AN ANALYSIS OF HANDS-ON MEDICAL EXPERIENCE AND STUDENT ENGAGEMENT IN THE SCIENCE CLASSROOM

by

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ABSTRACT

Over a period of six months, students in the Chinook anatomy and physiology class learned EMT training skill and completed work-based learning experiences, such as job shadowing, in order to increase engagement in the science classroom. This project also looked at the impact that this hands-on learning had on students' confidence and feelings of preparedness as well as their desire to pursue a career in the medical field. Students completed a pre- and post-treatment engagement surveys and post-treatment interviews. From the surveys, it was found that there was no statistical difference between the pre- and post-treatment survey responses. The raw data showed some shifts in students' attitudes but there was not enough change to be statistically significant. From the post-treatment interviews, students reported feeling more engaged and better able to make connections between the material learned in class and the real-world. They also reported developing skills that would help them succeed beyond high school such as time management and responsibility for their own learning.

INTRODUCTION AND BACKGROUND

Over the past few years, Chinook High School has added programs for students who may want to pursue technical careers rather than the traditional 4-year college degree. Currently, CHS has career technical education (CTE) classes in Culinary I, Prostart (an advanced culinary class), metals, agriculture business, accounting, and media technology, to name a few. These CTE classes allow students to explore careers within a chosen subject area and offer insight into the skills that they will need in their chosen careers. They also offer students hands-on learning experiences and even dual credit, where students can receive college credits while they complete their high school credits. These CTE classes help to eliminate the question, "When am I going to use this in real life?"

After seeing the success of the CTE classes in other subject areas, I began to wonder if there was a way to integrate similar hands-on, career-oriented learning in my science classes. I have seen the interest in other CTE subject areas increase while science has held steady, often times attracting those who intend on pursuing a 4-year college degree and ultimately a career in science. As the only high school science teacher, I teach almost all of the high school students in the mandatory classes of physical science and biology. Science is an optional class for juniors and seniors. Consequently, I see less than half of the students from those grades in my upper level classes: chemistry, physics, and anatomy and physiology.

For this study, I chose the anatomy and physiology class at Chinook High School (CHS), a public 7-12 school in Chinook, Montana. Chinook is a rural Montana town with

a population of around 1,230 (Chinook, Montana, n.d.) and is the county seat of Blaine County. In Chinook, the median household income is around $42,772 (Chinook, Montana, n.d.) and the students who attend CHS come from mostly middle-class farm and ranch families. There are 110 high school students enrolled at CHS for the 2018-2019 school year. After graduation, 78% of students on average will attend a 2-year or 4-year college (F. Friede, personal communication, January 15, 2019).

At CHS physical science and biology are required classes to graduate. These classes are taken during the freshman and sophomore years respectively, and science in junior and senior years is optional. Anatomy and physiology (A&P) is one of the optional classes for juniors and seniors, and the class size can range from as few as three to as many as eighteen. During this study, the class size was 16. Most of the students who take this class have an interest in the medical field or plan on taking similar classes in college. These students are more academically successful than their peers and are typically high achieving. Some have minor educational accommodations such as extended test time or taking the test in an alternate location. (F. Friede, personal communication, January 15, 2019).

My goal for this action research project was to integrate more hands-on, career-related experiences for students in order to increase the engagement of students in science. In addition to my normal classroom practices (notes, laboratory work, and other classroom-based projects), I integrated job shadowing, guest speakers in various medical fields, and emergency medical technician (EMT) skill training. My research question was

Does hands-on medical experience and work-based learning increase student engagement in science? I am also interested in the following sub-questions:

1. To what extent might hands-on medical experience affect students' confidence and feelings of preparedness in science?

2. Does job shadowing in the medical field increase student interest in those careers?

CONCEPTUAL FRAMEWORK

A Chinese proverb states "Teach me and I'll forget. Show me and I may remember. Involve me and I'll understand." (Alfeld, Charner, Johnson & Watts, 2013, p. 6). Educators across all subjects and grade levels are constantly seeking ways to increase student engagement, to apply that "Involve me and I'll understand" portion of the proverb. Sinatra, Heddy, and Lombardi (2015) have even gone so far as to claim that "Engagement could be described as the holy grail of learning" (p. 1). For the purpose of this paper, engagement is defined as the degree of attention, curiosity, interest, optimism, and passion that students show when they are learning or being taught (Partnership, Great Schools, 2016). Because student engagement can be measured across multiple levels, engagement is difficult for educators to assess (Sinatra, Heddy, & Lombardi, 2015).

Sinatra et al. (2015) explain that student engagement can include behavioral engagement, emotional engagement, and cognitive engagement. These different types or levels of engagement identify different aspects of student involvement, be it in the classroom or with activities beyond school and in the community. Behavioral engagement is defined as action-based engagement, including student participation in

class and other school activities and even attendance (Sinatra et al., 2015). Emotional engagement has to do with a student's sense of belonging in the school and classroom and even student attitudes (Hampden-Thompson & Bennett, 2013; Sinatra et al., 2015). Hampden-Thompson and Bennett (2013) found that students who enjoy science become emotionally attached to learning science and find that learning more meaningful. The third type of engagement is cognitive engagement, and this has to do with students' effort, willingness to participate, strategy use, and purposeful behavior (Sinatra et al., 2015). Overall, researchers have found that "consistent engagement can lead to long-term involvement in schooling" (Sinatra et al., 2015, p. 1).

One way to increase student engagement is to increase the number of hands-on activities and real-world experiences within the classroom. As students see the real-life applications of classroom concepts, they become more engaged with learning those concepts. Researchers also found that students were more active and engaged with lessons that they enjoyed, were interesting to them, and motivated them (Ateh & Charpentier, 2014). Stohr-Hunt (1996) analyzed 57 studies which measured various aspects of student performance, including science processes and content, and found that students in activity-based programs scored significantly higher than students who were in more traditional science programs. She also found that frequency of hands-on activity experiences also played a role in student scores. Students who participated in hands-on activities even once a week scored significantly higher than students who only participated in similar hands-on activities once a month or less or did not have them at all (Stohr-Hunt, 1996). She came to the conclusion that, "Ultimately, teachers in hands-on

science classrooms should be concerned with actively motivating and involving students in experiences that will in some way extend the students' knowledge and understanding of the science content being studied" (Stohr-Hunt, 1996, p. 106).

