IMPLEMENTATION OF COURSE-BASED UNDERGRADUATE RESEARCH EXPERIENCES IN NON-STEM FIELDS

By

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We respectfully acknowledge the University of Arizona is on the land and territories of Indigenous peoples. Today, Arizona is home to 22 federally recognized tribes, with Tucson being home to the O'odham and the Yaqui. Committed to diversity and inclusion, the University strives to build sustainable relationships with sovereign Native Nations and Indigenous communities through education offerings, partnerships, and community service.

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Abstract

This study investigates the implementation of Course-Based Undergraduate Research Experiences (CUREs) in non-STEM fields, analyzing the obstacles, adjustments, and accomplishments experienced by educators. Although CUREs have been extensively incorporated into STEM education to improve student engagement and research exposure, their application in non-STEM fields remains under-researched. This study employs qualitative research to examine interviews and classroom observations, aiming at identifying how instructors adapt essential research elements—discovery, iteration, collaboration, scientific practices, and broader impact—to conform to the methodologies of the humanities, social sciences, and arts disciplines.

The findings underscore the imperative for customized training, mentorship, and organized institutional frameworks to effectively maintain non-STEM CUREs. Observational data indicate that students gain from practical research experiences that enhance their analytical abilities, critical thinking, and involvement with real-world applications. Nonetheless, obstacles including financial inequities, absence of defined research frameworks, and time limitations limit the extensive implementation of CUREs in non-STEM disciplines. The study emphasizes the necessity for enhanced professional development opportunities, interdisciplinary collaborations, and centralized resource repositories to assist educators in integrating CURE ideas into their fields. By tackling these difficulties, schools may cultivate an inclusive research culture that transcends STEM, giving students in all disciplines with vital research abilities and problem-solving abilities.

Keywords: CUREs, critical elements, inclusive, instructors, non-STEM, research,resources

Chapter 1: Introduction

In recent years, Course-based Undergraduate Research Experiences (CUREs) have attained considerable prominence as an exciting educational instrument aimed at improving student learning, engagement, and skill acquisition (Scogin et al., 2023). These experiences provide students with the chance to engage in actual research within their courses, rendering research more inclusive and accessible than conventional internship or laboratory-based approaches, which frequently cater to a small group. CUREs, originating from the STEM disciplines, were initially created to fulfill the essential requirement of imparting research skills to undergraduate students early in their academic careers (Bangera & Brownell, 2014; Corwin et al., 2015). Historically, STEM disciplines have emphasized research as a fundamental component of education and professional practice, rendering them an ideal basis for the integration of CUREs.

CUREs in STEM rapidly attained importance owing to the experimental and inquiry-driven characteristics of these disciplines. STEM education conventionally prioritizes hypothesis-driven research, data acquisition, and scientific methods, which correspond effectively with the framework and objectives of CUREs (Waterman & Heemstra, 2018). Initial CURE programs replicated professional research laboratories, offering students practical skills in experimental design, data analysis, and contributions to the wider scientific community (Jones & Lerner, 2019). For instance, a biology course may involve students in ecological research or genetic analysis, whereas a chemistry course could encompass the synthesis and evaluation of novel substances. These encounters enhanced students' comprehension of the material and facilitated the development of practical skills relevant to real-world issues.

CUREs originated and developed in STEM disciplines; however, their potential extends beyond these areas (Corwin et al., 2015). To thoroughly investigate their relevance in academics, it is essential to differentiate between STEM and non-STEM fields. CUREs emerged and evolved through STEM fields, distinguished by systematic investigation, quantitative assessment, and regulated experimentation. Research in these domains is guided by explicit hypotheses and experimental techniques that depend on reproducible and quantifiable results (Koonce et. al., 2011; Hasanah, 2020). This approach has cultivated cultures in which students participate in systematic problem-solving, data analysis, and stringent testing of theories—essential characteristics of the scientific process that have driven technological and scientific progress (De Silva & Wickramasinghe, 2022).

Conversely, non-STEM disciplines—including the humanities, social sciences, and arts—employ a more diverse methodology for knowledge creation. In this setting, investigation frequently depends on qualitative analysis, interpretive frameworks, and creative methodologies that prioritize subjective perception and contextual awareness (Uddin et al., 2021). Instead of controlled experimentation, these disciplines promote reflective analysis, narrative inquiry, and theoretical critique. Despite the necessity for varied instructional approaches due to these methodological differences, the fundamental tenets of CUREs—engaging students in real research, fostering inquiry-based learning, and enhancing the communal knowledge base—are universally relevant (Ballen et. al., 2017). Customizing these features to meet the specific requirements of non-STEM contexts not only improves student engagement but also brings together various academic traditions with modern research methodologies.

The incorporation of CUREs in non-STEM disciplines is particularly important for promoting critical thinking and practical problem-solving skills (Ballen et al., 2017). Utilizing Piaget's Constructivist Theory, which asserts that knowledge is formed by active engagement and interaction, the integration of research into non-STEM courses enables students to immerse themselves in the content and relate abstract concepts to practical applications (Naylor & Keogh, 1999; Siegler & Ellis, 1996).

Piaget’s constructivist theory asserts that learners actively build knowledge by integrating new information with their pre-existing cognitive structures (Waite-Stupiansky, 2022). This concept is distinctly reflected in the fundamental components of CUREs. The discovery element of CUREs prompts students to begin with their personal experiences and existing knowledge—reflecting Piaget’s notion of assimilation—while urging them to integrate new discoveries during real investigation. For instance, when students contemplate the impact of music on their health or the role of social circumstances on human behavior, they are actively developing new insights by connecting established concepts with fresh information. This technique enhances their learning and fosters a sense of ownership over their educational journey. Similarly, a history student engaging in archive research may discover novel insights on society change, thereby refining their analytical and interpretive abilities. An art student undertaking a research-based creative project may investigate the convergence of theory and practice, illustrating the practical significance of their work. Such experiences not only deepen students' comprehension of their field but also furnish them with transferable abilities that are advantageous across other occupations and sectors.

Despite its potential, the implementation of CUREs in non-STEM disciplines encounters numerous obstacles. Non-STEM educators frequently face challenges in the design and execution of Course-Based Undergraduate Research Experiences (CUREs) due to insufficient formal training in research pedagogy, restricted access to resources, or ambiguity regarding the alignment of research activities with course objectives (Bangera & Brownell, 2014). In contrast to STEM, which often employs structured and hypothesis-driven research (Shortlidge et al., 2017), non-STEM disciplines necessitate more nuanced and context-specific methodologies. For instance, a literature professor may find it challenging to reconcile the open-ended aspects of interpretive research with the necessity for definitive outcomes in a classroom environment. These issues reveal a significant deficiency in the existing comprehension and implementation of CUREs, emphasizing the necessity for specialized assistance and professional advancement for non-STEM instructors.

This study seeks to explore their revolutionary potential for non-STEM education, and the distinct obstacles that must be surmounted to broaden their application across many disciplines (Ballen et al., 2017). By tackling these problems, educators can guarantee that the advantages of CUREs—improved critical thinking, active learning, and significant involvement with real-world issues—are available to students across all disciplines (Bangera & Brownell, 2014). The cross-disciplinary extension of CUREs has the potential to revolutionize undergraduate education, cultivating a generation of learners who are proficient in their subjects and prepared to address intricate, multidisciplinary difficulties.

Chapter 2: Literature Review

What is a Course-based Undergraduate Research Experience (CURE)?

Undergraduate Research Experiences (UREs) significantly enhance student engagement, retention, and skill development, especially in STEM disciplines. These programs offer practical chances for students to implement theoretical knowledge in real-world scientific investigations, enhancing their problem-solving and analytical abilities (Krim et al., 2019). Participation in UREs equips students with the skills to formulate research questions, design experiments, and analyze data, which are crucial for employment in science and research. Furthermore, UREs foster the formation of a scientific identity, as students start to perceive themselves as active participants in the research community. This sense of belonging enhances their drive and dedication to pursuing jobs in STEM (Hernandez et al., 2017).

