

Work-In-Progress: Scaffolded Podcasts through a Two-Semester Hydrology Course Sequence

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As a Master's Candidate in Engineering and Community Practice, I am looking for a way to support a variance of perspectives in engineering. I am always seeking to understand what I can about the world. I would also like to bring my collected knowledge into the realm of sustainable end-of-life care. Working with and learning from leaders who catalyze forward motion within engineering education has given me many opportunities to direct my student experience (as well as my emerging professional experience) to nurture my passions within the field. Overall, my goal is to use my education and understanding of the world as tools for accessible, loving change.

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Abstract

Key Words:

Hydrology, Podcasts, Scaffolding, Storytelling

Interests:

Academia-Industry Connections, Engineering, Undergraduate

This work-in-progress paper explores the efficacy of using student-recorded podcasts to inspire, motivate, summarize, and convey topics in hydrology. This study describes the pilot program structure and summarizes the benefits of this unique learning tool employed within the Environmental Resources Engineering program at Cal Poly Humboldt. In Spring 2025, 4th-year and graduate students enrolled in Hydrology II recorded a set of podcasts on an advanced hydrology topic of their choosing. In Fall 2025, these podcasts were integrated into the curriculum of Hydrology I for 3rd and 4th-year students. This scaffolded approach, where students share their expertise through oral media, is an effective pedagogical technique that supports a variety of learners and honors and uplifts storytelling as a valid learning tool.

Creation of the podcasts: Allowing the students to select their own topics promotes their agency as learners. The students worked in groups of 3-4 and were required to interview a working professional, which serves the dual purpose of professional networking. The Hydrology II class created four podcasts for this pilot study: “The 1964 Flood and How Extreme Storm Events Impact Watersheds”, “Impacts of Green Burials on Groundwater Quality”, “The Liquid Landscape: Klamath Dam Removal and Hydrology”, and “Are Water Parks a Waste of Water?”. The students also created an accompanying background slideshow, and have provided permission for the recordings to be used publicly.

Integrating the podcasts into an introductory hydrology course: For this pilot study, the four student-developed podcast episodes were presented in Hydrology I as part of a stand-alone assignment during their review week to assist in deepening their learning. Students were instructed to choose one of the four episodes to listen to and provide a reflection in which they connected the episode to topics and concepts covered in the course.

Assessment: To assess the efficacy of this project, students in both hydrology courses will be surveyed. For this pilot study, a modified version of the Music Model of Motivation survey will be utilized to assess the impact of this assignment on students’ motivation in the introductory

course. Additional qualitative questions will also be included to explore student feedback on improving the assignments as well as interest in developing their own hydrology podcast episodes. A simpler survey will be developed for the advanced hydrology course students in a future semester. The deliverables from this study will include a publicly available student-created podcast repository, and assessment data exploring the impacts of the podcast project on student learning.

Next Steps: Learnings from this pilot study will assist in refining the assignments as well as the research methods. We are looking for feedback and discussion on other methods to assess the efficacy of this scaffolding and assignment on student learning and motivation. We also hope to encourage and inspire other environmental engineering faculty to explore innovative ways to incorporate oral storytelling and technology in their classroom activities.

Introduction

This work-in-progress paper explores the efficacy of using student-recorded podcasts to inspire, motivate, summarize, and convey topics in hydrology. Cal Poly Humboldt curriculum in Environmental Resources Engineering (ERE) includes a potential two-course series on hydrology. Hydrology I (ENGR 440) is required for all ERE majors, and encompasses the hydrologic cycle, math models of rainfall runoff, surface and groundwater hydrology, and probabilistic design concepts. Students enrolled in Hydrology I are typically in their 3rd or 4th year of engineering study. Hydrology II is a cross-listed course that serves as a Design Elective (ENGR 441) or graduate-level course (ENGR 541) that covers rainfall runoff processes, infiltration and groundwater vadose zone, water quality models and operational (stochastic) hydrology, and groundwater quality. Design Electives include an engineering design component that is a major facet of the course curriculum, and the graduate-level courses require additional assignments and/or projects to stimulate independent engineering thought. Students are allowed to choose Hydrology II as one of their electives; thus introducing Hydrology I students to the content and assignments of Hydrology II through this podcast project may promote enrollment in this particular elective course.

Students in an advanced hydrology course (Hydrology II) were tasked with creating a podcast on a hydrology topic of their choosing, ideally promoting agency and self-efficacy by engaging with the material. This process was then repeated in the following semester's introductory hydrology course (Hydrology I), utilizing the Hydrology II podcasts as guidance, examples, and inspiration for the introductory students. This creates a scaffolded curriculum across the two courses; the technical content and storytelling tools are repeated and built upon throughout two semesters.

