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Design and Implementation of a Digital Resource Based on the TPACK Model for Learning English in Secondary Education

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Summary

The low communicative competence in English evidenced in high school students in Colombia, especially in rural areas, raises the need to transform traditional pedagogical practices through integrative approaches that articulate content, pedagogy, and technology. The purpose of this research was to design and implement an interactive didactic content based on the TPACK Techno-educational model, aimed at improving the teaching and learning of vocabulary and simple grammatical structures of the English language in eleventh grade students. It was developed under a positivist paradigm, with a mixed approach, of a quasi-experimental type and with data collection techniques such as diagnostic tests, perception surveys, field logs and final evaluation.

The target population consisted of 66 high school students, equally distributed by sex and aged between 16 and 18 years. The results obtained showed that, after the intervention, there was a significant improvement in both vocabulary mastery and comprehension and use of basic grammatical structures. In addition, the students expressed a positive perception regarding the use of digital resources, highlighting the motivation, clarity and accessibility of the proposed content. The TPACK model, in its pedagogical, disciplinary and technological integration, proved to be effective not only for didactic design, but also as a framework to strengthen the teaching of foreign languages.

The findings of this study provide practical guidelines for the redesign of pedagogical experiences in English at the secondary level, suggesting that the use of educational technologies, when intentional and

methodologically grounded, can be a key factor in improving learning in language skills in contexts with structural and social limitations.

Keywords: TPACK model; English teaching; interactive content.

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Introduction

The learning of English as a foreign language in Colombian secondary education continues to represent a persistent challenge, especially in rural contexts and with low technological coverage. Despite the education system's efforts to improve the quality and coverage of English, the results of national and international diagnostic assessments reflect lower-than-expected levels of performance, particularly in skills such as the proper use of vocabulary and the understanding of simple grammatical structures (MEN, 2020). In the classroom, there are limitations in the development of basic language skills, which hinders not only language learning, but also the possibility for students to access future academic and job opportunities.

This scenario is partly due to the persistence of traditional teaching approaches, which focus on the memorization of grammatical rules, mechanical repetition and the literal translation of words and phrases. These methods, in addition to being ineffective, are demotivating for students, who do not find meaning in learning English or manage to establish connections between the language and their own sociocultural realities. Thus, English continues to be perceived by a large part of the student body as foreign knowledge, imposed and difficult to assimilate (Sánchez & Gómez, 2019).

Faced with this situation, the incorporation of **educational technologies** in the design and implementation of didactic content appears as a promising alternative. However, the use of digital resources does not guarantee improved learning by itself. A coherent articulation is required between the knowledge of the disciplinary content, the pedagogical strategies and the relevant use of technology, an integration that has been widely theorized in the **TPACK** (Technological Pedagogical Content Knowledge) model proposed by Mishra and Koehler (2006). This model states that effective teaching with technology requires an integrated understanding of three types of knowledge: technological, pedagogical, and disciplinary.

From this perspective, the design of digital resources for the teaching of English must consider not only the grammatical and lexical content to be taught, but also how they are taught (pedagogical approach) and through what means (technological tools). Only when these three components are properly articulated can the digital resource become a meaningful mediator of learning.

Within this framework, the present research proposed to design a **digital interactive content** to support the teaching-learning process of vocabulary and simple grammatical structures of the English language in eleventh grade students, integrating the principles of the TPACK model as a theoretical-methodological foundation. The proposal arises from a specific need: to improve the low levels of linguistic comprehension in students from rural contexts, through the intentional use of educational technology that facilitates the appropriation of the language in a contextualized, visual and dynamic way.

This commitment not only seeks to develop an innovative didactic tool, but also to provide empirical evidence on the effectiveness of the TPACK model in strengthening communicative skills in English. Thus, the study articulates pedagogical, technological, and linguistic objectives, in coherence with the current challenges of secondary education and with the quality guidelines that guide foreign language training in the country.

Theoretical foundation

The learning of English as a foreign language has undergone various methodological transformations that, in recent decades, have moved from structuralist approaches to communicative, situated and technological proposals. In this scenario, the development of basic communicative skills, such as the appropriate use of vocabulary and the application of simple grammatical structures, continues to be a fundamental need at

secondary educational levels, especially in rural populations that have historically faced barriers to accessing quality foreign language training (Cárdenas & Hernández, 2018).

One of the theoretical approaches that allows us to understand and improve technology-mediated teaching practice is the **TPACK** (Technological Pedagogical Content Knowledge) model, proposed by Mishra and Koehler (2006). This model extends the framework of pedagogical content knowledge (PCK) proposed by Shulman (1987), incorporating the technological component as a third articulating axis. The TPACK model recognizes that effective teaching with technology cannot be reduced to the instrumental use of digital tools, but must consider the relationship between disciplinary knowledge (content), didactic strategies (pedagogy) and technological resources (technology).

