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Article

Creating a Podcast Using Generative Artificial Intelligence to Support Student Learning of Organic Reaction Mechanisms

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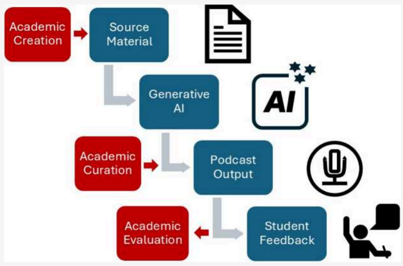
ABSTRACT: A podcast was created by Google NotebookLM artificial intelligence and applied to support learning in a Year 1 university organic chemistry course. The Generative AI (GenAI) was trained using an open access article presenting priority and selectivity rules for organic reaction mechanisms. The software performed very well in terms of background material, showing creativity. Coherent explanations of organic chemistry were also given, although some technical errors were made in chemical detail and there was some pedagogic confusion. The source material was edited and two further podcast versions created. All three podcast outputs were combined with academic curation to create a final output with minimal errors. The podcast was released to students, being advertised as AI-generated support material. Students who listened to the podcast reported it helped reinforce learning and was worth listening to. However, a number of students were concerned about ethical, societal, and sustainability concerns of using AI, and some actively chose not to engage with it. In summary, with academic curation, Google NotebookLM can make engaging scientific podcasts with limited workload. However, student attitudes to the use of AI in education must be carefully considered.



KEYWORDS: *First-Year Undergraduate, Self Instruction, Multimedia-Based Learning, Artificial Intelligence, Organic Chemistry*

■ INTRODUCTION

In recent years, artificial intelligence (AI) has made rapid progress, and is prompting a rethink of education.[1−9] Most educational work applying generative AI (GenAI) has used large language models in the form of chatbots (e.g., ChatGPT, Microsoft Copilot, Google Gemini etc.). In chemistry education, such tools have been evaluated in scientific writing,[10] green chemistry,[11,12] problem-based learning,[13] retrosynthesis,[14] and as examination support.[15] The uptake of chatbot tools is increasingly rapid and worldwide.[16,17] To interrogate the 'chemical ability' of GenAI chatbots, they have been tested with examination questions, performing best on generalizable material, rather than specific chemical detail.[18−22] Recently, GenAI has been used, alongside academic curation, to provide feedback and grade students' work.[23] As GenAI begins to integrate into education, student attitudes toward AI are of considerable interest, although their experience often remains at a relatively early stage.[24−27] It has also been noted in the literature that instructor-led AI tools remain rare, and that in general, many educators lag-behind students in terms of AI literacy.[28]

Google NotebookLM is an AI tool that allows users to create audio outputs, including 'podcasts', from source documents. This feature has received significant media attention.[29,30] The use of defined sources reduces the risk of 'hallucinatory' outputs, increasing reliability.[31] I therefore became interested in the potential of GenAI to create audio material as an additional resource to support student learning. Even before the advent of AI, there was interest in podcasts as educational tools, either as support materials,[32−34] or with students making podcasts to demonstrate creativity and/or subject mastery.[35−37] In the early stages of AI, scripted texts written by the user were directly converted into podcasts.[38] However, Google NotebookLM requires no script − the software generates one from the source material. Google NotebookLM has recently been used to create educational podcasts in topics such as philosophy, psychology and government − with students reporting greater enjoyment of listening to the podcasts than reading the source material.[39] Very recently, the reaction of researchers to GenAI podcasts created from their own research papers was studied.[40] A pedagogic classification methodology has also been applied by Mehta et al. to explore the potential of AI-generated podcasts in education.[41] In one case, it was reported that Google NotebookLM was used to create a podcast (with academic checking for accuracy) to introduce a writing exercise to pharmaceutical science students.[42]

Considering the specific use of GenAI in organic chemistry, a 2023 study compared the ability of students and ChatGPT to write about organic reaction mechanisms.[43] In general,

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ChatGPT rarely discussed electron movement and did not engage in mechanistic reasoning at the same level as students. However, in 2024, Yik and Dood found that that across 85 different organic reaction mechanisms, a quarter of explanations given by ChatGPT were fully accurate, with the majority being mostly correct.[44] Organic mechanisms are cognitively difficult for students, and a wide range of strategies have been developed to support learners.[45−49]

