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High school students' perceptions of podcast as a digital instructional resource in chemistry education

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ABSTRACT

Digital technologies (DT) have been progressively integrated into schools through the use of computers, the internet, and mobile devices. By adopting DT, chemistry teachers can explore innovative teaching methods that offer more dynamic and engaging learning experiences. This study aims to examine the potential of podcasts as a digital didactic resource (DDR) to support chemistry instruction for 12th-grade students. This qualitative, participatory study was conducted in four stages: (1) a diagnostic assessment of students' chemistry knowledge; (2) creation of a teacher-produced podcast; (3) design and implementation of an instructional intervention using the podcast; and (4) evaluation of the podcast based on students' perceptions. Data were collected through questionnaires and semi-structured interviews. The results indicate that podcasts can make chemistry teaching more dynamic and engaging and represent a valuable tool to help students prepare for Brazil's National High School Exam (ENEM). At the conclusion of the study, a podcast on the "Periodic Table" was made available for other students and teachers to use in their classes.

KEYWORDS: Digital Technologies; Chemistry Teaching; Podcast; Digital Didactic Resource.

Percepção de estudantes do ensino médio sobre o uso do *podcast* como recurso didático digital no ensino de química

RESUMO

As Tecnologias Digitais (TD) foram gradualmente incorporadas nas escolas por meio do uso de computadores, da internet e dos dispositivos móveis. Ao adotar as TD, os professores de Química têm a oportunidade de explorar métodos inovadores de ensino, proporcionando experiências de aprendizagem mais dinâmicas e envolventes. Nesse contexto, esta pesquisa teve como objetivo geral investigar o potencial do uso de podcast como Recurso Didático Digital (RDD) auxiliar no Ensino de Química para turmas do 3º ano do Ensino Médio (EM). A presente pesquisa tem natureza qualitativa do tipo participante, foi realizada em quatro etapas, (1) Avaliação diagnóstica com estudantes sobre conteúdos de Química; (2) Elaboração de um podcast pelo professor; (3) Elaboração de uma intervenção didática e apresentação do podcast para os estudantes; (4) Avaliação do podcast elaborado pelo professor a partir das percepções dos estudantes. Como instrumentos de coleta de dados foram utilizados questionários e entrevista semiestruturada. Os resultados mostram que o podcast pode contribuir para o Ensino de Química tornando-o mais dinâmico e atrativo, e que pode ser um recurso didático interessante para a preparação dos estudantes para o ENEM. Ao final do nosso trabalho foi disponibilizado um podcast abordando o tema "Tabela Periódica" para que outros estudantes e professores possam utilizar em suas aulas.

PALAVRAS-CHAVE: Tecnologias Digitais; Ensino de Química; Podcast; Recurso Didático Digital.

INTRODUCTION

Currently, rapid advances in digital technologies (DT) have driven changes in human behavior, transforming how information is accessed, shared, and processed. Their ease of use enables richer, real-time interaction, communication, and social connection. This transformation spans multiple sectors of society, including education.

The integration of digital technologies (DT) into education was first exemplified by the adoption of computers and the internet, which became foundational to the dissemination of scientific knowledge, much as earlier technologies, such as radio, once played a pivotal role in spreading and democratizing information. These tools enable the storage and sharing of content and research and provide capabilities to analyze, evaluate, and transform information into knowledge (Leite, 2015). In addition, mobile devices – smartphones, laptops, and tablets – have become indispensable in today's educational context, reshaping how we communicate and learn while giving both teachers and students access to information and services on a global scale (Dantas, 2022).

The use of digital technologies can positively impact instruction. However, it is essential to understand how their integration contributes to learning and how teachers are using these tools in the classroom. At the same time, technologies and their applications alone will not produce meaningful change unless they are aligned with pedagogical approaches that emphasize knowledge construction and address students' social realities (Leite, 2022).

In the specific context of chemistry instruction, several challenges, many shared with other subjects, warrant critical reflection: the teaching strategies employed; the implementation of the new high-school curriculum; curricular rigidity; the prevalence of teacher-centered, one-way lessons; and the limited appeal of instructional materials. Discussing and addressing these issues is essential for fostering changes in teachers' attitudes and classroom practices.

In this regard, with the aim of advancing chemistry education, the incorporation of digital technologies offers a viable pathway not only to enhance instructional quality but also to improve pedagogical practices, aligning them with ongoing global technological change. DT are transforming long-standing educational practices (Leite, 2022). They can also strengthen teacher–student interactions, peer-to-peer learning, and collaboration among teachers, thereby fostering meaningful learning environments. A wide range of DT can be leveraged to support teaching and learning (Leite, 2022).

Digital Didactic Resources (DDR) are technology-based materials that can support teachers' classroom practice. Among the many DDR used in chemistry instruction like videos, games, simulators, websites, blogs, apps, and software, podcasting stands out. Podcasts can serve as a valuable instructional tool, offering multiple benefits: introducing concepts, reviewing content, summarizing topics, providing guidance and feedback on assignments, and enabling learning anytime, anywhere. Podcasts also have considerable educational potential when used effectively (Dantas, 2022). Nonetheless, despite the significant contributions of digital technologies to chemistry teaching, they cannot replace the teacher's

role nor should they be the sole means of instruction. In the classroom, the teacher should act as a facilitator, carefully determining when and how to integrate DT into the learning process.

Accordingly, this study investigates the role of podcasts as a digital didactic resource in supporting high school chemistry instruction, with a focus on 12th-grade students' perceptions.

