
ARTICLE

The Outcomes and Experiences of Students in Course-based Undergraduate Research Experience (CURE)

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Acknowledgements: Funding for this research was provided by East Carolina University Office of Undergraduate Research. The authors would like to thank Dr. Eddie Jacobs for the use of the Electronic Music Studio for testing.

Driscoll, V., Palma, Z., and Beebe, K., *Dialogues in Music Therapy Education*, 3(1).
DOI: <https://10.18060/27164>

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Publisher: Department of Music and Arts Technology, Indiana University-Indianapolis

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Abstract

Research is a pivotal element of music therapy education. Finding, interpreting, and integrating research into clinical practice are required in the professional competencies (American Music Therapy Association, 2013, 2021). Course-based undergraduate research experiences (CURE) have been identified by the National Science Foundation to increase access to underrepresented student populations in STEM programs. Fewer studies have been seen in humanities. To develop competency in a cohort of music therapy students, a CURE was developed with student research collaborating on all parts of the study. Elements of the CURE were guided by Dvorak and Hernandez-Ruiz (2019); one of the first publications in music therapy using this approach with students. However, in the present CURE each student developed their own research question within a larger project, modeled after a lab-based approach. Students who wished to present their research as a poster for the regional or national conference were prepared to do so. Analyses of student responses on the Research Skill Development Questionnaire (RSDQ: Dvorak et al., 2021) revealed significant improvements in three categories including knowledge of research-related content, research skills, and research dispositions. Student reflections shared a growth in comfort with and accessibility of conducting research as something “not just for scientists and doctors” but that

Driscoll, V., Palma, Z., and Beebe, K., *Dialogues in Music Therapy Education*, 3(1).
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was “a lot less stressful, and really fun!” Others reported a motivation to identify questions and conduct research in the future. The outcome was a fully immersive educational experience and functioned as a resource for members within the School of Music to educate on hearing loss prevention.

Keywords: Music Therapy Education, Course-Based Undergraduate Research, Student Experiences, Student Outcomes

Driscoll, V., Palma, Z., and Beebe, K., *Dialogues in Music Therapy Education*, 3(1).
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Introduction

The concept of research is often an intimidating concept for undergraduate students who often think of it as someone in a lab coat, with goggles, and pipettes. More intimidating still is the outcome of research, “creating new knowledge,” which may seem beyond the grasp of a student’s ability. In music therapy, evidence-based practice involves incorporating the “best available research, the music therapists’ expertise, and the needs, values, and preferences of the individual(s) served” (American Music Therapy Association, 2010, 2015). Evidence-based practice and research have a mutualistic relationship; evidence informs the practice, which supports the development of new research questions and applications of new concepts. Students are exposed to many diverse types of research through their educational matriculation, but for many students the researchers and authors they access are often viewed as out of reach or placed on pedestals. They do not necessarily make a connection between the work they do, and the services they provide, as being a building block of research.

Music Therapy Pedagogy

Coursework in music therapy requires direct application of learning situations outside of the classroom per the American Music Therapy Association (AMTA) Standards for Education and Clinical Training (American Music Therapy Association, 2013, 2021). Often these applications come from education of therapeutic principles to clinical music therapy applications; however, the incorporation of data and research elements also inform clinical practice. Didactic approaches to learning are typically included in foundational coursework with elements of application incorporated and evaluated through assessments (i.e., tests), assignments, and small projects. Due to

limitations in course length and the often-complex nature of research, smaller or hypothetical projects are undertaken to provide opportunities for learning experience or scaled to fit a college course's constraints.

Conversely, course-based undergraduate research experiences (CUREs) are learning experiences that involve entire classes in addressing a research question, often embedded into a formal laboratory course (Auchincloss et al., 2014; Brownell & Kloser, 2015). CUREs can be independently created by the professor or implemented from a network model (Shortlidge et al., 2017). Outcomes from these research opportunities result in increased understanding of how to conduct a project and confidence among students in their research skills (Russell et al., 2007). When investigating what drives student interest and gain in CURE, Russell et al. (2007) found enthusiasm was the key element to optimizing the experience.