Despite their advantages, UREs encounter challenges concerning accessibility and sustainability. Ensuring fair participation, especially for minority students, is a significant challenge, as opportunities may be restricted by institutional resources and funding limitations. Moreover, UREs frequently lack inclusivity, since they typically involve only those students who are either interested or have access to laboratory experiences, thereby excluding others from these research chances. Consequently, numerous students might complete their undergraduate studies without participating in genuine research, which could increase the gaps between individuals with research experience and those lacking it (Krim et al., 2019). Mitigating these obstacles is crucial for preserving the inclusivity and efficacy of UREs. Enhancing institutional support, obtaining stable funding, and creating scalable models are essential to guarantee that all students, irrespective of their background, can participate in significant research experiences that improve their academic and professional paths (Linn et al., 2015).

CUREs emerged as an innovative way to overcome the constraints of conventional undergraduate research experiences (UREs), which typically engage only a limited number of students under teacher supervision. The objective was to enhance the inclusivity and scalability of research experiences (Alexander et al., 2000). Historically, independent research possibilities were restricted to high-achieving students possessing personal connections or prior familiarity with the academic setting. These chances, although advantageous, marginalized a considerable segment of the undergraduate demographic, especially individuals from minoritized backgrounds (Bangera & Brownell, 2014).

CUREs integrate authentic research experiences into regular courses, allowing entire classes to engage in significant scientific studies. This methodology tackles obstacles, including insufficient understanding of research opportunities and perceived cultural norms that dissuade students from pursuing independent research positions (Ballen et al., 2017). Since their beginnings, CUREs have been notably significant in biology and chemistry, and they have garnered attention as part of extensive initiatives to reinvent undergraduate STEM teaching.

The Critical Elements of CUREs

CUREs are characterized by five fundamental components that differentiate them from conventional laboratory courses (Bangera & Brownell, 2014):

Iteration

Iteration is the method of continuously enhancing concepts through successive cycles of feedback, evaluation, and modification. Iteration transcends basic task repetition; it becomes an intentional approach enabling individuals to derive insights from each cycle and progressively refine their work. In educational and research settings, adopting iteration entails pushing students to perceive each draft or experiment as a progression, wherein errors serve as opportunities for development, and each enhancement contributes to a more successful and thoroughly constructed result (Kapiszewski et al., 2022).

Connection to Ed. Psych Theories: Piaget's Theory of Cognitive Development

Iteration in CUREs signifies a dynamic learning process wherein students consistently refine their research questions, hypotheses, and final outputs in response to feedback and an increasing comprehension. This cyclical process strongly corresponds with Piaget's theory of cognitive development, namely its principles of assimilation and accommodation. Assimilation is the process of integrating new information into pre-existing cognitive frameworks. Accommodation is when existing schemas are altered, or new schemas are established to integrate new information that does not align with present comprehension. Students assimilate new research experiences into their previous knowledge frameworks, modifying their thinking as they confront unexpected material and views (Kuhn, 1979). Accommodation transpires when students adjust their strategies, reorganize their methodology, or alter their interpretations in response to criticism and unexpected challenges (Powell & Kalina, 2009). This continuous cycle of enhancement guarantees that learning is dynamic, progressively building on prior iterations, hence strengthening conceptual comprehension and research capabilities.

Discovery

Discovery is fundamental for research, acting as a driving force that extends research beyond established limits. New ideas, methodologies, and viewpoints often emerge unexpectedly through discovery as researchers investigate unexplored ground (Ahmad et al., 2022). This process exceeds the pursuit of a particular solution; it involves mastering the navigation of challenges, innovatively adapting tools, and revealing unforeseen discoveries. Discovery fosters ongoing learning and creativity, rendering research a dynamic, developing endeavor that enhances both personal comprehension and the wider discipline (Elgin et al., 2016).

Connection to Ed. Psych Theories: Piaget's Constructivist Theory and Vygotsky's Zone of Proximal Development

The discovery in CUREs corresponds with the viewpoints of Piaget and Vygotsky regarding knowledge construction and guided learning. Piaget's theory posits that learners construct knowledge by engagement with their environment (Waite-Stupiansky, 2022), corresponding to how students in CUREs investigate new concepts, improve hypotheses, and modify their research methodologies via trial and error. Vygotsky's Zone of Proximal Development (ZPD) represents the difference between a learner's autonomous skills and their potential achievements with support from a more knowledgeable individual. It underscores the significance of social interaction and scaffolding in facilitating cognitive growth (Vygotsky, 1978; Moll, 1990). It emphasizes the significance of guided discovery, wherein pupils initially obtain assistance from educators and peers, then assuming greater responsibility for intricate investigative tasks autonomously.

Collaboration

Collaboration is essential to research as it leverages multiple perspectives and complementary abilities, cultivating an environment suitable to the exchange, discussion, and enhancement of ideas. This collaborative method results in more resilient and inventive outputs while fostering a sense of community ownership and accountability (Parsons, 2021). Educators have observed that collaboration, whether in educational environments or via community alliances—guarantees that each member contributes to addressing a shared issue, thereby enhancing the research process (Lee & Bozeman, 2005).

Connection to Ed. Psych Theories: Deci and Ryan's Self-Determination Theory

Collaboration is associated with the Self-Determination Theory (SDT), which is a psychological framework that examines human motivation, highlighting the significance of autonomy, competence, and relatedness in promoting intrinsic drive and personal development. According to Self-Determination Theory, individuals who experience autonomy, competence, and relatedness are more inclined to exhibit motivation, engagement, and obtain optimal well-being (Deci & Ryan, 1985). In this context, SDT emphasizes the significance of relatedness, or the psychological necessity for social connection. When students engage in collaborative research projects, they establish academic communities that provide a sense of importance and support, so enhancing motivation and persistence in learning. The accountability inherent in teamwork cultivates an enhanced sense of responsibility and ownership in their research (Deci & Ryan, 1985).

Scientific Practices

Scientific practices in CUREs encompass the active involvement of students in genuine research processes, including the formulation of research questions, hypothesis generation, investigation design and execution, data collection and analysis, and presentation of results (Ahmad et al., 2022). This method promotes iterative enhancement, analytical reasoning, and cooperative problem-solving, allowing students to investigate intricate inquiries and relate theoretical concepts to practical applications.

Connection to Ed. Psych Theories: Vygotsky's Zone of Proximal Development

Scientific practices in CUREs correspond with Vygotsky's Zone of Proximal Development (ZPD), which highlights learning via guided assistance and progressively increased autonomy

(Vygotsky, 1978; Moll, 1990). In CUREs, students participate in scientific practices, including the drafting of research questions, the design of studies, the analysis of data, and the presentation of results. Initially, students may have difficulties with these intricate tasks; however, via scaffolding—assistance from instructors, peers, and organized activities—they acquire the competencies necessary for independent investigation. Vygotsky's Zone of Proximal Development posits that pupils optimize their learning when engaging with tasks slightly above their existing capabilities, with supervision facilitating the transition from independent competence to supported achievement (Verenikina, 2003). As students acquire expertise, scaffolding is progressively eliminated, enabling them to assume complete responsibility for their study, so enhancing higher-order thinking, problem-solving, and autonomy in scientific inquiry.

Broader impact

Broader impacts in research indicate the concrete, real-world results that expand the reach of research beyond the classroom environment. This entails actively participating in community organizations, tackling important societal issues, and guaranteeing that research outcomes advance overarching social, cultural, or policy objectives (Nadkarni & Stasch, 2013). This dynamic approach facilitates the connection between theoretical study and practical implementation, guaranteeing that student projects are both academically rigorous and contribute tangibly to the community.