Researchers also found that an increase in engagement can lead to an increase in knowledge attainment and ultimately to a continued interest in the subject. Some students may not continue on a science education path because they do not see themselves as competent in science, but for others, the deviation from science is due to a lack of interest in the subject (Masnick, Valenti, Cox, & Osman, 2010). This means that fewer students are pursuing science and ultimately careers in science (Hampden-Thompson & Bennett, 2013; Masnick et al., 2010). Ateh and Charpentier (2014) make the claim that the "Personal interest, experience, and enthusiasm, which are critical to acquiring scientific knowledge in school or other settings, are associated with future educational and career choices" (p. 259). Hampden-Thompson and Bennett (2013) state that engagement in science is higher for students who have a parent that is in a science-related career or expect to go into a science-related career themselves. A solution to this problem is to expose students to more real-world science experiences and science careers in the hopes of increasing student engagement in the science classroom.

Integration of work-based learning (WBL), such as apprenticeships and job shadowing, can be a promising way to increase student engagement and even career readiness. Many other countries already have some sort of WBL integrated into the school curriculum. When compared to students in 12 other countries, researchers found that students in the United States spend the least amount of time in a work place setting

(Alfeld et al., 2013). After conducting case studies on 13 different WBL schools in California, Svetlana Darche and her colleagues (2009) found that not only does WBL increase student engagement, it can also help to address different learning styles. WBL takes what students are using in the classroom and demonstrates to them how that information applies to the world around them, all while giving them experience in careers of interest to them. While work-based learning is not a "one-size fits all" solution to student engagement, when paired with hands-on activities, it just may keep students engaged and interested in science and even future science careers.

Student engagement can make or break a student's interest in science and perhaps even future pursuits of science careers. This engagement can be encouraged through the use of hands-on activities and work-based learning programs. These two components have been shown to increase student engagement and interest in science and also prepare them for lives and careers after formal schooling ends.

METHODOLOGY

This project investigated how exposure to Emergency Medical Technician (EMT) training skills and work-based learning (WBL) affected student engagement in an anatomy and physiology classroom. Over the course of six months, students shadowed medical professionals while also participating in standard classroom-based Anatomy and Physiology (A&P) instruction. The research methodology for this project received an exemption by Montana State University's Institutional Review Board and compliance for working with human subjects was maintained (Appendix A).

The class that participated in this study was composed primarily of junior and senior level A&P students in rural Montana. A&P is an elective course at Chinook High School. The students who take A&P at Chinook High School have previously taken biology and tend to be students who are considering college. Many students who participated in this study have expressed an interest in medical professions.

Methods

In order to accommodate WBL into the course content, the class transitioned into a flipped classroom model. With the flipped classroom model, students complete work at home that is traditionally considered classroom work. This includes taking notes on video lectures, watching podcasts, or preparing questions for classroom time. Flipped classrooms move from classroom time that is focused around the teacher to a model that is more student-centered, where the teacher acts as a guide (Ozdamli & Asiksoy, 2016). Within our A&P classroom, students were allowed to work at their own pace, which also allowed more class time for EMT instruction and WBL field trips (Figure 1).

During the first quarter, the class was conducted in a way that was consistent with how the course has been run in past years, which included lab and lecture-based instruction. During the second quarter, students transitioned to the self-paced flipped model. Students were given all assignments for the unit at the beginning of each unit and had autonomy in deciding the order in which they would like to complete assignments. Students were asked to watch lectures at home and complete labs and activities during class time. Class time was also used for EMT skills instruction, which included presentations and training from EMTs. Students used class time to practice skills such as

taking blood pressures, putting on cervical collars, and treating bleeding and shock (Figure 1). Once they felt confident in their mastery of the material, they were allowed to test on these skills.

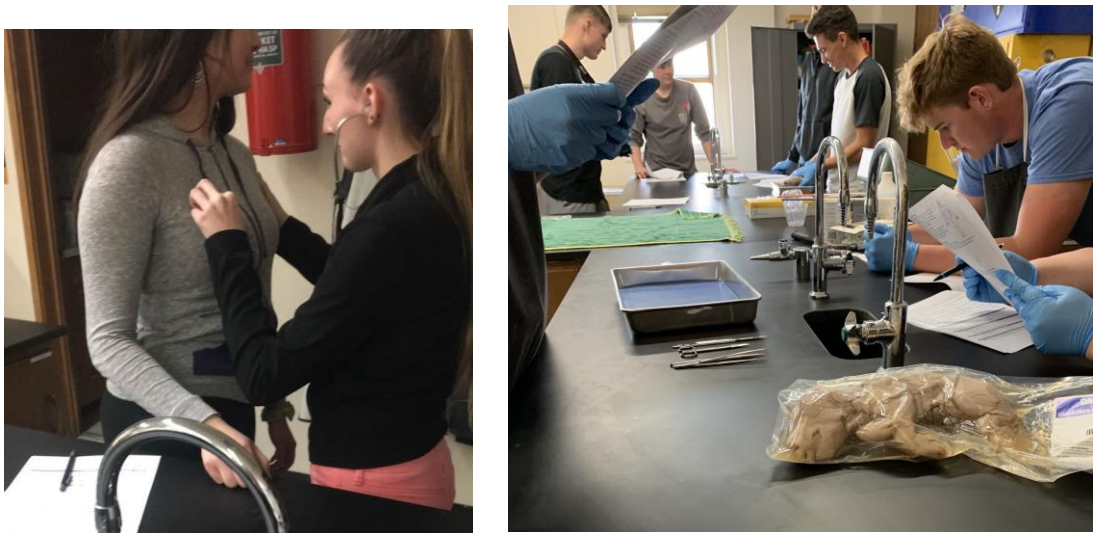

Figure 1. Students complete EMT training skill on listening to breath sounds (left) and students perform fetal pig autopsy (right).

