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# Ibero-American Edutokers: multidimensional analysis of their educational content

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**Abstract**

In recent years, TikTok has reshaped the educational landscape with a predominance of audiovisual capsules as teaching–learning channels. In this context, the emergence of edutokers presents a new educommunicative paradigm that fuses entertainment with education to give way to an informal training process. The aim of this research is to assess the educational quality of Ibero-American edutokers, based on five dimensions: curricular; technical-artistic-narrative; pedagogical; didactic; and accessibility. The study seeks to expand our understanding of the impact of edutokers' educational content on non-formal learning experiences within the digital environment, evaluating how these five dimensions are integrated into the learning process. The study uses a quantitative approach with a non-experimental cross-sectional design, exploratory and inferential in nature, based on a multidimensional instrument that analyzes the educational quality of the content presented by the 15 most representative edutokers in Ibero-America, selected through purposive sampling. The results reflect significant differences over time in the content presented by educational influencers on TikTok, with significant improvements in the dimensions analyzed. However, aspects such as pedagogy and didactics show more gradual development, while accessibility still has room for improvement in the transmission of educational content.

**Keywords:** Edutokers, Education, Pedagogy

## 1 Introduction

Since its launch in 2016 as Douyin, the social media platform TikTok has positioned itself as a globally successful social medium (d'Agnese, 2025). Although TikTok's original purpose was to offer short, fun, and engaging entertainment, its educational potential is now growing. With its brief and dynamic nature, it has become an attractive platform for creators (called edutokers) who use the platform's video and audio tools to reach large audiences with information on various academic disciplines in a non-formal educational setting.

The incorporation of cutting-edge technologies such as TikTok emphasizes the need for instructional approaches that leverage the unique capabilities of social media platforms to produce and disseminate short videos to improve learning outcomes and student engagement (Wang et al., 2024). Considering the educational pill of the moment, TikTok is a dynamic and interactive learning tool that aims to develop intellectual capacity in generations that enjoy short-form content (Perez Cabrejos et al., 2025). Authors



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such as Hu et al. (2025) believe that it can improve participation and learning outcomes through creative capsules that energize the learning process.

However, this educational potential is developed in a media environment characterized by immediacy, brevity, and the pursuit of visibility (Vizcaíno-Verdú & Abidin, 2023). Therefore, there is a tension between the simplification necessary to communicate in short formats and the need to establish the rigor required by educational processes. In this sense, popularity of metrics and fragmentation of knowledge can influence the shaping of content, in such a way that they can condition its depth and pedagogical structure.

In this context, edutokers, as educational agents who carry out their work through a mobile platform, enable students to form learning communities and benefit from shared knowledge in a language that is accessible and understandable to them (Collins, 2025). The use of platforms such as TikTok promotes learning experiences in line with people's sociocultural needs (Blanco Martinez & Gonzalez Sanmamed, 2021), through the expressive and creative contribution of music and movement as a means of teaching and learning (Escamilla-Fajardo et al., 2021).

This communicative potential does not imply that the educational quality of the content disseminated is sufficient. On the contrary, the lack of explicit pedagogical frameworks, teaching standards, and learning assessment criteria make TikTok a place where interesting educational practices coexist with superficial or even misinformative proposals, reinforcing the need for critical analysis as a space for non-formal learning.

Within this framework, the objective of this study is to record and determine the educational quality of the content created by Ibero-American edutokers on TikTok as a new form of non-formal digital education. To achieve its aims, the research: (1) analyzes the educational quality of the content created by Ibero-American edutokers based on five different analytical dimensions (curricular, technical-aesthetic-narrative, pedagogical, didactic, and accessibility); (2) investigates how these five dimensions are articulated in the audiovisual content of Ibero-American edutokers; and (3) identifies the evolution of these dimensions in the audiovisual content of leading Ibero-American edutokers over time.

### 1.1 Education in digital environments: challenges and opportunities

Digital transformation offers enormous opportunities for the field of education, considering that online platforms, immersive technologies, and adaptive learning tools increase access by promoting a participatory culture (Mexhuani, 2025). Current and future education depends directly on the development of information technologies and their role in the educational process (Yashalova & Vasiltsov, 2020), because their inclusion in knowledge transfer creates new possibilities for improving teaching and learning (Mhlongo et al., 2023). However, these possibilities should not be interpreted as automatically educational, since the pedagogical value of digital technologies depends precisely on their integration into teaching–learning processes and on the didactic guidelines that direct their use at the educational level.

Currently, technologies enable the development of new skills and, at the same time, become the method used to structure dynamic learning environments for students and teachers (Kaminskiene et al., 2022). In a context where digital culture is summarized as the management of information with digital tools, new forms of instruction

require ongoing collaborative learning, a transformation of the teaching role, and hybrid processes that reconfigure education as a proactive space (Balogh et al., 2020). As Hult et al. (2025) argue, new digital learning environments transform education, allowing educational actors to participate in real-time synchronous interactions and asynchronous online learning activities. Nevertheless, the expansion of commercial digital platforms for the educational environment highlights various tensions in relation to their pedagogical use, especially when the educational intention does not coincide with the criteria set by these platforms for what should be a visible, immediate, and attractive learning experience.

Despite this, the introduction of digital platforms in the field of education is not a neutral process, but rather one that carries risks. Their introduction into educational processes creates tensions between the pedagogical aims of educational content and the market logic that governs their operation (Tejedor Calvo et al., 2022). Being algorithmic in nature and focused on short-form audiovisual media, they measure educational value through popularity rather than depth of understanding and achievement of learning objectives. This implies that, in addition to access to technology, the success of training depends on the ability to incorporate technology into pedagogy so as not to reduce educational processes to an instrumental approach.

As a result, playful learning opportunities in digital spaces facilitate student motivation and interest (Gouseti et al., 2020) by introducing teaching, learning, and assessment strategies and technologies (Camacho-Zuniga et al., 2023). Virtual education combines the potential of technology with the ideas of experiential education in a powerful way at a time when learning transcends traditional classrooms and is driven by connectivity and technology (Aramburuzabala et al., 2024); therefore, the field of modern education is undergoing profound changes as an important part of the development of students' practical skills (Qi, 2024).

However, when these practices are carried out in a context where critical reflection takes a back seat, they give rise to fragmented learning experiences focused on superficial relationships, rather than meaningful knowledge construction (García-Marín, 2020; O'Sullivan et al., 2022). This risk is particularly due to time constraints and the continuous flow of content that encourages rapid consumption and cognitive fragmentation, limiting sustained attention and deep learning processes in some cases. It is likely that temporality and digital format will become elements that shape the cognitive processes involved in learning.