In 2023, I reported a new teaching approach to organic mechanisms based on algorithmic 'priority and selectivity rules'.[50] The Level 1 Priority Rules developed a simple algorithm to help students find potential reactive sites in organic molecules and move curly arrows between them in a predictable way, while the Level 2 Selectivity Rules allowed students to select between subtly different reactive sites in more complex systems. This methodology empowers students to predict mechanisms, rather than seeing them as an overwhelming set of processes to memorize. As a part of this course, it is important that students gain an understanding of the priority and selectivity rules so that they can apply them to unseen reactions. There are many ways in which student learning could be supported − indeed, the course has a series of video screencasts that students can access. However, I became interested in creating a podcast-style audio resource as extra support, because podcasts are easy for students to listen to even while engaged in other daily tasks when they would not be able to look at a screen, like driving to campus or cooking, which would otherwise be time unavailable for learning. Furthermore, given the priority and selectivity rules were developed in York, and only published in 2023, they are not currently discussed in textbooks or other online resources, meaning that providing additional ways outside of the lecture room, in which students can explore these concepts, has particular value. This paper reports the use of Google NotebookLM, with academic curation, to create a podcast on the rules (Figure 1), explores student attitudes using a survey tool, and reflects on the future potential of GenAI podcasts in chemical education.

■ PODCAST GENERATION

The podcast was developed following standard university policy, which strongly encourages instructor-led use of Google AI tools

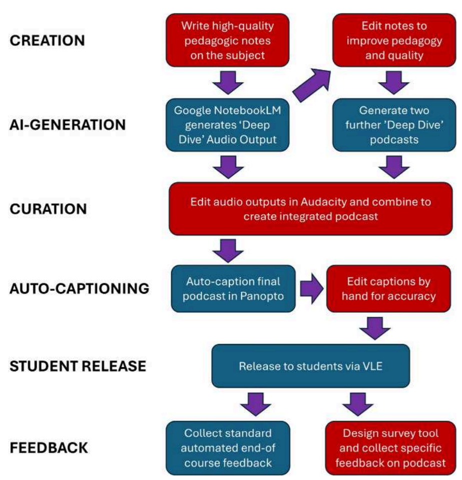

Figure 1. Schematic diagram illustrating the approach in this project to generate AI podcasts and assess their impact. Blue boxes were led by automation, red boxes were led by academic input.

in innovative teaching interventions. Google NotebookLM was provided with my open-access *Journal of Chemical Education* paper[50] as source material.[51] A default-length 'deep dive' podcast ('audio overview') was requested with a prompt that it should: 'explore the importance of organic reaction mechanisms, explaining how priority and selectivity rules can enable students to predict organic reaction mechanisms'. The software rapidly (ca. 5−10 min) generated a 20 min podcast with two voices (one male, one female).

A personal assessment of the initial podcast was then made. The AI voices discussed the material in a remarkably natural way. The parts dealing with the importance of organic reaction mechanisms were excellent and well-argued. The presenters expressed things in ways I may not have myself, going beyond the source material to provide context and humor. The priority and selectivity rules were also dealt with quite well. I was impressed with the choices the AI made in terms of which material to discuss − generally highlighting the most important aspects. Sometimes, however, the chemistry became a little confused and there were minor errors (see discussion below).

A significant problem was an example selected by the AI to discuss in detail, based on lidocaine synthesis. This was quite a complex example relying on both the simple Level 1 priority rules and the more subtle Level 2 selectivity rules to be fully understood. However, the AI presented it before describing Level 2 selectivity rules and the discussion became confused, failing to get to grips with the complexity. Ironically, I positioned this example in the same way in my original paper,[50] albeit discussing it with more care. Listening to the podcast made me consider whether this had been the best choice in terms of my own writing − a simpler case study may have been more effective! Given the source 'teaches' the AI, listening back is a powerful way of assessing my own pedagogy. Indeed, 'teaching' an AI before trying to teach students, may become a useful add-on step to teaching preparation.

The lidocaine example was therefore removed from the source document, replacing it with new text on a synthesis of salbutamol (Figure 2). This gave a more precise focus on curly arrows as decided by simple Level 1 priority rules. I also removed the section of the paper on classic reaction types − nucleophilic substitution/addition and electrophilic substitution/addition. Although important in the original paper to demonstrate how these reactions are predicted, the multiple examples distracted from the actual rules, and would have required more Figures for full comprehension.