In addition to classroom-based learning, students participated in three WBL experiences outside of the classroom and in the form of guest speakers. During the first quarter of the school year, before the treatment period began, students were asked to list four medical professions of interest for their shadowing experience. From these lists, I contacted medical professionals in the surrounding areas to arrange for shadowing. Students shadowed three different medical professionals over the course of three months. I divided students into three groups and then assigned them to one of ten different medical careers. These careers included chiropractors, physical therapists, nurses, and physician assistants. Students spent three hours with their assigned medical professional. Some students were allowed to take an active role in their WBL experience while others were mainly observers.

Before students engaged in their WBL experiences, they completed assignments on the Health Insurance Portability and Accountability Act of 1996. This Act details the type and amount of information expected to be kept confidential when working in a medical profession. Students also took home letters to parents, asking permission to participate in the WBL experience and for permission to drive since some students had to travel to Havre, which is 20 miles away (Appendix B). After each experience, students were asked to write a reflection paper about the experience. Students were also interviewed after each of the three shadowing trips.

Data Collection

In order to assess engagement, students participated in pre- and post-treatment Student Engagement Surveys (Appendix C). These Likert-style survey questions asked students to indicate how interested and engaged they felt in A&P and other classes. The Student Engagement Survey contained 16 questions that asked students to answer with values between 1 and 5. Students would answer one if they felt like the best response to the statement was strongly disagree and would answer five for strongly agree. The information from these surveys was then compared using a Wilcoxon's signed rank test and Fisher's test in order to examine the impact of the treatment. For the Wilcoxon's signed rank test and Fisher's test, a confidence interval of 0.05 was established such that any value below 0.05 was considered statistically significant.

In addition to the Student Engagement Survey, students were given the Post-Treatment Engagement Interview (Appendix D). The five interview questions focused on the level of engagement students felt after treatment. The questions were similar to the

Student Engagement Survey but allowed students to explain why they felt the way they did. They also were able to share their views on what was successful in the treatment and what may not have worked as well. Student interview responses for the Post-Treatment Engagement Interview were sorted according to common patterns that emerged during the interviews. These responses were used to support data collected from the Student Engagement Surveys and to provide depth to the data.

During the treatment period, students were interviewed after each of the three WBL field experiences. The Job Shadow Interview Questions asked students specific questions about their experiences. It also asked students what they learned from the experience and whether any part of the WBL experience was unexpected (Appendix E). The answers that students provided to the Job Shadow Interview Questions were sorted according to common patterns and were used to support the data gathered from the Student Engagement Survey.

After each WBL Experience, students were asked to complete a reflection paper. Students were given the Job Shadow Reflection Requirements (North Iowa Area Community College, 2017) and were asked to write a one-to-two page paper consisting of at least five paragraphs (Appendix F). Each paragraph of the paper asked students to reflect on one of the following topics; the worksite, likes and dislikes, expectations, education and skills, and relevance. The student's responses were compiled and used to provide support when attempting to answer the focus and sub-questions for this research. The focus and sub-questions for this research, as well as the data instruments used, are included in the data triangulation matrix (Table 1).

Table 1
Data Triangulation Matrix

Research Questions	Data Source 1	Data Source 2	Data Source 3
Primary Question: How do hands-on medical experience and work-based learning impact student engagement in the science classroom?	Pre- and Post-treatment Likert Surveys	Post-treatment interviews	Educator Reflections
Sub-question 1: To what extent might hands-on medical experience affect students' confidence and feelings of preparedness in science?	Pre- and Post-treatment Likert Surveys	Post-WBL experience reflection	Post-treatment interviews
Sub-question 2: Does job shadowing in the medical field increase student interest in those careers?	Post-WBL experience reflection	Post-WBL experience interviews	Pre- and Post-treatment Likert Surveys

DATA ANALYSIS

According to the Post-Treatment Engagement Interview Questions, 94% of students reported that they felt their engagement in Anatomy and Physiology (A&P) had increased during the treatment period (N=16). One student reported, "I like the class and the self-paced really helped me learn more and take time to get to know the material." Despite the claims made by students' interviews of increased engagement, when the SES statement "I feel engaged when I am in Anatomy and Physiology" was analyzed using Fisher's test, the p-value result was 0.1016. This p-value is greater than 0.05, failing to reject the null hypothesis, which states that there is no difference between the survey results of the pre- and post-treatment groups. When looking at the raw data, however,

there is a shift in survey responses (Figure 2). Students' responses moved away from the neutral response (3) and towards the more positive response (5 & 4).

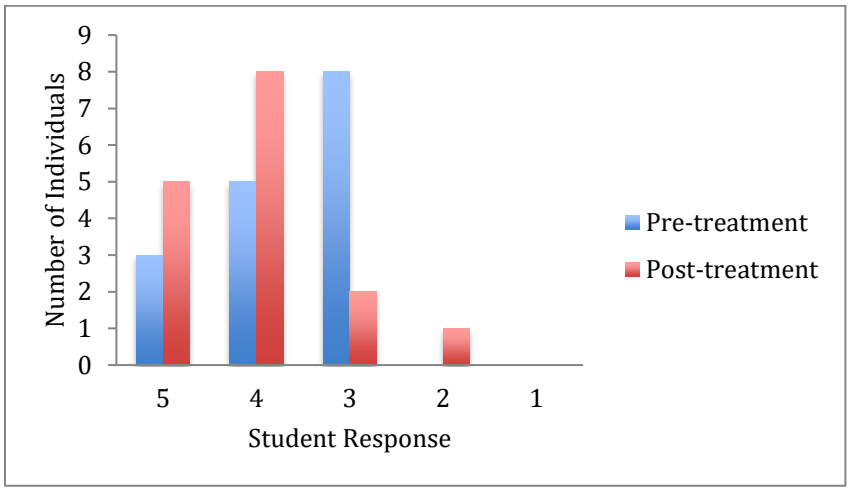

Figure 2. Student responses to statement: I feel engaged when I am in Anatomy and Physiology, (*N*=16); 5 = Strongly Agree, 4 = Agree, 3 = Neutral, 2 = Disagree, and 1 = Strongly Disagree.