Connection to Ed. Psych Theories: Eccles and Wigfield's Situated Expectancy-Value Theory

The concept of broader impact in Course-Based Undergraduate Research Experiences (CUREs) is strongly aligned with Situated Expectancy-Value Theory (SEVT), which is a motivational framework that discusses how students' expectation of success and the significance they attribute to a task affect their involvement, decisions, and performance. In contrast to conventional expectancy-value theories, SEVT highlights that these perceptions are influenced by the particular context or environment of learning, encompassing cultural, social, and situational aspects (Gladstone et al., 2022). Students' task value is increased when the contributions of their research to real-world communities, legislation, or cultural preservation is highlighted. When students recognize that their work transcends mere academic exercise and yields practical outcomes—such as impacting local governance, supporting marginalized groups, or tackling social justice issues—they attribute higher significance to their research. This corresponds with SEVT's utility value, which pertains to the relevance of an activity to future objectives (Wigfield & Eccles, 2023). Students who perceive their study as advantageous for their professions, communities, or societal transformation exhibit heightened intrinsic motivation to engage thoroughly in the learning process.

These components collectively strive to model an authentic research process, providing students with competencies that extend basic technical proficiency, including problem-solving, resilience, and communication (Bangera & Brownell, 2014).

By including these aspects, CUREs exemplify the ideals of constructivism, guaranteeing that learning is an active, contextual, and dynamic process that equips students to utilize their knowledge both within and beyond the classroom (Powell & Kalina, 2009).

STEM vs. Non-STEM

Disciplines conventionally linked to Science, Technology, Engineering, and Mathematics (STEM) focus on comprehending and utilizing ideas pertinent to natural and physical sciences (Hasanah, 2020). These fields prioritize logic, analysis, and empirical reasoning, frequently employing mathematical models, technical instruments, and experimental methodologies to address intricate issues (De Silva & Wickramasinghe, 2022). STEM applications encompass not only technical accuracy but also design, ethics, and societal implications in fields such as medical research, environmental sustainability, and artificial intelligence. STEM education cultivates critical thinking, inventiveness, and problem-solving abilities, providing learners with competencies that propel progress in sectors such as healthcare, information technology, and infrastructure (Koonce et al., 2011).

Fields within the arts, humanities, and social sciences examine human culture, society, and creative expression, employing both qualitative and quantitative approaches (Whalen et al., 2010). Disciplines like psychology and sociology utilize statistical analysis and data interpretation, whereas digital humanities leverage computational technologies to investigate literature, history, and cultural narratives. These domains prioritize critical analysis, interpretive reasoning, and interdisciplinary collaboration, cultivating viewpoints that impact policies, modify cultural discussions, and improve ethical decision-making (Uddin et al., 2021). Knowledge across all disciplines is cultivated through a synthesis of empirical research, theoretical study, and innovative problem-solving, illustrating the interconnectedness of academic inquiry.

Comparative Analysis of Support Strategies for STEM-Focused CUREs and Non-STEM Field CUREs

Support mechanisms are crucial for the effective execution and longevity of Course-Based Undergraduate Research Experiences (CUREs). These systems encompass institutional infrastructure, faculty development, finance processes, and resource accessibility (Rowland et. al., 2016). STEM-oriented CUREs leverage established frameworks and strong support networks (Corwin et al., 2015), whereas non-STEM adaptations encounter distinct hurdles emerging from the divergent nature of research in the arts, humanities, and social sciences. A comparison evaluation indicates substantial differences in the support systems accessible to these two domains.

The prevailing status of CUREs in STEM can be attributed to the strong infrastructure and institutional support present in these fields. STEM departments frequently possess cutting-edge laboratories, research funds, and partnerships with industry, allowing educators to incorporate research seamlessly into their curricula (Jones & Lerner, 2019). Moreover, national and international programs, including the National Science Foundation's Research Experiences for Undergraduates (REU) and the Vision and Change in Undergraduate Biology Education initiative by the American Association for the Advancement of Science (AAAS), have significantly advocated for the implementation of CUREs in STEM fields. These initiatives seek to confront structural issues, including low retention rates in STEM degrees, while simultaneously cultivating a workforce equipped to manage intricate scientific and technological difficulties. The quantifiable advantages of CUREs in STEM—namely enhanced student motivation, elevated critical thinking skills, and the generation of publishable research—have established their significance as a transformative educational approach (Castleman et al., 2017). Faculty training is a fundamental component of support in STEM-focused CUREs. National organizations like CUREnet and specialized projects provide workshops, conferences, and online tools to assist educators in developing and executing research-oriented courses. These training opportunities ensure that instructors are adequately prepared to mentor students in real academic initiatives. Moreover, STEM CUREs frequently coincide with faculty research objectives, fostering reciprocal opportunities for publication and the advancement of intellectual endeavors (Russell et al., 2007).

CUREs have revolutionized undergraduate STEM education by offering inclusive, scalable research opportunities that include students in authentic inquiry. Nonetheless, extending this educational methodology to the arts, humanities, and social sciences necessitates confronting the methodological and institutional disparities within these disciplines. Adapting the fundamental elements of CUREs—discovery, iteration, collaboration, scientific practices, and broader impact—to non-STEM contexts is crucial for their success across several fields (Ballen et al., 2017). Future initiatives should concentrate on creating tools, training programs, and frameworks that assist educators in designing and executing CUREs specifically tailored to the distinctive attributes of non-STEM research (Shortlidge et al., 2017).

Integrating Course-Based Undergraduate Research Experiences (CUREs) in non-STEM fields entails various obstacles and opportunities. A notable concern is the funding discrepancy between STEM and non-STEM disciplines (Whalen & Shelley, 2010). Organizations such as the National Science Foundation and the National Institutes of Health allocate significant funds to STEM research (Nadkarni & Stasch, 2013), but funding entities for the arts, humanities, and social sciences typically function with markedly less resources. This financial deficit may restrict access to funds and institutional assistance essential for the development and maintenance of CUREs in non-STEM disciplines. Notwithstanding these limitations, there is an increasing awareness of the significance that CUREs contribute to non-STEM education. Institutions are commencing the development of instruments and training programs specifically designed for the distinct approaches of the arts, humanities, and social sciences (Bangera & Brownell, 2014).

Additionally, organized research initiatives in non-STEM disciplines have demonstrated efficacy in enhancing students' confidence in their research abilities and cultivating a feeling of community. Students in the arts, humanities, and social sciences can profoundly engage with their subjects and cultivate critical thinking skills by navigating ambiguity within a supportive cohort, thereby providing new insights (Ballen et. al., 2017). These programs highlight the necessity of tailoring CUREs to align with the epistemological frameworks of non-STEM fields, guaranteeing that research experiences are both genuine and pedagogically effective. Although, non-STEM disciplines have unique hurdles in executing CUREs—especially regarding finance and methodological disparities—there has been a unified initiative to establish supportive infrastructures. Through the development of specific tools, training programs, and collaboration platforms, educators can effectively integrate the fundamental components of CUREs to enhance undergraduate teaching across several non-STEM disciplines. The study and application of CUREs in non-STEM fields are crucial for promoting inclusivity, enhancing educational outcomes, and guiding students toward fulfilling career paths. Despite continued attempts to support these programs, substantial difficulties remain, including the need for sustainable funding, specialized resources, and overcoming institutional challenges to fully achieve the potential of CUREs in non-STEM contexts.

This study seeks to enhance the comprehension of how non-STEM instructors manage the obstacles and opportunities associated with incorporating CUREs into their curricula. This project investigates the effectiveness and sustainability of educators' techniques for adapting core CURE elements—such as discovery, iteration, collaboration, scientific practices, and broader impact—to non-STEM environments. This study examines the essential support and resources required by educators to effectively adopt and sustain CUREs, highlighting the significance of institutional support, training, and collaborative networks. This investigation aims to enhance methods, foster diversity, and guarantee that research-oriented learning experiences transcend conventional STEM disciplines.

Research Questions

1. How do non-STEM instructors implement the critical elements of CURE?
2. What are the support and resources that non-STEM instructors need to design a CURE?

Chapter 3: Methodology

Research Design

This study utilized a qualitative research approach, employing thematic analysis (Braun & Clarke, 2006, 2016) to explore the experiences and views of non-STEM instructors participating in the Course-based Undergraduate Research Experiences (CURE) training program. A qualitative methodology is particularly appropriate for this research as it facilitates the examination of subjective experiences, contextual elements, and intricate interpretations that quantitative methods may not adequately capture. The project will employ thematic analysis to systematically find, analyze, and interpret patterns or themes within qualitative data (Braun & Clarke, 2006), facilitating a comprehensive knowledge of the adaptation and implementation of CURE principles in non-STEM areas. This method will yield comprehensive descriptive insights and reveal the underlying aspects affecting the success or obstacles encountered by teachers.