This study aims to address the following research questions:

1. Does scaffolding across curriculum increase agency and motivation?
2. Are students inspired by the use of audio as opposed to traditional course delivery?
3. Are podcasts effective ways to learn technical information?

Background

Using Podcasts

Podcast usage in the classroom has increased over the past several decades. The beginnings of their use in the engineering classroom were primarily instructor-produced podcasts, another way to convey information during the rise of online instruction [1, 2]. In recent years, a growing number of studies have evaluated the use and benefits of integrating student-led podcast creation into engineering education [3, 4], with some specifically in environmental engineering [5].

Reference [6] served as a case study on how a student-created podcast could be implemented in the engineering classroom. In this study, a team-based, student-created podcast assignment was developed for an upper-division engineering communication course at a large,

R1 institution. The students were tasked with generating a podcast episode examining an aspect of one of the 2017 Engineering Grand Challenges or wicked problems including an interview with an individual outside of their team. This study focused on the assignments aligned with the revised ABET outcomes and argued that podcast development supports student outcomes around communication, acquiring and applying new knowledge, exploring social impacts, and developing teamwork skills [6].

Reference [7] examined how a podcast-generation assignment in an online upper-division engineering technology course addressed common motivation and engagement challenges seen in online learning environments. In this course, Electrical and Mechanical Engineering Technology students at a large research-focused U.S. university were given eight weeks to complete an asynchronous iteration of this project. The students also completed a metacognitive reflection assignment, which the researchers analyzed using thematic analysis. Five themes were reported including seeing value in the content, often emphasizing real-world application and why the learning mattered to them beyond the class as well as interest-driven engagement and persistence associated with the project. These themes were then mapped to Alderfer's ERG theory of motivation. The preliminary results of this study indicate that the podcast design project addresses these motivation and engagement challenges for their students [7].

Scaffolding Across Curriculum

Scaffolding within a single engineering course or throughout a specific lesson or assignment has proven to be an effective strategy for student engagement and knowledge retention [8, 9]. Scaffolding is an effective technique in K-12 education through graduate level studies [10, 11], and also supports heightened interest for historically marginalized students [12]. For this study, scaffolding implies the use of concepts and assignments that span and

intentionally build across multiple courses. This strategy has not been as widely documented, though Reference [13] found that scaffolding across a six-semester design sequence resulted in increased interest and comprehension. We hope to build on this body of literature by assessing the efficacy of scaffolding through use of student-generated podcasts.

Methods

Creating the Podcasts

In Spring 2025, groups of 3-4 students in Hydrology II created their own hydrology podcasts. The objectives of this assignment were to:

1. Use effective science communication techniques to create, record, and produce a podcast episode
2. Build your professional network by interviewing at least one professional
3. Convey technical science and engineering content to a non-engineering audience
4. Become an expert on the hydrology topic of your choice

The guidelines for the podcasts were the following:

- 10-20 minutes in length
- At least one student voice in the recording
- Interview a professional who is not a Cal Poly Humboldt professor, have their input recorded
- Complete all recording waivers as needed
- Tell a cohesive story about a hydrology topic
- Be professionally edited
- Work as a team (quantified through a teamwork score adjustment)

The students were provided with explicit guidelines and due dates to keep everyone on track, and to provide an opportunity to receive feedback and adapt. The employed timeline is as follows:

- Week 1:
 - Select a general topic
 - Perform introductory research and find a professional to interview
- Week 2:
 - Continue research
 - Reach out to interviewee and schedule an interview
 - Complete a rough draft of interview questions
- Week 3:
 - Complete final draft of interview questions
 - Hold interview
 - Work on student script and begin recording
- Week 4:
 - Finish all recording
 - Work on editing
- Week 5:
 - Create timed slideshow with relevant images to play alongside podcast
 - Final editing
 - Submit podcast files
 - Listening Party

Each team selected a topic within hydrology, and was instructed to practice effective storytelling to convey the material. The students performed research, interviewed a professional, and

recorded and edited the podcast to be shared in Hydrology I and as a public-facing podcast available for download. Students also created a timed slideshow for each podcast episode with photos and/or relevant visual content to play automatically alongside the podcast. The culminating event for this assignment was a class listening party, complete with the accompanying visuals.

