and innovative learning experiences, making learning more meaningful and fun (OLIVEIRA FILHO, 2021).

One of TPACKI's greatest potentialities lies in its ability to personalize teaching and learning. Through the integration of digital technologies and creative imagination, the teacher can tailor the content and teaching strategies to the specific needs of each student, creating a personalized and more effective learning environment. The teacher can explore digital tools to create different types of activities and resources, such as games, simulations, videos, and interactive platforms, which can be adapted to the different learning styles and knowledge levels of the students.

TPACKI also offers a unique opportunity to connect mathematics with the real world, making it more relevant and meaningful. Through digital tools and creative imagination, the teacher can create problem situations and scenarios that simulate real situations, arousing interest and curiosity and encouraging the practical application of mathematical knowledge (Santos; Almeida, 2019).

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In addition, TPACKI facilitates collaboration and interaction, making the learning process more dynamic and interactive. Through online platforms, students can work together, share ideas, solve problems, and learn from each other, creating a collaborative and enriching learning environment. The use of digital tools to create collaborative activities stimulates the development of social and communication skills, preparing students for the professional world and the demands of contemporary society.

CHALLENGES IN IMPLEMENTING TPACKI

The implementation of TPACKI in pedagogical practice faces several challenges, which require attention and strategies to overcome. One of the main obstacles lies in the training of teachers. The integration of TPACKI requires mastery of digital tools, content creation skills, and the ability to transform imagination into innovative pedagogical resources.

The lack of access to technology in some schools, especially in rural areas or those with fewer resources, limits the application of TPACKI. Access to computers, fast internet, and specific software is essential for the effective use of digital tools. The lack of time and resources for the development of innovative activities is also a challenge. Planning and creating digital resources that integrate creative imagination require time and dedication, which are often limited by teachers' workloads and lack of institutional support.

Resistance to change on the part of some teachers can also be an obstacle. Familiarity with traditional teaching methods and lack of trust in digital technologies can make it difficult to adopt innovative practices with TPACKI.

Overcoming these challenges requires investments in infrastructure, continuing teacher education, and a collaborative environment that encourages experimentation and innovation. The development of TPACKI requires a concerted effort by educators, managers, and *policymakers* to ensure that students have access to engaging and meaningful mathematics education in the 21st century.

The development and implementation of TPACKI in mathematics education has significant implications for teaching practice and student learning. By integrating creative imagination, digital technologies, and pedagogical knowledge of content, teachers can create more engaging and motivating learning environments.

TPACKI allows students to explore mathematical concepts in a deeper and more meaningful way, connecting them with their individual experiences and interests. Creative

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imagination and digital tools make it possible to create visual representations, interactive simulations, and games that facilitate the understanding and development of mathematical intuition.

TPACKI fosters the development of essential skills for success in the 21st century, such as creativity, critical thinking, collaboration, and problem-solving. Students learn to use digital technologies critically and creatively, applying them to solve mathematical challenges and explore abstract concepts (OLIVEIRA FILHO, SANTOS 2018). Digital technologies can be used to create personalized learning opportunities that are accessible to all, including those with special needs or from different socioeconomic backgrounds. TPACKI allows teachers to adapt their teaching methods to meet individual needs and promote inclusion in the classroom (OLIVEIRA FILHO, 2021).

TPACKI prepares students for the professional future, where the ability to use technology and creativity to solve complex problems will be increasingly important. Mathematics, in combination with technology, plays an incisive role in several areas.

Succinctly, TPACKI represents a fundamental advancement in mathematics education, providing an innovative and stimulating learning environment that benefits both students and teachers. By integrating creative imagination, digital technologies, and pedagogical knowledge of content, teachers can create a more engaging, relevant, and meaningful learning experience for students (ALMEIDA, 2015).

Mathematical learning in the context of TPACKI requires a holistic approach, which encompasses the deep understanding of mathematical contents, the integration of digital technologies in a creative and imaginative way, and the application of effective pedagogical strategies. The focus should not only be on memorizing formulas and procedures, but on the construction of meaning, the resolution of real problems, and the application of mathematical knowledge in different contexts (MOLON, 2015).

Mathematical learning with TPACKI stimulates students' creativity and autonomy, allowing them to explore mathematical concepts in a more engaging and meaningful way. Digital tools, when used strategically and creatively, can transform the classroom into an interactive and dynamic environment, which facilitates the visualization of abstract concepts, experimentation, and the discovery of patterns.

It is essential that teachers are prepared to integrate TPACKI into their pedagogical practices, developing skills to use technologies efficiently and creatively, as well as adapting the mathematical content to the needs and interests of students. This adaptation

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is essential to ensure that learning is meaningful and relevant for the development of essential mathematical skills for life (OLIVEIRA FILHO, SANTOS, 2018).

Mathematical learning with TPACKI promotes collaboration among students, encouraging the exchange of ideas, group problem-solving, and the construction of collective knowledge. Digital tools facilitate communication and information sharing, creating a more dynamic and participatory learning environment.

CONTRIBUTIONS OF TPACKI TO MATHEMATICS EDUCATION

TPACKI, by integrating creative imagination, digital technologies, and pedagogical content knowledge, offers an innovative approach to mathematics education, boosting learning in a meaningful way. Its impact manifests itself in several areas, transforming the way teachers teach and students learn mathematics.

TPACKI encourages the use of technological resources and creative activities, making math classes more interactive and engaging, arousing the interest and curiosity of students. The integration of technological resources and the exploration of creative imagination allows students to visualize abstract mathematical concepts in a more concrete and accessible way, deepening their understanding (SANTOS, SILVA, 2019; ALMEIDA, 2015). TPACKI promotes the development of essential skills for the twenty-first century, such as critical thinking, problem-solving, creativity, teamwork, and communication. Digital technologies and creative imagination allow teachers to tailor math activities to each student's individual needs and learning styles, promoting a personalized learning experience.

Briefly, TPACKI contributes to the creation of a more dynamic and stimulating learning environment, where students become protagonists of their own mathematical learning.

FINAL CONSIDERATIONS

The present research demonstrates the relevance of the creative creative technological pedagogical content imaginary knowledge (TPACKI) in the teaching and learning of mathematics. TPACKI, by integrating creativity, technology and pedagogical knowledge of the content, provides a more engaging and meaningful learning environment for students. The research highlighted the potential of TPACKI to promote problem solving, the development of critical thinking, collaboration and communication in mathematics.

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However, the implementation of TPACKI in the educational context faces challenges such as the need for adequate teacher training, access to technological resources and adequate infrastructure, as well as the adaptation of curricula to integrate technology and creativity.

For mathematical learning to be enriched by TPACKI, it is essential that teachers engage in innovative practices that promote creativity and the use of digital technologies in a meaningful way. It is necessary that educators continue to investigate and develop pedagogical practices that enable the exploration of the potential of TPACKI in mathematics education. TPACKI's research contributes to the development of a more innovative mathematics education that meets the needs of students in an increasingly technological and dynamic world.

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