PODCASTING

Podcasting emerged in 2003 through the work of U.S.-based programmer and entrepreneur Dave Winer and video jockey (VJ) and businessman Adam Curry (Leite, 2015). Winer noted a growing trend: publishing audio on blogs. Curry, in turn, posted a tutorial on his blog explaining how to record MP3 audio and distribute it via Really Simple Syndication (RSS) to portable devices such as iPods. The term "podcasting" was coined by British radio host and journalist Ben Hammersley in a piece for The Guardian discussing the rise of online radio (Dantas, 2022).

In the literature, definitions of "podcast" vary widely, though several common elements recur. Podcasting is often framed as a Web 2.0 tool that facilitates online publishing and user interaction. Some sources describe the term as a backronym combining public on demand (POD) and broadcasting (CASTING) (Leite, 2015). However, other authors argue that podcast originated as a portmanteau of iPod and broadcasting (Carvalho, 2009; Tigre, 2021).

A distinction is commonly drawn between "podcast" and "podcasting." According to Leite (2015), podcasting refers to the practice of publishing digital media files online, whereas a podcast is the serialized collection of those releases. Cochrane (2005) succinctly characterizes podcasting as "public broadcast on demand," that is, a method for distributing audio (or audiovisual) content online that users can download directly or receive automatically by subscribing through aggregators (RSS podcatchers). Given its ease of distribution, podcasting is also an important tool for science communication (Dantas, 2022).

The key difference between podcasting and other audiovisual media lies in its publication and distribution model. Podcasts distribute content from a variety of sources and enable on-demand access at the user's convenience (Leite, 2022).

There are numerous podcast aggregators and apps, both free and paid, with free tiers typically offering fewer features. Major platforms include Spotify, Apple Podcasts, YouTube Music, Amazon Music, Deezer, Castbox, SoundCloud, and RadioPublic (Leite, 2022).

Podcasts can be classified using a taxonomy that guides teachers and students in designing them to meet specific goals and needs (Table 1). This taxonomy comprises six core dimensions: format, type, authorship, duration, style, and purpose (Carvalho, 2009; Leite, 2022).

Table 1

Taxonomy of podcasts

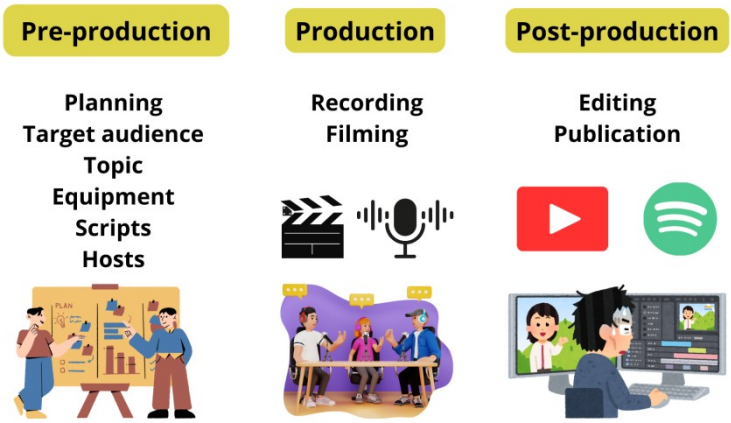
Format	Type	Authorship	Duration	Style	Purpose
Audiocast	Expository/ Informative	Teacher	Short < 5 minutes	Formal	Inform
Videocast	*Feedback*/ Commentary	Student	Moderate 6–15 minutes	Informal	Motivate
Enhanced Podcast	Instructions/ Guidance	Journalist	Long > 15 minutes		Raise awareness
Screencast	Authentic Materials	Scientist			Reflect
Animecast	Educational	Writer			Encourage
	Edited	Politician			Question
	Metaphor	Other			
	Documentary/ Record				

Source: Adapted from Carvalho (2009) and Leite (2022)

According to Leite (2022), within this taxonomy, students tend to prefer short-form podcasts. Podcast length should be calibrated to the complexity of the topic, as duration shapes the overall listening experience. Likewise, the podcast's style should align with the production's objectives. The creation process typically comprises three stages: pre-production, production, and post-production (Figure 1).

Figure 1

Stages of Podcast Production



Source: Adapted from Leite (2022)

The first stage of podcast creation is pre-production, when all subsequent steps are planned – choosing the topic, selecting equipment, and determining the recording (and, if applicable, filming) location. During this phase, you also define the podcast's objectives, length, and format. Pre-production involves curating the content and devising strategies to translate scientific material into an engaging audio or audiovisual experience. A script is drafted at this stage to guide the production and post-production phases.

The second stage is production, the phase in which the podcast is recorded (and, if applicable, filmed). Selecting the tools for this phase is essential. At a minimum, a smartphone is sufficient to record, edit, and publish. Depending on the desired format and quality, creators may also use microphones, laptops or desktop computers, tablets, webcams, or digital cameras. Several platforms such as Spotify for Podcasters (available as a mobile app for Android and iOS) offer integrated tools for recording, editing, and publishing, and can facilitate distribution to major platforms (e.g., Spotify, YouTube Music). Another widely used option is Audacity, a free, open-source audio editor for podcast post-production. As noted by Locatelli et al. (2018), Audacity may be used for personal, commercial, institutional, or educational purposes and, because it is open source, can be installed on as many computers as needed.

Finally, the post-production stage involves editing and publishing the episodes. Since podcasting's surge in popularity after 2018, numerous free options have emerged for distributing content across podcast aggregators. Major platforms for example, Spotify and YouTube Music offer free podcast-publishing services.

In chemistry education, numerous studies have documented the pedagogical potential of podcasts. Lines of inquiry include the use of software tools for podcast production, the development of podcasts for science communication, and the creation of instructional podcasts to enhance chemistry teaching and promote scientific literacy (Locatelli et al., 2018; Dantas, 2022; Leite, 2023; Aguiar & Antunes, 2023).

