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REVIEW

The impact of podcasts on knowledge, engagement, and empathy outcomes in pharmacy education

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Abstract

Background: With the increasing integration of educational technology and on-demand media, podcasts have emerged as a flexible and accessible tool for content delivery in pharmacy education. Despite the increased use of podcasts in pharmacy education, their impact on learner knowledge, engagement, and empathy is unknown. Objective: This research seeks to explore the impact of podcasts on learning and assessment outcomes in Pharmacy education. **Methods:** A systematic search was conducted using five databases. Inclusion criteria were experimental studies in pharmacy education reporting outcomes related to knowledge, engagement, and/or empathy. Of the 77 studies screened, nine studies were included in the final analysis and grouped by outcome. **Result:** Four of five studies that evaluated knowledge showed knowledge improvement, and one study that compared podcasts to traditional lecture showed that podcasts yielded poorer scores. Learners preferred podcasts due to various characteristics such as host tone, podcast format, and guest relatability. Student-created podcasts improved professional growth and collaboration. Podcasts yielded more empathetic survey responses, although no validated tools were used. **Conclusion:** Podcasts serve as a promising supplementary tool in pharmacy education. While they conditionally improve learner engagement and potentially improve empathy, their efficacy at disseminating knowledge compared to traditional methods remains unestablished.

Introduction

In the era of streaming, widespread internet access, and mobile devices, individuals have an infinite number of multimedia choices available for learning. Regardless of the content chosen, it needs to be flexible, engaging, and at the tip of our fingers. As our society gravitates towards portable media for both education and entertainment, podcasts effectively combine these two concepts, appealing to diverse learning preferences (Zhang *et al.,* 2015). A podcast is a media file that can be accessed or downloaded online, covering a variety of topics. Online education, including educational podcasts, has been more prominent since the COVID-19 pandemic (Baecker, 2022). Podcasts, like other online content, are free and widely accessible, allowing students to network and form global communities with educators and other students (Nematollahi *et al.,* 2022). With the increasing proficiency and reliance on technology, podcasts can serve as a useful educational tool to assist with different types of learning needs (Prakash *et al.,* 2017; Stephens & White, 2024). This text focuses on podcasts' use in pharmacy education as a supplemental mode of content delivery and as a means of assessment - these are the primary modes of use in pharmacy education per the literature to date (Wollen *et al.,* 2024).

With traditional methods of didactic lectures in pharmacy education, there is a potential for overlooking different learning preferences (Prakash *et al.,* 2017). Students in higher education come from diverse backgrounds; therefore, providing a variety of instructional methods could help engage more students (Schlesselman, 2018). For example, lessons that give an option for self-paced learning, such as podcasts, allow students more time and flexibility to absorb the information at a foundational level (Fina *et*

al., 2023; Schlesselman, 2018). This works towards levelling the playing field across different types of learners and schedules. For example, those who need more time to digest the foundational material and those who need more time due to busy life schedules (Fina *et al.,* 2023). Studies have demonstrated positive perceptions of podcasts as supplemental learning tools among dental students. For example, nearly 70% of students agreed that podcasts are a necessary supplemental educational tool, especially for the more complex concepts (Kalludi, 2013). Most healthcare education podcast studies have been conducted in medical education (Miesner *et al.,* 2017; Steffen *et al.,* 2019; Nematollahi *et al.,* 2022; Fitzpatrick *et al.,* 2023; King *et al.,* 2023; Mistry *et al.,* 2023, Connor *et al.,* 2024; Holstead & Quinn, 2024; 2024; Patel *et al.,* 2024). Additionally, a 2019 review found that pharmacists were underrepresented in the creation of drug-topic-related podcasts, where 83.2% of the hosts and guests were physicians compared to 10.4% of pharmacists (Kane *et al.,* 2019). There is a growing demand to explore the effects of podcast learning, specifically on pharmacy students.

According to a 2023 commentary, "*Educational technology is heavily incorporated into higher learning and […] media technology is firmly entrenched in society*" (Fina *et al.,* 2023). The academic community has the option to leverage this by releasing educational content that coincides with pharmacy students and our current community's norm of on-the-go media consumption. This review of the literature will explore how podcasts are used as a supplementary tool in pharmacy education and their impact on students' knowledge, engagement, and empathy. For this review, the authors have used the definition *"[…] audio files distributed via the Internet to share information asynchronously*" for the term "*podcast*" provided by Ahn and colleagues (Ahn *et al.,* 2016). Pharmacy education, in this context, will refer to information disseminated for pharmacy professional development across the spectrum of pharmacy learners from pre-pharmacy students, student pharmacists, postgraduate trainees, and pharmacy practitioners.

