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# An Explorative Diary Study of AI-Generated Podcasts in University Education: Benefits, Challenges, and Future Directions

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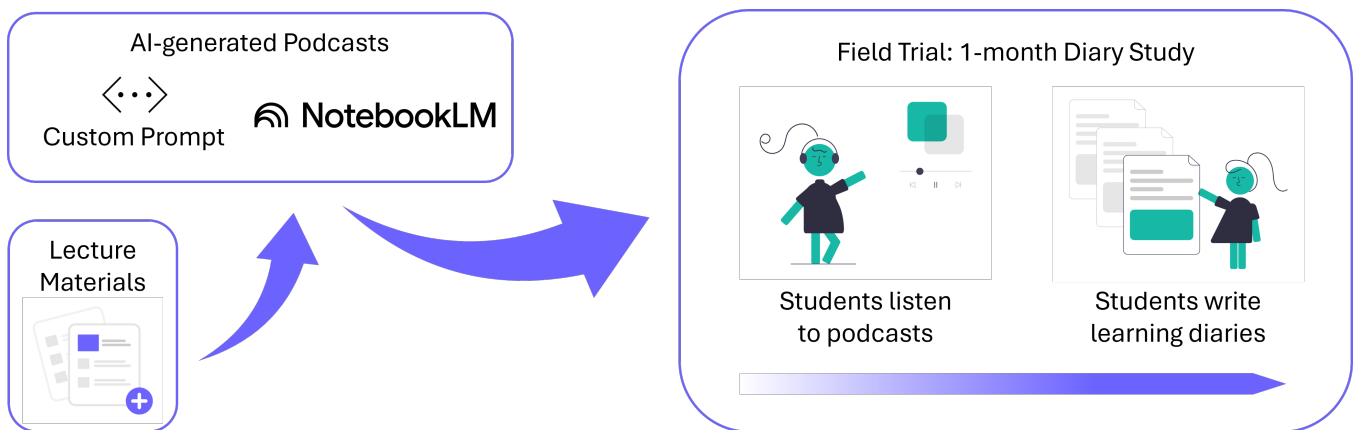


Figure 1: Overview of our study topic and procedure.

## Abstract

In this study, we explore the potential of AI-generated podcasts as an educational tool in the evolving landscape of learning media. Podcasts have grown increasingly relevant in education due to their accessibility and ability to integrate learning into everyday life. With the advent of generative artificial intelligence (AI), there is a unique opportunity for scalable and adaptable creation of learning media. However, with novel technology, there also come new challenges. Thus, we developed fine-tuned AI-generated podcasts using Google NotebookLM, our course materials, and a custom prompt. We conducted a one-month explorative evaluation in the field using a qualitative diary study. Our study reveals that students find the podcasts beneficial for flexible everyday learning but also point toward challenges like a lack of emotional engagement and

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technical non-English language issues. In sum, our study highlights the current benefits and challenges of AI-generated podcasts and presents an agenda for future research.

## CCS Concepts

• **Applied computing** → **Education**; *E-learning*; *Distance learning*; Computer-assisted instruction.

## Keywords

AI-Generated Podcasts, NotebookLM, Diary Study, Explorative Study, Field Study, Digital Education, University Education, Research Agenda

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## 1 Introduction and Background