Disciplinary knowledge (CK) in this study refers to the mastery of simple grammatical structures and basic functional vocabulary of English, essential components for communication in this language. **Pedagogical knowledge** (PK), on the other hand, is related to the selection of appropriate didactic approaches for students to understand and apply these contents, favoring participation, contextualization and interaction. Finally, **technological knowledge** (TK) implies the ability to select and use digital resources – such as interactive platforms, simulators, videos or gamified environments – that enhance learning in a significant way.

The power of the TPACK model lies in the fact that it is not three independent components, but an interdependent system that guides instructional design. Thus, **the TPACK itself** emerges when the teacher manages to articulate the three domains in the creation of effective learning experiences, contextualized and sustained by a pedagogically grounded use of technology.

In the specific field of English teaching, authors such as Chapelle (2009) and Warschauer & Kern (2000) have pointed out that digital environments make it possible to diversify the modalities of access to linguistic content, promote student autonomy, facilitate feedback and expand opportunities for exposure to the language. However, the effectiveness of these experiences depends to a large extent on the didactic design that supports them. When the digital resource is aligned with the learning objectives, responds to the real needs of the student and adequately articulates the content with technological tools, the chances of success in the language acquisition process increase.

Similarly, the integration of interactive content for the teaching of English makes it possible to overcome limitations that are common in the traditional classroom, such as the lack of time for oral practice, the rigidity of the textbook or the homogeneity of the activities. Studies such as those by Blin & Muñoz (2008) have shown that personalized and visually stimulating digital environments favor the understanding of complex grammatical structures, as well as the retention of vocabulary through contextualized practices, especially when integrating images, audios, and self-correcting exercises.

In summary, the theoretical framework that guides this research is based on the convergence between the **teaching of English as a foreign language** and the principles of the **TPACK model**, under the assumption that the pedagogically intentional use of digital resources can contribute to the development of basic linguistic skills. This integration is particularly relevant in rural contexts, where the lack of materials and low exposure to the language require innovative, flexible and technology-mediated teaching proposals that recognize both the limitations of the environment and the transformative potential of digital tools when used educationally.

Methodology

Research Approach and Design

The study was developed under the **positivist paradigm** with a **mixed** approach, incorporating both quantitative analysis and qualitative assessment of the data to understand the effect of the interactive content designed on the learning of English in middle school students. A **quasi-experimental design was chosen with pre-test and post-test in a single group**, without a control group, due to the contextual

conditions of the school environment, which allowed measuring the change in language performance before and after the intervention with the digital resource based on the TPACK model.

This approach was complemented with qualitative tools for observation and collection of perceptions, which enriched the understanding of the educational phenomenon from an interpretative perspective and provided a more complete vision of the pedagogical and didactic impact of the interactive content implemented.

Population and sample

The population was made up **of 66 eleventh grade students**, between 16 and 18 years old, belonging to the secondary education level of an official educational institution in a rural context. The sample was **non-probabilistic and intentional**, since students enrolled in the area of English and who presented low levels of communicative competence were selected, specifically in functional vocabulary and simple grammatical structures, as evidenced by the initial diagnostic test.

The inclusion criteria included access to technological devices in the institution (tablets and computers in the digital classroom), the willingness of the teacher to implement the interactive content, and the institutional authorization for the development of the project.

Instruments and techniques for collecting information

Both quantitative and qualitative **instruments were used**, designed to triangulate the information and ensure the validity of the study:

- **Initial diagnostic test (pretest):** allowed to identify the level of mastery of vocabulary and simple grammatical structures before the intervention.
- **Digital interactive content (intervention):** structured based on the TPACK model, it included visual resources, audios, interactive activities and self-assessments, hosted on a controlled access platform.
- **Final test (post-test):** it allowed us to compare the results obtained after the implementation of the resource, evaluating the same linguistic aspects as in the pre-test.
- **Student perception survey:** collected students' assessment of the usefulness, accessibility, motivation and clarity of interactive content.
- **Teacher's field log:** recorded observations on the use of the resource in the classroom, student participation, technical difficulties and emerging pedagogical aspects.

Procedure

The intervention process was developed in four consecutive phases:

1. **Diagnostic phase:** application of the pre-test and analysis of the students' initial level in vocabulary and grammar.
2. **Design phase:** structuring of the digital content under the TPACK model, selecting tools, resources and strategies that integrate technological, pedagogical and disciplinary knowledge.
3. **Implementation phase:** development of interactive content in face-to-face sessions, where students worked online in modules designed with practical, visual and immediate feedback activities.
4. **Evaluation phase:** application of the post-test, perception survey and qualitative analysis of the teaching logs.