Methods

A search using the terms "*podcast AND pharmacy education*" was conducted in May 2025 using the following databases: PubMed/Medline, CINAHL (EBSCO), Scopus, Journals@Ovid, and Science Direct. The results were filtered for the English language and were inclusive of all publication dates. Duplicates were removed using Rayyan version 052025 (Ouzzani *et al.,* 2016). Articles were included in the review results if they were experimental and had a study outcome related to knowledge, engagement, and/or empathy. Vodcast or video podcasts were excluded as they may not have the same efficacy as an audio-only medium, and vodcast interventions are difficult to discern from recorded didactic lectures. Additionally, reference sections were checked to include additional articles with relevant learning outcomes in other health-related fields, and articles from authors' first-hand knowledge were also included. Articles that were relevant for context, but didn't strictly meet the criteria, were reviewed and included for background information. General themes of impact in pharmacy education informed the grouping of studies in sections in the review. This study was not evaluated by the Institutional Review Board, as it is secondary research and therefore not human subject research.

Results

A total of 77 studies were screened, with a final nine studies included (n=9) in the review. The PRISMA flow diagram depicting the inclusion of studies is available in Figure 1 (Page *et al.,* 2021; Haddaway *et al.,* 2022). Themes for how to best use podcasts and their impact on student learning emerged. Podcasts were found to have been used in many contexts, including literature evaluation skills, active learning assignments, developing communication and presentation skills, and peer teaching and knowledge dissemination. Studies were found that assessed knowledge, engagement, and empathy.

Podcast impact on knowledge acquisition and retention

Five studies assessed knowledge acquisition and retention of pharmacy education podcasts (Table I). Four of the five found an increase in knowledge using a pre-post (Ro & Villarreal, 2019; Moeller *et al.,* 2021a; Nohria *et al.,* 2024) or cross-sectional (Wang et al., 2023) single-group analysis when using podcasts to acquire or demonstrate the acquisition of knowledge. Conversely, one study found a decrease in knowledge (Stewart *et al.,* 2013a) when comparing podcast vs traditional lectures head-to-head.

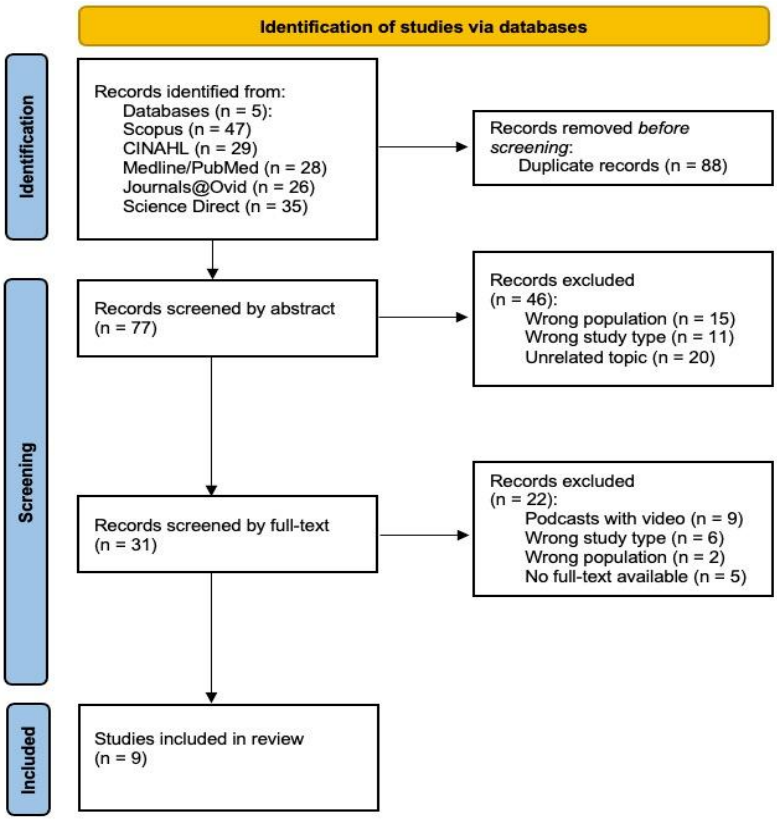

Figure 1: PRISMA-ScR flow diagram for systematic search results

Table I: Podcast impact on knowledge acquisition and retention (n=5)