The SES also asked students how prepared they felt for the next grade or after high school based on their classes. The raw class data reveals an increase in positive responses for the post-treatment surveys (Figure 3). According to analysis of the results of the SES, the p-value determined by Fisher's test was 0.7795 and the p-value determined by the Wilcoxon Signed Rank test was 0.8497. Both of these p-values are higher than 0.05, which again implies that there was failure to reject the null hypothesis. According to survey data, there is no statistical difference between the pre- and post-treatment surveys. During student interviews, students reported that the self-paced format of the class helped them feel more prepared for college and developed skills that they would need to succeed beyond high school. "Having to take charge of my labs, notes, presentations, and other homework without set dates has definitely increased my responsibility and engagement." Another student stated, "I feel my time management has

improved." In the reflections about their WBL experiences, students were asked to examine how the classes they have taken in high school help to prepare them for a medical career. One student commented that, "one of the most important things would be to work harder in school than I do at the moment."

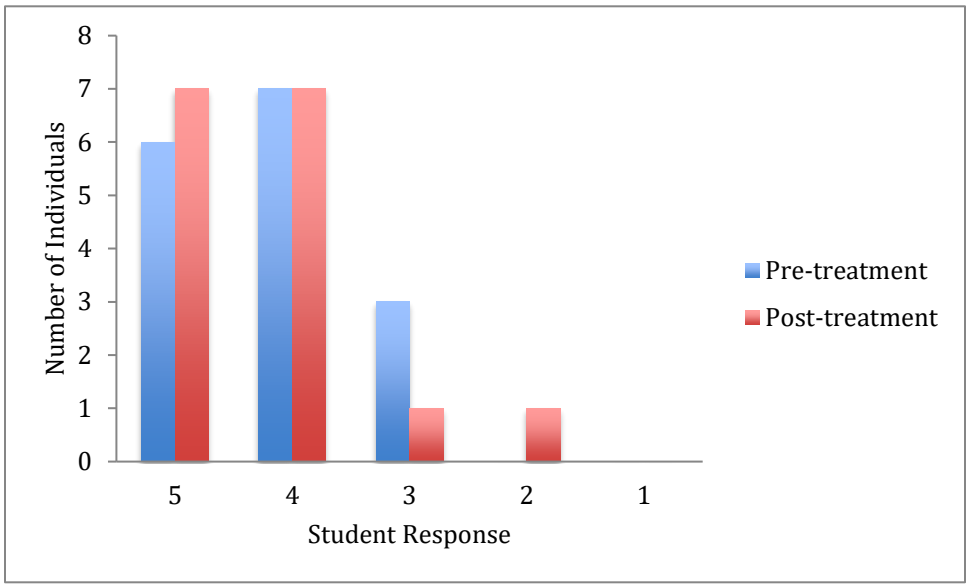

Figure 3. Student responses to statement: My classes are preparing me to do well in the next grade or after graduation, (*N*=16); 5 = Strongly Agree, 4 = Agree, 3 = Neutral, 2 = Disagree, and 1 = Strongly Disagree.

Throughout the treatment period, students were exposed to content in action, so to speak. They were taught EMT training skills and were asked to job shadow various medical professions. The SES asked students to respond to the statement "My classes are teaching me skills that I need to be successful in life outside of school" (Figure 4). The p-value for this statement as determined by Fisher's test was 0.1757 and was the lowest p-value calculated for the SES statements. This value is still larger than 0.05 so there is still a failure to reject the null hypothesis, which meant no statistical difference between pre- and post-treatment survey responses. Comments made during student interviews

contradict the results from the survey. One student stated, “I really liked doing the EMT skills and my shadowing experience was really good and it was cool to see everything in action.” Another student said, “it (the EMT training skills and WBL experiences) helped me realize that I can actually use what I learn in the classroom in real life.”

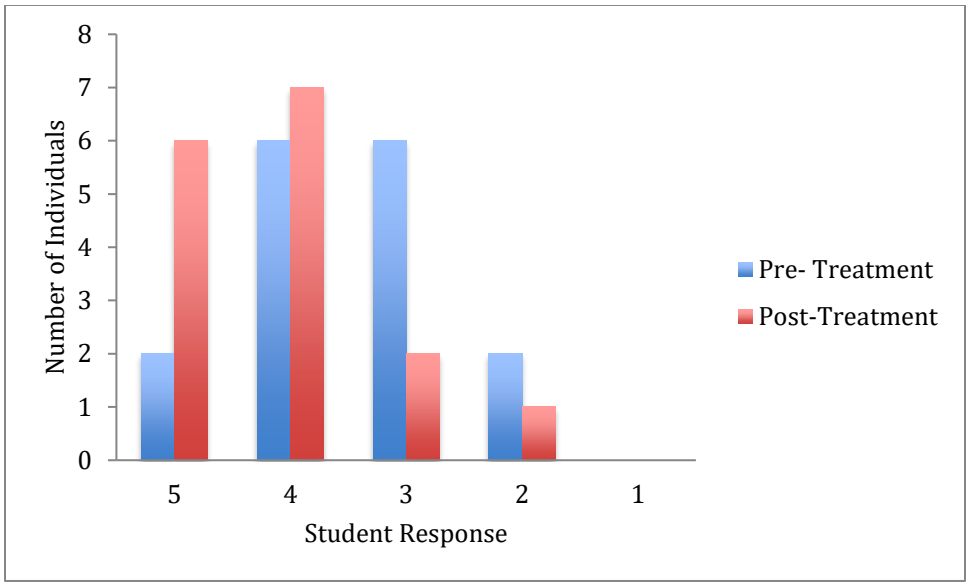

Figure 4. Student responses to statement: My classes are teaching me skills that I need to be successful in life outside of school, (*N*=16); 5 = Strongly Agree, 4 = Agree, 3 = Neutral, 2 = Disagree, and 1 = Strongly Disagree.