This is a part of a large project, which consisted of multiple research team members. However, for this particular thesis, I focused on a subset of data that were collected and analyzed by a faculty member, graduate student, and research scientist.

Participants

The study involved 10 non-STEM professors from the University of Arizona who have attended CURE training sessions at least once, which are held during the summer of different years. A purposeful sampling technique was utilized to guarantee the selection of participants with appropriate experience and insights (Taherdoost, 2016). The criterion for participant inclusion was as follows:

Completion of CURE Training: Participants must attend and complete a minimum of one CURE training session to ensure familiarity with the program's principles and objectives.

Teaching Experience in Non-STEM Disciplines: Participants must be actively involved in teaching non-STEM fields, ensuring their experiences illustrate the distinct problems and opportunities inherent in these disciplines.

Consent to Participate: Participants must furnish informed consent and demonstrate a readiness to share their experiences via interviews and provide relevant materials as examples.

Pseudonyms were used in this study to safeguard the identities of all participants. Personal information were substituted by pseudonyms, so preserving confidentiality and protecting individual privacy. See Table 1 for more detailed participant information.

These participants provided a comprehensive, contextual insights into the distinct obstacles and potential of adopting CUREs in disciplines such as humanities, social sciences, and arts. By focusing on this particular population and data, the study was able to explore specific elements of course design, educator experiences, and student involvement that may have been obscured in a broader dataset. This concentrated analysis facilitated a more comprehensive examination and yielded a representative overview of how non-STEM educators are incorporating research-based learning into their curricula, thus presenting significant implications for future initiatives and institutional support structures.

Table 1

Participants information

Course Name	Pseudonyms for the instructors
Religious Diversity in Healthcare: Intercultural Training	Viola
Introduction to Education Research Methods: STEM Education, College Access & Equity	Cynthia
Ideas into Action	Chloe
The Origins of Data in Politics and Policy	Farah
Community-led Language and Technology Development	Jennifer
Undergraduate Research Experience Through the Center for Digital Humanities	Theo
Conducting Ethnographic Studies of Health and Medicine in Action	Anna
Engaging in Psychology Research	Brooke
Imagining Alvar Nunez Cabseza de Vaca's Relacion: A mapping project	Justin
Music, Health, and Wellness Story	Kathy

Data collection

The study deployed two different data sources to ensure a comprehensive understanding of the application of CURE ideas in non-STEM settings: Interviews and Observations. This study specifically concentrated on the interviews of 10 non-STEM courses taught by 10 professors taken post implementation of the CURE and the observations conducted by the team members, despite the whole dataset encompassing a wide array of data, including pre-implementation interviews, and syllabi. The team comprised of a faculty member, one research scientist and one graduate student.

While I did not directly gather the data, my involvement in the data collection—especially the observations—might have afforded me a more profound understanding and a nuanced viewpoint in correlating the learning environment with the interview responses. Although this does not modify the findings of the research, it would have enabled me to draw from personal experience and provide additional context for the team and the data interpretation for this study.

Semi-Structured Interviews

Semi-structured interviews were conducted with participants to examine their perceptions of the CURE program and its relevance to non-STEM fields. The interviews were conducted via zoom by a research scientist in Ed. Psych department. This approach facilitated a mix between structured questions and the adaptability to explore particular topics further, depending upon participants' responses. Interviews were performed before and after the implementation of CUREs. For this study, only interviews performed post-implementation were examined. The interviews were about 1 hour long.

The interviewees addressed the following key topics:

For research question 1: How do non-STEM instructors implement the critical elements of CURE?

- Perceived applicability of CURE ideas to non-STEM disciplines.
- Methods and modifications employed to incorporate CURE components into their pedagogical approaches

For research question 2: What are the support and resources that non-STEM instructors need to design a CURE?

- The instructors' learning from the CURE training program

- Obstacles and limitations faced during execution.
- Essential resources and support systems are needed for effective implementation.

Interviews were performed through video conference or in person, according to participants' preferences.

Observations

This study conducted in-person classroom observations, with one session for each course, to acquire a direct understanding of the implementation of CUREs in non-STEM courses. Observing these courses provided direct insight into student engagement with research activities, instructor facilitation of essential CURE components, and the structural support for inquiry-based learning. In contrast to interviews which included instructor perspective and course design strategies, observations documented real-time interactions, student involvement levels, and classroom dynamics that influenced the study experience. This methodology facilitated a more thorough examination of the operational dynamics of CUREs, uncovering both advantages and opportunities for enhancement.

The observation notes included comprehensive descriptions of classroom dynamics, instructional tactics, student relationships, and the execution of critical CURE elements. Each field note document generally comprises 1-3 pages, providing succinct yet detailed account of how educators adapted research-based learning in non-STEM contexts. These notes provided immediate observations of the teachers' techniques to engage students, stimulate group discussions, and address obstacles during research activities. Furthermore, the field notes offer views on the teaching environment and insights into the practical implementation of CURE components beyond basic theoretical comprehension.

A primary advantage of the observations was the capacity to integrate findings from several data sources, including teacher interviews, and coded transcripts. Interviews highlighted instructors' desired methodologies, while classroom observations revealed the implementation of these techniques and the extent of student engagement in research activities as intended. The observations offered insights on course structure, student collaboration, and the nature of research that were not consistently articulated in course materials. By incorporating observational data with interviews the study attained a comprehensive perspective on CURE implementation, elucidating effective pedagogical tactics, patterns of student engagement, and potential obstacles in non-STEM research-based education.

Data Analysis

The data analysis procedure encompassed the following stages:

Data Preparation

Interview recordings were transcribed verbatim to guarantee accuracy and enable comprehensive analysis. The transcriptions were evaluated using the software, MAXQDA which is a qualitative data analysis software utilized for categorizing, organizing, and analyzing qualitative and mixed-methods data, including interview transcripts, surveys, and multimedia files. It allows researchers to identify patterns and themes using methods such as text coding, visualization, and mixing (Kuckartz & Rädiker, 2019). Instructional materials were systematically arranged and classified according to the aspects of the CURE framework they pertain to.

Coding and Thematic Evaluation

This study utilized an open coding method for identifying initial codes within the data. Open coding is the beginning phase of qualitative data analysis in which researchers deconstruct data into distinct components to discern concepts, categories, or themes (Cope, 2009). This method entails annotating portions of data—such as phrases, sentences, or paragraphs—that are deemed significant or informative regarding the topic under investigation. By doing so, researchers might identify reoccurring themes, ideas, or concerns articulated by participants, establishing a foundation for more systematic study (Corbin & Strauss, 1990; 1994).

Subsequent to open coding, axial coding was employed to organize linked codes into comprehensive themes. Axial coding is a stage in qualitative data analysis that involves identifying relationships among codes to establish broader categories or themes. This technique emphasizes comprehending the interrelations among various codes, identifying patterns in participants' experiences, and structuring codes around major themes to produce a cohesive story (Kendall, 1999). By methodically configuring relationships among codes, this study develops a profound comprehension of the data and discovers major insights regarding the application of CURE principles in non-STEM fields.

The relationships among the configured codes were classified according to the study objectives, ensuring a systematic method to evaluate the application of non-STEM CUREs. The coding procedure entailed carefully connecting open codes (particular statements and observations) to axial codes (more comprehensive conceptual patterns) and ultimately categorizing them into themes that represented essential results. This systematic classification facilitated a comprehensive comprehension of how educators modified research-informed teaching to their fields, emphasizing trends in teaching methodologies, student involvement, and institutional obstacles. By structuring the data in this manner, the study identified ongoing problems, the achievements, and the overall influence of CUREs in non-STEM disciplines, offering a thorough examination of the workings of these courses and potential areas for enhancement.