Traditional laboratory mentorships often involve one-on-one mentorship between a student and researcher. They also favor students with higher academic standing and those who have financial advantages that allow them time to pursue such endeavors (Shortlidge et al., 2017). Incorporating CUREs into the curriculum provides opportunities for increased understanding, direct application, interpretation, and presentation of the information in a way that is relevant and eases student learning (Russell et al., 2015; Russell et al., 2007; Shortlidge et al., 2017). CUREs increase access to direct research experiences for many students who would otherwise be unable to access the experience and increased the presence of underrepresented students (Auchincloss et al., 2014; Bangera & Brownell, 2014; Dolan, 2016; Russell et al., 2007; Shortlidge et al., 2017). The use of CURE was introduced into the education and training of music

therapy students within recent years by Dvorak and Hernandez-Ruiz, with reported gains in scientific thinking, attitudes and behaviors, personal gains, and research skills toward clinical research.

Effectiveness of CURE

Elements of the CURE were guided by Dvorak and Hernandez-Ruiz (2019). Additionally, Dvorak and Hernandez-Ruiz supplied suggestions for faculty when implementing CURE to increase the success of programs. These suggestions included spending more time educating students how to prepare a scientific poster and calibrating/maintaining the instruments used for measurements within the experiment (Dvorak & Hernandez-Ruiz, 2019). The authors noted students reported minimal improvement in feeling part of the scientific community and interacting with other scientists. The recommendations from Dvorak and Hernandez-Ruiz were incorporated within this CURE project by encouraging students to present findings at conferences and create scientific posters, discussing them with other attendees and professionals in the field, and empowering them to share their knowledge of the process and the product with other students, clinicians, and educators. This increased the student's ability to see the full process of research take place from conception to delivering the findings, to the generation of future questions.

Unlike the studies by Dvorak et al. (2021), which utilized bounded and scaffolded research approaches, the current project was driven by student interest and motivation resulting in an embedded study with an open-ended approach (Willison et al., 2018). According to Willison et al. (2018), open-ended approaches provide the opportunity for student ownership under the guidance of the advisor. The students, who functioned as

co-Primary Investigators (co-PIs) in this study, conceived of the proposed project during the Fall of 2021 in their Psychology of Music course. During open discussion about hearing, students expressed interest in learning more about specific concepts related to how age-related hearing loss affected perception of frequencies above the traditional audiogram (beyond 8000 Hz). This topic involved discussions related to how musicians perceive sound in comparison to non-musicians and the effect that exposure to sound over time can have on hearing perception and traditional audiogram frequencies. Topics included the effects between instrumental “families” of musicians and the results on musicians’ hearing as well as whether musicians within their school are showing greater propensity to experience issues. The critical moment occurred when a student in the course played a “dog whistle” tone through their phone to which most classmates recoiled while other students and the professor showed no reaction. This dichotomous response prompted the students to ask if certain musical experiences might lead to a more rapid loss of higher frequencies typically associated with increased age and noise exposure.

Purpose

The purpose of this project was two-fold: 1) to undertake an open-ended research project embedded into the course content of research methods realized through active research investigations, and 2) to educate the research team and fellow music students on the importance of hearing health protection to sustain their careers as musicians. It was expected that students would grow in their knowledge of the research process. Additional hopes for outcomes were increased confidence in the research process and their abilities to undertake future projects. We hypothesized that

significant differences would be present from the questionnaire analysis comparing the first to last day of coursework.

The overarching research questions for the current study were similar to those of Hernandez-Ruiz et al. (2023):

1. What are the students' self-reported differences pretest to posttest in their research knowledge, research skills, and research dispositions after participating in a CURE, as measured by the Research Skills Development Questionnaire (RSDQ; Dvorak et al., 2021)?
2. Do individual items within each RSDQ category show significant changes pre- to posttest?
3. What are the perceived outcomes of a CURE as reported by students' open-ended responses to reflection questions?

Method

Study Design

Nine students enrolled in a required music psychology course at a Southeastern university completed a collaborative research project. Students represented a range of socioeconomic and racial groups. Nearly every student held employment in order to support their education. The experience was informed by Dvorak and Hernandez-Ruiz (2019) study in which students were included in a research study where they assisted in the active phases of the study: consent, data collection, and analysis. In the present study, students took active roles in the development of all aspects of the project, including the study's inception, collaborating with the instructor to conceptualize and apply for grant funding.