The technologization of the classroom contributes to the emergence of a new vision of the meaning of teaching and learning, but it implicitly requires teacher training and accessible technological resources to contribute significantly to student education (Simao & Medici, 2024). Teachers today must adapt and reformulate their pedagogical practices and teaching methodologies in a virtual learning environment, often without the fundamental digital skills to promote quality learning (Vieira, 2023). There is a need for educational actors to improve their skill levels through specific training (Dias-Trindade et al., 2023). If platforms do not include adequate preparation, their use may contribute to reinforcing the creation of ad hoc practices that place more emphasis on content production than on thoughtful pedagogical design.

With the emergence of digital platforms, the focus has shifted from addressing challenges and barriers to exploring the opportunities and benefits of education in digital environments (Omar & Abdullahi, 2024). Information and digital technologies contribute to improving the educational experience (Aubakirova et al., 2023), given that, as Karhapää et al. (2024) state, digital environments are becoming increasingly essential parts of educational work, making it essential to understand how they can support learning. A complete framework of understanding must critically evaluate the architecture of platforms governs the access, engagement, and visibility of some forms of knowledge relative to other form.

The characteristics of digital education include both the challenges associated with its implementation (Mhlongo et al., 2023) and ongoing research into how this digitization process has affected people's learning capacity. Developing and establishing appropriate teaching styles and methods is a significant challenge for all education professionals (Bitar & Davidovich, 2024). Furthermore, establishing a solid foundation for pedagogy or pedagogical thinking is another challenge that educators continue to face (Makarenko et al., 2023). Thus, the lack of inclusive design principles and the skill gap between students and educators are among the many challenges educators face when using social media in their teaching (Zou et al., 2025). Therefore, continuous professional development through collaboration fosters a more inclusive and effective learning environment.

The main challenges for the teaching community and the risks associated with new roles and declining educational quality require serious rethinking in the context of digital transformation (Prokazina, 2024). As Gutiérrez-Ujaque (2024) argues, a critical approach is still needed to address the challenges posed by technological inequalities and the ethical and social implications of a digital society that must prioritize literacy and awareness from a critical perspective. Educational practices developed on digital platforms must also take into account commercial approaches geared toward entertainment and how they affect teachers' use of technology, as well as other dynamics, such as the influence of algorithms on learning.

### 1.2 Educational influencers: between entertainment and pedagogy

The emergence of educational influencers on social media and online platforms plays a crucial role in contemporary education, as they encompass diverse groups and generational interests, with opportunities to diversify knowledge transfer through innovative and engaging formats (Szabo & Dani, 2024). Some educators use social media platforms to gain large audiences of followers, develop a digital identity focused on edutainment (education and entertainment), and even monetize their perceived influence (Carpenter et al., 2023). As Azzari and Mayer (2022) point out, it is argued that such teachers take on the role of digital influencers as they adopt the practice of video production and sharing, while focusing on educational topics of interest to an audience. To understand this phenomenon, it is necessary to consider and understand the development of digital environments and the structures through which they operate, examining the ways in which educational practices increasingly depend on factors related to capturing users' attention.

However, the rise of educational influencers is not without tensions and limitations. The critical view of digital education argues that technology alone does not add

educational value to its configurations; the value of the learning experience is based on the correspondence between technology, pedagogy, and epistemology, which is a balance that is often lacking in most commercial social media platforms.

Teachers are deeply affected by the same cultural influences as their students, both directly and indirectly (Sandau & Cousineau, 2025), positioning themselves as new digital artisans by integrating new dynamics that foster a culture of collaboration, through the creation of spaces to facilitate informal learning and action based on motivation and constructivist leadership (Marcelo et al., 2023). Authors such as Gil-Quintana et al. (2022) argue that educational influencers who increasingly disseminate and produce content on social media become content creators who use their own channels or profiles as educational platforms, offering interaction tools adapted to younger generations who are regular users of digital communication. This change could result in pedagogical changes where the design of the curricular content is derived from platform's standards and audience's expectations of teaching and learning instead of from the curricula or instructional criteria. Aslan (2024) argues that the facilitating power of social media to observe linguistic forms, interaction, and participation has important implications for online educational references, especially given the changing professional development in a digital world.

The audiovisual code specific to social media functions as a channel for transmitting knowledge (students follow certain profiles not only for the content they offer, but also because they are interested in the process of learning know-how). Rational and emotional reasons influence the criteria for following these profiles (Izquierdo-Iranzo & Gallardo-Echenique, 2020); emotions (surprise, happiness, neutrality, anger, sadness, fear) and content quality are positively associated with user engagement (Son & Park, 2025). Emotional engagement improves attention and motivation, but when emotional engagement is overwhelming, it can lead to a greater preference for narrative or story-based content over deeper analysis, reinforcing consumption-based educational approaches. In this context, elements of entertainment are intertwined with cognitive and affective dimensions of learning, giving rise to educommunicative experiences, both short- and long-term, that demonstrate specific strategies for managing relationships and maintaining an audience (Fang et al., 2024).

The influence that teachers exert on their students is significant, turning them into true followers of what they teach. This situation requires teachers to understand their students' needs and adapt their teaching and entertainment strategies to the context in which their audience operates (Leon, 2023). However, through developing relationships based on follower counts, educators may inadvertently reduce an individual's ability to critically evaluate the legitimacy of information. Collado-Alonso et al. (2023) warn that followers lack an adequate critical attitude, but they do learn valuable lessons from digital society. This reality highlights the need and urgency for media education as a basis for promoting free, safe, and critical interaction within social networks.

Creating an educational system that fosters each person's individuality, but at the same time offers opportunities to recognize and include others, involves rehumanizing the online world (the environment in which educational influencers work) (Sanchez-Rojo et al., 2024). The rehumanization process requires focusing digital practices on the student and the educator, as well as reevaluating the application of educational influence in

platform-mediated spaces. In this way, rehumanization consists of reinforcing the ethical commitment, inclusivity, and professionalism associated with the use of educational influence, especially in spaces that lack equality and equity in both visibility and participation, and that are often influenced by the logic of the platforms themselves.

In a new digital landscape that intertwines education and media, educational influencers are not perceived as educational role models because of their number of followers, popularity, or recognition on social media, but because of their constant ability to contribute to a network of professionals that offers educational services and promotes collaboration among stakeholders (Marcelo-Garcia et al., 2022). The perspective, therefore, lies in distancing oneself from mere entertainment to position oneself as an agent of a digital educational ecosystem that promotes critical instructional processes through various elements.

### 1.3 Edutokers in Ibero-America: analytical dimensions of a new educational mediation

In an increasingly digitalized world, social media platforms such as TikTok are driving the creation of online teaching and learning environments through short, dynamic videos (Galvez-Ruiz et al., 2025). In Ibero-America, the use of TikTok as an active learning tool is aligned with improved academic performance, especially when combined with traditional methodology (Zapata-Martinez et al., 2025). In this context, the rise of educational references within the TikTok platform demonstrates its impact on motivation and learning, especially its contribution to the development of digital skills and the responsible use of mobile platforms in the teaching–learning process (Caldeiro-Pedreira & Yot-Dominguez, 2023). In addition to the motivational and instrumental advantages, it is necessary to conduct an in-depth analysis of the emergence of edutokers as educational mediators do not subject to institutional curriculum regulation, to effectively address the growing educational importance of TikTok in teaching–learning processes.