Table 2

Analysis of the Codes

Research Questions	**Interview Questions**	**Examples of Open Codes**	**Examples of Axial Codes**	**Theme**
How do non-STEM instructors implement the critical elements of CURE?	How did you implement the 5 critical elements?	"Through the peer review, I found that really helpful that they could help each other" "Collaboration because we are all a team on one research question."	Group work	Collaboration
		"Creating a space where we are learning together with community members…"	Partnerships	
		"A few times a week we call it sitting code, where we troubleshoot research problems together."	Digital Collaboration	
		"If we get data that looks publishable, we will certainly try to publish it."	Contribution	Broader Impact

"These sustainability report cards… senators are going to be looking at these things."	Impact on Policy	
"The broader impact is the fact that they're actually even working with a Community group and forwarding that group's mission."	Real-world Applications	
"I start by asking students to reflect on their relationship with music and health."	Reflection	Discovery
"They are collecting data… they are discovering patterns in human behavior."	Research Process	
"We were discovering things in the most inconvenient possible ways."	Unexpected Learning Outcomes	
"Students do something, look at it, go back, and refine it again."	Revision	Iteration
"We structured it so students start with smaller tasks, build	Structure of Tasks	

		confidence, and take on bigger challenges."		
		"They have to learn the skills, understand how to apply those to the project, and those will change."	Research skills	
		"STEM people have no idea what it's like to go through human subjects review…"	Ethical Research	Scientific Practices
		"Students learned how to construct hypotheses, collect survey data, and use research tools."	Research skills	
		"The scientific practices, I believe, will be… the theory that goes behind research decisions."	Methodologies	
What are the support and resources that non-STEM instructors	What did you learn from the CURE training sessions?	"Just hearing some of the different examples of… research and actually envisioning how students can go out there and do different types of research."	Research Impact	Program Strengths

need to design a CURE?				
		"There was definitely a degree to which it became more exciting."	Motivation	
		"I changed it from my application… students could identify their own mini research projects… then they pick their own little mini project."	Student-Driven Research	
	What can be improved about the program?	"Having a university structure in place where we can see current CUREs would be helpful."	Structured Resources	Program Improvements
		"It would be great to continue discussions, check-ins, and peer meetings during the semester."	Peer Support Networks	
		"More examples, such as worksheets, completed syllabi, and templates, would be useful."	Course Design Examples	

Do you have any concerns related to implementing a CURE?	"It would be great to have access to places that we can go, especially in fields like the arts where funding is limited."	Funding	Concerns
	"If it's not an existing course that is part of a regular load, then support must be ensured for continuation."	Sustainability	

This thematic analysis especially examined two major aspects: (1) Implementation Practices: The interpretation and application of CURE principles by non-STEM instructors in their courses, encompassing any discipline-specific modifications or advances, and (2) Resource Requirements and Challenges: Categories in which educators encounter challenges or necessitate further support and materials to effectively execute CURE.

Observation data analysis

The observational data was studied by assessing the structure and implementation of CUREs in actual classroom environments, emphasizing the role of instructors in facilitating discovery, cooperation, iteration, scientific practices, and broader impact. Researchers analyzed field notes in order to identify patterns in classroom interactions, student involvement, and teaching tactics that corresponded with or diverged from instructors' accounts in interviews. For example, in the PSY course, observations documented students' participation in practical research activities, including survey administration and discussions on experimental design, illustrating the integration of scientific methods within a social sciences framework. Conversely, the LING course emphasized collaborative problem-solving, wherein students collaborated to create linguistic tools for minority language populations. Through the examination of these classroom activities, researchers acquired understanding of the translation of CUREs from theory to practice and the ways in which teachers modified research components to align with their respective fields.

An essential component of the analysis involved connecting observational data with interview responses to ascertain the implementation of CUREs and the extent of student engagement in research as intended. Instructors frequently characterized iteration as fundamental to their courses, and the examination of MUSIC and HNRS courses corroborated this, demonstrating students improving digital projects and enhancing their sustainability research through peer and instructor feedback. Likewise, a significant impact was observed in the AFAS course, where students utilized their study for tangible cultural preservation initiatives. Through systematic analysis of these relationships, researchers recognized beneficial tactics for promoting CUREs, alongside obstacles like time restrictions that hinder iteration and the necessity for more explicit research scaffolding. This methodology facilitated a comprehensive, data-informed comprehension of the functioning of CUREs in non-STEM environments and the elements that enhance their efficacy.

Trustworthiness

The trustworthiness of this study is enhanced by its reliance on post-implementation interview data, which offered profound, reflective insights into the perspectives of educators following the implementation of CUREs. The research team utilized triangulation in the coding procedure, with various researchers independently analyzing the interview data before gathering to compare and reconcile their findings. This collaborative coding method improved the consistency and dependability of the detected themes while including diverse perspectives, hence minimizing individual biases (Stahl & King, 2020). Through collaborative discussion and cross-verification of data, the study attained a high degree of trustworthiness, as the conclusions are substantiated by convergent evidence from several investigators.

The study's trustworthiness is further enhanced by continuous talks among team members concerning the evolving findings and interpretations, in addition to triangulation in coding. These reflective discussions enabled researchers to interrogate initial assumptions, enhance their comprehension of the data, and guarantee that the final themes truly represented participants' experiences. This thorough, cooperative review process enhances the study's trustworthiness and general rigor, ensuring that the insights derived from the post-implementation interview data are both valid and dependable.

Chapter 4: Results

Findings for Research Question 1

Incorporating the critical elements in non-STEM CUREs is vital as they convert theoretical concepts into real research experiences that are both rigorous and significant. These components—scientific practices, iteration, discovery, broad impact and collaboration—facilitate students' profound engagement with their tasks, develop essential competencies, and link what they're learning to practical situations (Rowland et al., 2016). They assist non-STEM educators in converting STEM terminology into language compatible with their disciplinary techniques, thus bridging the divide between theory and practice. The following section offers a comprehensive discussion of the CURE's critical elements made by non-STEM instructors.

Broader impact

Broad impact incorporates influencing, community involvement, and real-world applications in addition to academic research. A key aspect of this impact is partnering with community organizations to further their objectives (Nadkarni & Stasch, 2013). Data showed that in Theo's CURE, students collaborated with a community organization on "forwarding that group's mission", through their research. Additionally, in the observation of Theo's course, students partnered with artists and community organizations to digitize artifacts, thereby preserving cultural histories and actively supporting community-driven initiatives. Jennifer's students collaborated with a minority language community to create tools that facilitate language instruction, exemplifying research applied for societal benefit. During the observation, Jennifer's students partnered with a minority language community to create digital tools for language preservation, guaranteeing that their research directly enhanced linguistic accessibility. In the observation of Justin's course, students developed interactive StoryMaps that converted literary analysis into digital data, enhancing the accessibility of historical narratives to broader audiences. This transition from theoretical learning to practical impact cultivates a sense of responsibility, as students observe their efforts influencing political discussions, cultural conservation, and public education (Nadkarni & Stasch, 2013; Watts et al., 2015).

The broader impact encompasses addressing specific gaps in literature in the material that the students were studying while also ensuring that students participate in research with practical applications. Data showed that when student research yields useful data, instructors advocate for publication of findings or participation in community conversations, emphasizing that their efforts have "benefits for them" beyond the classroom. By integrating research with practical applicability, non-STEM CUREs enable students to both contextualize their activities and cultivate a persistent feeling of agency, responsibility, and purpose in their pursuits (Skrip, 2015).

Scientific practices

Scientific practices tend to be defined as scholarly or research practices to align with discipline-specific approaches in non-STEM. In contrast to STEM, where scientific practices focus on hypothesis-driven experimentation, non-STEM CUREs prioritize theory-driven inquiry, methodological adaptability, and applied research. In the humanities, scientific methodologies correspond with theoretical paradigms that direct research choices. As Justin noted, “the scientific practices, I believe, will be, at least in the case of the humanities, the theory that goes behind the decisions that they make and being able to test some of the things that they're doing”. Students do research by evaluating ideas, arguments, and communication strategies, especially in collaboration with community groups, so ensuring their study is both thorough and significant (Ballen et al., 2017).

