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CUREing Health Science: The integration of CURE into the Health Science Program

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Abstract

Background: Teaching styles are evolving in higher education to create more qualified students with critical thinking skills. Interestingly, independent research has been shown to enhance critical thinking skills using the course-based undergraduate research experiences (CUREs) model. Here, we investigated the appropriateness and success of adopting CURE in a health sciences course. **Method:** This study analyzed student perceptions following the implementation of the CURE pedagogy in a health science course via survey. The course success was compared with a previous non-CURE version of the class. **Results:** The students did not display a significantly higher overall class grade after the implementation of CURE; however, their cumulative final exam average improved statistically (72% *vs.* 77%; p=0.003). Student's perceptions of the CURE model were positive in addition to perceiving their knowledge of the subject had increased. Overall, the students preferred the CURE implementation compared with traditional learning styles. **Conclusion:** Teaching styles are subject to change overtime in coordination with course content and student goals. Here, we adopted the CURE and found it was successful in meeting course objectives as shown through the increase in the final exam score. In addition, the perception of students is very important for student engagement which could have led to stronger studying habits and overall excitement for learning the content. This study suggests the use of CURE in health science courses is advantageous and can be implemented successfully.

Keywords: Health sciences; CURE (Course-based Undergraduate Research Experiences); Teaching pedagogy

Introduction

Student engagement is the key to reaching learning outcomes in the classroom. In today's digital world, students often get lost in the vast network of content and lack the ability to adapt knowledge into critical reasoning and problem solving skills. As educators, we have altered teaching styles and adopted different pedagogies in lieu of the digitally enhanced, changing student that lacks these crucial analytic skills. One such trend in education is the adoption of course-based undergraduate research experiences (CUREs) in the classroom [1,2].

A CURE embeds original research into the curriculum of both STEM and non-stem classes designed to engage students in the learning process [1,2]. CUREs, unlike traditional undergraduate research experiences (UREs), that are more apprenticeship-style model, are designed to accommodate large classrooms, therefore including students who may not have been afforded the ability to do research due to lack of mentors [3-5]. The Boyer commission report and several other published articles have highlighted the importance and benefits of research-based learning in higher education. Indeed, positive reviews of this adaption have been published in several fields of study including biochemistry, biology, and cell biology [6-9]. In fact, published reports show higher student learning outcomes and an overall positive impact for both the student and the mentor [10]. The use of CUREs in other non-STEM classes is postulated to also be impactful in addition to altering negative opinions on non-science majors taking science courses.

In this study, the CURE model was implemented to understand its implications and impact on student engagement and learning in a health science, non-laboratory class. The course, HP 320: Introduction to Research in Health Sciences, is a core requirement for Health Science majors at Marshall University. Health Science, a relatively new major on college campuses, is designed for students interested in clinical practices and further education in the medical field. At Marshall University, there are over 400 Health Science majors ranging in interests from occupational therapy to physician assistant to health care administration. Due to this large range of interests, this class encompasses a plethora of mind-sets. Many of the students have no interest in research and the idea of research is abstract. Following three semesters of content delivery via traditional methods, CURE was embedded. In short, CURE was met with scepticism but ultimately led to positive perceptions and an increase in learning outcomes. Students faired better on critical thinking exam questions and trended toward a better grade compared to non-CURE students. This study shows the implementation of a CURE class in a non-laboratory setting with positive results, suggesting CUREs can have positive impacts across the curriculum.

Methods

Course

CURE was embedded into HP320 over two semesters (Fall and Spring). Following the final exam in students were

asked to participate in a brief survey regarding perceptions of the CURE modeled class. Group CURE projects were IRB approved (Approval Number: 1135537-2) under exempt status. Surveys were approved as a quality measure (Approval number: 1483035-1)

Statistics

Following survey completion, mean differences were tested for significance using a Student two-tailed t-test. The minimal level of statistical significance is listed in the figure legend.

Results

The assignment

For this study, Health Professions 320 (HP320: Introduction to Research in Health Sciences) was used to determine the effectiveness of the CURE model. This course is a junior/senior level core course and is also listed as a writing intensive course. Prior to the installation of CURE, students were asked to pick from one of six topics ranging from clinical, basic science, and health care administration topics and write a manuscript-style introduction. Students were given a study question but had to formulate their own study hypothesis and topic points for the introduction. The introduction was first turned in as a rough draft and the instructor provided feedback and grades significantly improved with this step. Students were then given "fake data" that corresponded to each study. The students had to create figures from this data and connect their hypothesis/topic points to these figures. Lastly, students had to write a discussion based on the results. This assignment accounted for 30 percent of their total grade in the class. Other grades included class participation, quizzes, and exams. Following three semesters of this model, the class average was 76.7 (Figure 1).