In an attempt to link the activities done in class to the A&P content material, students were asked to respond to the statement “The activities we do in class help me learn.” An analysis of the pre- and post-treatment responses with a Wilcoxon signed rank test yielded a p-value of 0.6291 and Fisher’s test gave a p-value of 0.5476. Due to the high p-values, it was determined that the null hypothesis could not be rejected suggesting there was no statistical difference between the survey groups. During the post-treatment interview one student stated, “I am a very visual learner so the EMT training, though rough at times, did help me understand better.” After analyzing the bar graph created

from the raw data, it suggested that while the activities helped some students learn, there were still others that felt as though they did not (Figure 5).

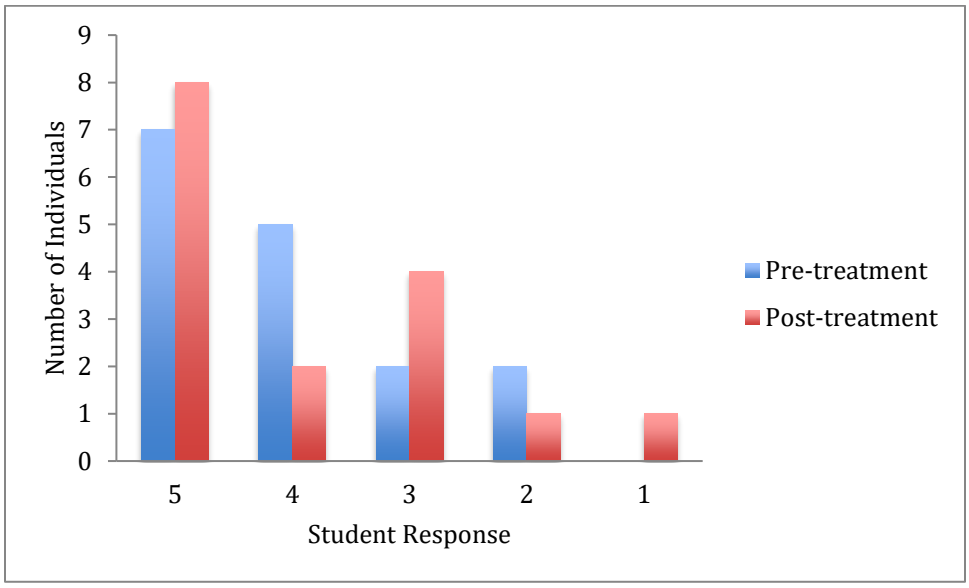

Figure 5. Student responses to statement: The activities we do in class help me learn, (*N*=16); 5 = Strongly Agree, 4 = Agree, 3 = Neutral, 2 = Disagree, and 1 = Strongly Disagree.

During the treatment period, students were asked to complete reflection papers about their WBL experiences. These reflections, along with the Job Shadow Interviews, gave some insight into the experience students had during the three hours that they job shadowed. According to the SES, only 38% of students expressed interest in a career in the medical field after the treatment period (Figure 6). When the post-treatment survey results were compared to the pre-treatment survey responses through a Fisher's test, the calculated p-value was 1. This result reveals no statistical difference between the two data sets.

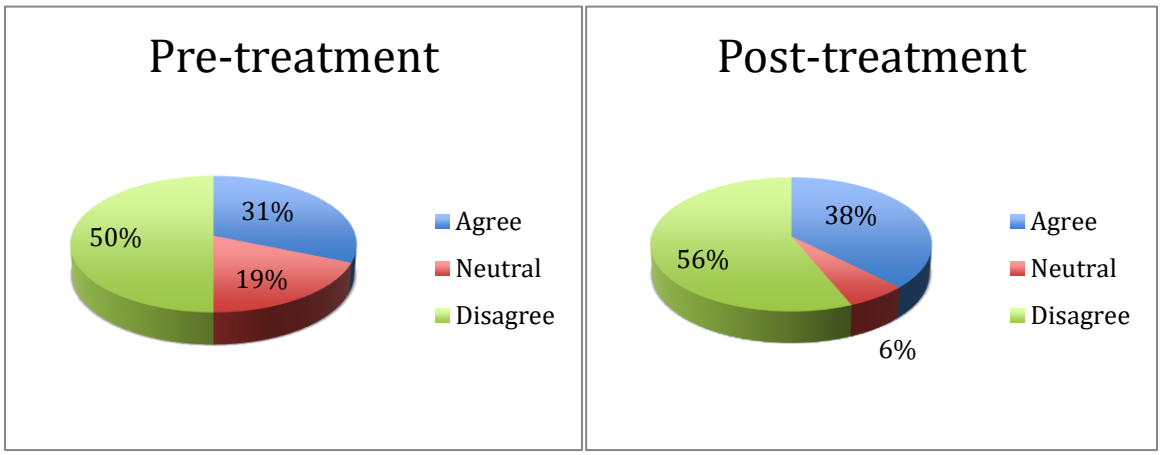

Figure 6. Student response to statement: I am interested in a career in the medical field, (*N*=16).