Due to a collective interest in extended, high-frequency hearing among the class, a large-scale study was created that enveloped the students' skills and interests. Within the research methods course and its lab, student members took part in an embedded open-ended research project during the Spring 2022 semester. The students were guided through the research process by the professor, as part of a research lab course, ensuring they were supplied ample time to complete the full project and the experience of a collaborative project. Elements of the course included completing ethics and training requirements; reviewing and approving the IRB application; finding and analyzing research; engaging in experiential activities; collecting data; debriefing study participants; and interpreting and writing about findings. Additionally, students were provided with the opportunity to present their findings to other music therapy professionals and students at an academic conference, an internal conference promoted by the University and following a general recital class within the School of Music. Rather than developing individual studies, as has occurred in the previous semesters, the students were guided through the research process being conducted as a collective project, ensuring a larger-scale study could be conducted and the timeline completed with ample time to allow for adequate analysis and interpretation. Exceptions from student responsibility included acquisition of materials (audiometer, iPads, and study compensation; gift cards that required additional access from the university).

By embedding the open-ended approach into this course, each student was able to develop their own research question about hearing abilities specific to one or more subgroups of the target population (musicians) that were collectively discussed in a class. These comparisons included faculty, students, instrumentalists, vocalists, specific

families of instruments (i.e., brass vs. woodwind), gender, and specific instrumentation comparisons (i.e., high brass versus low brass, trombone vs. tuba), years in education, as well as non-musician comparisons in the student and community populations.

Students collaborated on the order of protocol, data collection tools and analysis, and presentation of their individual findings.

Within the study protocol, students measured pure-tone and high-frequency audiometry with faculty, staff, and students in the School of Music and a comparison group of non-musicians. Specifically, their population recruited students majoring or minoring in music, their primary instrumental or voice faculty, and ensemble directors as well as non-musicians from the university and community (n=96). Because of the project's collaborative nature, students could determine how much time they could dedicate toward the project's specifics without affecting those who had employment and added demands outside the classroom. We were interested in how this approach to their coursework would affect their learning and their view of undertaking a research project.

Assessment of student knowledge and development was generated through coursework, exams, and a final manuscript. More information was collected throughout the course in the form of self-reflection by the professor, material preparation, and a final presentation of their learning in the form of a research paper. Requirements for the final paper were to create a manuscript that was eligible for submission to the E. Thayer Gaston writing competition (American Music Therapy Association, 2022). Students who wished to present their research as a poster for the regional or national AMTA conference were prepared to do so.

Measures

Research Skill Development Questionnaire (RSDQ)

To evaluate gains in student learning and ensure the development of goals across the course, the Research Skill Development Questionnaire (RSDQ) was administered on the first and last day of the course as modeled by (Dvorak & Hernandez-Ruiz, 2019). The measure includes 30 statements broken over three sections: 1) Research related content knowledge (nine statements); 2) Research Skills (16 statements); and 3) Research dispositions (five statements). Each statement is assessed on a five-point Likert scale from 1=Very Poor to 5=Excellent. Students were tasked with rating each statement as it related to their confidence and knowledge.

Students completed the first RSDQ on the first day of coursework as a self-assessment, prior to participation in the CURE, and once again at the end of the semester. The CURE and completion of the RSDQ were part of the regular course assignments, so all students were expected to take part in the CURE and complete the assessment.

Educator Reflections

Throughout the course, the professor collected thoughts and reflections on the project, including observations of student behavior. These reflections and notes were evaluated upon the semester's completion, after grades were reported, but before student surveys of instruction were provided to prevent any effects of anonymous student feedback on the interpretation of notes.

Student Reflections

At the course's beginning, student researchers were given a notebook to include drafts of research questions, thoughts, and reflections on the project. A collective lab notebook was also used to input each subject's de-identified information, to include possible issues that could cause noise in the data, and to include other information that might have been of interest to the team. Following coursework students were prompted to share their thoughts and feelings with the following questions as well as anything else they wished to share:

1. What did you learn about research?
2. What was scary when we started?
3. What surprised you about the class?
4. What are you most proud of?
5. What would you recommend I (professor) do in future classes?