The ongoing evolution of digital technologies has significantly transformed the educational landscape, enabling educators to include new technologies and methods that enhance learning experiences [6]. Among these advancements, podcasts have emerged as a powerful medium for delivering educational content, offering accessibility and flexibility that cater to a wide array of learning preferences while simultaneously presenting a scalable solution for educators [1, 2]. Traditionally used as supplementary resources, podcasts enable learners to engage with material anytime and anywhere, effectively complementing conventional teaching methods or, in extreme cases, potentially replacing traditional learning if that is not available or feasible [1]. This adaptability has positioned podcasts as a particularly valuable tool in higher education, where the diversity of student needs necessitates flexible and inclusive approaches to teaching [16]. Simultaneously, the advent of generative artificial intelligence (AI) has revolutionized the creation and distribution of educational content [13, 19]. Generative AI technologies enable the automated generation of more tailored learning materials, addressing challenges such as the significant time and effort traditionally required for content production [13, 20]. Furthermore, these technologies offer the potential for a more personalized learning experience by adapting content to the increasingly diverse needs of students worldwide [18]. This transformative capability aligns seamlessly with the inherent flexibility of podcasts. However, from the student perspective, podcasts may not always be a suitable medium for learning or improving the experience [22, 43]. With even "normal" podcasts being somewhat controversial, existing issues could be magnified or alleviated [15].

In this context, our study explores the intersection of learning podcasts and generative AI, examining the potential of AI-generated podcasts as a medium for interaction between students and their learning materials in university education [45]. We investigate how these AI-generated podcasts can transform traditional learning paradigms from the students' perspective, how students perceive them and learn with them. Specifically, we focus on the implementation, efficacy, and reception of AI-generated podcasts among bachelor students in a real university environment over four weeks, shedding light on the opportunities and challenges associated with this emerging approach. To extract student perceptions of AI-generated podcasts, we employed an explorative approach using a qualitative diary study and following best practices [5, 32]. We then analyzed the data with a hybrid manual and GPT-based approach. Our findings underscore the potential of AI-generated podcasts in university education. However, our findings also outline the challenges for AI-generated podcasts, like a lack of relatability, emotional connection, and technical difficulties regarding the AI voices, as our podcasts were generated for the German language. In sum, by providing a detailed account of the development, deployment, and explorative evaluation of AI-generated podcasts, our study contributes to the broader discourse on the integration of AI-driven tools and learning media in education. To this end, we conclude with an agenda for future research, encompassing four potential topics, such as advanced personalization of AI-generated podcasts and the AI-generation of podcasts as self-service for students. Thus, our study can inform the future application and research of generative AI for creating

more innovative and inclusive learning environments for students worldwide.

### 1.1 Podcasts for Learning

Podcasts hold significant potential as tools for enhancing student learning, as evidenced by extensive research (e.g., [1, 26, 30, 43]). They provide unique flexibility and accessibility, allowing students to engage with course content anytime and anywhere [33, 42], thus catering to diverse learning approaches and schedules. Podcasts also aid in understanding complex concepts through repeated listening and customizable pacing [28]. When integrated into curricula as supplemental or primary materials, they foster self-paced and independent learning, motivate engagement, and support skill acquisition in learner-centered environments [1]. Beyond their flexibility, podcasts offer opportunities for experiential learning, particularly within educational models such as flipped classrooms that emphasize the acquisition of knowledge before applying it. Experiential learning, as conceptualized by Kolb [10], emphasizes learning through direct experience, reflection, and application. In experiential learning, the integration of podcasts offers a unique opportunity to engage learners at multiple stages of Kolb's learning cycle [10]. Podcasts can present concrete experiences through real-world case studies or storytelling, prompting reflective observation as learners analyze and relate the content to their own experiences [23, 26]. The abstract conceptualization phase is supported by podcasts that discuss theories or frameworks, while active experimentation can be encouraged through follow-up tasks or practical applications suggested in the podcast content.