Two more podcasts were created from the revised source. The audio from the three different podcasts was then combined using Audacity software, selecting the best analogies and liveliest discussions, and removing errors or confusing descriptions. Although the GenAI content was generally good, I would not have been happy to release it without this editing. However, Google NotebookLM has only made podcasts since late 2024 − given the rate of progress, it seems likely the amount of curation required will decrease in future. A version of the final podcast is available on YouTube,[52] as a useful resource to support this paper, and as an additional resource to support others using my previously published 'priority rules' approach[50] as an educational intervention in organic reaction mechanisms.

To exemplify problems, some of which were solved by editing, the AI struggled with pronunciation of technical terms − e.g. carbocation (rhymed with 'vacation'). The source was edited to spell this word phonetically (carbo-cat-eye-on), but this did not solve the problem. Ultimately, this was relatively minor and was

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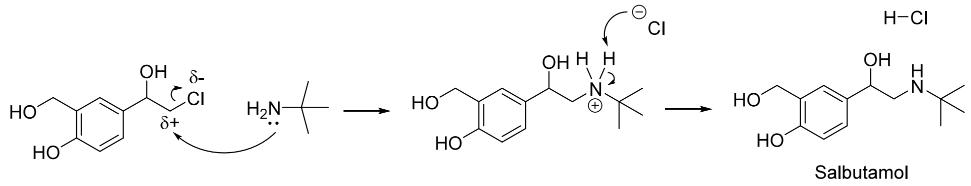

Figure 2. Synthesis of salbutamol from the modified source material.

left in the final podcast; closed captioning was used to clear-up misunderstanding.

In another minor glitch, the AI said: 'the lowest unoccupied molecular orbital – the HOMO'. It is not clear why the AI would make this mistake, as it is neither in the source, nor prevalent online. It is the kind of error a human would make, getting muddled/distracted for no good reason. It was left in, because everything else about the orbital description in that particular 'take' was excellent, but it was captioned with corrected information. This kind of error is frustrating and cannot currently be fixed in the software (see 'limitations' section).

The AI struggled a little with the nomenclature of atoms and ions. In the salbutamol example (Figure 2), a chloride ion is the leaving group, but the AI referred to 'chlorine' leaving. This is a known AI problem, with one study showing that Copilot, like many student learners, makes this type of mistake.[53] Interestingly, in the literature report, after an active debate, the AI adaptively corrected itself. It is anticipated that in the future Google NotebookLM may learn to correct itself.

In one particularly interesting case, when describing the salbutamol mechanism, the AI wrongly suggested an epoxide was present. This was edited out of the final podcast. Although there is no epoxide in the reaction presented (Figure 2), an epoxide is used in the standard salbutamol synthesis (and would likely, in reality, be an intermediate in the reaction shown). This may have been uncovered by the AI from information within its prior training set. The alternative is that the AI simply muddled in an epoxide because it was discussed elsewhere in the source document.

Beyond using different podcast versions to correct errors, it was noteworthy that in each case, the AI discussed different examples. Some of these were pedagogically clearer, and some were better explained. Having a choice of audio streams was therefore beneficial to the pedagogy of the final podcast.

To generate a time-stamped transcript, the final podcast was uploaded into Panopto (university audio/visual software) that offers autocaptioning, which required minor manual editing. The final transcript is in the Supporting Information. A PowerPoint image was also created to provide essential visual support for the salbutamol synthesis discussed in the podcast; this was attached to the audio file.

Reflecting on the final output, it is my opinion that the AI did a better job than many academics would achieve (at least without extensive training). The conversation flows seamlessly, helping listener engagement – this can be very challenging for academic presenters to achieve. Furthermore, the AI often went beyond the uploaded source, showing a degree of 'creativity'. A recent study attempted to measure the creativity of GenAI podcasts based on (i) divergent thinking, (ii) emotional diversity, and (iii) use of analogies.[54] In summary, the AI struggled most in describing mechanistic detail, but the use of high-quality source material limited this, and using several audio streams created a final podcast[52] of very good scientific quality (as judged by myself and the students – see feedback).