TikTok promotes learning experiences that are consistent with people's sociocultural demands through curriculum enrichment and encouragement of a comprehensive and expanded approach to education at all levels (Blanco Martinez & Gonzalez Sanmamed, 2021). Instructors who use platforms such as TikTok become creators of resources and, as a result, act as intermediaries between the curriculum and practice (Moreno et al., 2024). In this way, edutokers represent informal agents within the curriculum, where the choice and abandonment of content, as well as the way it is presented and validated, are subject to the decisions of the educational creator. This increase in curricular activities involves new strategies that use learning technologies and more attractive platforms (Saposnik, 2023), considering that young students perceive the benefits more positively, which demands integration between knowledge and the use of continuous digital elements (Marcelo-Martinez et al., 2025).

TikTok users' propensity to use more instructional content is influenced by their perception of value and their level of satisfaction, which is why TikTok adapts features that match users' preferences for content on a dynamic platform (Rahimullah et al., 2022). Educators have valid concerns related to the educational perspective regarding the amount and quality of instructional content being standardized because the concept of value has shifted away from being measured solely on epistemological coherence or integrative depth toward a utility measurement. Currently, as Huebner (2022) points out,

TikTok's performative practices involve working with young people or using expository and entertaining teaching methods. For educators who use the platform as a teaching tool, this has implications for their educational work. It has been observed that edutokers use different types of possibilities offered by the platform, with a special emphasis on short videos, selfies, and the teacher's voice to represent themselves, rather than music or playback (Sánchez-Lopez et al., 2023). The methods mentioned above continue to promote how people acquire knowledge in a highly individualized learning style, focusing more on how the teacher is conveying the knowledge than through an open and transparent structure of pedagogy (pedagogical framework).

This trend is especially evident in Ibero-America, where social and cultural diversity influences how these digital tools are appropriated and modified. Some educational interventions by well-known edutokers have proven effective in improving the acquisition of theoretical and practical knowledge (Poza-Mendez et al., 2024), thus facilitating the development of communication skills and the ability to learn through autonomous, questioning, and experiential learning in a specific study context and taking into account the limitations of the recipients. (Acevedo Borrega et al., 2022). However, the success of microvideo applications does not mean that these achievements can be extrapolated to other contexts with educational inequality and disparate levels of access among a population with digital skills. There are microvideos that are quite popular among consumers in Ibero-America, but there is also concern about the risk of presenting a false image of their consumers, because much of the educational content currently being produced lack's reliability and quality (Izquierdo-Condoy et al., 2025).

Although there are concerns about the incursion of edutokers into the media-educational landscape, their experimentation involves a set of pedagogical experiences and cultures, particularly linked to the interaction of human and non-human facets of teaching and learning in non-formal educational environments (Heyang & Martin, 2024). Some authors (Galvez-Ruiz et al., 2025) consider that, despite the rise and popularity of TikTok among younger generations and the first explorations of its pedagogical use, its educational benefits are largely unexplored. Along these lines, Díaz-Herrera et al. (2022) describe a need to promote teacher training in critical thinking in education, because it currently represents a training gap that limits the inclusion of emerging digital tools.

Through the work of educators on TikTok, it is possible to design a content creation system to promote quality learning through microlearning that can be transferred to different disciplines (Conde-Caballero et al., 2024). These advances in the creation of digital educational content reflect specific trends in Ibero-America, where growing access to mobile devices provides fertile ground for educational innovations. Given that young people use TikTok as a social media platform, it shows promise as a method for improving education. Therefore, experts are needed to join the platform and offer users high-quality content (Olsson et al., 2024). TikTok should not be dismissed as a dance and entertainment app, because edutokers reach a considerable audience, which means greater care must be taken at the professional and educational level due to the implicit factors involved (Kauffman et al., 2022).

In this context, it is therefore necessary to critically examine the level of accessibility and authenticity of a social media platform and the educational references developed therein (Vizcaíno-Verdú et al., 2025). As Collado-Alonso et al. (2023) point out, free,

safe, and critical interaction with social media requires media literacy and education. Some critics (Tejedor Calvo et al., 2022) point to the lack of teaching guidelines, which results in videos that prioritize comedy rather than an invitation to debate, a situation that leads to a failure to take advantage of common resources in audiovisual narratives.

## 2 Methodology

### 2.1 Type of study

The study adopted a quantitative approach with a non-experimental, cross-sectional, exploratory-inferential design. This methodological choice is justified by the emerging nature of the phenomenon analyzed and by the limited previous empirical evidence on the educational quality of the content produced by edutokers on TikTok. According to Hernández-Sampieri and Mendoza (2018), exploratory designs are suitable for estimating trends, initial patterns, and preliminary associations in poorly studied contexts, without attempting to establish causal relationships.

By not intervening in the observed variables, the design reduces the risk of bias derived from experimental manipulation and allows the phenomenon to be analyzed in its natural production context. However, given the small sample size and the use of purposive sampling, inferential analyses were used for strictly analytical and descriptive purposes, aimed at identifying intra-subject variations and consistent patterns across dimensions, rather than making population generalizations. Consequently, any statistically significant results should be interpreted with caution, prioritizing the direction of the effect and consistency between the different analyses performed.

### 2.2 Participants

The sample consisted of 15 creators of educational content on TikTok (edutokers), selected through purposive sampling and snowball sampling. This type of sampling is considered appropriate when access to the target population is limited and the profiles of interest are not easily identifiable through probabilistic procedures (Lee & Spratling, 2019; Leighton et al., 2021).

The selection process began with an initial screening of 39 profiles of Ibero-American edutokers, segmented by country. From this preliminary population, the following inclusion criteria were applied: (1) creators with academic training directly related to the educational content disseminated; (2) independent edutokers, i.e., not institutionally linked to educational organizations; (3) profiles with at least one million followers and a minimum of 30 published videos; and (4) content production in Ibero-American countries, in Spanish or Portuguese. The application of these criteria allowed for the formation of a heterogeneous sample in terms of geography, discipline, and platform history. The profiles finally selected and their approximate number of followers are presented in Table 1, while Table 2 summarizes the main sociodemographic and professional characteristics of the participants (country of origin, years of activity, and discipline).