In hybrid learning environments, such as ours, where we employ podcasts as supplementary components to the regular lecture and materials, podcasts can serve as a bridge between online and in-person learning. They can be used to introduce topics before class, allowing in-person sessions to focus on application and discussion. Alternatively, they can reinforce key concepts post-class, enabling learners to engage with the material at their convenience. This flexibility aligns with the diverse schedules and learning preferences of students. The use of AI-generated podcasts further enhances their potential in learning environments [3, 7]. By automating the creation of personalized and interactive content, AI systems can address the resource-intensive nature of traditional podcast production. Generative AI can tailor content to align with specific educational objectives, incorporate diverse perspectives, and adapt to individual learner needs. Additionally, AI-generated podcasts can dynamically integrate feedback or updates, ensuring content remains relevant and engaging [13]. Despite their promise, the integration of AI-generated podcasts in learning environments requires careful consideration [3, 20]. Key challenges include ensuring content quality, providing high-quality voice outputs, maintaining alignment with educational goals, and evaluating their impact on learner engagement and outcomes [22, 26]. This study explores the potential of AI-generated podcasts to enhance experiential learning within hybrid educational settings, contributing to a deeper understanding of their role in modern pedagogy.

## 1.2 AI-generated Podcasts

Educational podcasts typically complement traditional instructional methods by providing concise, focused content that supports comprehension and retention [1, 8]. Despite these advantages, the creation of high-quality podcasts requires significant effort, experience, and time, which can limit their widespread adoption in academic environments [14]. Generative AI introduces a transformative approach to overcoming these challenges [3]. In this regard, AI and particularly generative AI can be leveraged to automate or augment the creation of high-quality educational content, material, or media, including educational podcasts. By integrating natural language processing and voice synthesis technologies, these systems can produce humanlike audio content that resonates with learners [7]. This capability not only streamlines the production process but also enables the development of personalized and scalable educational resources tailored to specific learning objectives and audience needs. Thus, AI-generated podcasts hold the potential to reduce the resource burden traditionally associated with podcast production while enhancing accessibility and engagement. However, the use of AI-generated podcasts in education remains in its early stages, with limited empirical evidence available to support their efficacy, especially from the student perspective (e.g., [3, 11]). Moreover, generative AI may introduce new problems, such as hallucination of content [11], while existing issues such as artificial or robotic sounding speech may or may not be solved [9, 36]. Nevertheless, AI-generated podcasts can combine the accessibility and flexibility of traditional formats with the dynamic capabilities of AI, potentially offering a new medium for educational content delivery. By aligning with pedagogical goals and adapting to individual learning preferences, AI-generated podcasts present an opportunity to reimagine how educational materials are created and consumed [3, 13]. However, their development requires careful consideration of both theoretical and practical factors, including the quality of generated content, its alignment with educational outcomes, and its reception by learners [14, 15].

## 2 Design of AI-generated Podcasts

For the generation of our podcasts, we followed an iterative prompt engineering process and best practices (i.e., Mollick/Mollick [31]) for prompt engineering [27, 41]. Regarding the generation itself, we chose to employ Google’s NotebookLM, which can be considered the leading technology in the AI generation of podcasts [12, 29]. We began by exploring different prompts and configurations of the source materials, including entire chapters combined with presentation slides and selected sections with supplementary materials. For illustration, we first started with all materials being available without restrictions and prompted for precise podcast output. We discovered that this approach was unsatisfactory as NotebookLM swayed from the topic at times or started hallucinating, although prompts should have ensured precise output. Thus, we created an instance for each specific topic for which we desired to create a podcast and supplied only limited materials. While this may limit the scope beyond core knowledge, we found that this way, the technical limitations can be resolved. This also allowed us to focus less on prompting boundaries and include instructions on

patterns and characteristics of the podcast. We also found that simple textual materials as PDFs (i.e., our lecture book [25]) work best, although other materials are possible too. Regardless, based on this observation, we used our lecture book as the main information source for the podcasts and only supplemented additional materials where we thought it was required. During initial trials, we observed challenges such as inconsistent language use and a lack of logical structure in the generated content. Therefore, we made iterative adjustments to improve language quality, ensure a logical flow of content, and enhance thematic relevance. For example, we included specific prompt instructions to maintain consistent roles for podcast hosts, clear guidelines for articulation, and emphasized concise yet comprehensive coverage of key topics, for which we sub-selected key materials that map the topic of each podcast. As we refined the prompts and selection of lecture materials, we tailored them increasingly to the specific objectives of each podcast episode, ensuring they aligned with our educational goals and user expectations. For illustration, if one chapter of our textbook covers project management, agile projects, and linear projects, we would generate one podcast per subtopic. We rigorously tested the final prompts (see Fig. 2; 500 character limitation) and configuration of supplementary materials to confirm their ability to produce high-quality outputs that were structured, accessible, and engaging. Through this iterative process, we ensured that the podcasts addressed both pedagogical and learning experience requirements, which should meet the diverse needs of students according to theory (see sections 1.1 and 1.2).