Author	Country	Population	Outcome(s)	Results
Nohria, 2024	United States	P1-P4 student pharmacists n=73	Knowledge retention for the top 200 drugs from the beginning to the end of a fall semester for PharmD students.	Knowledge score increased by 11.32% (p=0.0011, Cohen's d = 0.84).
Stewart, 2013	United States	P3 student pharmacists n=136	Mean assessment score for an exam covering content presented via podcast vs traditional lecture in pharmacotherapy course.	Podcast cohort scored 4.6% lower on assessment (p=0.019).
Wang, 2023	United States	P3 student pharmacists n=92	a) Mean change in student confidence in literature evaluation skills. b) Proficiency in literature evaluation skills via a student-created podcast as an assessment medium.	a) Confidence in each component improved (p<0.001 for all). b) Full proficiency (all components of rubric met) was achieved for 96.7% for both introduction and background, 90.3% for study methods, and 78.3% for results/conclusions. Technical creation, group discussion, applicability, and strengths/limitations components were all 100% fully proficient
Moeller, 2021	United States	P3 student pharmacists n=120	Knowledge of urine drug testing after consuming content via a pre-lab podcast.	Knowledge increased by a median of 1/5 correct questions (p<0.001).
Ro, 2021	United States	Student pharmacists (n=5) and advanced practice nurse practitioner students (n=14) n=19	Mean change in ECG fundamental knowledge score pre- to post-intervention.	The mean score increased by 30%.

P1, first professional year student pharmacist; P3, third professional year student pharmacist; P4, fourth professional year student pharmacist; PharmD, Doctor of Pharmacy, ECG, electrocardiogram.

Podcast impact on content engagement

A total of five studies evaluated engagement via user feedback (Table II). One study found that an overwhelming majority of students (83.5%) preferred a podcast to traditional lectures for acquiring knowledge (Steuber *et al.,* 2024). The Steuber study evaluated listener feedback and qualities of the podcast that the students enjoyed, including attributes such as short episode length, questions and answers segments, guest interaction, positive and laidback demeanour, and conversational tone. Regarding the guest speakers on the podcast, student listeners preferred guests who seemed relatable, authentic, and diverse. They also like it when guests share personal stories and insights (Steuber *et al.,* 2024). Three studies evaluated an experience as a proxy for engagement with the podcast (Poirier *et al.,* 2017; Ro & Villarreal, 2019; Moeller *et al.,* 2021a). For example, the Poirier study used course evaluations, which evaluate the entire experience of the course and the content on the whole when podcasts represented a fraction of the content delivered (Poirier *et al.,* 2017). One additional study asked students to reflect on their experience creating podcasts, and themes of relationship development, interprofessional collaboration, and professional growth were found via thematic analysis (Brown Wilson *et al.,* 2024).

Table II: Podcast user engagement findings

Author	Country	Population	Outcome(s)	Results
Steuber, 2024	United States	P2 and P3 student pharmacists n=91	a) Student pharmacist preference of podcast vs traditional lecture. b) Perception of guests' qualitative feedback. c) Learners experience qualitative feedback. d) Episode production qualitative feedback.	a) 83.5% preferred podcast b) Students enjoyed authenticity, personal stories, diversity, insight, and relatability. c) The podcast was a safe space to have Q&A questions answered, was laidback, entertaining, not enough guest interaction, positive, and the sequencing. d) Episodes were of appropriate length (7-20 min) but some may have preferred longer. Also, the conversational nature was appreciated by listeners.
Moeller, 2021	United States	P3 student pharmacists n=120	Perceptions of urine drug testing lab experience.	84.2% agreed or strongly agreed that the lab was valuable.
Ro, 2021	United States	Student pharmacists (n=5) and advanced practice nurse practitioner students (n=14) n=19	Perception of activity.	83.3% found the IPE to be "*strongly positive*"
Brown Wilson, 2024	Ireland	Student pharmacist (n=4), medical students (n=4), nursing students (n=10), and an occupational therapy student (n=1) n=19	Analysis of reflections by students after co-creating an interprofessional podcast education resource on delirium.	Themes of relationship development, interprofessional collaboration, and professional growth were discovered.
Poirier, 2017	United States	Pre-professional pharmacy students (n=11), pre-medical and pre-dental students (n=7), and other pre-health or related field students (n=4) n=22	Course evaluation item-by-item analysis.	5-point course evaluation scores for the course-related questions in the course evaluation ranged from 4.45 ("*The activities/assignments were useful in helping me to learn*.") to 4.85 "*The honours course helped [me] learn how to think creatively about the issue [I] have been examining*."