WORKLOAD IMPLICATIONS

A basic podcast can be created from source material and prompt in <10 min using Google NotebookLM. Auto captioning without editing could be achieved in ca. 5 min. It would thus be possible to create a 20 min podcast, and launch it online, in only around 15 min. In my view, this would not currently yield a satisfactory conclusion with pedagogically challenging or technical material. However, the developing evidence of the use of this tool in other disciplines[39] or to provide instructions to students[42] suggests it might suffice for a general, nontechnical discussion (e.g., the societal impacts of chemistry). Academic curation and editing introduce significant steps into the workflow (Figure 1) but add significant value, aligning with the view that AI use should integrate the content knowledge and pedagogical insights of the instructor.[55] Listening to audio files (or reading transcripts), editing out errors, and combining the best parts, was the most time-consuming aspect, perhaps taking ca. 2 h (for someone well-acquainted with audio-editing). Editing captions took ca. 20–30 min.

In total, for about 3 h of academic work, a podcast was produced. It would be challenging to generate an authentic equivalent podcast, with two people naturally discussing a subject, in the same amount of time (1.5 h each) – there is also a very significant barrier in terms of getting two people together to record a podcast. This process would require academic preparation time from both individuals and recording time and still need significant editing (it is particularly hard to edit podcasts because of the interplay between the two voices), before captioning and release. As such, GenAI offers a potential workload saving and opens-up podcasts in a way that may not have previously been possible for many academics. As AI improves, it is likely that the curation required will decrease significantly and the workload benefits will increase.

This workflow assumes a high-quality source document is available. In this specific case, adaptation of the source to obtain better outputs added ca. 60 min, although I did personally learn about my own pedagogy from the AI in the process. On ethical grounds, the source document should have the ownership of the academic user or be open-access and copyright-free.

APPLICATION OF PODCAST AS STUDENT SUPPORT

The podcast was delivered via Panopto and Blackboard to Year 1 students taking a standard face-to-face 5-lecture course on Organic Reaction Mechanisms in the middle of their first semester of university study. This course had ca. 275 students enrolled; a mixture of chemistry and biochemistry majors. Almost all students were aged 18–20 with ca. 90% being UK nationals and 10% coming from overseas. The University of York is an academically selective institution, with student performance in standardized exams at age 18 being among the top 20% of all students. The podcast was advertised to students part-way through this course. Students were told listening to the podcast was an ideal 'consolidation week' exercise while they prepared for their tutorial class. It was clearly stated that the podcast was produced using AI and was an additional resource. Engagement with the podcast was voluntary, not a course requirement.

■ STUDENT ENGAGEMENT AND FEEDBACK

In previous studies, students rated ChatGPT content about applications of chemistry more understandable than research-summary Web sites.[56] In other disciplines, the enjoyment of AI podcasts has been rated higher than reading source text.[39] Here, student feedback was collected through a carefully designed survey tool. Informed consent for data collection in the survey tool was obtained in accordance with institutional policies – the survey was delivered on an opt-in basis, with all participants being made aware prior to participation that survey data and qualitative feedback would potentially be used as part of a publication. The survey was released to students via our VLE and had separate sections for those who had, and had not, listened to the podcast, and questions exploring the attitudes of all students to AI in education. Likert responses probed the level of agreement with statements. The responses (N = 48) were interesting and divergent (Tables 1–3).

Table 1. Responses of Students Who Had Listened to the Podcast (N = 28) on a Likert Scale from 1 (Strongly Disagree) To 5 (Strongly Agree), with a Mean and Standard Deviation Calculated by Assigning Integer Scores to Responses

	1, Strongly Disagree	2	3	4	5, Strongly Agree	MEAN (SD)
The podcast was scientifically accurate			1	9	18	4.61 (0.56)
Listening to the podcast reinforced my understanding			4	14	10	4.21 (0.67)
Listening to the podcast was enjoyable		2	6	15	5	3.82 (0.80)
It was worth listening to the podcast	1		1	17	9	4.18 (0.80)
I would like more podcasts to be available to support my learning		1	5	8	14	4.25 (0.87)
Podcasts could be used to replace some lectures	9	9	4	3	3	2.36 (1.32)

For those students who listened to the podcast (N = 28), there was a high degree of satisfaction (Table 1). Students found it scientifically accurate (4.61/5.00) and reported that it reinforced their understanding (4.21) and was enjoyable (3.82). Students felt it was worth listening to the podcast (4.18) and indicated they would like more podcasts to be available to support their learning (4.25). Responses included students noting that "the podcast really helped me" allowing them to "audibly remember rather than just reading it in the handout over and over again" It was also noted that even though it was AI, it felt like "listening to an actual podcast as it was quite interactive". A number of students shared the sentiment "I hope that you continue to use it as a learning tool."