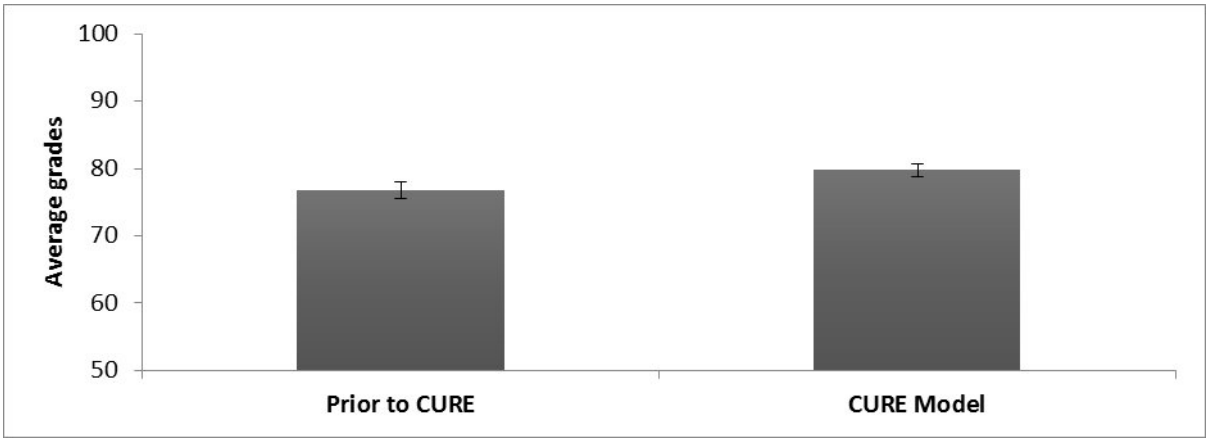

Figure 1: Using the CURE model, average final grades trended higher than previous non-CURE semesters. Two sections (fall and spring) of students (n=85) were delivered content via traditional methods of lecture and mock manuscript writing. The final grade of students still enrolled in the class was 76.7. Two additional sections (the following fall and spring semesters) completed a CURE modeled course complete with an individual research project (n=75). The final grades of students still enrolled in the class were 79.7. Although not statistically significant (p=0.09), the final grades trended to be higher in CURE model students. Data represent means +/- SEM.

Following the implementation of CURE in the class, the students no longer wrote an introduction, results, or discussion but instead created a document similar to an IRB abstract submission. The abstract consisted of an introduction (450+ words), hypothesis statements, inclusion/exclusion statement, results, conclusions, and a reference section. The students were grouped together (3-5 members per group) and were allowed to create their own study topic under the umbrella of "Issues that Affect College Students." The mentor currently is working on a project examining health issues on college campuses in regards to cardiometabolic health and could also benefit from research questions under this umbrella. Students were asked not to inquire about overly sensitive topics like depression because of challenges associated with IRB approval for such content. Following topic identification, students created a survey and participated in pilot groups with other members of the class. Topics for surveys included alcohol use, exercise/eating habits, caffeine consumption, studying habits, insurance knowledge, sexual activity, and sleep habits. Following CITI training and IRB approval, students handed out their surveys (>15 surveys/student). Once the data was collected, students created a database and analyzed data. Like the previous assignment, the abstract with submitted first as a rough draft to assist students. This assignment accounted for 30 percent of their grade in total. Figures were also created within the results section following data analysis and a conclusion statement was required. Following two semesters of the CURE model, the class average was 79.7 (Figure 1).

Student Perspectives/Testing Results

Following the second semester of CURE implementation, students participated in a brief survey to evaluate students' perspectives of the assignments and their overall thoughts of

using the CURE model. The survey was answered by 33 of the 47 students over 2 sections of the course. Survey questions are listed on table 1. Students were divided into one of two categories based on their answer for what they thought helped then understand research better, lectures or the research project (Question 5). 15 students answered lectures were more helpful compared to at 18 students that felt the research project was more helpful for overall understanding of desired course outcomes (Figure 2). No student survey chose the book as being the most helpful medium for understanding course objectives.