P2, second professional year student pharmacist; P3, third professional year student pharmacist; Q&A, question and answer segment; IPE, interprofessional education.

Podcasts' impact on empathy

Two studies evaluated empathy (Table III). In both studies, empathy was evaluated using unvalidated questions on a single topic via survey (Poirier *et al.,* 2017; Matulewicz *et al.,* 2020). While the Matulewicz study also evaluated critical thinking skills, the outcome of interest to this review was how critical reflection on the podcast content impacted the students' empathy. Almost all students reported challenging their beliefs and biases from the content and having a new perspective on healthcare and their role as a pharmacist (Matulewicz *et al.,* 2020). The Poirier study

used two assessment tools: a 20-question survey with empathy-related questions (although not framed as such by the authors) and a course evaluation with six questions related to empathy in the context of the course (eg. "*My views on health care providers have changed as a result of this course*" and "*This course allowed me to better relate to my classmates*") and 10 questions related to the course (e.g. "*The course requirements were communicated in the syllabus*" and "*I feel free to discuss sensitive topics in this course*."). Of the 20 empathy questions, 12 showed an increase in agreement. Of note, the eight items that did not show an increase in agreement were related to seniors, healthcare providers' ethical portrayal, ability to see things from others' perspectives, comfort working with transgender people, and treating patients with human immunodeficiency virus (Poirier *et al.,* 2017).

Table III: Podcast impact on student empathy

Author	Country	Population	Outcome(s)	Results
Matulewicz, 2020	United States	P2 student pharmacists n=116	Analysis of student reflections after consuming podcast content regarding ethics, healthcare, medication safety, pharmacoeconomics, and self-awareness.	81.9% reported that they challenged their beliefs and biases, 91.4% reported thinking about healthcare differently, and 90.5% reflected on what it means to be a pharmacist.
Poirier, 2017	United States	Pre-professional pharmacy students (n=11), pre-medical and pre-dental students (n=7), and other pre-health or related field students (n=4) n=22	a) An item-by-item analysis of healthcare-related perceptions in a pre-health honours course that uses podcasts with other media to deliver content on developing interprofessional skills. b) Course evaluation item-by-item analysis.	a) Many of the survey items reflecting empathy (eg. "*I can imagine what it would be like to be diagnosed with a terminal illness*" or "*If I see someone being treated unfairly, I desire to make it right*.") had increased agreement, although some items related to seniors (eg. "*Older individuals cannot contribute to society's needs*" and "*Older individuals have active social lives*") were unchanged. b) 5-point course evaluation scores for the empathy-related items from the course evaluation ranged from 4.05 ("*I am more likely to consider a character's feelings when viewing a film or reading a book as a result of this course*") to 4.85 "*The honors course provided [me] an opportunity to engage in self-reflection and come to better understand [myself]*."

Discussion

Podcast impact on knowledge acquisition and retention

The ability of podcasts to improve knowledge has been demonstrated in multiple studies in this review, but with conflicting results. When assessing knowledge without a comparator, podcasts consistently demonstrated that they improve knowledge (Ro & Villarreal, 2019; Moeller *et al.,* 2021a; Wang *et al.,* 2023 Nohria et al., 2024;); however, the literature suggests that they are inferior to didactic teaching when compared head-to-head (Stewart *et al.,* 2013) in the most methodologically rigorous of the studies evaluating knowledge. This effect was approximately doubled in the Stewart study when analysing the bottom 50 percentile of scorers in both groups. Stewart and colleagues felt that a lack of accountability for completion may have contributed (Stewart *et al.,* 2013). All studies' samples were of student pharmacists only, except Ro and Villarreal, where student pharmacists represented about 25% of the sample (Ro & Villarreal, 2019). Podcasts may be a reliable means of delivering content for learning, but seem to be subpar to didactic lecturing by an unknown mechanism. Future areas of study should include more head-to-head studies in multiple educational contexts (i.e. didactic, skills-based, and experiential settings) to determine the value of podcasts as a content delivery tool for knowledge acquisition and retention compared to more traditional methods of content delivery.