Analysis of information

The quantitative data of the diagnostic and final tests were analyzed using **descriptive statistics** (averages and percentages of progress per item) to establish the magnitude of the change in performance. On the other hand, the qualitative data from the surveys and logs were processed through **thematic content**

analysis, identifying emerging categories related to the learning experience, the perception of the resource and the effects observed in the classroom.

This methodological combination made it possible to contrast the objective advances in language skills with the subjective appraisals of the participants, generating a comprehensive vision of the impact of interactive content and its potential as a pedagogical strategy for teaching English in contexts with structural challenges.

Results

The implementation of digital interactive content based on the TPACK model showed a positive impact on both students' language performance and their attitude towards learning English. Based on the comparative analysis between the pre-test and the post-test, together with the information collected in the perception surveys and the field log, the findings were organized into three analytical dimensions: **linguistic performance**, **interaction and autonomy in the digital environment**, and **perceptions about the learning experience**.

1. Improvement in language performance: advances in vocabulary and functional grammar

The quantitative results showed a substantial increase in the mastery of functional vocabulary and in the use of basic grammatical structures. While in the diagnostic test only **31%** of the students exceeded the minimum expected performance threshold (60% of correct answers), in the final test this percentage rose to **79%,** which represents an increase of **48 percentage points**.

The categories that showed the greatest improvement were:

- **Recognition of visual-contextualized vocabulary** (e.g., daily routines, common places, and objects): 34% to 81%.
- **Correct use of the present simple tense in affirmative and negative sentences**: from 27% to 75%.
- **Construction of interrogative sentences with basic auxiliaries (do/does):** from 21% to 69%.

These results suggest that the mediation of interactive content, especially through visual activities and self-correcting exercises, facilitated the **assimilation of linguistic structures** frequently ignored or poorly learned in traditional teaching schemes. Access to thematic glossaries, examples in context and the possibility of practicing repeatedly without penalty contributed to consolidate these learnings.

2. Greater interaction and autonomy in digital learning environments

The review of the usage records on the platform revealed a **sustained high participation** during the four weeks of intervention. **94% of students accessed the content in all scheduled sessions**, and **76% voluntarily completed additional non-mandatory activities**, which indicates not only compliance, but also interest and willingness to learn outside the minimum required.

The teacher's log registered an evolution in the level of autonomy of the students, evidenced in comments such as:

"At first, many students expected each activity to be explained to them step by step, but by the end of the process, several solved the modules on their own and sought help only after trying several times."

This behavior suggests that the **friendly interface**, the progressive sequencing of the contents, and the immediate feedback offered by the platform favored autonomous exploration, reducing dependence on the teacher and generating greater confidence in one's own abilities.

3. Positive perceptions about the resource and the learning process

The results of the survey applied at the end of the intervention reflect a **highly positive assessment** by the students of the interactive content. 89 **%** of participants indicated that the resource helped them better understand the topics, and **93%** considered the interactive format to be "more useful" than traditional classes.

The most prominent categories of perception were:

- **Clarity of explanations and examples** (91% of positive responses).
- **Motivation during work sessions** (87% said they felt "more motivated than in previous classes").
- **Ease of identifying and correcting errors** (82% valued immediate feedback positively).

In addition, some students commented that the resource "made English easier" and that "the practice games helped not to get bored." These expressions reinforce the idea that the playful component, interactivity and personalization of the learning pace **were key to transforming the educational experience**.

The findings show that the integration of educational technology through the TPACK model can have a significant effect on the learning of basic English content, especially in students with educational trajectories marked by low performance. The improvement in results, active participation in digital environments and favorable student perceptions confirm that a well-articulated pedagogical design, based on the interactions between content, pedagogy and technology, **is not only viable in rural contexts, but can overcome historical barriers in the teaching of English**.

Discussion

The results obtained in this research reaffirm the relevance and effectiveness of the TPACK model as an integrative framework for the design of teaching resources that respond to the needs of English learning in secondary school contexts. The notable increase in the scores obtained between the pre-test and the post-test, together with the highly positive perceptions by the students, confirms that the **coherent articulation between content, pedagogy and technology** favors not only the mastery of basic linguistic structures, but also the student's attitude towards the language and their active involvement in the learning process.

From the perspective of disciplinary knowledge, the findings show that the visual, contextualized and repeatable treatment of functional vocabulary and simple grammatical structures contributed significantly to their appropriation. The logical sequencing of contents, exemplification in situations close to everyday life and the availability of resources for immediate consultation made it possible to overcome the limitations of the traditional approach, where grammatical learning is usually fragmented, mechanical and detached from communicative use. This result coincides with what Chapelle (2009) suggests, who points out that well-structured digital environments facilitate language acquisition by offering opportunities for meaningful input, guided practice, and personalized feedback.