Although the sample size is small and does not guarantee statistical representativeness, its heterogeneous composition in geographical and disciplinary terms is consistent with the exploratory nature of the study. The cases analyzed allow us to identify indicative patterns and intra-subject contrasts, although the results should not be extrapolated

**Table 1** Research sample

| Profile | Followers |
|---|---|
| @historiaparatontos | 7.7 millions |
| @jeffrey.navarro | 6.6 millions |
| @Bio_makers | 6.1 millions |
| @sciencewithana | 3.5 millions |
| @tuprofesoradelengua | 3.4 millions |
| @miprofefidelito | 3.3 millions |
| @inge_darwin | 2.9 millions |
| @mateyisus | 2.8 millions |
| @elingefrancisco | 2.7 millions |
| @elvis_el_unico | 2.4 millions |
| @preguntalealbiologo | 2.4 millions |
| @matemagiks | 1.4 millions |
| @javiermafla | 1.3 millions |
| @matemovil | 1.2 millions |
| @art.cres | 1.1 millions |

**Table 2** Participant profile ($N = 15$)

| Criterion | Description | N | % |
|---|---|---|---|
| Country of origin | Ecuador | 3 | 20,0 |
| | Spain | 2 | 13,3 |
| | Mexico | 6 | 40,0 |
| | Peru | 4 | 26,7 |
| Active time | 4 years | 3 | 20,0 |
| | 5 years | 9 | 60,0 |
| | 6 years | 3 | 20,0 |
| Discipline | Art, illustration | 1 | 6,7 |
| | Biology | 1 | 6,7 |
| | Excel | 1 | 6,7 |
| | History | 1 | 6,7 |
| | English | 1 | 6,7 |
| | Language and Literature | 1 | 6,7 |
| | Mathematics | 6 | 40,0 |
| | Mathematics, Electronics, Physics | 1 | 6,7 |
| | Chemistry | 1 | 6,7 |
| | Robotics | 1 | 6,7 |

to the total population of edutokers. Consequently, the interpretation focuses on trends observed within the analyzed group and not on population inferences.

#### *2.2.1 Video selection criteria*

The videos selected for analysis were based on three specific criteria: (1) the first video published by each creator, (2) the creator's most popular video to date (the most viewed), and (3) the most recent video published at the time of data collection. This selection was not arbitrary but was based on an intra-profile comparative logic consistent with the non-experimental cross-sectional design of the study.

The first video was used as an initial reference for the content produced before the creator established a consolidated relationship with the platform and its audience. The most viewed video was considered representative of the content with the greatest algorithmic and social impact, while the most recent video was interpreted as an indicator of the current state of the creator's educational practices. To avoid pseudo-replication issues, videos were not treated as independent units. Instead, a nested data structure was used, considering the creator as the primary unit of analysis. Contrasts between video types were performed exclusively using intra-subject nonparametric tests (Friedman and Wilcoxon), which allow for control of interindividual variability and avoid artificially inflating the sample size.

### 2.3 Instrument

The development of the instrument is based on the model proposed by Romero-Tena et al. (2017), which establishes five dimensions of analysis: 1) Curricular; 2) Technical, aesthetic, and expressive; 3) Pedagogical; 4) Didactic; 5) Accessibility. Based on this model, the TikTok Video Educational Quality Assessment Tool was developed with the aim of analyzing the educational quality of the content presented by edutokers on their profiles. The approach of this tool responds to the current need for valid and reliable tools that comprehensively assess the educational content presented on a mobile platform. The expansion of the original instrument responds to the need to capture specific characteristics of the TikTok format and mobile learning environments.

The final instrument consists of 38 items distributed across the five dimensions mentioned above and was designed for use through structured observation of the selected videos. It was developed in response to the need for a tool that could comprehensively capture both the technical components of the content and the pedagogical, didactic, and accessibility elements that characterize educational materials disseminated on social media.

Content validity was established through expert judgment, with the participation of seven reviewers selected according to the following criteria: (a) academic background and scientific output in education and communication; (b) experience in educational technology and educommunication; and (c) previous research on social networks, digital communities, and platform-mediated learning. The process was carried out in a single structured round, in which the experts evaluated each item in terms of relevance, representativeness, and clarity, as well as providing qualitative comments for improvement.

The degree of agreement was calculated using the Content Validity Index (CVI), obtaining values above 0.80 in all dimensions, indicating a high level of consensus among the judges. Hernández-Nieto (2002) recommends the participation of between three and five experts for each of the different items and for the instrument in general (Pedrosa et al., 2014). The CVI results by dimension are presented in Table 3, demonstrating the adequate content validity of the instrument. Consequently, each dimension of the instrument was implemented through a specific set of observable elements, and the complete list of dimensions and their corresponding elements is included in Appendix A.

Internal reliability was assessed using Cronbach's alpha coefficient for each dimension and for the overall scale (Table 4), considering the three moments of analysis (first video, most viewed video, and recent video). In general terms, the results show adequate to

**Table 3** CVI results for the dimensions

| Dimensions | N° Items | Relevance | Representativeness | Clarity | Global |
|---|---|---|---|---|---|
| Dimension 1: Curricular aspects (6 items) | 6 | 0,99 | 0,98 | 0,98 | 0,98 |
| Dimension 2: Technical, aesthetic, and narrative aspects (8 items) | 8 | 0,99 | 0,99 | 0,97 | 0,98 |
| Dimension 3: Pedagogical aspects (8 items) | 8 | 0,99 | 0,99 | 1,00 | 0,99 |
| Dimension 4: Didactic aspects (11 items) | 11 | 0,99 | 0,99 | 1,00 | 1,00 |
| Dimension 5: Accessibility (5 items) | 5 | 0,97 | 0,98 | 1,00 | 0,98 |
| **Total** | 38 | 0,99 | 0,99 | 0,99 | 0,99 |

**Table 4** Cronbach's alpha (α) coefficient for dimensions

| Dimension | Items | α First video | α Most viewed | α Recent video |
|---|---|---|---|---|
| Curricular aspects | 6 | .95 | .92 | .90 |
| Technical, aesthetic, and narrative aspects | 8 | .88 | .82 | .83 |
| Pedagogical aspects | 8 | .86 | .89 | .83 |
| Didactic aspects | 11 | .89 | .81 | .78 |
| Accessibility | 5 | .58 | .72 | .72 |
| Global | 38 | .96 | .96 | .88 |

α ≥.90 = excellent; α.70–.89 = good; α <.70 = acceptable-moderate

high levels of internal consistency in most dimensions, indicating acceptable homogeneity among the items that comprise them and supporting the use of the derived scores for subsequent analyses. The overall scale showed high internal consistency across the three moments, confirming the stability of the instrument in capturing the educational quality of the content at different stages of production.

Some variations in reliability coefficients between moments reflect changes in the internal consistency of certain dimensions over time, especially those related to pedagogical, didactic, and accessibility aspects. In particular, the accessibility dimension showed more heterogeneous behavior, attributable both to the smaller number of items that comprise it and to the difficulties inherent in operationalizing inclusive practices in short audiovisual content. In this study, accessibility is assessed through specific, predefined items, including the presence of subtitles, the availability of links to complementary resources, audiovisual features designed to facilitate access for people with partial visual impairment (such as color contrast, text legibility, descriptions of images and graphics, and the use of appropriate voice-over), as well as teaching strategies aimed at promoting cognitive accessibility (including the use of short sentences, repetition of key concepts, visual aids, subtitles, and on-screen text). Likewise, advertising integrated into the content is considered not to interfere negatively with its usability. This situation reinforces the need to interpret the results of this dimension with caution and to consider accessibility as a developing construct within the analyzed context.