Podcast impact on content engagement

Pharmacy education podcast listeners seemed to be more engaged by content delivered in podcast format compared to traditional formats. This preference was measured directly head-to-head by Steuber. The same study found many characteristics of podcasts (i.e. episode length, guest speaker qualities, tone, etc.) that

listeners preferred. The Brown Wilson study used reflections to find what lessons were learned from co-creating a podcast with an interprofessional team of learners. The results were convincing in that they were methodologically robust, and they came from focus group reflections. The lessons learned from the learners were almost exclusively positively framed, which may suggest response bias. Additionally, the reflections were based on their experience creating the podcast, but not the podcast's content. This is one of two studies in the review (Brown Wilson et al., 2024; Wang *et al.,* 2023) that evaluate podcasts made by students, which has been occurring more in the past few years (Wollen *et al.,* 2024). The studies that evaluated listener engagement and satisfaction using an assessment that was not specific to the podcast (Poirier *et al.,* 2017; Ro & Villarreal, 2019; Moeller *et al.,* 2021;) showed improvement, but such measures are difficult to determine if the learners were satisfied with lab, activity, or course because of the podcast element or the overall design which makes the results less useful in the context of this review. The findings suggest that there are specific characteristics of pharmacy education podcast episodes that are favoured by listeners and that learners enjoy courses, labs, and activities that use podcasts for content delivery. Significantly more scholarship on these qualities among pharmacy learners of all levels is needed. The authors recommend using user experience (also known as UX) research methods such as semantic differential analysis, tree testing, and various usability methods (Albert & Tullis, 2023; Sauro, 2016). More rigorously measured qualities of podcasts that improve engagement and motivation may secondarily improve learning outcomes.

Podcast impact on empathy

Studies that evaluated empathy were rare (n=2). Both studies that evaluated empathy did so as an aside to their primary outcome and used no validated measure. That said, the results of the studies suggest that podcasts may be a good medium to deliver content to convey experiences to learners. Pathos appeals may be easier to make with verbal communication than in written communication. To corroborate this, future studies should use validated questionnaires that measure empathy as a construct. The authors suggest the Kiersma-Chen Empathy Scale (Aronson et al., 2022; Kiersma et al., 2013), which has been validated using pharmacy learner subjects and is likely the most prominent tool for measuring empathy in pharmacy education.

Incorporating Podcasts in Pharmacy Education

Podcasts can be effectively incorporated into healthcare education as both supplemental learning tools and tools for assessment. Educators can use podcasts to deliver complex concepts in concise, engaging formats that students can access on their schedule, enhancing knowledge acquisition and retention. Assignments that involve students creating their own podcasts foster creativity, critical thinking, and active learning, which allows them to explore topics from different perspectives. Podcasts can also be integrated into courses as review materials which offer students quick, focused summaries of key content before exams. Additionally, patient-centred podcast series can be used to cultivate empathy and reduce stigma by exposing students to diverse patient narratives and experiences. Some barriers to implementation may include faculty workload restrictions, recording and production quality issues, equipment costs, information technology support, and compatibility with institutional assessment modalities. A review that explores barriers to implementation is needed to establish exactly what these barriers are and the relative degree to which they impact implementation.

Conclusion

Podcasts used as a supplementary tool in pharmacy education increase knowledge, but potentially less so than traditional means of content delivery. They are preferred by learners over traditional means, and certain podcast characteristics may contribute to engagement. Podcasts may be a powerful medium for communicating experiences and feelings that traditional means of content delivery cannot, and widen pharmacy learners' perspectives on sensitive topics. With the cultural shift and reliance on technology, the educational experience has changed along with it, offering unique ways to view and digest information. More studies with head-to-head comparisons, user experience research methods, and validated empathy tools may improve the quality of literature regarding knowledge, engagement, and empathy from podcasted content.

Conflicts of interest

Author Alice Vu is the president of the Never Generic Podcast student organisation at the University of Houston College of Pharmacy. Author Elisabeth M Wang is the co-producer and co-creator of the Cardioscripts cardiology pharmacy podcast. Author

Joshua Wollen is the faculty advisor for the Never Generic Podcast student organisation at the University of Houston College of Pharmacy.

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