Results

To address Research questions 1 and 2, student outcomes and scores were analyzed with JMP® software. Wilcoxon each pair test was selected due to the non-normal distribution. Wilcoxon each pair is a non-parametric test that also corrects for multiple comparisons. Because student data on the forms was blinded, comparisons within individual students were not possible. Instead, responses were analyzed as composite scores.

Pre- to Posttest Comparison

To address the first research question, composite scores for the three content areas were analyzed. Total scores were varied for each group due to the number of items differing in each content area. Scores were significant from pre- to posttest in each of the content areas (see Table 1), with an increase of 10.75 points in Research Knowledge, a 20.78 increase in Research Skills, and a small but significant increase of 3.95 for Research Dispositions.

	Range		Average per Student <i>SD</i>		p-value
	Pre	Post	Pre (<i>SD</i>)	Post (<i>SD</i>)	
Research Knowledge	21-36	28-45	28.125 (5.03)	38.875 (5.69)	0.0072
Research Skills	36-63	42-78	47.875 (9.05)	68.625 (11.84)	0.0098
Research Dispositions	12-22	11-25	17.429 (3.91)	21.375 (4.47)	0.0477

Table 1. Average Total Pre- and Postscores for the content areas of the RSDQ. P-values that are bolded indicate significance.

For Research Question 2, analysis of independent items conducted using average scores for each question. At pre-test student average self-assessment results for individual items were “fair” for all items on the RSDQ. Student averages at pretest across items ranged from 2.32 to 4.03, with a class average at pretest of 3.12 points. Post-test scores ranged from 2.59 to 4.93 ($m=4.31$). Significant differences were found for all items in “research related content knowledge” ($p \leq .02$), except for item 5, which queries student perceived ability to employ primary and secondary evidence as support for the argument of findings. The greatest significance was found for the students’ ability

analyze texts and data in ways consistent with a recognized and articulated theory/approach ($p=.0048$).

	Range		Average, <i>SD</i>		p-value
	Pre	Post	Pre (<i>SD</i>)	Post (<i>SD</i>)	
Research Knowledge					
1. Define a topic of appropriate scope and significance in the discipline.	2-4	3-5	3.125 (0.64)	4.375 (0.74)	0.0080
2. Pose a clear, arguable significant research question at the outset.	2-4	3-5	3.5 (0.76)	4.625 (0.74)	0.0105
3. Read texts and data closely and critically.	2-4	4-5	3.25 (0.89)	4.25 (0.46)	0.0183
4. Develop a clear, arguable, and significant argument or hypothesis.	1-4	3-5	3 (1.07)	4.375 (0.74)	0.0137
5. Employ primary and secondary evidence (texts and/or data) as support for the argument of findings.	2-5	3-5	3.125 (0.99)	4.125 (0.83)	0.055
6. Analyze texts and data in ways consistent with a recognized and articulated theory/approach.	2-4	3-5	2.875 (0.64)	4.125 (0.64)	0.0048
7. Show awareness of a disciplinary audience, the critical context, and rhetorical purpose.	2-4	3-5	2.75 (0.89)	4.25 (0.71)	0.0074
8. Explain the significance of your argument or findings.	3-5	3-5	3.5 (0.76)	4.5 (0.76)	0.0292
9. Acknowledge and respond to significant counterarguments or limitations of the research	2-4	2-5	3 (0.53)	4.25 (1.16)	0.0295
Research Skills					
1. Identify important resources (research literature and/or data). Search effectively for scholarly, current, and influential sources, learning the range of particular databases and where to look for which information.	2-4	2-5	3.625 (0.74)	4.25 (1.04)	0.0796