When asked how the WBL experience impacted their career goals, one student responded, “Although it’s (being a chiropractor) an interesting career, I have no plans of doing it.” Another student that was uninterested in a health career in the future said, “I don’t think I will consider this profession (massage therapy) because I don’t think I would enjoy the massage aspect of the job but I would enjoy helping people relieve their stresses.” All students, regardless of their interest in pursuing a medical profession, seemed to get some benefit from the WBL experience, “An important thing I learned from this experience is how keeping everything organized and in place is a skill I need to develop.” Another student said, “I think the most important thing I learned from this guest speaker was that to achieve some dreams you need to have a lot of dedication and perseverance.”

Students interested in pursuing a career in the medical field found the WBL experiences beneficial. “This shadow helped me prepare for educational planning in the future, but instead of being a county nurse, I have a different area of nursing that I would want to go into.” Another student expressed that he was considering a career in medicine

because he wanted to be the first in his family with a medical degree. When asked about his WBL experience, he said, “I learned so much more about the career path I wanted to take going into the future and that starting out in a small work environment may not be all that bad.”

INTERPRETATION AND CONCLUSION

The overall goal of this study was to examine the impact made by hands-on medical experiences on student engagement in anatomy and physiology (A&P). Though the results of data analysis of the quantitative data seemed in contrast to the qualitative data, the treatment did seem to have an impact on students. The engagement of students as reported by the SES, indicated no statistical difference post-treatment compared to pre-treatment. Student interviews indicated that a majority of the class, 94%, felt as though they were more engaged post-treatment than in the pre-treatment period.

In the beginning of the treatment period, students appeared to struggle with the self-paced format. This was the first time that they had been exposed to this style, and my hope was that it would give them some insight into classes taken at higher education levels. One student commented, “After finding a routine, it was better to have a self-paced class because I was able to organize assignments in a way that was best for me whereas in the beginning of the year, we could have lots of homework one day and not much on another.” In the end, this classroom format became students’ favorite part of the class. They liked the autonomy of being able to work on whatever assignment they felt like on that day. During the post-treatment interview a student made the following claim, “Self-pacing really sets the slackers apart from those who really care.” It also seemed to

reduce the stress levels of students who were gone often for sports and other activities, as they knew all the assignments before they would be gone. “The self-paced class and online notes (worked well) so you could do school if you are going to be gone or work on the weekends.”

An analysis of the Student Engagement Surveys (SES) that students took pre- and post-treatment, revealed no statistical difference between the responses before the treatment period compared to after. The SES indicated no increase in student engagement, no increased interest in the medical field, or change in how students viewed homework and activities.

Despite the SES data analysis results, student interviews denoted an increase in student engagement as perceived by the students. Almost the entire class reported that they felt more engaged in A&P than they had pre-treatment when the class depended on a lecture style. When discussing with students how engaged they felt they were in class, one student said, “It wasn’t great in the beginning now it’s better.” Another student said, “I feel like I have learned a lot more.” From my perception, it seemed that students were more focused throughout the class period, and when we completed the EMT training skills, they were very engaged and interested. Through the class period, there was less time spent on phones or with heads on their desks. Instead, students spent time working together to complete labs or practice their EMT training skills in order to test out. It was entertaining to listen to them argue over how to take pulses, for example, and then to teach one another the correct way to do so.

My A&P class this year was the largest upper level class that I have taught, so I was surprised that only 38% of students enrolled in the class were interested in a medical career. The SES also showed no statistical difference in the desire to pursue a medical career pre- and post-treatment. This makes sense to me because at this point, most seniors and some juniors have already decided what they want to do after high school. All students, regardless of their future career plans, had to complete WBL experiences. The initial plan was for three experiences to be completed, but issues with the hospital in Havre made it difficult to place students. For some of the careers, like a surgeon for example, it was not possible to place a student. Instead, I worked to bring in guest speakers to address those career interests. All students did, however, end up completing two experiences and some have even expressed a desire to go back and shadow for additional hours.

Students got to experience a few hours in that job and see some of what they could expect. In one post-WBL experience reflection paper, a student stated, “I like the job shadow because I got to look at some of the health statistics for Blaine County and some of the main health challenges that we face in Blaine County.” Some students had their desires reaffirmed as to whether or not a medical career was for them and other learned that certain avenues might not be as suited for them. For example, “This job shadow experience made me realize that if I do want to become a nurse, I would want to be one who works in a hospital instead of a clinic.” For the students interested in medical careers, it seems that the WBL experiences were beneficial for them. It gave students a better picture of their chosen career and experience that they may not receive until later in

college when they may feel trapped in their chosen path. They also showed students how the material that they were learning in A&P (and hopefully in other courses) was being used practically.

VALUE

This research project has made me feel like a more flexible teacher. In the beginning, the transition to a self-paced classroom was pure chaos. Students were working on so many different things that it was hard for me to let go and let them experience the material on their own. Over time though, this style became normal, and I felt more at ease being able to float around and help wherever I was needed. I have also become a more organized teacher. I have always been pretty good at organizing my classroom but in the past few years I have been more week-to-week scheduling. Completing this action research has required me to plan out a month at time at least for A&P. I have gotten better at not putting things (creating notes, making copies, and making video lectures) off until last minute. In order for the self-paced classroom to work, students need to have access to all materials from day one.

I have wanted to flip my classroom for a while, and this project gave me the push to do that. I look forward to continuing with this classroom structure and experience, not only with A&P but by integrating it into other classes that I teach as well. Throughout the treatment period, students seemed more engaged and collaborative with their fellow students, saying, “You can be more involved with classmates while working with labs, and we have learned to study together for the tests.” Although the self-paced format of the class was a great way to make more time for the EMT training skills, the WBL

experiences were more time consuming for students and required them to miss other classes. I am not sure if there is a way around this but having students schedule their own WBL experience may be one solution. Students can work with health care professionals to set up days and times that work best for their class schedules or even non-school days if possible.