Podcasts have significant pedagogical potential for chemistry instruction. Beyond serving as an innovative strategy, they help teachers connect formal content with oral communication, giving students authentic opportunities to practice and apply speaking and listening skills. When thoughtfully integrated, podcasts can make meaningful contributions to teaching and learning. They also broaden learning opportunities by enabling engagement anytime, anywhere.

METHODOLY APPROACH

This study is qualitative, aimed at understanding the social and cultural contexts in which participants are situated (Gil, 2017). It employs a participatory research design, in which the researcher here, the classroom teacher, actively engages in the inquiry (Gil, 2017).

The study was conducted in four stages. In Stage 1, we administered a diagnostic questionnaire on chemistry topics (Table 2) to identify the concepts students found most difficult to understand.

Table 2

Diagnostic Assessment

Diagnostic assessment questions			
1) Which class section are you in? ( ) 3rd year A (3ºA) ( ) 3rd year B (3ºB) ( ) 3rd year C (3ºC).			
2) Do you find it difficult to learn Chemistry? ( ) Yes ( ) No			
3) Which chemistry topics do you find most difficult to learn? (Select up to two.)			
( ) Separation of Mixtures	( ) Atomic Structure	( ) Chemical Bonding	( ) Periodic Table
( )Intermolecular Forces	( ) Inorganic Compounds	( ) Chemical Reactions	( ) Stoichiometry
( ) Gas laws	( ) Solution Concentration	( ) Colligative Properties	( ) Thermochemistry
( ) Chemical Kinetics	( ) Chemical Equilibrium	( ) Electrochemistry	( ) Radioactivity
( ) Introduction to organic chemistry (carbon chemistry)	( ) Functional groups (organic)	( ) Isomerism	( ) Organic Reactions
( ) Polymers	( ) Environmental Chemistry	( ) Properties of Organic Compounds	

Source: Research data (2024).

In Stage 2, based on the analysis of students' responses, the teacher–researcher created a podcast on the topic students had identified as most difficult. In Stage 3, we designed and implemented an instructional intervention featuring that podcast. During this phase, the teacher–researcher presented and discussed the selected topic and then provided the podcast for students to listen to.

Finally, in Stage 4, we evaluated the podcast from students' perspectives. The objective was to analyze students' perceptions of the podcast as a digital didactic resource for chemistry instruction. The evaluation comprised two components: (1) a questionnaire (Table 3) administered via Google Forms and

distributed through shareable links, WhatsApp groups, QR codes, and Google Classroom; and (2) semi-structured interviews with students who volunteered to participate.

Table 3

Post-intervention evaluation questionnaire

Post-intervention evaluation questionnaire					
1) What is your age?					
2) Do you have internet access?					
( ) Yes, home broadband/Wi-Fi			( ) Yes, mobile data		
( ) Yes, both home broadband/Wi-Fi and mobile data			( ) No		
3) Which digital didactic resources do you use most often to study? (Select all that apply.)					
( ) Video lessons/lectures ( ) Podcasts ( ) Ebooks ( ) Images/infographics ( )Apps ( ) Slides/ presentations					
4) Before this study, were you familiar with podcasts? ( ) Yes ( ) No					
5) Do you usually use podecasts to study? ( ) Yes ( ) No					
6) Did you listen to the teacher-produced podcast? ( ) Yes. All episodes. ( )Yes. Some episodes. ( )No.					
7) How would you rate the teacher-produced podcast overall? ( ) Very good ( ) Good ( ) Fair ( ) Poor ( ) Very poor					
8) Which episode of the podcast caught your attention the most? Why?					
9) Did the teacher-produced podcast, as a supplemental educational resource, help you understand the content? Please explain.					
10) Please rate the following aspects of the podcast:					
Content coverage / relevance	( ) Very good	( ) Good	( ) Fair	( ) Poor	( ) Very poor
Sound clarity	( ) Very good	( ) Good	( ) Fair	( ) Poor	( ) Very poor
Episode length	( ) Very good	( ) Good	( ) Fair	( ) Poor	( ) Very poor
Speaking pace	( ) Very good	( ) Good	( ) Fair	( ) Poor	( ) Very poor
Clarity of explanations	( ) Very good	( ) Good	( ) Fair	( ) Poor	( ) Very poor
11) In your opinion, what are the main strengths and areas for improvement of the teacher-produced podcast?					
12) Do you agree to participate in the interview? ( ) Yes ( ) No					

Source: Research data (2024).

For the semi-structured interview, we developed a preliminary interview guide consisting of core questions (Table 4).

Table 4

Interview Questions

Interview Questions
1) What do you find most interesting about your chemistry classes?
2) Which digital didactic resources do you use most often to study?
3) Do you think digital didactic resources help you learn chemistry content? Do you prefer digital or traditional resources?
4) Do you usually listen to or watch podcasts? What types?
5)How was your experience using the teacher-produced podcast? Do you think it helped you study? In what ways?
6) Which platform did you use to access the podcast (e.g., Spotify, Spotify for Creators, YouTube Music, or YouTube)? How would you evaluate your access to that platform?
7) What could be improved about the podcast?
8) Would you recommend the podcast to students preparing for Brazil's National High School Exam (ENEM)?

Source: Research data (2024).

The study was conducted at a school in the Recife Metropolitan Region with 12th-grade students. The institution had 100 students officially enrolled across three classes and operated on an extended-day schedule. Of these, 70 completed the Stage 1 diagnostic assessment, 80 completed the online questionnaire evaluating the teacher-researcher's podcast, and 12 participated in the Stage 4 semi-structured interviews.