2. Use a variety of key search terms, Boolean operators, and truncation symbols to locate all of the useful resources for your topic.	1-4	1-5	2.25 (1.04)	3.5 (1.31)	0.0562
3. Determine new search terms, as needed, for more breadth or more focus.	1-4	3-5	2.143 (0.90)	4.375 (0.74)	0.0027
4. Use a variety of library databases and print sources.	2-4	2-5	3 (0.76)	4.375 (1.06)	0.0146
5. Use Interlibrary Loan, submitting requests early enough to receive them on time.	1-3	2-5	1.5 (0.76)	4 (1.07)	0.0018
6. Consult with peers and professors who know about a topic.	3-5	4-5	4 (0.76)	4.75 (0.46)	0.0428
7. Ask for help from professors and reference librarians while maintaining self-motivation. State clearly what specific assistance you need.	3-5	2-5	3.75 (0.89)	4.5 (1.07)	0.0998
8. Evaluate sources/data for relevance to your topic question, remembering that such sources do not need to agree with your findings nor focus entirely on your topic to be valuable resources.	2-5	3-5	3.375 (0.92)	4.5 (0.76)	0.0272
9. Take thorough notes on research sources/data, responding as a fellow researcher to other's arguments and findings.	2-5	3-5	3.25 (1.16)	4.25 (0.71)	0.0716
10. Look up in the dictionary unfamiliar terms and work to understand difficult prose. Re-read, take notes, and discuss articles to clarify understanding.	2-5	3-5	3.5 (0.93)	4.375 (0.74)	0.0684
11. Use the bibliographies of books and articles to expand your literature review.	2-4	4-5	3.375 (0.74)	4.5 (0.53)	0.0076

12. Formulate an understanding of the critical discourse surrounding the topic.	2-4	3-5	3.125 (0.64)	4.375 (0.74)	0.0080
13. Order points from your research in logical structures by creating outlines, flow charts, or other organizing plans.	1-3	3-5	2.375 (0.74)	3.875 (0.99)	0.0093
14. Keep track meticulously of bibliographic information.	1-4	3-5	2.5 (0.93)	4.625 (0.74)	0.0019
15. Create an annotated bibliography.	2-5	4-5	3.5 (1.07)	4.857 (0.38)	0.0074
16. Cite and document every source correctly in the required style (e.g., APA)	1-5	2-5	2.875 (1.46)	4.125 (1.13)	0.0842
Research Dispositions					
1. Participate in an interactive research process with flexibility and patients.	2-5	2-5	3.714 (1.11)	4.5 (1.07)	0.1296
2. Think creatively and critically to create a compelling project.	3-5	3-5	3.571 (0.79)	4.25 (0.89)	0.1569
3. Engage intellectually with the topic by reading everything you can about it and giving time daily for the research-writing process.	2-4	2-5	3.286 (0.95)	4.125 (0.99)	0.0875
4. Practice self-discipline, time management, and initiative.	1-5	1-5	3.571 (1.27)	4.125 (1.36)	0.2127
5. Present your findings with clarity, thoroughness, and confidence at a defense/symposium/conference	3-4	3-5	3.286 (0.49)	4.375 (0.74)	0.0138

Table 2. Average Total Pre- and Postscores for questions of the RSDQ. P-values that are bolded indicate significance.

Within the second section (research skills), 10 of the 16 items showed significant changes from pre- to posttest (See Table 2). The six items that did not reveal significant changes included statements about 1) ability to identify and search for relevant literature; 2) use key search terms; 3) ask for help from professors and reference

librarians; 4) take notes on research sources; 5) look up unfamiliar terms in the dictionary; and 6) provide appropriate citations and documentation of resources using appropriate formatting (i.e., American Psychiatric Association formatting). These items address topics covered in coursework prior to the senior year and are encouraging that students enter their final year with skills they believe are necessary and helpful for success in research.

In the third category, Research Dispositions, only one of the five statements showed significant changes from pre- to posttest, while demonstrating growth in each item. The significant item was found regarding the ability to present findings with confidence ($p = .0138$). The items which were not significant addressed the abilities to: participate in interactive research; think creatively to create a compelling project; engaging with the topic by reading; and practicing self-discipline, time management and initiative. Again, students are pushed in these areas throughout their music therapy coursework, so it is unsurprising that they feel their skills in creativity and time management are developed and competent.

Student Perspectives

Each student's responses to the project provided insight into how they viewed the experience and highlighted benefit areas and suggestions for improving the experience for future cohorts. The questions posed following course completion are highlighted below: what they learned about research; what was scary when we started; what surprised them about the class; of what they were most proud; and suggestions for future courses.

Greatest student learning

Student learning involved the demystifying of the process of research. “Through this project, I learned that research can be used for anything and anyone. Not just for the “super smart” scientists and doctors, but research is more of a tool that anyone can use to answer questions about their work, about life, or even about themselves!” This statement reflects a large shift in the student’s research disposition as confirmed by the RSDQ scores.