Table 1: Quality Survey
1. Prior to this class, please rank your knowledge of research in general (1 being no knowledge and 10 being extremely knowledgeable)
2. Prior to this class, please rank your knowledge of the research process (1 being no knowledge and 10 being extremely knowledgeable)
3. Following this class, please rank your knowledge of research in general (1 being no knowledge and 10 being extremely knowledgeable)
4. Following this class, please rank your knowledge of the research process (1 being no knowledge and 10 being extremely knowledgeable)
5. What component of the class helped you the most understand the subject of research? Lectures Your Research Project Textbook
6. Did you enjoy making a survey and carrying out research compared to just lectures/reading about research? (1 being no, not enjoyable and 10 being yes, very enjoyable)
7. Do you have any additional comments?

Table 1: Quality survey dispersed to students following the CURE modeled class. 33 of 47 students participated.

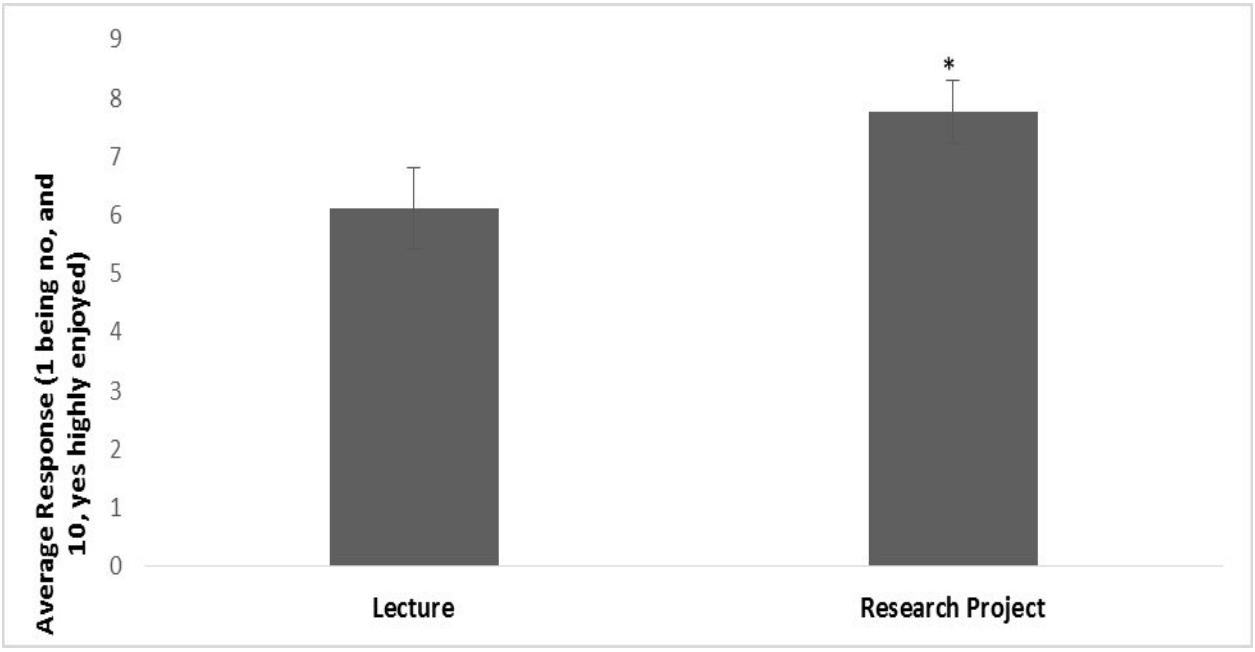

Figure 2: Students preferred the research project compared to lectures and textbooks. Students were first divided into 1 of 2 categories, based on what they thought helped them learn research and the research process (lecture *vs.* research project). Students rated on a 1-10 scale if they enjoyed the research project (1 being did not enjoy, 10 being very enjoyable). * denotes P-value 0.03 comparing lecture *vs.* research project. Data shown represent means +/- SEM.

In addition to the delivery of content, students were also asked to rank how their knowledge of research in general and the research process changed over the course of the semester. On average, students rank their prior knowledge of research as a 3.6 and their knowledge following content delivery via the CURE model as 7.5, a statically significant change (Figure 3). In addition, students also enhanced their knowledge of the overall research process during the semester, 3.73 to 8.05 (Figure 3).