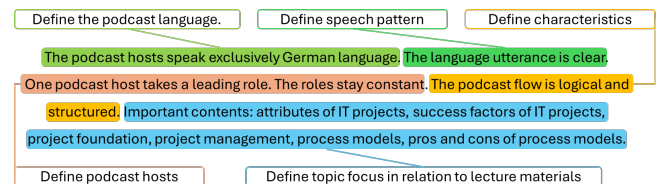


Figure 2: Example Prompt of an AI-generated Podcast

## 3 Evaluation

### 3.1 Method

To evaluate user experiences and perceptions of our students learning with AI-generated podcasts, we conducted an explorative qualitative diary study [5, 32]. The study was set in our bachelor course for Introduction to Management Information Systems at our University. Participation was entirely voluntary, thus not requiring a review by our research ethics board. Regardless, we also considered ethical aspects for the design and testing [4]. To motivate students, we gave vouchers to all participants as an incentive. This way, we could acquire nine student participants, of which eight successfully completed participation by handing in their diaries on time. All students (including non-participants) had access to the AI-generated podcasts for four weeks, encompassing two in-class lectures. During that time, students could access, listen to, and learn from the AI-generated podcasts as they pleased. The resulting qualitative diary data were analyzed using a hybrid approach of manual content analysis and GPT-based sentiment and emotion analysis

[17]. To this end, we split the sentiments into positive and negative ones and conducted an emotion analysis per sentiment polarity. To classify emotions, we follow the categories introduced by Shaver et al. and Parrot [34, 39]. This dual analysis enabled a nuanced understanding of participant experiences, revealing both strengths and areas for improvement for our AI-generated podcasts.

## 3.2 Results

Our diary study provided a rich dataset revealing the diverse experiences of our students when learning with AI generated podcasts. We present our results in three categories: benefits, challenges, and suggested improvements. These findings are contextualized to highlight contrasting perspectives and emergent patterns across the diverse experiences our students expressed. Before going into the detailed experiences of our students, we briefly describe behavioral data and present the results of our sentiment and emotion analysis (see Fig. 3). Regarding the behavioral data and usage, we can describe that overall 41 individual students accessed the podcasts<sup>1</sup> with 177 unique views of the podcasts amounting to a total of 1337 minutes of streamed podcasts. We also observed a gradual and continuous increase of usage throughout the semester (i.e., access and minutes streamed per unique student). The analysis reveals that most positive sentiment is centered around the emotions of surprise, interest, and joy. We find this to be reflected in the diary data perfectly well. Our manual content analysis matches these results, as many students who expressed positive feelings described that the AI-generated podcasts were surprisingly good (i.e., better than they expected), interesting as a new learning medium, and engaging (i.e., joyful) to listen to. Regarding the negative sentiment, we find that the emotions revolve around joy (or lack thereof), disgust, and confusion. As previously, we find these results to also match our manual content analysis perfectly well. Most students who expressed negative feelings described that they did not enjoy the learning experience and found the AI voices confusing and even disturbing, similar to automated voice mail bots.