Another student shared on the clarity required when undertaking the task, highlighting elements of research skill development:

I learned about how meticulous everything is, from submitting a research topic to IRB and getting said approval and reviewing the process to having to say the exact say thing to all participants and making sure that there was [minimal] bias when facilitating examinations. I learned about the stages that a research project goes through and how to portray the data that comes out of the other side. I learned how to differentiate data types (qualitative and quantitative) and how each is effective in their own right. I learned that doing a research project leaves you with more questions than when you started, like “what if we did this with a different population, what would have changed if we did X differently” and so on. I learned that research is a lot of fun and presenting the data can lead to new opportunities.

Student were surprised with some of the requirements and expectations outside of the coursework:

What surprised me the most was how formal everything was, with stuff like the ethics workbook and IRB review process, with comments and changes requested on single words. I did not realize it would be that in-depth and vigorous. Another surprise for me was the multiple types of tests you could run on the acquired data! Stuff like T-tests and ANOVAs. I was also surprised that non-experimental does not mean you aren't conducting a research study, there are still things you are adapting and changing but not to the extent of an experimental.

One insightful synthesis between the process of undertaking the project and the application to being a clinician was shared:

The ability to incorporate the most up to date research into practice is essential in helping the individuals we work with reach their highest and fullest potential. Preparing us for a future in which we research and reflect on our own methodology as music therapists is imperative to the growth of our profession. The opportunities provided through CURE helped develop the skills needed to do research within the field.

Regarding the research topic, as it relates to research-related content, which was significant on the RSDQ, another student commented:

I was always curious about how my hearing compared to my other peer musicians around me considering our differing backgrounds and experiences that we've had with music and sound. I figured being in a loud marching band for years and always being in front of brass would significantly affect my hearing more than other students, so I was even more interested to do more digging in

the comparison of musicians' hearing; and the simple fact that I *could* do more digging as an undergraduate is pretty cool!

One student concluded with an insightful remark, applying the experience to their future goals:

These skills broadly help develop speaking skills, writing skills & an adept understanding of what it takes to facilitate, participate & lead research studies. I feel incredibly grateful to have had this opportunity to develop myself further and hope that this will not be the last time I get to research.

Students and faculty within the School of Music were also interested in the outcomes of the studies. Several students shared interests in taking part in future classes, learning more about their hearing, and having their hearing tested continuously to evaluate any potential changes and try to mitigate them if they occur.

Feeling Intimidated by Research

When asked about what was intimidating/scary to them when starting, one student replied:

Honestly, everything was scary when we first started. I knew what I was looking for but having to learn how to use all the audio instruments, learning how to properly do research, learning how to analyze the data that we collect, even learning how to correctly understand all the information and data seemed scary to me! I had never done any research prior to this study, and I am extremely bad with technology so in the beginning this project was very daunting.

Conversely, they also shared they were pleasantly surprised with their abilities when put to the test:

What surprised me about the research class was how much a lot of things came easy to me! Even with a lot of aspects being scary in the beginning, I quickly caught on and was able to apply what we were learning in class towards our study in a very simple and real way that made complete sense to me.

This response was echoed by another classmate:

It wasn't necessarily scary when we started but it was intimidating, I was worried that I would not have enough data to write a paper or that I would miss one small constant and the data would be impacted because of it. I was intimidated by the prospect of the entire process and how time-consuming it would be.

Student Points of Pride

On their proudest take from the project, one student shared:

I'm most proud of how I was able to articulate and present our findings and explain why it matters. Whenever I read research/scholarly articles, I'm always asking myself, "ok so why does this matter?" and whenever I can't come up with a clear concise answer, it's hard for me to understand or even take it seriously. However, since this research topic was something that I enjoy and live out every day, it was very easy for me to explain to people why our findings matter. Being able to step back from my work and accurately explain what it means, why comparing the hearing in my chosen population matters, and what we can all do to prevent these trends was just surreal.

Another student commented on the scope of the project, “I am very proud of how many people we saw through our research project, and I am very proud of our group for all being able to present at a conference like SER-AMTA and how frequently throughout the semester we were given the opportunity to present.”