All students were invited to participate. The study protocol was approved by the UFRPE Research Ethics Committee (Approval No. 6,678,874).

RESULTS AND DISCUSSION

This section presents results from each stage of the study. We begin with the diagnostic assessment (Stage 1) and the development of the teacher-produced podcast (Stage 2). We then report on the instructional intervention (Stage 3) and, finally, discuss students' evaluations and perceptions of the podcast (Stage 4).

DIAGNOSTIC ASSESSMENT

To identify the topics students found most difficult to understand, we conducted a diagnostic assessment (Table 2). Of the 100 students invited, 70 completed the questionnaire.

In response to the first item, 32 students were from class 3A, 27 from 3B, and 11 from 3C. The school typically groups students by age, so those in 3A tend to be younger than those in 3B and 3C. Students in 3A also showed stronger academic performance than the other two classes, submitting assignments more consistently on time.

For the second item ("Do you find it difficult to learn chemistry?"), 42 of 70 students (60.0%) reported difficulty, 19 (27.1%) reported no difficulty, and 9 (12.9%) were unsure. These results suggest that a majority perceive chemistry as challenging. Potential contributing factors include difficulty grasping abstract

concepts, the quantitative demands of problem solving, how content is presented, limited interest, and weak connections between classroom topics and everyday contexts (Matias et al., 2025).

Conversely, 19 students (27.1%) reported that they do not find chemistry difficult, suggesting that a minority perceive the subject as manageable. This aligns with Leite and Lima (2015), who observed that students are more inclined to enjoy chemistry when they recognize its relevance to their lives and when teachers present content effectively. The 9 students (12.9%) who were unsure about their level of difficulty may reflect ambivalence or fluctuating self-efficacy; for these learners, teachers can provide targeted encouragement—e.g., formative assessments, scaffolded practice, and real-world applications to boost engagement and support effective learning.

The final item ("Which chemistry topics do you find most difficult to learn?") yielded 174 selections. Respondents could choose up to two topics, but some selected more than two, which accounts for the total. Analysis indicated that the Periodic Table was the topic students found most challenging. A plausible explanation is the difficulty of understanding its organizational logic and how this structure relates to elemental properties. This finding echoes Ferreira et al. (2012), who observed that the Periodic Table being extensive and often perceived as uninteresting, can make chemistry less engaging for learners. Moreover, content such as the Periodic Table employs specialized notation and symbolism, which often leads students toward rote memorization rather than meaningful understanding (Carbuloni et al., 2017).

DEVELOPMENT OF THE TEACHER–RESEARCHER'S PODCAST

Following analysis of the diagnostic questionnaire, the podcast's theme was defined. The teacher–researcher selected an audio-only format (audiocast) because it is comparatively simple to produce, record, and edit, and it requires minimal storage on smartphones (Leite, 2015). The podcast's type and purpose were set as educational, expository, and informative. The series was designed as long-form (episodes >15 minutes) and divided into six episodes, each addressing a distinct concept related to the periodic table (Table 5).

Table 5

Podcast Episodes

Episode	Title	Brief description	Duration
1	A Brief History	Contributions of key scientists to the development of the periodic table.	03min58s
2	Organization of the Periodic Table	How the table is organized, with emphasis on groups (families) and periods.	06min40s
3	Periodic Trends	Atomic radius, electronegativity, ionization energy, and electron affinity.	05min33s
4	Elemental Abundance in Earth's Crust	Distribution of common elements, highlighting the most abundant.	02min25s
5	Interesting Facts About Elements	Notable applications, discoveries, and distinctive properties.	04min05s

6	ENEM Practice	Worked solutions to two periodic-table items from Brazil's National High School Exam (2017, 2018), with commentary.	05min19s

Source: Research data (2024).

The podcast provides an accessible treatment of the periodic table, serving as a learning tool for students seeking to consolidate and review key concepts. Each episode addresses a specific theme from the history and organization of the periodic table to periodic trends and the distribution of elements in Earth's crust. One episode presents interesting facts about selected elements, and another offers worked solutions to ENEM items. After production, the podcast was incorporated into an instructional intervention to deepen students' understanding of the topic. All episodes were made available on Spotify for easy access.

STUDENTS' OVERALL PERCEPTIONS OF PODCAST USE

Eighty 12th-grade (third-year) students completed the questionnaire. For Item 1 ("Which class are you in?"), Class 3A showed the highest participation (42.5%), consistent with its leading participation in Stages 1 and 2. For Item 2 ("What is your age?"), the predominant age group was 17–18 years (63 of 80; 79%).

For the item "Do you have internet access?", 79 of 80 students (98.8%) answered yes. The most common mode was access via both home broadband/Wi-Fi and mobile data (45 students; 56.3%), followed by home broadband/Wi-Fi only (24; 30.0%) and mobile data only (10; 12.5%). Only one student (1.3%) reported having no internet access. These results underscore the central role of connectivity in shaping students' learning both inside and outside the classroom (Matos et al., 2024).

For Item 3 ("Which digital didactic resources do you use most often to study?"), respondents could select multiple options, yielding 146 selections from 80 students. Video lessons were the most frequently cited (61/146; 41.8%), followed by apps (27/146; 18.5%), slides/presentations (16/146; 11.0%), images/infographics (16/146; 11.0%), podcasts (15/146; 10.3%), eBooks (9/146; 6.2%), web search (Google) (1/146; 0.7%), and "other" (1/146; 0.7%). (Percentages sum to >100% because multiple responses were allowed.) These results indicate a clear preference for resources that combine visual and auditory explanations, consistent with prior findings highlighting the effectiveness and everyday uptake of video lessons (Lopes et al., 2021; Karat & Giraldi, 2019).