Figure 3: Emotion Analysis of Diary Data

**3.2.1 Benefits.** First, we find that most students highlighted the intuitive aspects and benefits of podcasts in general, which also apply to AI-generated podcasts in our study. For instance, they can offer flexibility, accessibility, and concise content delivery, especially in comparison to traditional media like textbooks, slides, or videos. Many participants valued the ability to integrate podcasts into their daily routines. Listening while performing other tasks, such as commuting, cooking, or exercising, was repeatedly praised. For instance, one participant described the benefit as follows: "Podcasts allow me to learn while doing other things, like tidying up. This is a big advantage compared to traditional learning formats where I have to sit down and focus solely on studying." Another student noted that

<sup>1</sup>Number exceeds participant sample because not only participating students had access.

this approach turned idle time into productive learning moments, making podcasts a valuable supplementary tool for busy schedules. The student described how instead of procrastinating and listening to music, he just instead listened to podcasts, which helped to solidify what he learned during the week's lecture. Many students also appreciated the manageable duration of episodes, typically lasting around 20 minutes, which made them easy to consume without becoming overwhelming. For example, one student shared, "The length is perfect for short bursts of learning. I can easily fit it into my day without feeling like I'm cramming." Additionally, students also noted how this format made the podcasts particularly appealing for revision purposes, as one student stated that "They're great for refreshing content you've already learned." Moreover, several students praised the overall structure and organization of the podcasts, as well as the use of summaries at the end of each episode. In this regard, one student stated, "The recap at the end ties everything together nicely. It reinforces key points and helps retain the material." Students also noted that episodes that contained clear and practical examples or explanations were very relatable and comprehensive, although not all episodes contained these.

**3.2.2 Challenges.** Despite the positives, our students also encountered several challenges that negatively impacted their learning experience. The use of AI-generated voices emerged as a significant drawback. Most students described these voices as robotic, not engaging, and unable to convey emotion, while only a few students found the voices to be likable. For example, one participant compared the experience to interacting with automated phone systems, stating, "The voices lacked any sense of enthusiasm or motivation. It felt monotonous, like an automated hotline." Virtually all students who reported similar perceptions noted how this lack of emotional resonance often led to decreased engagement and, therefore, negatively impacted their learning. Another challenge was the rapid pace of delivery and the density of information presented in the podcasts. Many students noted the need to frequently pause or replay sections to process the content fully, especially if they were taking notes. For example, one student commented, "The pacing was too fast to keep up with note-taking. I had to stop and rewind multiple times, which disrupted the flow completely." Additionally, some students expressed difficulty in distinguishing between core concepts and supplementary details, in particular during fast-paced sections, which led to confusion and difficulties in comprehending the contents. Students also compared the podcasts to lecture recordings and consistently identified the absence of visual aids as a critical limitation. Without diagrams, slides, or handouts, understanding the contents by hearing podcasts alone became challenging. One student remarked, "Some concepts are too abstract to grasp without visuals. A simple diagram would have made a huge difference." This finding may expose an inherent drawback of podcasts in general and highlight that this medium is not suited for all content in education – being AI-generated or not. However, AI-generated podcasts and AI-generated transcripts as supplemental material may address this challenge, especially from a scalability of digital education perspective.

**3.2.3 Suggested Improvements.** Based on their experiences and personal ideas, students provided actionable recommendations to enhance their learning experiences with educational podcasts. As

students frequently noted, the AI-generated voices were distracting and should be improved. Students believed that more human-like voices without errors, artifacts, or weird accents would bring warmth, emotion, and relatability to the content. For illustration, one student commented that *"More human-like narrators would make it easier to connect with the material. It's hard to stay engaged when the delivery feels so mechanical."* Further, many students called for a slower delivery pace and the inclusion of natural pauses, which are natural in human-human conversation, to allow for reflection and note-taking. One student explained, *"Adding pauses would make it much easier to process and retain information. Right now, it feels like there's no breathing room."* However, some students also noted that the existing feature to pause and rewind the podcast somewhat alleviates that issue. As a potential alternative, some students suggested that breaking down episodes into even shorter segments (e.g., 10 instead of 20 minutes) and focusing on one specific topic per podcast could enhance clarity and reduce cognitive overload. Additionally, students requested clearer differentiation between essential and supplementary contents, i.e., what is (not) relevant for the final exam. Another suggestion by students that we find promising was the individualization of podcasts according to the individual needs of each student. For instance, one student noted, *"I'd love to see more podcasts on specific subtopics that I can pick how I like. It would make the content more relevant to my interests or where I feel I need to learn more."* Lastly, students repeatedly asked for supplementary materials, such as slides, diagrams, or handouts, to accompany the podcasts. It seems that, at least in our case, our students heavily rely on visual learning and find that simple audio media are not sufficient to learn.