Overall, the results of the validation and internal reliability process support the use of the instrument for analytical and exploratory purposes in the present study. However, given the small sample size and cross-sectional design, the scores obtained should be understood as indicative of emerging trends and patterns rather than definitive or generalizable measures of the educational quality of content on TikTok.

### 2.4 Data analysis

Data analysis was performed using IBM SPSS Statistics v.25 and Jamovi v.2.7.14. In the descriptive phase, robust measures of central tendency and dispersion (median and interquartile range) were used, as these are considered more appropriate for small samples and ordinal data. The normality of the distributions was assessed using the Kolmogorov–Smirnov test with Lilliefors correction. Given that most variables did not meet the assumption of normality and considering the sample size (n = 15), nonparametric tests were chosen. Intra-subject comparisons between the three moments were performed using the Friedman test, supplemented with Wilcoxon paired contrasts and Kruskal–Wallis when relevant.

It is recognized that nonparametric tests have limitations in terms of statistical power when applied to small, nonprobabilistic samples. Therefore, the results were interpreted based not only on statistical significance values, but also on effect sizes and consistency between the different analyses and visualizations. This strategy reinforced the methodological rigor of the study without overstating the inferential robustness of the findings.

## 3 Results

Given the small sample size (n = 15) and the ordinal nature of the data, the descriptive results are presented mainly using medians and interquartile ranges (IQR), which are considered more robust indicators than means and standard deviations in contexts that are highly sensitive to extreme values. This approach allows for a more accurate interpretation of the central tendency and dispersion, in line with methodological recommendations for exploratory studies with small samples. In this regard, Table 5 shows a progressive evolution in the educational quality of the content throughout the three moments analyzed (first video, most viewed video, and most recent video). In all dimensions, there is an upward shift in the medians, accompanied by a gradual reduction in

**Table 5** Descriptive statistics of the instrument by dimension and publication moment

| Dimensions | Video | Median | IQR | Minimum | Maximum |
|---|---|---|---|---|---|
| Curricular aspects | First video | 3.50 | 1.9167 | 1.00 | 4.00 |
| | Most viewed | 3.83 | 0.8333 | 1.33 | 4.00 |
| | Recent video | 4.00 | 0.0833 | 2.00 | 4.00 |
| Technical, aesthetic, and narrative aspects | First video | 3.50 | 0.9375 | 1.88 | 4.00 |
| | Most viewed | 4.00 | 0.5000 | 2.88 | 4.00 |
| | Recent video | 4.00 | 0.0000 | 3.75 | 4.00 |
| Pedagogical aspects | First video | 2.38 | 1.1875 | 1.00 | 3.63 |
| | Most viewed | 3.38 | 0.8125 | 1.25 | 3.88 |
| | Recent video | 3.63 | 0.5625 | 1.63 | 4.00 |
| Didactic aspects | First video | 2.64 | 1.0455 | 1.00 | 3.82 |
| | Most viewed | 2.82 | 0.3182 | 1.18 | 3.73 |
| | Recent video | 3.45 | 1.0909 | 2.00 | 4.00 |
| Accessibility | First video | 3.00 | 0.8000 | 1.60 | 4.00 |
| | Most viewed | 3.40 | 0.4000 | 2.00 | 4.00 |
| | Recent video | 3.40 | 0.2000 | 3.00 | 4.00 |
| Global | First video | 3.03 | 1.3895 | 1.49 | 3.72 |
| | Most viewed | 3.47 | 0.5648 | 1.79 | 3.87 |
| | Recent video | 3.72 | 0.1898 | 2.62 | 3.91 |

the interquartile ranges. This pattern suggests that, in addition to improving central scores, the variability among creators tends to decrease over time, pointing to greater homogeneity in production practices at more advanced stages.

The most consistent progress has been made in the technical, aesthetic, and narrative dimensions. In the most recent video, the median reaches the maximum value on the scale, and the IQR is reduced to practically zero, indicating a marked convergence in audiovisual performance. This result suggests that edutokers acquire technical skills related to the format, the visual language of the platform, and audience expectations relatively quickly. In contrast, although the pedagogical and didactic dimensions show clear increases in their medians, they maintain wider interquartile ranges, reflecting less uniform improvement of trajectories. This difference suggests that the incorporation of more in-depth educational strategies progresses more gradually than the technical optimization of content.

The accessibility dimension shows positive progress, characterized by an increase in the median and an upward shift in the minimum values. However, unlike other dimensions, the reduction in dispersion is more moderate. This heterogeneity suggests that the adoption of inclusive practices—such as the use of subtitles, visual aids, or complementary descriptions—is not systematic among all creators. The lack of a more detailed operationalization of this dimension limits the interpretation of the results and requires caution in considering these findings, especially given the central role of accessibility in contemporary educational research.

These descriptive trends are more clearly visualized in Fig. 1, where box plots provide an integrated view of the evolution of each dimension. In particular, the boxplots show a progressive shift of the medians toward higher values and a contraction of the interquartile ranges in the most recent videos. This type of visualization is especially informative in small samples, as it allows for the simultaneous identification of the central tendency, the dispersion, and the presence of outliers, avoiding interpretations based exclusively on averages.

From an inferential point of view, Friedman's test (Table 6) identified statistically significant differences between the three moments of analysis in the technical, pedagogical, and didactic dimensions, as well as in the overall score. Kendall's W coefficients associated with these contrasts indicate moderate to large effect sizes, suggesting the presence of systematic changes over time. However, although the curricular and accessibility dimensions show descriptive upward trends, they did not reach levels of statistical significance. This result reinforces the need to interpret accessibility not only from a statistical significance perspective, but also from an educational and social relevance perspective, especially in contexts where inclusion is a priority objective beyond the magnitude of the observed effect.