For Item 4 ("Were you familiar with podcasts?"), 70 of 80 students (87.5%) reported prior familiarity, while 10 (12.5%) did not. This high level of familiarity suggests that many had already encountered podcasts in class or via media platforms (e.g., YouTube and other streaming services). Dantas (2022) notes that podcast popularity rose after the pandemic, although Zacariotti et al. (2021) indicate that podcasts were already well received beforehand.

For Item 5 ("Do you usually use podcasts to study?"), 59 of 80 students (73.8%) reported that they do not typically use podcasts, 20 (25.0%) said they do,

and 1 (1.3%) reported occasional use. The relatively low uptake likely reflects students' preference for video-based formats, video lessons were the most frequently cited resource in Item 3 (61/146 selections; 41.8%). To increase engagement, instructors might pilot video podcasts (videocasts/vodcasts), which blend audio with visuals and align more closely with students' stated preferences.

For Item 6 ("Did you listen to the teacher-produced podcast?"), 49 of 80 students (61.3%) listened to some episodes, 23 (28.8%) listened to all episodes, and 8 (10.0%) did not listen to any. Because 72 of 80 students (90.0%) listened to at least part of the series, overall engagement with the activity was high. For Item 7 ("What did you think of the teacher-produced podcast?"), among the 72 respondents who had listened, 37 (51.4%) rated it very good, 34 (47.2%) good, and 1 (1.4%) fair. These results reflect strong student approval, consistent with prior studies reporting positive perceptions of podcast use in educational contexts (Dantas, 2022; Silva et al., 2023; Leite, 2023; Aguiar & Antunes, 2023).

For Item 8 ("Which episode of the podcast caught your attention the most? Please explain."), 72 students responded. Twenty-six responses were non-classifiable (e.g., "don't remember," "because it's good," "gases," "nothing"), leaving 46 valid answers for analysis. Among these, Episode 1 (A Brief History) was most frequently cited (15/46; 32.6%), suggesting that the introductory framing resonated with students. Episode 6 (ENEM Practice) ranked second (12/46; 26.1%), reinforcing that exam-oriented content is highly engaging. This pattern aligns with prior findings highlighting podcasts' effectiveness as resources for ENEM preparation (Dias, 2022; Dantas, 2022).

Episodes 2 (Organization of the Periodic Table) and 4 (Elemental Abundance in Earth's Crust) received 8 (17.4%) and 7 (15.2%) mentions, respectively—moderate engagement, though lower than Episodes 1 and 6. By contrast, Episode 5 (Interesting Facts About Elements) drew 3 mentions (6.5%), and Episode 3 (Periodic Trends) only 1 (2.2%), the lowest engagement. The latter's emphasis on conceptually demanding content e.g., atomic radius, electronegativity, ionization energy, and electron affinity likely contributed to its limited appeal (Carbuloni et al., 2017). The modest uptake of Episode 5 suggests that curiosities, while appealing, may not sustain attention without a stronger link to students' immediate learning goals.

Continuing with Item 8, students explained the reasons for their choices. For example, EA05 wrote, "Organization of the periodic table. I have difficulty organizing it" (Episode 2). EA06 stated, "The first one, because it tells the story of the table" (Episode 1). EA11 commented, "The episode with ENEM questions, it's good because it helps me understand the topic better" (Episode 6), and EA26 simply replied, "The ENEM." Taken together, these responses indicate that EA05 viewed the "Organization" episode as an opportunity to address a specific difficulty; EA06 was engaged by the historical framing; and EA11 and EA26 emphasized exam preparation as a practical benefit. Overall, the pattern underscores strong interest in the periodic table, a topic whose breadth and complexity often limit classroom contextualization (Ferreira et al., 2012).

For Item 9 ("Did the teacher-produced podcast, as a supplemental educational resource, help you understand the content? Please explain."), 72 students responded; 69 (95.8%) answered "yes." This overwhelming majority

indicates that students perceived the podcast as an effective support for learning, consistent with prior reports of positive evaluations of podcast-based activities (Silva et al., 2023) and arguments that podcasting can promote effective teaching practices (Leite, 2023). Several students elaborated. For example, EA03 wrote, "Yes, it helped me review some of the things I had forgotten," highlighting the podcast's value for review and reinforcement. This perception aligns with Leite (2023, p. 107), who notes that "the podcast can be used to deepen knowledge on a given topic." Such responses are typical of learners who already possess a basic grasp of the material and seek alternative formats to consolidate classroom concepts.

EA27 remarked, "I think the podcast is more for reviewing content, so it can help, but using only a podcast for studying wouldn't be efficient." This response acknowledges the value of podcasts while underscoring their limits: they work best as supplemental resources rather than standalone tools for initial learning, which often requires reading and direct instruction. EA45 highlighted podcasts' portability and flexibility: "Because it's audio, you can listen on the bus, while washing the dishes, etc." This advantage – making productive use of otherwise idle time – echoes Leite's observation that "students can access podcasting anywhere" (2023, p. 107). In short, podcasts can help optimize time and turn non-study moments into learning opportunities.

For Item 10, we evaluated specific aspects of the podcast content coverage, sound clarity, episode length, speaking pace, and overall audio comprehension. Only students who had listened to at least one episode responded. For content coverage, 44 of 72 students (61.1%) rated it very good, 24 (33.3%) good, and 4 (5.6%) fair; there were no negative ratings. For sound clarity, 33 (45.8%) rated it very good, 30 (41.7%) good, 8 (11.1%) fair, and 1 (1.4%) poor. In podcasting, intelligibility and audio quality are critical for effective communication and for sustaining listener engagement.