Kathy emphasized the challenges of teaching numerous abilities simultaneously, such as "video editing skills," within a limited course timeframe. In Farah and Brooke's CUREs, students participate in activities such as creating a survey, utilization of research tools like Qualtrics, and understanding control groups in studies. In Cynthia's class, students conducted qualitative research by interviewing peers regarding their experiences with gender and prejudice. These studies demonstrate how non-STEM students employ scientific rigor in human-centered research, frequently encountering supplementary challenges such as obtaining Institutional Review Board (IRB) approvals for engaging with human subjects. Brooke remarked, "STEM people have no idea what it's like to go through human subjects review," emphasizing the added complication that social science research introduces to scientific research. During the observation, Anna's course utilized ethnographic approaches, necessitating students to perform site observations and examine hospital environments, so enabling them to connect human experiences with larger social frameworks. Farah's students used systematic research procedures by creating surveys, submitting IRB applications, and evaluating experimental data, reflecting conventional scientific rigor within a political science context. Likewise, Viola's course prompted students to integrate religion studies with healthcare research, employing interdisciplinary thinking to address tangible health equality issues.

Although scientific practices in non-STEM CUREs may not consistently mirror conventional laboratory techniques, they uphold the fundamental concepts of methodical investigation, evidence-based analysis, and critical review. Non-STEM students do rigorous research through theoretical testing, qualitative surveys, technical applications, or creative approaches, broadening the scope of scientific research to encompass several modes of understanding and exploration.

Iteration

Iteration in non-STEM CUREs signifies a dynamic process of refinement and development, wherein students acquire skills, seek feedback, and incrementally improve their work. Theo explained, “the iteration because they have to learn the skills and literally begin to learn, understand how to apply those to the project and those will change”. This iterative process involves not merely replicating earlier work, but rather enhancing prior efforts, revising drafts, and experimenting with innovative methodologies. In the Music CURE, Kathy described it as, “teaching students iteration. You do something, and then you do it again. You do something, and you look and you go back. You do something, and you bring it back to the person you're working with, and you do it again”. The cycle of action and feedback is crucial for the growth of skills. Additionally, during the observation of Kathy's course, students refined their digital storytelling projects by integrating feedback from community members with disabilities to ensure their narratives accurately reflected real experiences. Jennifer remarked, “it takes multiple iterations before you feel really comfortable with it”, highlighting the importance of repeated practice and progressive development.

In another instance, Viola underscored the significance of iterative analysis by asserting, “we're like building the scholarly conversation… there might be stages of feedback that then they go back and expand, or you know, and so it's an iteration. It's a growth”. Their students employed iterative learning through several site visits, eventually enhancing their analyses as they accumulated additional data. This iterative process of editing and reflection guaranteed that students consistently enhanced their study and adjusted to new findings during the observation. Chloe's students developed sustainability report cards for a community in Mexico, enhancing their work through multiple rounds of peer evaluation and instructor assessment

These insights demonstrate that iteration in non-STEM CUREs focuses less on replicating experiments in a controlled environment and more on promoting continuous enhancement through repeated cycles of assessment, feedback, and refinement—ensuring that students' work progresses, improves in quality, and remains adaptable to both academic and community requirements.

Collaboration

Collaboration is characterized as a communal, dynamic process wherein students, educators, and community partners engage in a unified endeavor. Theo points out that "the collaboration definitely is effective because they'll be collaborating on a singular project", creating an integrated space where everyone contributes to their study. This method promotes collaboration among students via organized in-class group activities, brainstorming sessions, and peer evaluations, while also incorporating community people into the educational experience. Their course also necessitated student collaboration with local artists and cultural institutions to produce digital content that corresponded with community requirements. Anna said, "create a space in which we are learning together in collaboration with community members, about issues that I know are important." which emphasized the objective of fostering a collaborative environment with community members to address significant challenges, ensuring that research findings are both academically rigorous and socially significant (Kyvik & Reymert, 2017).

During the observation, Cynthia's students collaborated to formulate research questions, examine mixed-methods data, and enhance their methodology through collective feedback. Farah's students collaborated as a research team on IRB filings and survey design, fostering a feeling of collective accountability and cooperation.

Collaboration in these circumstances encompasses several formats: in-person discussions, online Zoom meetings, and peer review groups. Brooke talked about how they encourage grouplevel collaboration by “brainstorming together and doing kind of a team initial search to compile our data together, then sorting through all the data together”. This approach not only improves students' capacity to plan and refine their research inquiries but also cultivates essential interpersonal skills. Instructors observed that when students are granted autonomy in determining "how and when" to interact, they frequently exhibit initiative, such as participating in regular Zoom conversations dedicated to addressing one topic at a time. Cynthia also remarked, “It should be a group project, like we need to come together with a question, and each can do a piece of the research question,” highlighting that collaboration enables students to contribute to research outcomes while providing room for continuous enhancement through shared feedback. This comprehensive and inclusive method of collaboration not only strengthens academic research but also guarantees that findings have practical significance and applicability (Abramo et. al, 2009).

Discovery

Discovery in non-STEM CUREs is understood as a dynamic and diverse process that transcends traditional definitions of scientific breakthroughs. Kathy stated, “It is all discovery, because it's this, you know, I start out by asking students to reflect on their own relationships between music and health, and you know where music has played a role in their own lives and then over the course of the semester. I think that's just a whole process of discovery to find out.”. This viewpoint highlights that discovery in non-STEM contexts includes students realizing personal insights and building links between their living experiences and academic research. Kathy's students also examined the connections between music and well-being, revealing individual and communal insights via reflection and analysis. It is a procedure that develops over time—as Farah noted, “we were discovering things all the time in the most inconvenient possible ways”. This research helps students to recognize and address gaps in their comprehension, discovering the complexities and unforeseen problems intrinsic to their work.

During the observation, Anna's students performed ethnographic investigations, investigating and evaluating healthcare settings to interrogate their preconceptions regarding medical systems and patient care. In Justin's class, students converted textual analysis into data-driven StoryMaps, uncovering innovative ways to evaluate historical tales and literary frameworks.

Furthermore, discovery in these contexts involves not just the generation of new results but also the process of learning through experimentation, mistakes, and improvement. Brooke remarks that discovery involves the collection and synthesis of data—“they are collecting data, right”—and utilizing that information to pinpoint knowledge gaps and enhance their research methodologies. This overall perspective on discovery, which combines personal introspection, technology adjustment, and thorough data analysis, enables students to see the entire importance of their research efforts in a contextually applicable and transforming way.

Instructors integrated essential components by adapting traditional STEM research procedures to meet the distinct needs of their disciplines. Observations indicated that discovery was frequently initiated by encouraging students to contemplate their personal experiences to formulate research concerns. In Kathy’s course, students examined the influence of music on health through structured discussions prior to developing their research questions, consistent with the methodology outlined in the transcript. In Cynthia’s course, students formulated research questions derived from personal narratives regarding their journeys into STEM education, illustrating the integration of discovery within the learning process. Furthermore, observations in

Jennifer's course underscored discovery in action as students faced unexpected challenges while creating linguistic tools, compelling them to engage in problem-solving and adjust their techniques in real time.

The course design integrated iterative processes through structured cycles of feedback and revision, allowing students to refine their concepts via peer review sessions and incremental adjustments, with Kathy and Justin highlighting the importance of draft evaluation. Observations of Justin and Kathy's courses indicated that students participated in organized peer review sessions, during which they got specific comments and adjusted their research outputs accordingly, underscoring the significance of progressive enhancements in research methods. The collaboration was broadened to include both in-class teamwork and community engagement, with Theo and Cynthia detailing the facilitation of group projects where all members contributed to a cohesive study topic, as evidenced in the transcripts. Observation of Theo's course indicated that collaboration transcended the classroom, with students engaging directly with local organizations to digitize cultural items, thereby applying their study in a concrete and significant way. Furthermore, scientific procedures were reorganized to align with the academic research pertinent to each discipline, enhancing skills in critical analysis and the practical implementation of research methodologies, as detailed in the interview with Viola. This adaptation was apparent in Brooke's course, where students developed surveys and performed qualitative analyses, matching their efforts with social scientific procedures. Furthermore, in Farah's course, students progressively enhanced their research inquiries and survey instruments, utilizing research technologies like Qualtrics to create significant datasets. These modifications collectively cultivated a dynamic and inclusive teaching environment that connects theoretical concepts to practical challenges, while simultaneously encouraging students to take responsibility for their learning.