Wilcoxon paired contrasts (Table 7) complement these findings by showing that the most consistent differences are concentrated in the comparison between the first video and the most recent one. In particular, the largest effect sizes are recorded in the technical, aesthetic, and narrative dimensions, followed by the pedagogical and didactic dimensions. The overall score replicates this pattern, indicating that the improvement observed is not limited to an isolated component of the content, but is manifested across the board. However, given the sample size and purposive sampling, these results should

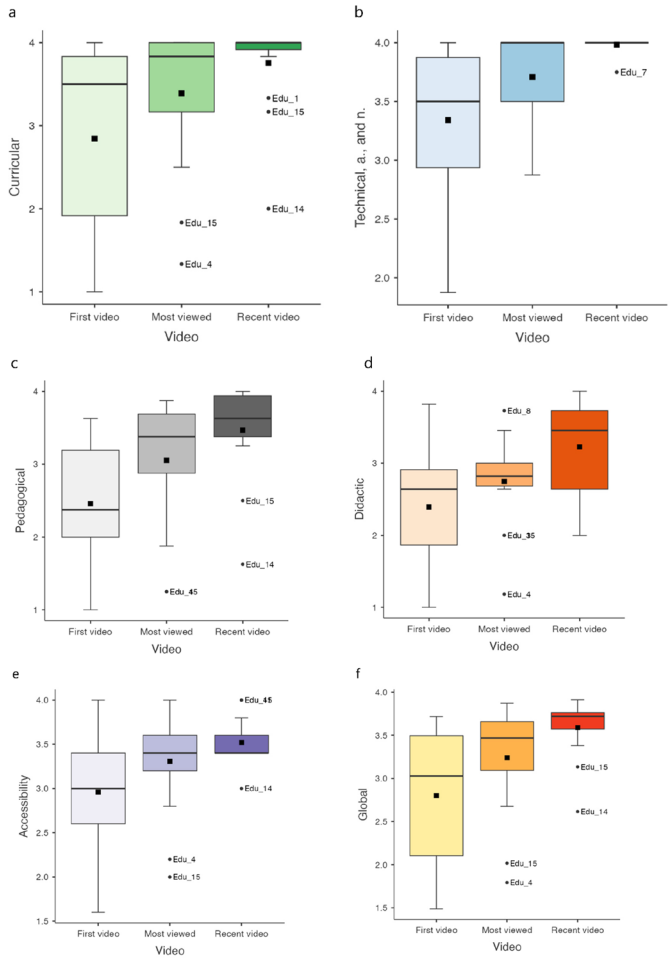


**Fig. 1** Distribution of educational quality dimensions across publication moments

be interpreted as indications of change within the analyzed group and not as robust evidence of generalizable effects.

It is important to note that the nonparametric tests used assume independence between observations and are limited by the low statistical power associated with small samples. In this context, statistical significance should not be interpreted as an absolute criterion, but rather as a complement to descriptive and visual evidence. For this reason, the emphasis of the analysis is placed on consistency between tables, effect sizes, and graphs, rather than on the accumulation of statistical values.

Overall, the results describe a trajectory of progressive improvement in the educational quality of the content analyzed, characterized by an increase in medians and a reduction in interindividual variability. However, given the limitations of the cross-sectional design, the small sample size, and the absence of formal longitudinal follow-up, these findings do not allow us to affirm the existence of a consolidated professionalization process. Rather, the data suggest a gradual process of learning and adjustment to the dynamics of the platform, in which edutokers tend to converge toward higher quality standards, especially at the technical level, while the pedagogical, didactic, and accessibility components require more sustained and systematic development.

**Table 6** Non-parametric comparison of educational quality dimensions across publication moments (Friedman test and Kendall's W)

| Dimensión | $\chi^2(2)$ | *p* | Kendall's W | Magnitude of the effect[a] |
|---|---|---|---|---|
| Curricular aspects | 5,76 | .056 | .192 | Small |
| Technical, aesthetic, and narrative aspects | 15,43 | .000 | .514 | Large |
| Pedagogical aspects | 11,09 | .004 | .369 | Moderate |
| Didactic aspects | 8,17 | .017 | .272 | Small–moderate |
| Accessibility | 4,10 | .129 | .137 | Small |
| Global | 8,53 | .014 | .284 | Small–moderate |

[a] Interpretive cutoff: W ≈.10–.29 = small;.30–.49 = moderate; ≥.50 = large

**Table 7** Pairwise non-parametric comparisons between publication moments (Wilcoxon signed-rank test)

| Dimensions | Pair of moments | Z | *p* | r = \|Z\|/√N | Magnitude[a] |
|---|---|---|---|---|---|
| Curricular aspects | Most viewed—First | −1,67 | 0,10 | 0,43 | Moderate |
| | Recent—Most viewed | −1,69 | 0,09 | 0,44 | Moderate |
| | Recent—First | −2,24 | 0,03 | 0,58 | Large |
| Technical, aesthetic, and narrative aspects | Most viewed—First | −2,24 | 0,03 | 0,58 | Large |
| | Recent—Most viewed | −2,38 | 0,02 | 0,61 | Large |
| | Recent—First | −2,94 | 0,00 | 0,76 | Large |
| Pedagogical aspects | Most viewed—First | −1,85 | 0,06 | 0,48 | Moderate |
| | Recent—Most viewed | −1,94 | 0,05 | 0,50 | Large |
| | Recent—First | −2,51 | 0,01 | 0,65 | Large |
| Didactic aspects | Most viewed—First | −1,57 | 0,12 | 0,40 | Moderate |
| | Recent—Most viewed | −2,14 | 0,03 | 0,55 | Large |
| | Recent—First | −3,10 | 0,00 | 0,80 | Large |
| Accessibility | Most viewed—First | −1,53 | 0,13 | 0,39 | Moderate |
| | Recent—Most viewed | −0,94 | 0,35 | 0,24 | Moderate |
| | Recent—First | −2,05 | 0,04 | 0,53 | Large |
| Global | Most viewed—First | −1,82 | 0,07 | 0,47 | Moderate |
| | Recent—Most viewed | −2,05 | 0,04 | 0,53 | Large |
| | Recent—First | −2,73 | 0,01 | 0,70 | Large |

[a] Conventional criteria: 0.10 = small, 0.30 = moderate, ≥ 0.50 = large (Field, 2018). N = 15 ⇒ $\sqrt{N} \approx 3.87$

### 3.1 The profile of edutokers and their influence on the educational quality of content

Inferential analyses aimed at examining the influence of edutoker profiles on the educational quality of content did not reveal statistically significant differences between groups defined by country of origin, years of activity, or field of study. For this purpose, nonparametric Kruskal–Wallis (H) tests were applied, appropriate for the categorical nature of the grouping variables, the small sample size, and the absence of normality assumptions.

In inferential terms, the results show that overall educational quality does not vary significantly based on geographical context or the creators' experience. At the three points of analysis (first video, most viewed video, and recent video), the H statistic values remained consistently low ($H \leq 1.00$), with significance levels far from the critical threshold. This pattern indicates that neither the country of origin nor the years of activity

explain a relevant proportion of the variability observed in the scores, suggesting that the improvements documented in previous sections do not respond to structural attributes of the profile, but rather to dynamics shared by the group of edutokers analyzed.

This inferential reading is reinforced by visual analysis of the distributions. As shown in Fig. 2a, the box plots by country of origin show moderate initial dispersion in the first video, followed by a progressive concentration of scores in the most recent video. Despite specific differences in initial trajectories, the medians tend to align in similar ranges and interindividual variability is consistently reduced, suggesting a process of cross-sectional convergence independent of the national context.