While looking back on the treatment period more closely, I realize some issues that came up throughout this process will need to be addressed before the next year this class is taught again. At points through the treatment period, the self-paced class left students with too much free time. Students commented that one change that should be made for future classes is to schedule labs out so everyone works on them at the same time. “Since there are several stations where you can only perform the action at school, it would be beneficial for students to get those done in class.” Another student commented, “I think you should do notes during class because then the students could ask questions during the lecture.” I was surprised that students desired more structure but this has been what they are used to in regards to the format of their other high school classes.

In the future, if I move forward with the flipped classroom, it is something that will have to be eased into. I would love to begin integrating some flipped classroom units into my under-classman classes. I am working with administration on creating an honor’s biology class that is run in a similar self-pace/flipped classroom style and in my physical science and regular biology classes, I am planning on completing at least one unit per class as a flipped class. My hope is that through this self-paced classroom experience, students learn to take responsibility for their own work and education. Developing this

responsibility will help them with the transition from high school to college. During the post-treatment interviews, one student shared that he believes all upper level sciences should be self-paced in format.

The method that was used to collect data also did not seem to be as useful as expected. I had debated early on about putting a neutral option on my Likert-style Student Engagement Survey and ultimately decided to do so. Now I feel as though I might have seen more of an impact represented by the data if students did not have that neutral option. I also wished that I had utilized another method, in addition to the surveys, for measuring student engagement. I could have noted the amount of time that students spent on task and working or had another teacher come in and make note of that.

I hope this project has shown students not only the wide variety of medical professions available but also that they do not necessarily need to go to college for all of them. I tried to give them some exposure to careers that involve the human body but do not require a 4-year college degree. These included careers in massage therapy, becoming a paramedic or lab technician, and phlebotomy. Furthermore, I hope that students are not as daunted about becoming EMTs if the opportunity presents itself because small rural communities like Chinook rely heavily on volunteer EMTs. EMT training skills, like treating bleeding and shock and basic CPR, are wonderful skills for these students to learn. Many families in this area have farms and ranches that students live and work on and these are often in isolated areas. Knowing basic EMT skills could be the difference between life and death.

From these WBL experiences, I hope that students are able to see the larger picture in regards to what they are learning in class. It is so frustrating to hear "yeah, but when am I ever going to need to know this?" This statement has been so disheartening over my years of teaching because students aren't being shown the real-world applications of their education, even if that application is just how to think about things. Integrating EMT training skills and the WBL experiences took material learned in class and showed students direct situations where that classroom knowledge could be applied. It has become my goal to attempt to do that in my other classes, even if just in a unit or two. I was also surprised at the connections that I saw students making throughout this treatment period to aspects of their high school life. After listening to Dr. Ymzon, who is a surgeon and was one of our guest speakers, one student shared, "The work environment can be with a lot of people, they're in and out of the operating room or rooms helping patients. I would feel comfortable in this environment because it is almost like a game that I play as a high school athlete." Students were beginning to realize that other aspects of their life, not solely their education, were preparing them for lives and careers beyond high school. As a coach, you are trying to instill values into your athletes that extend beyond the activity itself, so for me, seeing a student make this connection was really awesome and gratifying.

Through this action research, I was able to share the type of science that I discovered at the college level and the science that made me want to pursue more, to learn more. It was hands-on science that I got to explore and discover on my own with the guide of a professor. Science that is so much more than a textbook and cookie-cutter

style labs. Science is a process of exploration and, as I have learned through this study, sometimes messy. The data doesn't necessarily always agree with expected outcomes and you don't always get the result you had hoped for. But the beauty of science is that whenever it answers one question, it often asks another, opening up additional areas for exploration, modification, and repetition, with the ultimate goal of learning that which you hadn't known before.

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APPENDICES

APPENDIX A

MONTANA STATE UNIVERSITY INSTITUTIONAL REVIEW BOARD EXEMPTION

INSTITUTIONAL REVIEW BOARD

For the Protection of Human Subjects
FWA 00000165

MONTANA STATE UNIVERSITY

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MEMORANDUM

TO: Jerilyn Wood and John Graves

FROM: Mark Quinn, Chair Mark Quinn chj

DATE: October 1, 2018

RE: *"An Analysis of Hands on Medical Experience and Student Engagement in the Science Classroom" [JW100118-EX]*

The above research, described in your submission of September 28, 2018, is exempt from the requirement of review by the Institutional Review Board in accordance with the Code of Federal regulations, Part 46, section 101. The specific paragraph which applies to your research is:

_X_ (b) (1) Research conducted in established or commonly accepted educational settings, involving normal educational practices such as (i) research on regular and special education instructional strategies, or (ii) research on the effectiveness of or the comparison among instructional techniques, curricula, or classroom management methods.

_X_ (b) (2) Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures or observation of public behavior, unless: (i) information obtained is recorded in such a manner that human subjects can be identified, directly or through identifiers linked to the subjects; and (ii) any disclosure of the human subjects' responses outside the research could reasonably place the subjects at risk of criminal or civil liability, or be damaging to the subjects' financial standing, employability, or reputation.

____ (b) (3) Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures, or observation of public behavior that is not exempt under paragraph (b)(2) of this section, if: (i) the human subjects are elected or appointed public officials or candidates for public office; or (ii) federal statute(s) without exception that the confidentiality of the personally identifiable information will be maintained throughout the research and thereafter.

____ (b) (4) Research involving the collection or study of existing data, documents, records, pathological specimens, or diagnostic specimens, if these sources are publicly available, or if the information is recorded by the investigator in such a manner that the subjects cannot be identified, directly or through identifiers linked to the subjects.

____ (b) (5) Research and demonstration projects, which are conducted by or subject to the approval of department or agency heads, and which are designed to study, evaluate, or otherwise examine: (i) public benefit or service programs; (ii) procedures for obtaining benefits or services under those programs; (iii) possible changes in or alternatives to those programs or procedures; or (iv) possible changes in methods or levels of payment for benefits or services under those programs.