While students reported enjoying the CURE class over the traditional methods, quantitatively they also scored higher on the cumulative exams compared to non-CURE peers. The cumulative exam was equivalent between non-CURE and CURE students and contained both multiple choice and short answer questions. Overall adoption of the CURE pedagogy increased cumulative exam scores significantly, from a 72, low C average to a 77, a high C average (Figure 4).

Unfortunately, there was not a statistical significant increase in their final grade, although it did trend higher in CURE students (Figure 1).

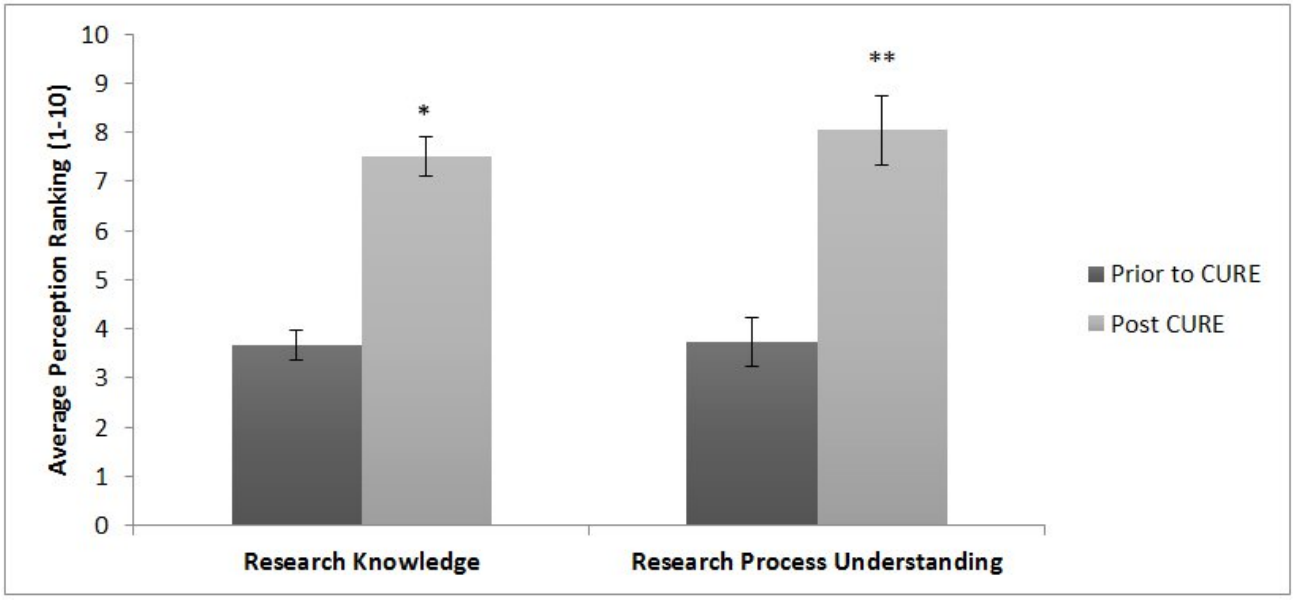

Figure 3: Overall, students' perceptions of their knowledge in both research knowledge and the research process was enhanced. Students were asked to rank their perception of knowledge on a 1-10 scale, 1 being no knowledge and 10 being very knowledgeable. * denotes P-value 7.4E-12; ** denotes P-value 9.18E-15. Data shown represents means +/- SEM of all surveys.