Finding for Research Question 2

The following findings for research question 2, which specifically addresses the challenges that the instructors face while implementing a CURE is purely based on the interviews taken by the team. There is no observation data incorporated in this finding.

The CURE (Course-based Undergraduate Research Experience) training program provides a framework for incorporating research-based learning into diverse courses. Numerous educators from various disciplines valued the program's methodology, especially its focus on rendering research accessible to all students, irrespective of their subject of study. Many of the instructors, including those from typical non-research-intensive disciplines, emphasized the significance of this inclusion (Bangera & Brownell, 2014). Viola remarked, “The CURE training about making research experiences less elite and more accessible… is really important to kind of keep telling the humanities and social sciences.” Farah stated, “The teaching of the course… set us up for something very successful,” indicating assurance in utilizing the program’s resources to integrate research into areas where it may not often assume a central position. Although the non-STEM educators expressed contentment and appreciated the flexibility of the training, the data reflects a lot more about the improvement that non-STEM instructors wish to see.

The instructors expressed a distinct need for more comprehensive, practical guidance that surpasses general training, underscoring that although they like the CURE program's framework, they require additional help on course development. Alongside course design assistance, instructors emphasized the necessity for continuous networking and collaborative possibilities.

Numerous individuals indicated that a centralized platform, such as a website cataloging current CURE implementations and a directory of peers for ongoing discussions, would cultivate a supportive community. This network might enable regular evaluations, peer assessments, and brainstorming sessions, which would assist in refining procedures and tackling difficulties such as recruiting and sustainability. One important advantage emphasized by non-STEM instructors was the chance to participate in multidisciplinary discussions during the training sessions, which expanded their viewpoints on research-oriented pedagogy. CURE offered valuable insights into how research principles might enhance student engagement and promote critical thinking, especially outside of STEM disciplines. Justin stated, “The sessions reinforced things I was already doing but now with a formalized theory,” indicating gratitude for the framework that CURE training introduced to their teaching methodology.

Furthermore, educators appreciated the opportunity to understand how STEM disciplines conduct research and innovatively integrated some of these methodologies into their own teaching environments. By observing the many uses of CURE concepts, they might investigate more diversified and new methods to engage students in research as a process of discovery. This interdisciplinary exposure enabled instructors to transcend the confines of their specialties, enhancing their educational methods and broadening the scope of research opportunities across academic disciplines (Whalen et al., 2010).

However, multiple instructors saw aspects of the training curriculum that should be enhanced. There is broad agreement among the ten instructors surveyed that creating successful non-STEM CUREs necessitates a strong support and resource infrastructure. Educators articulated a want for clear, practical examples of effective CURE implementations, encompassing comprehensive syllabi, assignment and deliverable templates, and a centralized website that highlights current CURE models. Viola said, “having kind of some of that, those university structures in place where there's that website to go to and a list of current CUREs was really helpful”. This resource serves as both an advertising element and a template for course design, facilitating new teachers' comprehension and replication of excellent practices. These tools enhance course creation and reinforce the program's overarching objective of democratizing research experiences across all fields.

Brooke addressed the need to provide examples like completed forms, sample syllabi, and peer-reviewed materials that illustrate the integration of discovery, iteration, and collaboration into course deliverables. Others emphasized that the training must encompass comprehensive guidelines on scaffolding the iterative process inside the curriculum. Cynthia mentioned, “I needed to focus more on iteration. I had different drafts that people were peer reviewing, but just due to timing and how I structured the class, the turnaround time between drafts was a lot for community members”, highlighting the necessity for a more coordinated system that facilitates substantial revisions and input.

Educators also saw the need for strong networking and continuous professional growth. A number of instructors indicated that the capacity to engage with colleagues—via a list of fellow educators or organized drop-in sessions—would mitigate the isolation frequently experienced during the development of new courses. Jennifer noted, “I spent a lot of mental energy during the time just trying to figure out who I wanted to connect with… I'm hoping to kind of pair with [a colleague] because I think working together would be helpful.” This peer-to-peer support is regarded as essential for both the exchange of best practices and the ongoing enhancement of course design over different versions and semesters.

Overall, issues pertaining to sustainability, application, and funding were recurrently highlighted. Instructors observed that, in the absence of institutional support and specified financial guidelines, the establishment of CUREs may persist as a singular project rather than an ongoing program (Bettinger et al., 2013).Theo emphasized, “if it's not an existing course that's a part of a regular load then definitely making sure that everyone understands it if you want to continue this, then the support will be there to continue”. This request for organized institutional support is accompanied by a wish for continuous evaluations throughout the semester, guaranteeing that the course can adapt based on feedback.

The CURE training program offers a systematic framework for incorporating research-based learning into numerous courses, and educators from multiple fields have commended its inclusive approach. Almost fifty percent of the professors emphasized the need of making research available to all students, irrespective of their discipline. Instructors value the program's flexibility and core framework, however they also identified areas needing enhancement. A significant number indicated a demand for more practical, operational assistance, including thorough syllabi, assignment templates, and extensive recommendations for the creation of a whole course rather than merely discrete lab components. It was observed that the presence of well-defined university infrastructure, including a centralized website cataloging current CUREs, would be quite advantageous. Furthermore, there was a demand for enhanced networking possibilities and continuous mentorship to alleviate the sense of isolation experienced during course development. Concerns were expressed about sustainability, recruitment, and finance, with instructors highlighting that without institutional backing and explicit budgetary directives, these programs may stay standalone initiatives rather than integrating into the curriculum permanently.

Chapter 5: Discussions and Implications

This study is essential as it discusses the experiences and perceptions of instructors who implemented non-STEM CUREs, highlighting the challenges and successes of incorporating research-based learning into fields where research has not been historically prioritized (Shortlidge et. al., 2017). The study emphasizes the substantial effort needed for integrating important CURE elements—such as discovery, scientific practices, broader impact, iteration, and collaboration—into non-STEM pedagogies by examining how teachers adapt these concepts. Comprehending these initiatives is crucial, as it acknowledges the unique techniques utilized by educators and provides effective approaches for enhancing the efficacy and sustainability of CUREs across various disciplines.

A significant finding from this research is the imbalance in resources accessible to non-STEM educators. Despite having access to formal training and institutional assistance, many instructors faced challenges due to the absence of defined frameworks, practical examples, and continuous mentorship. Numerous teachers highlighted the necessity for concrete tools, including comprehensive syllabi, assignment frameworks, and systematic approaches for integrating iterative feedback into the curriculum. The research emphasizes that the absence of these resources can render the implementation of CUREs in non-STEM subjects a discontinuous and difficult work, ultimately compromising the quality and sustainability of such programs. Rectifying these resource deficiencies is crucial for guaranteeing that research-based learning is genuinely accessible to students in all disciplines (Bangera & Brownell, 2014).

A non-STEM CURE could include students participating in qualitative or theoretical research initiatives, including conducting interviews, examining existing texts or media, and interpreting human experiences within disciplinary frameworks. These initiatives frequently engage human subjects, so imposing significant ethical obligations—such as adhering to IRB protocols—that diverge from laboratory-based research. Consequently, CURE training for non-STEM instructors will need explicit instructions on navigating these challenges. Educators require assistance in organizing the research process from the beginning, including the guidance of students in formulating research topics, carrying out literature reviews, critically analyzing scholarly papers, comprehending prior study, and adhering to appropriate formatting styles such as APA. Training sessions ought to provide practical tools, including sample syllabi, assignment frameworks, and peer-reviewed examples, to assist instructors with conceptualizing a comprehensive non-STEM CURE. By providing educators with specialized tools and pedagogical methods, institutions may guarantee that the design and implementation of non-STEM CUREs are as thorough and effective as those in STEM fields.