For episode length, 22 of 72 students (30.6%) rated it very good, 33 (45.8%) good, 14 (19.4%) fair, and 3 (4.2%) poor. This item drew the largest share of negative ratings (poor: 4.2%) and a comparatively higher share of fair responses, suggesting a preference for shorter episodes. For speaking pace, 27 (37.5%) rated it very good and 40 (55.6%) good; 5 (6.9%) rated it fair, and there were no negative ratings. These results indicate that most students found the pacing appropriate and easy to follow.

For Item 11 ("What are the positive and negative aspects of the teacher-produced podcast?"), 72 students responded. Representative positive remarks included: "It helped me study" (EA39); "If you don't understand, you can replay it as many times as you want until you understand the topic" (EA62); and "Good audio, good narration, good structure" (EA66).

EA39 viewed the podcast as a useful study tool that supports independent learning. EA62 emphasized the advantage of replay, "If you don't understand, you can repeat it as many times as you want until you get it", highlighting self-paced review as a key benefit. This observation aligns with Leite (2022), who notes that podcasts allow students to revisit material repeatedly and learn at their own pace (including watching, in the case of video podcasts). EA66 pointed to production quality, "Good audio, good narration, good structure" (EA66),

factors that likely enhanced intelligibility and engagement, reinforcing how well-produced audio can facilitate comprehension.

Regarding negative aspects, EA39 cited episode length: “it could have been shorter.” This aligns with prior work indicating that students tend to prefer shorter episodes and that lengths beyond about five minutes can reduce attention and hinder comprehension (Dantas, 2022; Leite, 2015; Carvalho, 2009). EA66 suggested including more practice items: “I would include more questions about the topic”; which is consistent with Dias (2022), who emphasizes the value of podcasts for ENEM preparation when they integrate exercises to reinforce learning. Finally, EA78 noted issues with audio quality, though without specifying whether the problem involved volume, background noise, or clarity. Collectively, these comments point to opportunities to optimize episode length, embed practice, and improve audio fidelity.

Overall, data from this stage indicate positive student perceptions of podcasts and digital technologies. Most students access the internet via smartphones, and video lessons remain the most commonly used digital didactic resource. The findings also suggest that podcasts work well as a complementary tool for reviewing and consolidating content and for ENEM preparation, thereby supporting effective pedagogy. At the same time, student feedback points to refinements particularly in episode length, format, and language that could further enhance effectiveness and engagement.

ANALYSIS OF STUDENTS’ PERCEPTIONS OF PODCAST USE

This section reports findings from the semi-structured interviews, which complement the questionnaire results. The goal was to analyze students’ perceptions of podcast use in chemistry education. Eligible participants were those who answered “Yes” to Item 12 of the post-intervention questionnaire (Table 3). Twenty-seven students volunteered (33.8% of the 80 respondents). From these, 12 were randomly selected for analysis (44.4% of volunteers; 15.0% overall). Interviewees are identified by alphanumeric codes (EE01–EE27); only the 12 selected are reported here. The interview guide comprised eight core questions (Table 4).

For Interview Question 1 (“What do you find most engaging about your chemistry classes?”), 10 of 12 students (83.3%) cited laboratory/practical work as the most engaging component. Representative comments included: “Everything in class is interesting, especially the practical part, where we can see everything happening for real” (EE01) and “I like the lab because I enjoy doing experiments” (EE02). Two students (16.7%) highlighted the periodic table, e.g., “The periodic table lessons” (EE20). Taken together, these responses underscore the central role of experimentation in fostering interest and hands-on engagement. As Leite (2019, p. 702) notes, the periodic table “is more than just a guide or catalog of all the known atoms in the universe; it can be used as a valuable didactic resource in chemistry teaching.”

For Interview Question 2 (“Which digital didactic resources do you use most often to study?”), 11 of 12 students (91.7%) cited video lessons as their primary resource. Representative comments included: “I usually use YouTube video

lessons to complement something the teacher explained in class that I didn't understand" (EE03); "I use apps and video lessons" (EE05); and "Video lessons, because it's easier to learn; you can review the topic several times" (EE20).

YouTube has become a significant platform for learning (Alves & Leite, 2023). It enables students to review, supplement, or deepen content they did not fully grasp in class. The platform hosts a large catalog of free instructional videos – including chemistry – that students can access and rewatch on demand as often as needed (Alves & Leite, 2023). Such video lessons support review and consolidation of concepts, improving comprehension and contributing to learning (Arroio & Giordan, 2006).

For Interview Question 3 ("Do you think digital didactic resources contribute to learning chemistry content?"), all 12 students answered yes. In the follow-up on modality preferences, six students (50.0%) preferred digital resources, for example: "I prefer digital ones such as videos, images, and apps, because by visualizing the topic I can understand what we're studying" (EE03); "I prefer digital, like eBooks" (EE11); "Studying on the internet is better" (EE17). Four (33.3%) preferred traditional materials – "I learn better with a notebook and textbook" (EE10) – and two (16.7%) favored a blended approach – "I complement what we cover in class with materials from the internet, so I use both" (EE13); "I like video lessons, but I also like studying with my notebook" (EE20). Taken together, these responses affirm students' belief that digital didactic resources can support chemistry learning, while also underscoring the value of aligning resource choice with learner preference and, for many, combining formats to optimize learning (Leite, 2022).