#### 4 Discussion and Future Research Directions

The results of our study demonstrate the potential of AI-generated podcasts while also revealing key challenges and areas for future research. On the positive side, students valued the convenience and flexibility of the podcasts, highlighting their utility for multitasking and what we would call *"leisure learning,"* for example, during cooking or exercising. The concise format and portability of podcasts made them particularly appealing for those with busy schedules or working full-time. However, the study also underscored significant limitations, including engagement barriers with a focus on the sketchy anthropomorphism of the voices, the absence of visual aids compared to lecture videos, and challenges in processing dense information through audio alone. Overall, our findings reflect the benefits and challenges of regular podcasts outlined in literature that get magnified in the case of AI-generated ones (e.g., [22, 26, 43]). Drawing on the student feedback, their described positive and negative perceptions, as well as suggestions and related research, we discuss our findings and present an agenda for future research.

Students who described themselves as auditory learners and those familiar with podcasts tended to rate the experience more positively, whereas visual learners who prefer videos or slides and novices, regarding their experiences with podcasts, expressed dissatisfaction. These findings suggest that the effectiveness of and the experiences of students learning with podcasts depends on the individual learning preferences and prior familiarity with the medium. This finding has serious implications for the general application of

podcasts in education. First, we find that podcasts – AI-generated or human-made – alone are not a suitable medium. However, they can indeed be a valuable addition. Second, podcasts may need to be tailored to individual students' needs, which is virtually impossible for human-made ones; here, AI-generated podcasts may present a solution. Thus, we present our first suggestion for future research, **Topic 1: The personalization of podcasts in education.** For this topic, we find that future research may want to investigate how to adapt podcasts to individual students' needs. Possible criteria for personalization may encompass individual topics selected by students, the duration and speed of the podcast, or even interactive podcasts as outlined by recent research [24]. It may also be worthwhile to investigate the option of making podcast generation in education a co-creative self-service where students can create the exact materials they feel they need to learn. In this regard, recent research made first advances towards co-creation of podcast media [44]. Future research should consequently evaluate how personalization tools influence engagement, learning outcomes, and learning experiences. Additionally, mixed-gender voices in AI-generated podcasts can introduce biases through gender-specific stereotypes, such as using female-sounding voices solely for moderation and male-sounding voices exclusively for presenting facts. These stereotypical aspects that we encountered in our AI-generated podcasts could further influence content perception and unconsciously affect trust formation and perceived authority, potentially leading to biases depending on the topic or the perceived role of each voice within the podcast [40]. Nonetheless, when personalizing podcasts in diverse and inclusive ways, we could also actively combat stereotypes in educational podcasts.