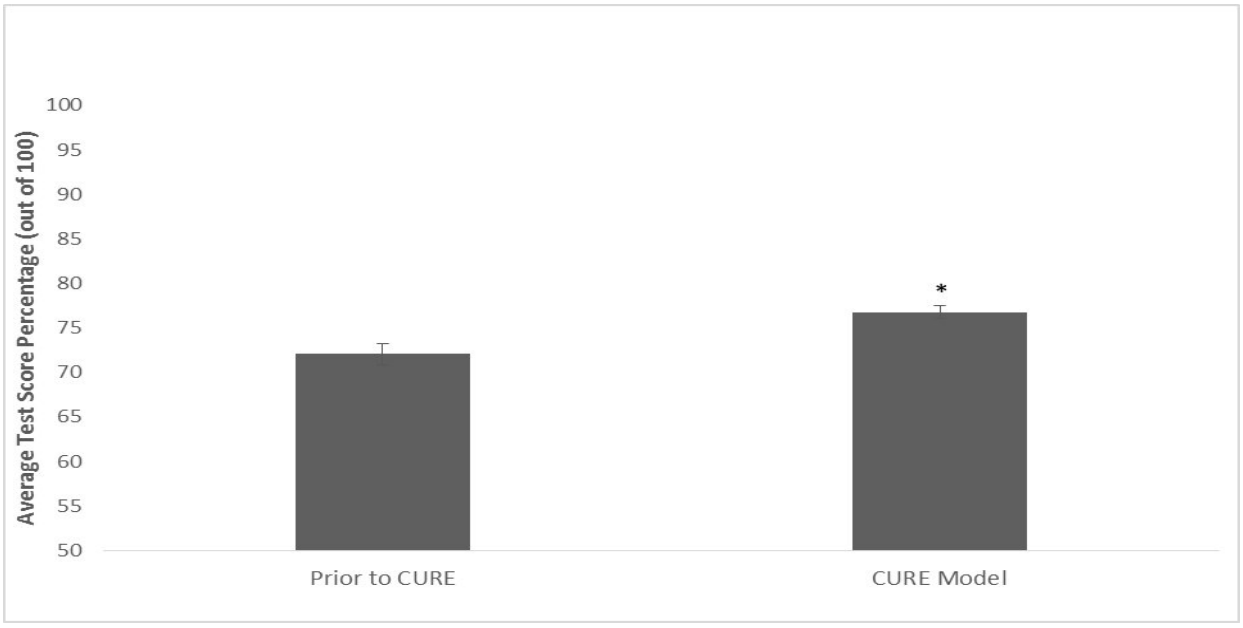

Figure 4: Cumulative final exam scores were higher in CURE students. An equivalent cumulative final exam was administered to all students. The final exam contained multiple choice and short answer questions. Students in the CURE modeled class averaged 76.77 (round to 77) percent while traditional, non-CURE driven material students averaged a 72 percent. * denotes P-value 0.0039. Data shown represents means +/- SEM of all students that took the final exam. Students that did not take the final exam and therefore received a zero were excluded from this calculation.

Discussion

Implementing CURE pedagogy had positive outcomes for both the students and the instructor. Students trended higher on final scores (Figure 4) and had a higher perception of their knowledge following the course (Figure 3). Although initially met with skepticism and negativity, students were actively engaged in the research project.

Some faculty are hesitant to adopt the CURE model due a disconnect to their own research program and a potential increase in workload (11). While the surveys themselves didn't directly initially impact the instructor's research

program, there were several facets of data collected that opened up new windows in a longitudinal study that could alter outcomes. For instance, the sleep surveys revealed very large deficits in sleep habits, more than previously understood in this population. This is now under further investigation into its correlation with cardiometabolic disease as a potential risk factor. In regards to work load, I feel as though it was manageable and the reward outweighed the cost. Once the project was reviewed and approved, the assignment flowed along and the students took initiative, thus reducing work faculty workload.

The CURE model in this course was utilized to better engage the students and get them excited and over the negativity of research and lab work, 2 things I feel were accomplished. By letting students navigate their project and go through the research project, they enhanced their appreciation for the research process and critical thinking skills. Although this survey was brief and collection of a survey from none CURE students would have been ideal, I believe this small sample gives validation for this model in non-laboratory classes, especially in disciplines associated with the medical profession. In addition, although the sample size was small, I believe the trend in final grades is valid and would be statistically significant with more sections of the class.

Overall, this brief survey shed light on students' perceptions while the final grades showed more objective data as to the benefit of CURE. As an instructor, I believe this model aids in critical thinking and allows the student to gain much needed experience in navigating individual projects and working as a team. With teaching to an eclectic group of students, it can be difficult to find a balance of pedagogy that attracts the entire class. Using research in the classroom not only broadens their education and knowledge but also is accompanied by collegiately, collaboration, and leadership by doing a group project. Because CURE is set up to reach a larger subset of students, I consider this model pivotal in altering the negative mindset of students toward research and allowing students who wouldn't normally get the chance to further develop critical thinking skills outside of didactic pedagogies.

Ethical approval

Ethical approval has been granted through the Internal Review Board (Approval number: 1483035-1)

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