For Interview Question 4 ("Do you usually listen to or watch podcasts? What types?"), 8 of 12 students (66.7%) said they do, citing examples such as "Podcasts on YouTube, like the channel Nostalgia" (EE01), "I follow Podpah" (EE02), and "I follow podcasts on random topics" (EE13). The remaining 4 students (33.3%) reported that they do not follow podcasts. These responses indicate substantial familiarity with podcasts, consistent with reports of their post-pandemic rise in popularity (Dantas, 2022). The shows mentioned by students (Podpah, Poddelas, Nostalgia) are also noted in Silva et al. (2023). Podpah launched in 2020 and, in 2022, became Spotify's most-listened podcast in Brazil, ranking 24th worldwide (Costa, 2024).

For Interview Question 5 ("What did you think about using the podcast to study? Did it help?"), 10 of 12 students (83.3%) reported a positive experience. Representative comments included: "I liked the episode about the history of the periodic table—it was new to me" (EE01); "I liked the first one; it helped me review the content" (EE10); and "Yes, I really liked it. I only listened to the first episode" (EE13). One student noted a limitation: "I liked it up to a point; it got tedious later. The language was very technical. It needs a more accessible tone so everyone can understand" (EE04). Overall, these responses align with Locatelli et al. (2018), Leite (2023), and Aguiar & Antunes (2023), who report that podcasts, as a DDR, can support teaching and learning, whereas EE04's feedback echoes Dantas (2022) on the value of a more informal, accessible register.

For Interview Question 6 ("Which platform did you use to access the podcast? How would you rate your access?"), all students reported that access

was easy or straightforward. Spotify was the primary platform (6 of 12; 50.0%), followed by YouTube Music (4 of 12; 33.3%) and YouTube (2 of 12; 16.7%). This distribution reflects Spotify's prominence as a podcast platform in Brazil and the broad availability of podcasts across major services.

For Interview Question 7 ("What could be improved about the podcast?"), 8 of 12 students (66.7%) felt no changes were needed, noting, for example, "It's great" (EE02); "None of the ones I listened to were bad—overall, it's good in terms of audio, quality, and explanation" (EE03); and "I think nothing" (EE13). Three students (25.0%) recommended shorter episodes or fewer installments (e.g., "It could be shorter" [EE01]; "Make it shorter" [EE25]). One student (8.3%) suggested a less formal, more inclusive tone: "Use less formal language, be more to the point, more engaging, more inclusive, because some people won't fully understand the topic" (EE04). Overall, most students were satisfied with the podcast, while a smaller group pointed to episode length and register (level of formality) as areas for refinement. This feedback supports keeping episodes long enough to convey key ideas without tedium and, where appropriate, favoring concise formats that spark curiosity and encourage deeper exploration.

For Interview Question 8 ("Would you recommend the podcast to students preparing for the ENEM?"), 10 of 12 students (83.3%) responded yes, while 2 (16.7%) noted it should be used alongside other materials (e.g., workbooks, textbooks). These responses reaffirm the questionnaire findings that students view the podcast as a useful resource for review, preparation, and deeper study for the ENEM.

Findings from the semi-structured interviews corroborated and elaborated on the questionnaire results. Overall, students reported positive experiences with the podcast. Among digital didactic resources, video lessons were preferred and commonly used to supplement or review classroom instruction. Students also indicated that traditional materials should be used alongside digital tools. The results further suggest that shorter episodes are better suited to the topic and that careful attention to tone, register, and clarity improves accessibility. Finally, students emphasized the value of podcasts for review and ENEM preparation.

CONCLUDING REMARKS

This study examined the potential of podcasts as a digital didactic resource in high school chemistry. The primary aim was to investigate how podcasts, used as a supplementary tool, support instruction, as reflected in 12th-grade students' perceptions. To this end, we developed a teacher-produced podcast series on the periodic table and subsequently evaluated its educational contribution.

The study identified positive aspects of digital technology use, particularly students' reliance on smartphones and laptops to access the periodic-table podcast. Students noted that longer episodes can be less effective, especially for complex or extensive content. Even so, the podcast proved to be a valuable supplementary resource in chemistry instruction, notably for content review and ENEM preparation. Interview data corroborated and extended the questionnaire results, underscoring the role of digital didactic educational resources in review and exam readiness. Students also emphasized the value of a more informal,

accessible register to broaden comprehension and suggested that optimizing episode length could improve engagement.

With the completion of this study, we hope chemistry teachers in secondary education will feel encouraged to develop their own podcasts tailored to their pedagogical goals. We also expect that students will be engaged by this format and take a more active, self-directed role in learning, constructing their own understanding. Podcasts offer a practical opportunity to enrich teaching and learning by making content more accessible, engaging, and dynamic. By incorporating podcasts into their lessons, chemistry teachers can diversify instructional strategies, increase flexibility, and better accommodate diverse learning preferences.

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REFERENCES

Aguiar, C. K., & Antunes, E. P. (2023). Podcast como ferramenta para alfabetização científica e tecnológica no ensino da química no novo ensino médio. *ACTIO: Docência em Ciências*, 8(3), 1-20. https://periodicos.utfpr.edu.br/actio/article/view/16694/9935.

Alves, F. A. N., & Leite, B. S. (2023). Análise dos vídeos produzidos nos canais mais acessados da plataforma YouTube em 2021 para o ensino de Química. *Paradigma*, 44(2), 62-86. https://doi.org/10.37618/PARADIGMA.1011-2251.2023.p62-86.id1322

Alvarenga, C. F., Sales, A. P., Costa, A. D., Costa, M. D., Veroneze, R. B., & Santos, T. L. B. (2012). Desafios do ensino superior para estudantes de escola pública: um estudo na UFLA. *Revista Pensamento Contemporâneo em Administração*, 6(1), 55-71. http://dx.doi.org/10.12712/rpca.v6i1.110.

Associação Brasileira de Podcasters. (2023). PodPesquisa 2020-2021. *ABPOD*. https://abpod.org.