Students participating in CUREs achieve significant advancements in both academic and personal growth. Engagement in genuine research fosters essential competencies, including data analysis, problem-solving, communication, and collaboration. Moreover, it cultivates the formation of a scientific or scholarly identity, enabling students to perceive themselves as competent contributors to their discipline (Wayment & Dickson, 2008). The sense of belonging and confidence in one's talents, also known as self-efficacy, is significantly correlated with increased academic persistence. As students assume responsibility for their learning and recognize the significance and influence of their efforts, their motivation escalates, frequently resulting in enhanced retention rates and an increased likelihood of engaging in graduate courses or research-oriented professions (Petrella et al., 2008).

CUREs and conventional UREs have significantly improved student engagement and learning results across multiple disciplines. Undergraduate Research Experiences (UREs), generally characterized by individualized mentorship between a student and a faculty member, have demonstrated enhancements in students' scientific identity, self-efficacy, scientific process skills, knowledge, and motivation, ultimately resulting in improved retention in STEM disciplines (Hernandez et al., 2017). One of the most significant benefits of including students in research is the enhancement of self-efficacy, the cultivation of a strong scientific identity, and the increase in their confidence in learning and making meaningful contributions. These experiences enable students to perceive themselves as competent researchers and engaged contributors to the creation of knowledge (Wayment & Dickson, 2008). Nonetheless, UREs frequently exhibit constraints, such as restricted availability, competitive selection procedures, and accessibility challenges for marginalized student demographics (Krim et al., 2019).

CUREs mitigate these restrictions by incorporating genuine research activities directly into the curriculum, hence enhancing accessibility for a wider student demographic. This inclusivity is especially advantageous for non-STEM fields, where research options may be more limited. Integrating CUREs in non-STEM disciplines has been linked to enhanced scientific literacy, increased evidence-based decision-making skills, and favorable perceptions of research and researchers (Alexander et. al., 2000; Ballen et. al., 2017). Furthermore, students engaged in undergraduate research have indicated improvements in communication, organizational abilities, time management, and information literacy skills (Linn et al., 2015). These results indicate that CUREs not only improve discipline-specific skills but also provide students with transferable abilities relevant to diverse career environments.

The study emphasizes the significance of institutional support in maintaining CUREs beyond their initial implementation. Numerous teachers observed that although they successfully included research elements into their classes, they lacked the sustained financing and administrative support required to sustain and enhance these initiatives. Sustaining CUREs has been a common challenge in both STEM and non-STEM fields, highlighting the need for broader institutional commitment to long-term support for undergraduate research (M. Jones et al., 2008). Creating strengthened resources, including a university-wide repository of CURE examples, networking opportunities, and uniform funding procedures, will greatly improve the scalability of non-STEM CUREs (Ballen et. al., 2017). Moreover, formalizing collaborative networks among educators can establish a platform for exchanging best practices, enhancing instructional strategies, and cultivating a community of practice that guarantees ongoing advancement in research-informed teaching methods. Making research more accessible and sustainable across disciplines is vital to ensuring that all students benefit from the transformative potential of these experiences.

This study provides critical insights into the implementation of CUREs in non-STEM fields, clarifying the challenges, achievements, and broader implications of integrating research into areas that have not traditionally emphasized it. The study clarifies how educators adapted fundamental research elements—discovery, iteration, collaboration, scientific procedures, and broader impact—by examining instructors' experiences, observational data, and course structures to align with the distinct methodologies of their disciplines. The findings underscore the significant effort required to implement research-based learning in non-STEM contexts, emphasizing the necessity of institutional support, structured frameworks, and accessible resources to ensure the sustainability and effectiveness of these programs. This work has considerable importance by enhancing our comprehension of constructivist and experiential learning theories in non-STEM domains. This illustrates that the iterative, inquiry-driven methodology inherent in CUREs fosters cognitive advancement across various fields, emphasizing that active, reflective learning extends beyond the sciences. The study demonstrates that by modifying essential research components to correspond with non-STEM methodologies, cognitive processes like assimilation and accommodation, as articulated by Piaget (Waite-Stupiansky, 2022), can be effectively utilized in disciplines that prioritize qualitative and interpretative analysis.

The practical implications of this study are equally significant. Observational data, interviews, and course materials indicate that when non-STEM educators incorporate CUREs into their curricula, students enhance their analytical and creative abilities while also acquiring concrete skills in communication, collaboration, and problem-solving (Taylor et al., 2011). These experiences result in enhanced student engagement and a heightened sense of ownership over their learning, as demonstrated by increased involvement in real-world initiatives and community connections. The study indicates that the effective implementation of CUREs can cultivate a dynamic academic culture in which research extends beyond conventional classroom confines, therefore contributing to wider societal and cultural effects.

The advantages for both instructors and institutions are extensive. Educators acquire novel pedagogical instruments and mentorship competencies that enable them to customize research-informed learning to the specific requirements of their fields, while institutions can utilize these creative methodologies to foster more inclusive and dynamic academic settings. By offering students accessible research opportunities, non-STEM CUREs equip a diverse group of learners to tackle intricate, interdisciplinary difficulties in the future. The study emphasizes the necessity of establishing supportive infrastructures, such as extensive training programs, resource repositories, and collaborative networks, to guarantee that research-based learning remains a transformative and sustainable element of higher education in all disciplines.

Considering these encouraging results, the study possesses numerous limitations that warrant acknowledgment. The material utilized for this analysis—interviews and classroom observations—was not gathered by the researcher personally. Consequently, there was restricted opportunity to explore responses further, resolve ambiguities, or provide contextual insights that could have enhanced the understanding of how instructors executed CUREs. Furthermore, the results were not communicated to the participants for validation, so constraining the capacity to ascertain whether the conclusions truly represent the instructors' goals and experiences. Incorporating a member-checking process could have enhanced the study's credibility and maintained consistency between interpretation and actual experiences. A further constraint pertains to the sample size and context. The research is based on a limited sample of ten professors from one university, which constrains the applicability of the results to wider institutional or disciplinary settings.

Conclusion

The study's notable contribution is the identification of resource gaps and the necessity for institutional reform to support non-STEM educators in the design and implementation of CUREs. This study reveals that, whereas established undergraduate research experiences (UREs) and CURE frameworks in STEM disciplines offer significant benefits (Linn et al., 2015), non-STEM educators often lack clear models, mentorship, and financial resources to sustain these initiatives. Observational data demonstrated that CUREs improved student engagement, critical thinking, and research competencies, confirming that organized research activities had a transformative impact across all fields (Russell et al., 2007). This discovery aligns with contemporary literature that highlights CUREs as a scalable and inclusive alternative to traditional, selected research opportunities, hence broadening participation in research-oriented education.

It highlights the extensive socioeconomic benefits of incorporating CUREs into non-STEM disciplines. By integrating research with practical applications, non-STEM CUREs enable students to participate in policy discussions, community development, cultural preservation, and ethical considerations (Ballen et al., 2017). The significant impact of these encounters ensures that research extends beyond academia, promoting societal change, public discourse, and interdisciplinary collaboration. The paper underscores that collaboration among educators, institutions, and students is essential for improving the inclusion, accessibility, and efficacy of research, regardless of discipline (Kyvik & Reymert, 2017).

This study demonstrates that expanding CUREs beyond STEM is crucial for democratizing research and ensuring that all students, regardless of their academic path, obtain significant, inquiry-based learning experiences. Addressing the resource deficiencies identified in this study—by implementing comprehensive training, establishing peer mentorship programs, and increasing institutional investment—will enhance CUREs in non-STEM disciplines and elevate education by fostering a culture of inquiry, critical thinking, and practical problem-solving (Bangera & Sara E. Brownell, 2014). Moving forward, continuous research and institutional commitment are crucial to enhance the sustainability and scalability of non-STEM CUREs, ensuring that research-oriented education remains a core and accessible component of undergraduate learning across all disciplines.

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