_____ (b) (6) Taste and food quality evaluation and consumer acceptance studies, (i) if wholesome foods without additives are consumed, or (ii) if a food is consumed that contains a food ingredient at or below the level and for a use found to be safe, or agricultural chemical or environmental contaminant at or below the level found to be safe, by the FDA, or approved by the EPA, or the Food Safety and Inspection Service of the USDA.

Although review by the Institutional Review Board is not required for the above research, the Committee will be glad to review it. If you wish a review and committee approval, please submit 3 copies of the usual application form and it will be processed by expedited review.

APPENDIX B

JOB SHADOW PERMISSION FORMS

Dear Parent(s),

Your student is enrolled in/a part of Anatomy and Physiology. As an important component of this course, we are partnering with local healthcare professionals to offer each student a job shadow opportunity during school hours. There will be one required job shadow experience provided for your student. Students will have an array of job shadow options to choose from based on the results of their interest survey to ensure they are actively engaged in this experience.

The job shadow experience for your student will take place on _____.

Students are to provide their own transportation with permission from parents. Arrangements can be made, if a student does not have transportation.

We are excited for this opportunity for real and relevant learning, and for our students to experience how skills and passion meet to create a career. We hope we have your support as well!

If you have any questions or concerns, please contact me at woodj@chinookschools.org or 357-2236.

Authorization of Transportation

By signing below, I give consent to allow _____ to use their own transportation or to ride with a classmate to and from the job shadow experience. Chinook High School is not responsible for accidents or personal injury. Do not sign if you want transportation provided.

_____
Signature of Parent

_____ _____
Printed Name Date

APPENDIX C

STUDENT ENGAGEMENT SURVEY

Directions: As you read through this survey please circle the response that best represents your feelings to the statement. Please read all statements carefully. Do not circle answers based on what you think that I want to hear.

This survey will not be graded; your answers in response to this survey will not affect your grades in this class in any way.
School in general

The teachers talk about interesting subjects in my classes.

1 2 3 4 5
Strongly Disagree *Strongly Agree*

My classes are preparing me to do well in the next grade or after graduation.

1 2 3 4 5
Strongly Disagree *Strongly Agree*

My classes are teaching me skills that I need to be successful in life outside of school.

1 2 3 4 5
Strongly Disagree *Strongly Agree*

My teachers care about how I am doing.

1 2 3 4 5
Strongly Disagree *Strongly Agree*

I participate in extracurricular activities like sports and clubs.

1 2 3 4 5
Strongly Disagree *Strongly Agree*

Getting good grades is my main focus in classes.

1 2 3 4 5
Strongly Disagree *Strongly Agree*

Anatomy and Physiology
My homework and other assignments are interesting to me.

1 2 3 4 5
Strongly Disagree *Strongly Agree*

I look forward to seeing what we will do in class each day.

1 2 3 4 5
Strongly Disagree *Strongly Agree*

The activities we do in class are fun and exciting.

1 2 3 4 5
Strongly Disagree *Strongly Agree*

I participate in class discussions and other activities.

1	2	3	4	5
Strongly Disagree				*Strongly Agree*

The activities we do in class help me to learn.

1	2	3	4	5
Strongly Disagree				*Strongly Agree*

In class, I always spend my time working instead of acting like I am working.

1	2	3	4	5
Strongly Disagree				*Strongly Agree*

I never have trouble with my mind wandering when I am in class.

1	2	3	4	5
Strongly Disagree				*Strongly Agree*

I have a solid plan for what I want to do after high school.

1	2	3	4	5
Strongly Disagree				*Strongly Agree*

I am interested in a career in the medical field.

1	2	3	4	5
Strongly Disagree				*Strongly Agree*

I feel engaged when I am in Anatomy and Physiology.

1	2	3	4	5
Strongly Disagree				*Strongly Agree*

Is there anything else you would like me to know?

APPENDIX D

POST-TREATMENT ENGAGEMENT INTERVIEW QUESTIONS

How do you feel your engagement in anatomy and physiology has changed from the beginning of the year?

Do you feel that the EMT training skills and WBL experiences helped with your understanding of anatomy and physiology?

What do you think worked well?

What changes do you think should be made for future classes?

Is there anything else you would like me to know?

APPENDIX E

JOB SHADOW INTERVIEW QUESTIONS

How did the job shadow impact your career goals?

Did it confirm your interest in the industry/field? How?

Did it make you rethink your perceptions of this type of work?

Did anything about the experience surprise you?

Did anything about the experience reassure you?

Is there anything else that you would like me to know?

APPENDIX F

JOB SHADOW REFLECTION REQUIREMENTS

Student Job Shadow Reflection

Directions: Using the template below, write a one to two page reflection about your job shadow.

Paragraph 1 – The Worksite
• What department(s) area(s) did you shadow?
• What type of work did you observe?
• What safety aspects and considerations were you shown at your job shadow?
• Describe the working environment (clean, loud, fun, lots of people, atmosphere etc.)
• How did you feel while in this environment (comfortable, uneasy, liked it, didn't like it –why?)

Paragraph 2 – Likes and Dislikes
• From your perspective (your interests, abilities, and goals) identify aspects that were positive and negative.
• What did you like about the job shadow and why?
• What did you dislike about the job shadow and why?

Paragraph 3 - Expectations
• What ideas and expectations did you have about this job and career pathway prior to going on the job shadow?
• What surprises were there on the job shadow?
• If you had more time, what would you like to have seen, done, and/or learned?

Paragraph 4 – Education and Skills
• What classes at your school do you plan to take or have you taken that tie in with your job shadow experience, and how?
• What type of post-secondary education is needed for this career?
• What type of skills are needed?
• What would you need to do to acquire the education and skills needed if you do not presently have them? Is this something that would interest you?

Paragraph 5 – Relevance
• In reality, how did the company and the career you observed fit into your education and career plans? How do they differ?
• What do you think was the most important thing you learned from your experience?
• Would you consider a career path in this career? Why or why not?