In pedagogical terms, the observation of the increase in student autonomy, documented both in the teacher's log and in the activity records on the platform, allows us to infer that the TPACK model, by promoting a student-centered design, encourages active learning and self-regulation. Students not only performed the assigned tasks, but also explored the content beyond the minimum requirements, which reinforces the hypothesis that **commitment to learning increases when the teaching environment is interactive, personalized and** meaningful.

These observations are in line with what Mishra and Koehler (2006) have argued, who warn that the true potential of the use of technology in the classroom does not lie in the tool per se, but in the way in which it is didactically integrated into the content and adjusted to the real needs of the learners. In this study, the design of the digital resource avoided the decorative or superficial use of technology, and instead prioritized its function as a cognitive mediator, content organizer, and facilitator of understanding.

Another relevant aspect is the subjective assessment expressed by the students, who stated that they felt more motivated and understood the topics better when they worked with the interactive resource. This perception has important didactic implications, since it indicates that **motivation does not depend exclusively on interest in the language itself, but on the pedagogical conditions that shape the learning experience**. Interactivity, visual design, flexible pacing, and the ability to rehearse without fear of error were determining factors in improving students' relationship with English.

However, it should be noted that these advances should not be attributed solely to the use of a digital resource, but to the combination of factors that converged in instructional design: carefully structured content, an active pedagogical approach, and relevant technological selection. Therefore, the success of the proposal lies in the **synergy between the components of the TPACK model**, not in the isolated presence of technology.

These results coincide with recent studies in the field of teaching English as a foreign language (EFL), which have documented improvements in student performance and attitude when digital platforms with a defined pedagogical purpose are incorporated (Blin & Muñoz, 2008; Warschauer & Kern, 2000). The findings also reaffirm that, even in rural or technologically limited contexts, it is possible to innovate in foreign language teaching as long as pedagogical design is at the service of meaningful learning.

Finally, the experience documented here allows us to conclude that the TPACK model not only constitutes a framework for didactic design, but also a tool for professional reflection for teachers, who, by integrating these three types of knowledge, can rethink their practice, redefine their strategies, and resignify their role as a mediator of learning in the digital age.

Conclusions

The findings of this research allow us to conclude that the implementation of interactive digital content, designed under the principles of the TPACK model, has a positive impact on the learning of English as a foreign language, specifically on the development of functional vocabulary and the appropriation of simple grammatical structures in middle school students. The model proved to be an effective theoretical and practical reference, allowing a coherent and balanced integration of disciplinary, pedagogical and technological knowledge.

In terms of language performance, students showed significant progress between the pre-test and post-test, suggesting that the use of visual strategies, immediate feedback, and contextualized exercises contributed to content comprehension and retention. This improvement was especially noticeable in key categories such as the simple present tense and the formation of affirmative, negative and interrogative sentences, indicating that the didactic sequence facilitated the transition from grammatical theory to its practical application.

From a pedagogical point of view, the resource encouraged autonomous learning, self-evaluation, gradual exploration of knowledge and decision-making during the resolution of exercises. This autonomy was accompanied by an increase in motivation and interest in the subject, as evidenced by the student perception surveys and the observations recorded in the teaching log. The structure of the resource, designed with principles of progressiveness, visual clarity and interactivity, was key to keeping the students' attention and facilitating their understanding.

Additionally, this experience suggests that the use of digital resources should not be considered as a supplement to traditional teaching, but as an articulating component that can transform learning environments, even in institutions with technological limitations. The TPACK model provides a conceptual scaffolding for the teacher to design materials adjusted to the real conditions of the classroom, recognizing both the technical challenges and the pedagogical opportunities offered by technology.

Based on these results, it is recommended:

1. **To train teachers in the use of the TPACK model as a** tool for the design of integrative pedagogical content.

2. **To promote the development of contextually relevant digital resources**, which respond to the levels of linguistic competence of students and the conditions of school infrastructure.

3. **To promote similar research** in other areas of the curriculum, which validates the potential of the TPACK model to promote significant learning in different fields of knowledge.

4. **Consolidate communities of practice among teachers**, where experiences of design, implementation and evaluation of digital content are shared, favoring collaborative professional learning.

This study shows that it is possible to articulate pedagogy, content and technology in a strategic way, favoring not only the learning of English, but also the development of transversal skills such as autonomy, self-assessment and the willingness to learn through digital environments. The TPACK model, in this sense, is consolidated as a relevant way to innovate in teaching practice and move towards a more inclusive, meaningful education in line with the challenges of the twenty-first century.

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