A few students reflected on how the podcast could be improved to better suit them – in particular, a number of students wanted more worked examples, or more visuals. With different prompts or more work on PowerPoint slides this would be possible, although it would also mean the podcast would have to be watched, and could not be listened to while engaging in other activities – screencasts are already available to help the students with this.

When students were asked how open they would be to AI replacing other forms of teaching, like lectures, it was clear that, although happy with the podcast as a support tool, they would not want it to replace human-led teaching (2.36/5.00).

Students who had not accessed the podcast (N = 20) were asked why (Table 2). It was not a lack of time (2.10), plans to

Table 2. Responses of Students Who Had Not Listened to the Podcast (N = 20) on a Likert Scale from 1 (Strongly Disagree) To 5 (Strongly Agree), with a Mean and Standard Deviation Calculated by Assigning Integer Scores to Responses

	1 Strongly Disagree	2	3	4	5 Strongly Agree	MEAN (SD)
I did not listen because I did not have time	8	4	6	2		2.10 (1.04)
I did not listen because I am not interested in it	4	3	4	5	4	3.10 (1.41)
I did not listen because I do not agree with the use of AI	3	1	2	4	10	3.85 (1.46)
I did not listen because I was already happy with the course material	2	3	6	6	3	3.25 (1.18)
I did not listen because I do not like podcasts	7	4	4	3	2	2.45 (1.36)
I plan to listen in future during the revision period before exams	8	5	5		2	2.15 (1.24)

access the material later (2.15), or a dislike for podcasts (2.45) that led to them not engaging. Some were simply not interested (3.10), others were happy with the course material and did not feel the need (3.25). However, the most significant reason for some students not engaging was disagreement with the use of AI (3.85).

The free comments made the views of some of these 'nonlistening' students very clear, with responses including: "I think it's vital to control how much thinking we outsource to AI, as this seems to reduce our ability to problem-solve." Others had sustainability concerns: "In an age of trying to be climate conscious, I do not think it has a place in most academic spaces." Others had academic concerns: "Not keen on the concept of generative AI being used to usurp the actual human knowledge of professors and other, more traditional, academic resources." Opinions were strong, with some students describing "hating" AI.

All respondents were finally asked general questions about the use of AI in education (Table 3). First, students were asked if they had used AI to support their own studies – half had (24/48). Considering the whole cohort, students loosely agreed AI could help staff/students work more efficiently (3.35) but there were worries about ethical problems (3.40), and there was little real appetite for it to become more integrated in education (2.54). Interestingly, when the results were divided between those who did and did not personally use AI, significant differences emerged. Users of AI were more supportive of it becoming integrated into education (3.08) than nonusers (2.00). AI-users were more likely to agree that it could help students and educators work more efficiently (3.79) compared

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Table 3. Responses of Students to Questions Probing Attitudes toward AI (N = 48) and Then Divided into Responses of Students Who Stated They Had Personally Used AI to Support Their Work, and Those Who Had Not Used AI (Users [N = 24]/Nonusers [N = 24])[a]

	1 Strongly Disagree	2	3	4	5 Strongly Agree	MEAN (SD)
AI should become more integrated into education	12	7	21	7	1	2.54 (1.08)
AI-Users	1	3	14	5	1	3.08 (0.81)
Non-AI-Users	11	4	7	2	0	2.00 (1.04)
AI can help students and educators work more efficiently	5	5	12	20	6	3.35 (1.15)
AI-Users	1	1	4	14	4	3.79 (0.91)
Non-AI-Users	4	4	8	6	2	2.92 (1.19)
AI is ethically problematic and should not be used in education		11	14	16	7	3.40 (0.99)
AI-Users		9	8	7	0	2.92 (0.81)
Non-AI-Users		2	6	9	7	3.88 (0.93)

[a]Data presented on a Likert scale from 1 (strongly disagree) to 5 (strongly agree), with a mean and standard deviation calculated by assigning integer scores to responses.

to nonusers (2.92). Conversely, ethical concerns were more likely to be cited by nonusers of AI (3.88) than users (2.92). Interestingly, students who personally used AI were more likely to have listened to the podcast (17/24, 71%) than nonusers (10/24, 42%).