To prepare for the podcast creation, several specific assignments and activities were provided leading up to the podcast project. First, students were instructed to individually listen to three selected podcasts referencing advanced hydrology themes: 99% Invisible “A River Runs through Los Angeles” [14]; The Economics of Everyday Things “Weather Forecasts” [15]; and Stuff You Should Know “Why is Venice so Wet?” [16]. The students provided a brief summary of each podcast, and reflected on two or more aspects of effective storytelling each podcast employed. Lastly, the students were asked to describe three techniques they would like to use when creating their own podcasts.

Next, students participated in a storytelling activity during a lab session as a way to “warm up” and begin to think more deeply about their communication [17]. Students learned the basics of a story arc, and were encouraged to quick-write their own story on any topic within a ten minute time-limit that followed the traditional story structure of Exposition, Initial Incident, Rising Action, Climax, Falling Action, Resolution, and Denouement. At the end of the quick-write, students were invited to voluntarily share their stories. This activity allowed students to practice creating effective stories, and to build community with their peers by sharing out and listening.

Immediately after this exercise, groups and topics for the podcast project were selected using an intentional brainstorming session. Students were asked to brainstorm different

hydrology podcast ideas and write them on separate sticky notes. The notes were assembled on the board, rearranged and amended until themes emerged. Students were then asked to select which topics they were most interested in, which eventually resulted in four groups of 3-4 students who were excited to explore their topic more deeply.

To interview a working professional, students were encouraged to reach out to their own professional networks, find professionals online (e.g. using LinkedIn), and were permitted to seek the instructor's assistance. Incorporating professional networking into the curriculum for these students is valuable; these were all 4th-year or graduate students who were approaching the job-search phase of their careers. The interviews were conducted in a semi-structured format where the research questions were pre-developed but open-ended [18]. Students submitted a draft of their interview questions, and received feedback before conducting the interviews to ensure productive meetings and to help shape the narrative. The questions varied from exploratory (e.g. "what is your background and your current work in the field of hydrology?") to project specific (e.g. "what kinds of short- and long-term impacts do extreme storm events, like the 1964 flood, typically have on watersheds?"), and also touched on advice for early-career engineers and the future of the discipline (e.g. "what are some of the biggest challenges or opportunities you see for hydrologists today?").

The students conveyed the voluntary and public-facing nature of this assignment to each of the interviewed professionals; all subjects whose voices were recorded submitted the requisite waivers provided by Cal Poly Humboldt ensuring that the podcasts could be publicly disseminated. To prepare for the development, recording, and editing process, the students were directed to the Library Guide on Creating Podcasts [19] and were encouraged to use Zoom,

phone recordings, and the podcast recording studio and software available at the Cal Poly Humboldt Library to create the .m4a audio files.

The students developed four podcasts for this pilot study: “The 1964 Flood and How Extreme Storm Events Impact Watersheds”, “Impacts of Green Burials on Groundwater Quality”, “The Liquid Landscape: Klamath Dam Removal and Hydrology”, and “Are Water Parks a Waste of Water?”.

This process was then repeated in the Fall 2025 semester with introductory hydrology students (Hydrology I). These students were provided the podcasts developed in Hydrology II as inspiration and guidance, resulting in seven new podcasts created by teams of two or individual students. Topics included impacts of local groundwater use on stream levels, local wastewater treatment systems and the policies surrounding them, and Indigenous stream restoration projects in western Montana.

Assessment

The MUSIC Model of Motivation [20] is an academic framework that supports the design of effective classes by considering empowerment, usefulness, success, interest, and caring. In order to assess research questions 1 and 2 (RQ1. Does scaffolding across curriculum increase agency and motivation? And RQ2. Are students inspired by the use of audio as opposed to traditional course delivery?), a modified MUSIC Inventory may be implemented [21]. To address RQ1, students in Hydrology I will be asked to reflect on their success in future Hydrology classes resulting from their interaction with the podcast project. To address RQ2, the students in both classes will be provided a survey specific to a traditional assignment (such as homework or an exam) and another survey specific to the podcast project. Table 1 provides a

selection of potential questions derived from the MUSIC Model to address the motivational climate of the hydrology classrooms.