Suggestions for Future CUREs

General take-aways from the study were overwhelmingly positive:

I think doing a research class while everyone simultaneously translates what we learn through doing one, collective study is a stroke of genius. Being able to apply what we learn in class into something practical and hands on is perfect so that we can check each other, ask each other questions, and help one another further understand research. I think if we all did individual projects it would have been even more intimidating, so in my opinion how we did it was extremely helpful, significantly less stressful, and incredibly enjoyable!”

I am very grateful for being a part of this study, this research class and learning about the processes and experiencing it at the same time made learning these concepts so much easier to learn because we were putting them to use. The takeaways from this class will be something that I will be applying for a long time to come, and the skills gained learning about the research project have led me to being a more curious individual.

Students reported excitement about conducting research in the future, some of whom are considering graduate education.

Recommendations for future research included a request for more time spent with the data analysis software, “It was extremely overwhelming and took me a second

to get my bearings.” This suggestion was valid and has been incorporated into future coursework in which a CURE project is embedded and other research-based projects:

For future classes I would have training and pre-research project stuff done ahead of the class. Completing the training and knowing topics ahead of the start of the class. (We did our best with the time we had but some individuals did not have their topic picked out or training completed at the start of the class, so it took a couple of weeks to really get into it). This way the class can start with getting a project approved and the edits that need to be made. More hands-on experience with editing and interacting with the IRB so that we can get a perspective for future jobs.

As students, we (authors) stepped outside of our comfort zones to better ourselves as researchers, students and learners. It is not always easy for us to learn and grasp concepts when they are hard to conceptualize. An opportunity to develop clinical writing skills, public speaking skills and critical thinking skills while implementing this project has led all participants to better themselves in one way or another. The process included a lot of waiting followed by a lot of stress trying to meet deadlines and then a lot of waiting again. Collecting data, interacting with members of the school and community, analyzing a bunch of numbers & making colorful charts are memories that these student researchers will not soon forget. I am grateful this CURE provided us with the means to perform such a project and would highly encourage other educators to do the same. It made my final semester one of the best.

Professor Perspective

Coordinating a project of this size, with multiple students working on a larger, overarching project was something with which I had significant experience. Prior to becoming an instructor, I spent over a decade coordinating a research lab within a university hospital in the research of hearing abilities and music. In that capacity, I mentored students in various projects from conception to conclusion from undergraduate to doctoral levels. In addition, I spent two years at the university collaborating in a research lab across campus with non-music major students. They created their own studies under certain guidelines by a lead faculty with whom I co-taught. Due to these experiences, I was confident in my ability to address the areas of inquiry, walk students through the process of study development and implementation, and train them on the tasks they would need to be successful in their respective studies.

When the class expressed a collective interest in conducting a project together, I was extremely excited. Professionally, I had a desire to create a research lab that would incorporate undergraduate students in the research process. That their interests aligned with mine was the catalyst. The timing also allowed us to apply for grant funding to provide financial support for the project and their resulting travel needs. I was unsure whether the process would result in a change in workload, but the excitement overrode the concern.

There were many expected benefits of this project, both tangible and intangible for professor and student as identified by Shortlidge et al. (2017). The conception and execution of the project centered around tangible and intangible student-centered outcomes: attaining specific sets of skills; taking part in an active learning pedagogy;

learning skills that can be transferred to their careers, life and resumes; students enjoying their time with research; and having a meaningful experience (Shortlidge et al., 2017). Even the grant application was co-written with the students and for their benefit; financial and otherwise. Because of the collaborative grant, all students were provided with registration and travel funding to present their studies, which supplied an element of financial equality as noted by Bangera & Brownell (2014).

Professor-centered outcomes included intangible areas (being able to draw connections in class that transferred to all individualized questions across a variety of topics; having fun; seeing “aha!” moments) and tangible areas (taking part in research related to my area of inquiry; assisting in a singular IRB over several individual applications; acquiring materials that I can use in future research and clinical areas). The largest tangible benefit resulted in greater time to mentor students and provide them with the support while they tested their first participants. I led the students through the process, by modeling each step up to and including the presentation of a research poster to aid them in their goals.