Simplifying these responses, there were broadly three main groups of students. The first group was more likely to have accessed the podcast, had fewer concerns about the use of AI, used it themselves, and found the podcast useful and supportive. The second smaller group had very strong ethical concerns about the use of AI in education, were not AI-users, and did not want to engage with the podcast. A smaller third group of students were intermediate.

At this point, the survey tool explained how the podcast had been made, and some free comments reflected positively on this: "I appreciate that you looked over and edited it to make it useful for us." However, others were more negative: "Spending effort on an imperfect generative AI result feels wasteful of time and the resources used to generate the result, as the time spent altering the product could have been used creating a consolidation material without AI." Many students discussed the potential of AI in education in a balanced way and talked at length about their own experiences of AI.

The number of students responding to this opt-in survey was ca. 20% of the total cohort, and it is possible the balance of views do not fully reflect the 'average' student. It is nonetheless clear that the podcast was considered by many students to be a successful and useful tool, but some students have genuine concerns about AI. As AI is increasingly used, we must think carefully about how it is introduced into education to ensure we do not disadvantage this latter group of students.

■ LIMITATIONS OF AI

As a first step toward the creation of podcasts, this AI surpassed my personal expectations. I used the software expecting it to fail with technical chemical content, never thinking it would produce something that could be released to students. However, there were some significant limitations, although given Google NotebookLM is relatively new, it is likely many of these will disappear in future.

It is not possible to choose different voices, meaning all podcasts produced will currently be presented by the same generic American white male/female voices.[57] Some of our students reported finding these accents annoying. It would be good to have more diverse voices that better reflect the students we teach − voices with different accents, including ethnic minority groups, would engage our diverse student body in different ways. As a member of a chemistry department aiming to diversify and decolonise our chemistry teaching,[58,59] this would be a major improvement.

Most frustrating, is the inability to edit the podcast at the textual level − removing or replacing individual words or sentences. This would avoid some of the issues that led me to generate and combine multiple podcasts, and make it much easier to correct minor technical errors. It would also be useful to have the capacity to train the voices to pronounce technical words. In my experience, the software largely ignored phonetic attempts, and using phonetics makes it impossible for the software to fully understand the 'sense' of the text.

At present, Google NotebookLM podcast outputs are audio-only − although graphics can be added later using different software. Graphics are of high value in organic chemistry − indeed, in this case a graphic was added to illustrate the salbutamol synthesis, otherwise this example would have made little sense. In feedback, students wanted more visuals, although this would negate the advantage of being able to just listen while doing other things. It seems likely that in future, the AI will integrate graphics directly, to create video-enhanced podcasts. This could benefit chemistry, which is a visual, technical subject − however, GenAI can struggle, especially with molecular structures.[60,61] Indeed, some chemists have recently called for an outright ban on AI-generated structures.[62] This will remain a limitation until AI is better trained and it is expected that academic curation of chemical structures will be required some way into the future.

It is worth reflecting on the ethics of using GenAI to create podcasts. Students had concerns about environmental sustainability, the loss of human connection and the intellectual damage that may be caused by AI (see above). This software also threatens the ability of educators (or podcasters) to make a living − although the curation currently required in technical subjects may limit this in the short term. Most students expressed a strong preference that AI material should not replace face-to-face teaching. There are also other ethical concerns,[63] e.g. (i) use of content without consent to train data sets, (ii) accessibility for those in digital poverty (although this applies to much tech-assisted leaning), (iii) limited regulation leading to poor-quality online information, (iv) reduction in diversity of opinion and marginalisation of minoritised voices. However, in my personal view, it would seem better to steer AI development, rather than try to outlaw it, which may be impossible given the potential benefits.

■ POTENTIAL FUTURE DEVELOPMENTS OF AI PODCASTING

The example here only scratches the surface of podcasts in education. The PICRAT approach is useful for classification of educational interventions,[64] where 'PIC' indicates learner behaviors (Passive, Interactive, or Creative) while 'RAT' represents pedagogy (Replacement, Amplification, or Trans-

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formation). Here, the podcast was provided for passive use to amplify understanding – a 'PA' intervention. It is, however, possible to use AI podcasting to create more active pedagogies.