Araujo, R. V. G., Leão, M. B. C., Leite, B. S., & Silva, J. R. R. T. (2009). Elaboração, aplicação e avaliação de Podcasting de química no ensino médio. In: *XIV Taller Internacional de Software Educativo*, 2009, Santiago. https://www.tise.cl/volumen5/TISE2009/Documento13.pdf.

Arroio, A., & Giordan, M. (2006). O vídeo educativo: aspectos da organização do ensino. *Química Nova na Escola*, 24(2), 8-11. http://qnesc.sbq.org.br/online/qnesc24/eqm1.pdf

Carvalho, A. A. A. (2009). Podcasts no ensino: contributos para uma taxonomia. Ozarfaxinars, *Matosinhos,* 8, 1-15. https://repositorium.uminho.pt/handle/1822/9432.

Carbuloni, C. F., Oliveira, J. B., Santos, K. B., & Rivelini-Silva, A. C. (2017). Levantamento bibliográfico em revistas brasileiras de ensino: artigos sobre o conteúdo tabela periódica. *ACTIO: Docência em Ciências*, 2(1), 225-242. https://revistas.utfpr.edu.br/actio/article/view/6758.

Cochrane, T. (2005). *Podcast: Do it yourself guide*. Wiley.

Costa, L. C. V. (2024) A construção discursiva de Luiz Inácio Lula da Silva na entrevista ao canal de podcast Podpah. https://repositorio.ufu.br/handle/123456789/43505.

Dantas, L. F. S. (2022). *Ciência em pingos*: o podcast como recurso de divulgação científica. Programa de Pós-Graduação Stricto Sensu em Ensino de Ciências – IFRJ. Nilópolis – RJ.

Dias, M. L. (2022). *Podcasts de estudantes na preparação para a prova de redação do ENEM*. Mestrado em Educação, Universidade de Brasília, Brasília.

Ferreira, E. A., Godoi, T. R. A., Silva, L. G. M., Silva, T. P., & Albuquerque, A. V. (2012). Aplicação de jogos lúdicos para o ensino de química: auxilio nas aulas sobre tabela periódica. *In: Encontro Nacional de Educação, Ciência e Tecnologia UEPB*, v. 1, p. 1-10. https://www.editorarealize.com.br/editora/anais/enect/2012/Comunicacao_177.pdf.

Gil, A. C. (2017). *Como elaborar projetos de pesquisa*. Atlas.

Karat, M. T., & Giraldi, P. M. (2019). A origem da vida: uma análise sobre a natureza da ciência em um vídeo educativo do YouTube. *ACTIO: Docência em Ciências*, 4(3), 58-76. http://dx.doi.org/10.3895/actio.v4n3.9399.

Leite, B. S. (2015). *Tecnologias no Ensino de Química: teoria de prática na formação docente*. Appris.

Leite, B. S. (2022). *Tecnologias digitais na educação: da formação à aplicação*. Livraria da Física.

Leite, B. S. (2023). Podcasts para o ensino de Química. *Química Nova na Escola*, 45(2), 101-108. https://dx.doi.org/10.21577/0104-8899.20160325.

Leite, B. S. (2019). O Ano Internacional da Tabela Periódica e o Ensino de Química: das cartas ao digital. *Química Nova*, 42(6), 702-710. http://dx.doi.org/10.21577/0100-4042.20170359.

Leite, L. R., & Lima, J. O. G. (2015). O aprendizado da Química na concepção de professores e alunos do ensino médio: um estudo de caso. *Revista Brasileira de Estudos Pedagógicos*, 96(243), 380-398. https://doi.org/10.1590/S2176-6681/340312848.

Locatelli, A., Geller, R., Trentin, M. A. S., & Bernieri, J. (2018). O software Audacity como ferramenta no ensino de Química. *RENOTE,* 16(2), 434–443. https://seer.ufrgs.br/index.php/renote/article/view/89271.

Lopes, A. R., Silva, F. R., Araújo, A. F. F., & Bezerra, D. P. (2021). Videoaulas no processo de ensino-aprendizagem de química no ensino médio. *Interfaces Científicas - Educação*, 10(3), 238–249. https://doi.org/10.17564/2316-3828.2021v10n3p238-249.

Matias, A. F., Matias, A. F., Soares, C. P. G., Silva, V. F. M., Barbosa, R. R. S., Rodrigues, W. R., Maia, J. V., & Silva, A. R. (2025). As dificuldades apontadas por alunos do ensino médio na disciplina de química em uma escola pública de fortaleza. *LUMEN ET VIRTUS*, 16(49), 7324–7350. https://doi.org/10.56238/levv16n49-081.

Matos, L. S., Martins, J. L., & Amorim, W. B. (2024). Navegando pelo conhecimento - o impacto da internet em atividades escolares. *Revista Ciências & Ideias*, 15(1), e24152455. https://doi.org/10.22407/2176-1477/2024.v15.2455.

Silva, L. B., Pires, E. V., Silva, N. S., & Silva, D. S. (2023). A aplicação de podcasts e aplicativos como ferramenta pedagógica para o ensino de química. *Revista Científica e-Locução,* 1(24), 186-203. https://doi.org/10.57209/e-locucao.v1i24.562.

Tigre, R. (2021). *Podcast S/A: uma revolução em alto e bom som*. Nacional.

Zacariotti, M., Guimarães, V., & Maia, I. (2021). Podcast Fala Calango: experienciando o fazer jornalístico na pandemia do coronavírus. *Revista Brasileira de Ensino de Jornalismo*, 11(28), 102-116. https://doi.org/10.46952/rebej.v11i28.429.

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