The most frequently described challenges included issues related to the technical quality of the AI-generated podcasts. Students complained about robotic AI-generated voices, disturbing accents or voice artifacts, and uncertainty whether two or three voices were present. Despite the advancements in AI, these persistent technical challenges remain fundamental issues for voice-dependent media like podcasts [15, 36]. Thus, we present the second topic for future research **Topic 2: (Technical) foundations for truly human-like AI-generated voice.** As the non-humanlike quality of AI voices continues to detract from engagement and decreases the processing fluency of information [37], investigating how more natural-sounding AI voices could guide future improvements. For instance, in human-human dialogue, pauses during speech and vocal emphasis are perceived as more natural [9, 36]. Further, prosodic signals might support learning through lower cognitive load [15]. Seaborn et al. [38] provide further guidance on the design of voice modality. However, current AI seems to be incapable of mirroring these human-like dialogue features for podcasts in a way that is appropriate to the context of the dialogue. While this may be a non-English language issue only, we argue that research should still address this topic as there are many more languages and cultures than Western or English-speaking ones. Without such research, entire populations may be left excluded from these advancements.

Another recurrent comment from our students was a lack of visual support and supporting materials. While this is inherent in podcasts as a non-visual learning medium, we find that this finding may point toward an important need of many students to have visual materials to support their learning. Thus, how to



make an audio medium like a podcast visually enhanced or integrated with visual media may prove to be another topic for future research. **Topic 3: A multi-modal investigation into visually-enhanced podcast learning.** The integration of visuals into podcast formats may offer significant promise, particularly for abstract or concept-heavy subjects. Future research should explore the development of AI-generated and visually-enhanced podcasts, e.g., where slides, diagrams, or infographics accompany the audio content (e.g., [21, 35, 44]). One approach could involve generating audio tied to specific slides or visual segments of textbooks, enabling learners to follow along seamlessly while being able to rely on a visual medium as well. Another one could involve the opposite approach, generating visuals from AI-generated podcasts, e.g., condensed summaries of what is being talked about. Either way, exploring how such enhancements impact learning experiences compared to audio-only formats may be critical for refining AI-generated learning media.

Lastly, some students expressed their concerns about different domains. As this is an information systems course, some students are required to pass math or computer science lectures and wonder how AI-generated podcasts would extend to these areas. While podcasts have shown promise in general education and theoretical subjects, their applicability to technical fields like mathematics, computer science, and engineering may prove difficult. These domains often require visual demonstrations, such as equations, algorithms, or graphs, which are difficult to convey through audio alone. Thus, we present our fourth topic for future research, **Topic 4: Potentials of AI-generated podcasts across domains.** In these domains, the aforementioned audio-visual extension of AI-podcasts may also prove as useful e.g., for providing visual support for less tangible concepts like formulas or code which may be very difficult to explain by speech only [24, 35, 44]. Examining how AI-generated podcasts can complement traditional teaching methods in STEM fields would provide valuable insights into their broader applicability.

## 5 Conclusion

In this study, we examined AI-generated podcasts as a learning tool in a university setting, aiming to understand their strengths and limitations from the students' perspective. By conducting a four-week diary study with bachelor students, we have highlighted the benefits of AI-generated podcasts but also identified key challenges that need to be overcome. In this context, we have also outlined an agenda for future research encompassing four topics. From a theoretical perspective, our research adds to the growing understanding of how generative AI can transform education by providing scalable, flexible tools that cater to the diverse learning needs of students. Our findings highlight the importance of personalization and the potential for the integration of multimodal elements to enhance engagement and learning experiences. In practice, we have demonstrated that AI-generated podcasts offer practical benefits and good learning experiences to students, particularly students balancing academic and personal commitments. However, challenges like the lack of human-like voice quality, the absence of visual aids, and fast-paced content delivery can lead to dissatisfaction and cognitive overload. Additionally, we acknowledge our shortcomings in

this study. We can only report findings with a small sample size and focus on only one technological approach (i.e., market leading Google NotebookLM). Future research may want to replicate and extend our study with a larger sample or investigate different technological solutions (e.g., OpenAI, DeekSeek, etc.). With our findings, we provide actionable insights for educators and developers aiming to refine AI-based educational tools as well as directions for future research. In sum, while promising, AI-generated podcasts require further refinement and research to better serve students with diverse needs. Addressing the identified challenges could elevate AI-generated podcasts to become a key tool and medium in modern-day education.

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