A similar pattern can be seen when considering years of activity (Fig. 2b). The corresponding visualizations show that, although creators with more experience have heterogeneous initial trajectories, these differences diminish over time. In the most recent video, the distributions of educational quality are closely grouped, with reduced interquartile ranges and comparable medians between different levels of experience. This graphical behavior supports the idea that the observed improvement is not directly associated with the duration of activity on the platform, but rather with a process of progressive adjustment to the logic of production and circulation of educational content on TikTok.

With regard to the discipline of training, the results (Fig. 2c) should be interpreted with particular caution. Although the diagrams reveal marked descriptive heterogeneity in the first video—with extreme values in some specific disciplines—these differences do not consolidate as stable patterns over time. On the contrary, in the most recent video, there is a clear reduction in dispersion and a convergence of medians, even in contexts where disciplinary representation is limited to one or two cases. This visual convergence, together with the absence of significant inferential contrasts, suggests that the initial differences respond more to the individual variability inherent in cells with minimum size than to systematic effects attributable to the disciplinary field.

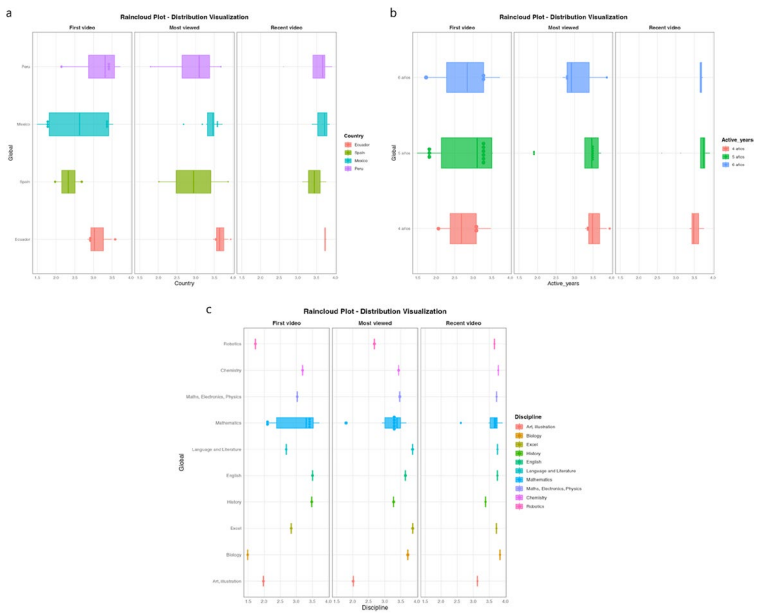


**Fig. 2** Educational quality of content according to the profile of edutokers

Overall, the integration of statistical analyses and descriptive visualizations points to a phenomenon of progressive convergence in the educational quality of content. Regardless of country, seniority, or discipline, edutokers tend to achieve similar levels of performance in advanced stages of their production. From an interpretive perspective, these findings suggest that the trajectory of learning and adaptation to the logic of the platform—rather than the creator's initial profile—emerges as the predominant factor in explaining the observed evolution. However, this conclusion must be understood within the exploratory nature of the study and the limitations derived from the size and composition of the sample, avoiding any generalization beyond the context analyzed.

## 4 Discussion

The results of this study confirm that content production on informal digital platforms has become a relevant practice within the current educational ecosystem (Balogh et al., 2020; Gouseti et al., 2020; Yashalova & Vasiltsov, 2020). However, despite the progressive improvement of some dimensions implicit in the learning process, the edutoker model in Ibero-America invites critical reflection on the role of TikTok as an educational space, as well as the conditions that allow—or prevent—entertainment from becoming truly meaningful learning.

First, improvements in technical, artistic, and narrative aspects indicate that edutokers abilities are evolving quickly and are focused on the communicative significance of TikTok. This outcome is consistent with other strategies that highlight the visual impact, content speed, or instant attention generated on algorithm-controlled platforms (Rahimullah et al., 2022; Sánchez-Lopez et al., 2023; Son & Park, 2025). Even though audiovisual language predominates, there is a structural tension that implies that the more reliant you are on narrative transport to guarantee analog visibility, the more likely it is that educational content will be influenced by popularity rather than pedagogical standards (Izquierdo-Iranzo & Gallardo-Echenique, 2020).

With this premise, the edutoker phenomenon can be understood as a change in the power structure in pedagogy, where pedagogical authority demands social recognition, engagement, and media exposure beyond curriculum or academic validation, rather than just as a representation and new methodological proposal (an innovative insertion of teaching). The critical literature on the trivialization of knowledge mastery in situations where fragmentation and simplification are among the dominant didactic communication strategies is thus reinforced (Aslan, 2024; Prokazina, 2024; Sandau & Cousineau, 2025).

Although the results indicate progress in pedagogical and didactic dimensions, their slower growth reveals that technical competence alone is not sufficient to guarantee educational quality. In-depth didactic design requires processes of reflection, co-pedagogical training, and a good understanding of teaching–learning educational processes, which are not always integrated into the trajectory of educational content decision-makers on social media (Dias-Trindade et al., 2023; Makarenko et al., 2023; Vieira, 2023). In this vein, the study highlights the existence of a gap between knowing how to communicate and knowing how to teach, a gap that has already been noted in research on pedagogical innovation in the digital environment (Aubakirova et al., 2023; Qi, 2024).

Accessibility is one of the most important aspects of this analysis. Progress has been made, but inclusive practices are not yet a guiding principle for the educational content developed on TikTok. This lack of implementation is particularly worrying in Ibero-America, where educational and technological inequalities are structural (Simao & Medici, 2024; Karhapää et al., 2024). Therefore, in addition to not functioning as a democratizing practice, exclusionary dynamics are generated, with access only for users with better digital skills, greater and better technological conditions, and more prior skills to interpret fragmented content.

Similarly, audience and interaction metrics give teaching practice a dual nature. On the one hand, feedback encourages active participation and the creation of virtual learning communities (Carpenter et al., 2023; Marcelo et al., 2023), but on the other hand, it can generate a dependence on social acceptance, displacing conceptually complex or pedagogically demanding content. In this regard, the results point to a growing need for critical media literacy that allows users to differentiate between engaging educational content and rigorous educational content (Collado-Alonso et al., 2023).

Comparing platforms such as YouTube, Instagram, and Twitch contextually places the research results within a broader digital educational ecosystem. Platforms such as YouTube are more conducive to lengthy explanations and structured teaching sequences, while Twitch is more conducive to much longer interactions and implicit discussion. In contrast, TikTok is a form of communication organized into short segments and snippets of content, which conditions the way teaching and learning take place (Acevedo Borrega et al., 2022). What is specific is not the distance from educational use, but rather the effectiveness of its didactic purposes, which must find specific strategies and establish the limits of that learning (Zapata-Martinez et al., 2025).