Table 1: Adapted MUSIC Model questions addressing RQ1 and RQ2

	RQ1: Does scaffolding across curriculum increase agency and motivation?	RQ2: Are students inspired by the use of audio as opposed to traditional course delivery?
Empowerment	N/A	• I had the opportunity to decide for myself how to meet the assignments goals. • I had control over how I learned the assignment's contents.
Usefulness	• In general, the listening to the Hydro II podcasts was useful to me. • I will be able to use the knowledge I gained in this course in future classes like Hydro II.	• In general, the assignment was useful to me. • The knowledge I gained in this assignment is important for my future.
Success	• I feel I could be successful in Hydro II.	• I felt that I could be successful in meeting the academic challenges in this assignment.
Interest	• I would enjoy the instructional methods used in courses like Hydro II.	• The instructional methods used for this assignment held my attention.
Caring	• The instructors in Hydro I and II were/seem to be willing if I need help. • The instructors in Hydro I and II were/seem to be respectful of me and the other students.	N/A

To assess research question 3 (RQ3. Are podcasts effective ways to learn technical information?), we intend to develop instruments assessing pre- and post-activity technical knowledge, with the intent to separate the efficacy of learning from a previously recorded podcast from creating your own podcast. Lastly, general student feedback on the podcast activity has been collected through course surveys and upon reflection of one of the student co-authors.

Preliminary Results: Student Reflections

Student reflections as submitted through the course evaluations were largely positive. A student in Hydrology II noted “[I] enjoyed the podcast assignment, which was also very engaging for me, likely because I was able to work on a topic I am passionate about.” Students

from Hydrology I also reflected on high levels of engagement: students commented on being “most engaged” while “completing the project at the end of the semester for this class.”

A co-author of this study has provided the following reflection:

The final project in the Hydrology II course (taken in my final undergraduate semester) was one of my favorite projects of my academic career as an engineering student and one of the most directly applicable to my professional development and career. The podcast project was daunting, it was unconventional, started near the end of the semester, and included central aspects of self-motivation and self-direction as well as collaboration and group work. As such, there were several of my peers who felt a lack of excitement for the project. My feelings were the opposite, I was looking forward to a project that used engineering knowledge for something more creative and open ended than the typical design projects I experienced in other upper division classes.

Through working on this project I was able to practice group leadership, interdisciplinary skills (video and audio editing, journalism, etc.), and professional relationship building. I also got to spend time researching and compiling information on a topic I am largely fond of that does not naturally overlap with engineering work. The professional that our group interviewed for our podcast (“Impacts of Green Burial on Groundwater Quality”) is a soil and rangeland specialist and co-founder/current board member for a local conservation burial ground trying to get up and running. I was invited, after conducting the interview, to join the advisory board for the cemetery and conservation burial ground. I was able to make a connection in my dream field, one that I have had to force-fit into my engineering studies for the full length of my academic career. This project was helpful to me both as a student who wants to find a place between two fields that have a low frequency of intersecting, and as a person struggling to find the creativity and community in the engineering world.

Lessons Learned and Next Steps

This work-in-progress paper represents a pilot study, and as such, there are many avenues for improvement and refinement. Understanding, adapting, and selecting appropriate artifacts or tools for assessment, and completing the Institutional Review Board approval is a top priority. We seek any suggestions or recommendations that would ensure we are asking the appropriate questions to accurately understand the impacts of this project.

It is challenging to sustain scaffolding across curriculum in the face of changing university dynamics and course offerings. Due to shifts in enrollment and teaching assignments, Hydrology II is not offered in Spring 2026; thus the next round of podcast creation will either be postponed, or may be moved to another upper division course. To facilitate the use of podcasts as a learning tool, the authors intend to develop a customizable rubric that addresses expectations for referencing the appropriate course material and including relevant citations that could be easily adopted in other courses. It is entirely feasible that this concept could grow beyond hydrology and be applied more widely to many topics in Environmental Resources Engineering.

As the four podcasts from Hydrology II represented the interests of that particular group of students, it was difficult to align the limited podcast topics to the weekly topics covered in Hydrology I. To build a more robust podcast repository and to give the students a chance to create their own stories, Hydrology I students also created podcasts. The authors intend to create a topic inventory to steer towards more complete coverage of introductory hydrology curriculum without compromising the ability for students to select their own topics. As this podcast repository grows, topically relevant podcasts could be implemented within each lesson.

The podcasts will be made publicly available, such that they can be easily integrated into curriculum at other universities, or used as a tool to inspire anyone to learn about this overlapping niche of earth science and engineering. This will also provide each podcasting student with a unique, citable deliverable that could be used for self-promotion in their future careers. Continuation of this scaffolded podcast project will help us determine whether students experience increased agency, motivation, inspiration, and breadth of technical knowledge.