For example, it would be a valuable exercise to get students to error-check an AI podcast, perhaps asking them to find a specified number of errors and write a summary of each. Although, as AI 'learns', such errors will become less common. There is also the possibility of students using AI to make podcasts themselves. This could involve students creating a short source document for the AI, converting it into a podcast, and reflecting on how they might have improved the output. This would be a creative and transformative ('CT') intervention with potentially high value. Indeed, using AI shifts the emphasis of podcast work away from oral presentation and production skills to focus on quality source creation and critical reflection – perhaps representing higher-level skills that will have most value in an 'AI-world'.

Interestingly, one survey response indicated that some students already use AI this way: "If I do use AI, I'm constantly scanning it so I can see if it's made any mistakes. I think doing this helps me learn because... trying to correct the mistake allows me to develop a really deep understanding."

Google NotebookLM can also rapidly create podcasts for specific audiences – either with different levels of knowledge or with a degree of personalization.[39] The potential of AI to generate podcasts to engage the general public has been noted elsewhere.[65] It would be interesting for students to create personalized outputs, reflect on the process, and potentially collect feedback on how they connect with their target audience.

Importantly, however, student feedback provides critical reflection on the use of AI technologies in education. A small but significant number of students reported very strong negative attitudes toward AI – going as far as to criticize the institution (or myself) for using it. If we want to ensure equitable access to learning, we should avoid materials that a significant number of students refuse to engage with. This needs careful balance, although it is likely that societal attitudes toward AI will shift very rapidly – it is essential that we keep track of opinion.

■ CONCLUSIONS

In conclusion, Google NotebookLM helped create an engaging educational podcast about predicting organic reaction mechanisms. The software used high-quality source material to create a 'deep dive' audio output. Reflecting on the podcast led to the source document being edited to enhance its pedagogy – an interesting way in which AI allowed me to reflect on my own teaching. Several podcast versions were created and edited together to create a single optimized output based on the 'best bits' and avoiding technical errors. This podcast was disseminated to students via the VLE in support of a course on organic reaction mechanisms and student feedback was collected and reflected on.

The podcast outputs were surprisingly engaging, with two voices talking in a natural way. In my view, the AI did very well with background and summary material, struggling more with technically or pedagogically challenging material. However, the quality of the source, combined with careful academic curation, created a final podcast suitable for Year 1 undergraduates. The workload was relatively low, and the use of AI made it possible to integrate a 'two-person' podcast into lecture support material for the first time in my Department.

Student feedback indicates those who listened to the podcast were very positive, finding it scientifically accurate and worth listening to. However, a number of students did not engage with the podcast, in a significant number of cases because they disagreed with the use of AI in education, on ethical, societal and sustainability grounds.

It should be noted that this was a single institution study focused on organic chemistry content – AI podcasting may have different implications in different types of institution or subject areas. Many of the reflections on the process described here are personal and therefore subjective. It is also possible that the opt-in survey may not fully represent student opinion. However, it is nonetheless clear that AI interventions in education are currently somewhat divisive, and as AI is increasingly prevalent, we must think carefully to ensure that one group of students is not disadvantaged because of their concerns about the technology. Furthermore, this study did not set out to measure any specific learning gain offered by this AI podcast – that is left to future work.

In summary, this work demonstrates the potential of Google NotebookLM, with academic curation, to generate usable audio podcast material even in a highly technical topic, like organic reaction mechanisms. It is anticipated that the software will develop further and overcome some limitations, like fixed voices, lack of editing, and incorporation of images. Furthermore, there is significant potential for this tool to be used in more creative and transformative ways with students. We stand at the precipice of change in terms of the capacity of AI to produce high-quality audio material in technical subjects. With responsible development, this could potentially emerge as a powerful approach in educational settings.

■ ASSOCIATED CONTENT

Supporting Information

The Supporting Information is available at https://pubs.acs.org/doi/10.1021/acs.jchemed.5c01652.

Ethics statement, podcast original scripts (including highlights of what was used in the final version), and full final written podcast transcript with timings (PDF)

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Notes

The author declares no competing financial interest.
Weblink to podcast: https://www.youtube.com/watch?v=gK36R_i-AMs

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