Finally, although the results point to the existence of initial dynamics of professionalization in the practices of the edutokers analyzed, this interpretation should be taken with caution. The gradual improvement observed in some dimensions of the content is not closely related to a process of formalization and consolidation of their digital educational practices, but rather to a professionalization that is neither complete nor sufficiently formalized. Considering the size of the sample, it should be noted that these results cannot be extrapolated to all TikTok edutokers, but rather describe initial trends that are limited to the specific environment of the study. This consideration is important in order to avoid interpretations that are not in line with the scope of the study and to properly situate the scope of the results obtained.

## 5 Conclusions, limitations and future lines of research

The research concludes that the quality of educational content produced and transmitted by Ibero-American edutokers through TikTok should be considered merely a reconfiguration of existing traditional teaching and learning frameworks. On its own, the use of TikTok in educational content does not add value to learning opportunities. However, it creates different levels and types of mediating elements in education, which must be evaluated more thoroughly with a critical and systematic view using the following lenses: curricular, technological, pedagogical, didactic, and accessibility.

The study reveals that the educational value of edutokers is based to a greater extent on the context and design of the products they broadcast, limiting the ability to draw

generalized conclusions about their educational capacity. It is therefore necessary to define the limitations and areas of application of this form of education, understanding it as a field of great variation in terms of inequality, due to the algorithmic method of promoting visibility and the restrictions of technological platforms both in the development of new knowledge and in its distribution.

The conclusions drawn can only be made from a limited perspective based on the current research methodology. The small size of the dataset, as well as selective sampling methods, may prevent the results from being applied to all edutokers in general, as they were created separately and did not include any potential learning outcomes or feedback that would have provided insight into how the results are received by the audience. Therefore, the conclusions presented indicate trends at that specific time and place, rather than the overall picture of all edutokers today.

The findings of this study have valuable implications for educational use. The results suggest that educators should consider edutoker materials as a complement to their structured teaching, rather than a substitute for it; within this framework, they should encourage students to engage critically with the content. Furthermore, considering that teacher preparation programs should provide integrated training in the use of short videos for effective teaching, students should be equipped with the skills and knowledge necessary to create effective video content, understand instructional design, and follow the principles of equitable access to educational resources. Finally, about content creators, the study suggests the need to balance engagement-oriented methods with rigorous academic content development, as well as to provide equitable access to educational resources, particularly in areas of the world that experience significant disparities in access.

Based on these conclusions, multiple lines of research can be established for the future. One of them is how people respond to the content of an edutoker and how they learn from it, using learning indicators, as well as the experience of participants and the perspective of the audience. Second, further analysis is needed on how algorithms can play an implicit role in educational systems. Third, researchers should provide educational guidelines and assessment frameworks for mobile digital platforms that evaluate educational activities beyond simply measuring popularity. This will help develop educational guidelines that promote deeper, more critical, and socially responsible perspectives on how non-formal digital education is conducted and how it is digitally assessed.

## Appendix A

### Research instrument

| Dimensions and items that make up the educational quality of Ibero-American edutokers |
|---|
| **Curricular aspects** |
| 1. The video explains the curricular objectives it pursues |
| 2. The video content addresses the stated curricular objectives |
| 3. The content is adapted to the dynamics of the chosen format within the platform (POV, roleplay, challenges, duets, tutorials) |
| 4. The content encourages the user to engage in exploratory activities (research, analysis, or practice) related to the concepts presented |

| Dimensions and items that make up the educational quality of Ibero-American edutokers |
|---|
| 5. Only data and explanations directly related to the topic are provided, without digressing to other subjects |
| 6. The information contained in the video presents scientific sources and verified facts |
| **Technical, aesthetic, and expressive aspects** |
| 1. The video uses visual resources that illustrate the educational content (images, graphics, visual effects) |
| 2. The volume of the music and sound effects does not interfere with the main narrative |
| 3. The image quality is consistent with the video's visual aesthetic |
| 4. The audiovisual resources used are linked to the video's objectives |
| 5. The synchronization of visual and auditory elements features scene changes and music at key points in the video |
| 6. The message is clear in the first few seconds of the video |
| 7. The content structure and the speed at which it is delivered ensure the fulfillment of the communicative intention |
| 8. The creator optimizes its visibility by using relevant hashtags, popular sounds, and an engaging title |
| **Pedagogical aspects** |
| 1. The video uses reinforcement strategies, such as repetition of key concepts and ideas |
| 2. The content is presented in an orderly sequence: from general to specific |
| 3. The vocabulary used is understandable (avoiding ambiguity and unnecessary technical terms) |
| 4. The amount of information presented is appropriate for the video's length, covering the educational objectives without omitting key aspects |
| 5. The video includes explicit references to previous or subsequent videos on the profile to contextualize the content |
| 6. It addresses common learning errors related to the topic being taught |
| 7. The video includes calls to action to encourage user participation (surveys, questions, or challenges) |
| 8. The video includes a clear conclusion that summarizes or reinforces the content covered |
| **Didactic aspects** |
| 1. The video organizes and presents knowledge in a way that facilitates progressive learning |
| 2. The video uses examples, situations, and references that align with the everyday experiences and cultural context of the target audience |
| 3. It stimulates the development of skills (thinking, reasoning, arguing, communicating, proposing, representing, and using formal/technical language) |
| 4. It complements the material with additional resources available for users to review |
| 5. It includes exercises and activities related to the topic for users to complete independently |
| 6. The proposed exercises and activities are related to the content of the presented video |
| 7. The video uses gamification elements (rewards, challenges, levels) |
| 8. The video presents problems or situations that the viewer must solve |
| 9. The video includes specific moments for discussions that require user interaction |
| 10. The video includes practical demonstrations and applications of knowledge in real or simulated situations |
| 11. The legibility of the text, graphics, and diagrams is adjusted to the screen time |
| **Accessibility** |
| 1. The videos offer subtitles for users |
| 2. The video provides links to other channels/resources |
| 3. The audiovisual approach allows accessibility for users with partial visual impairment (color contrast, legible text, image and graphic descriptions, and a measured voiceover) |
| 4. The didactic approach allows accessibility for users with cognitive disabilities (use of short sentences, repetition of key concepts, use of visual aids, subtitles, and on-screen text) |
| 5. Advertising within or before the video does not negatively impact its usability |

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**Informed consent**
Not applicable. The study does not include private individual information (images or video captures).

**Authors' contributions**
G.S.V. conceived and designed the study and performed the analysis/wrote the article. D.R.R. and A.D.H. reviewed, corrected, and wrote the article. C.L.J. processed the statistical data.

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**Data availability**
The data obtained for this study are processed by the authors themselves in SPSS Statistics.

## Declarations

**Ethics approval and consent to participate**
Ethics approval was not required for this study as it did not involve direct work with humans or animals. All information was obtained through public publications.

**Consent for publication**
All authors have approved the final version of the manuscript and consent to its publication.

**Competing interests**
The authors indicate no conflict of interest to report.

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