The outcomes of the study were greater than just the grades they received and the posters they created. At the onset of the course, students appeared anxious at the thought of conducting research. Their confidence was low, and they did not seem to be sure of their abilities, despite the encouragement I provided. Some concern was expressed regarding “the best” research question to develop. I provided encouragement to find something that interested them and illustrated how their questions each fit into the larger project. Once the initial steps were taken and they were able to work collaboratively to put the protocol and IRB application together, I saw their confidence

grow. I worked closely with the students during the pilot data phase to help them understand the steps they had developed and how they worked in application. It was then that I saw their confidence and belief in themselves grow. A treasured memory is of one of the co-authors (KB) coming into my office following their first solo testing of a subject, eyes and smile wide, exclaiming “That was so much fun!”.

At the end of the study, I was and continue to be so impressed with and proud of the work the students were able to do. They seemed empowered by the experience and the task of conducting research. Students who were admittedly frightened of the task and its size, were able to understand the tasks of taking a study concept and developing the various parts of the tasks, implementing those tasks, and understanding how to take their results, interpret them, and apply them to future possibilities. On reflection, the project's workload was likely less than that of mentoring nine separate research projects, and the inclusion of the CURE allowed direct connections to course material in each step of the process.

Discussion

Contrasting with Dvorak et al. (2021), significant changes were found on each of the three areas of the RSDQ. This discrepancy may be due to the difference in the types of embedded research used in each respective process. Where Dvorak and colleagues (2021) used bounded and scaffolded approaches, the current study used an open-ended response. This factor may have contributed to more perceived ownership of the study for the students and affected their enthusiasm towards the project, which Russell et al. (2007) attributed as a key element to experience optimization.

Students in this study reported increased interests in research experience as well as continuing on to graduate education, findings which are supported by Auchincloss et al. (2014), Hunter et al. (2007) and Russell et al. (2007). Moreover, they were excited to share the findings with their School of Music colleagues and were able to articulate their findings in ways that made connections to their everyday life.

At the onset of the course, students appeared anxious at the thought of conducting research. Their confidence was low, and they did not seem to be sure of their abilities, despite the encouragement the professor provided, but they trusted they would be guided successfully. Some concern was expressed regarding “the best” research question to develop. Student outcomes show they achieved the goals set up for the class and student feedback and tangible outcomes mirrored the results reported by Russell et al. (2007). In the study by Russel and colleagues (2007), increased understanding and confidence was reported by students on their abilities to conduct a research project. Results on the RSDQ showed significant gains in research-related content, research skills, and research dispositions including co-authorship on this manuscript.

Within the School of Music, when student-researchers shared their findings, other music students learned about their hearing and about the interests of their classmates. Professors and faculty learned more about the training of music therapy students and were also impressed with their abilities to articulate their knowledge. A day has now been set aside each spring for the music therapy students to present their findings to the school during a designated recital time.

Limitations

The numeric results of this study should be taken with caution due to the small sample size of the group. Further studies are warranted to determine if additional open-ended CUREs result in similar outcomes. Additional measures, such as the Undergraduate Research Student Self-Assessment (URSSA; Weston & Laursen, 2015) could have provided additional information to the findings and further illustrate the areas of growth. Additionally, as the experimental phase of the project was undertaken in one semester, student gains have been limited than if they extended across an academic year. However, the pace of the project was laid out prior to the semester start and timelines were realistic and met.

Recommendations for Future Research

Instructors considering the use of CUREs in their coursework should understand the diverse types of work that are put into the process. While certain areas were less-demanding (i.e., the professor did not have to mentor nine very divergent research topics, aid with nine IRB applications, become sufficiently familiar with a variety of material), other areas required slightly more guidance and support such as setting up methods for group collaboration, ensuring all questions were sufficiently addressed, identifying scheduling tools, and overseeing the pilot phase before the students were able to take the roles independently. However, once each student achieved mastery of the protocol, they were able to work in pairs for data collection.

Music therapy pedagogy can benefit from greater research opportunities to incorporate research experiences, particularly those presented in collaborative approaches. Working within and across disciplines will serve to strengthen the

profession and move policy imperatives and research capacity closer to those goals identified as part of the Music Therapy Research 2025 (American Music Therapy Association, 2015).

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