References

- [1] Paterson, K. (2007, June), *Podcast Enhanced Learning In Environmental Engineering* Paper presented at 2007 Annual Conference & Exposition, Honolulu, Hawaii. 10.18260/1-2--2047
- [2] Chen, J. (2009, June), *The Effectiveness Of Asynchronous Podcasting Of Classes* Paper presented at 2009 Annual Conference & Exposition, Austin, Texas. 10.18260/1-2--5424
- [3] R. V. Adams and E. Blair, "The learner-generated podcast: engaging postgraduate engineering students in a mathematics-intensive course," *Research in Post-Compulsory Education*, vol. 19, no. 2, pp. 132-146, 2014.
- [4] E. Alpay and S. Gulati, "Student-led podcasting for engineering education," *European Journal of Engineering Education*, vol. 35, no. 4, pp. 415-427, 2010.
- [5] Paterson, Kurtis G. "Assessment of Podcast-Enhanced Learning in Engineering Education." *2007 North Midwest Section Meeting*. 2021.
- [6] Ramsey, H. (2019, April), *Student-Created Podcasts in the Engineering Communication Classroom* Paper presented at 2019 Pacific Southwest Section Meeting, California State University, Los Angeles , California. 10.18260/1-2--31843
- [7] Lucas, T., & Kotla, B., & Shirey, K., & Bosman, L. (2024, June), *Motivating Students to Engage, Collaborate, and Persist with Classroom Podcast Creation* Paper presented at 2024 ASEE Annual Conference & Exposition, Portland, Oregon. 10.18260/1-2--47783
- [8] Kaul, Sudhir, and Pattabhi Sitaram. "Curriculum design of statics and dynamics: An integrated scaffolding and hands-on approach." *2013 ASEE Annual Conference & Exposition*. 2013.

- [9] Clark, Renee M., and Arash Mahboobin. "Scaffolding to support problem-solving performance in a bioengineering lab—a case study." *IEEE Transactions on Education* 61.2 (2017): 109-118.
- [10] Boylan-Ashraf, Peggy, Steven Freeman, and Mack Shelley. "A case for the need of using scaffolding methods in teaching introductory, fundamental engineering mechanics classes." *Journal of STEM Education* 16.4 (2015).
- [11] Lee, Chien-Sing, and Janet L. Kolodner. "Scaffolding students' development of creative design skills: A curriculum reference model." *Journal of Educational Technology & Society* 14.1 (2011): 3-15.
- [12] Girgis, Morris M. "A Scaffolding Case Study for Teaching Engineering Problem Solving to Underrepresented Minorities." *2015 ASEE Annual Conference & Exposition*. 2015.
- [13] Putnam, Craig, James O'Donnell, and Nicholas Bertozzi. "Scaffolding and fading within and across a six-semester CDIO design sequence." *Proceedings of the 6th International CDIO Conference*. 2010.
- [14] Jacobs, Gillian. *A River Runs Through Los Angeles*. 16 July 2024. *99% Invisible*, 99% Invisible, <https://99percentinvisible.org/episode/a-river-runs-through-los-angeles/>. Podcast.
- [15] Crockett, Zachary. *Weather Forecasts*. 19 May 2024. *The Economics of Everyday Things*, The Economics of Everyday Things, <https://99percentinvisible.org/episode/a-river-runs-through-los-angeles/>.
- [16] Bryant, Chuck, and Josh Clark. *Why is Venice so Wet?* 3 June 2014. *iHeartRadio*, Stuff You Should Know, <https://www.iheart.com/podcast/1119-stuff-you-should-know-26940277/episode/why-is-venice-so-wet-29467765/>.

- [17] Barchas-Lichtenstein, Jena, et al. "Science through storytelling or storytelling about science? Identifying cognitive task demands and expert strategies in cross-curricular STEM education." *Frontiers in Education*. Vol. 8. Frontiers Media SA, 2023.
- [18] Given, L. M. (2008). Semi-Structured Interview. In: The SAGE Encyclopedia of Qualitative Research Methods. *Thousand Oaks, CA: SAGE Publications, Inc.* pp. 811-812 Retrieved from: <https://doi.org/10.4135/9781412963909.n420>
- [19] Miller, Tim. "Creating Podcasts." *Cal Poly Humboldt Library Guides*, 2025, <https://libguides.humboldt.edu/creatingpodcasts>. Accessed 7 April 2025.
- [20] Jones, Brett D. "Motivating Students to Engage in Learning: The MUSIC Model of Academic Motivation." *International Journal of Teaching and Learning in Higher Education*, vol. 21, no. 2, 2009, pp. 272-285. *ERIC Institute of Education Sciences*, <https://eric.ed.gov/?id=EJ899315>.
- [21] Jones, B. D. (2025). User guide for assessing the components of the MUSIC® Model of Motivation. Retrieved from <http://www.theMUSICmodel.com>