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Students' Perspectives and Engagement: Transforming Newly Acquired Knowledge to Long-Term Memory Utilizing the Deliberate Practice Framework

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As students progress through their college years, they face the task of acquiring large volumes of information from a variety of classes. Many educative and psychological associations have proven that student performance is directly affected by the student perspective and the amount of engagement with each exercise. The greater the effort a student invests in the exercise, the greater the classroom performance quality. The results demonstrate better long-term memory while utilizing the deliberate practice framework through repetition. For our exercise, we started by administering a brief survey to assess students' perspectives, confidence levels and engagement preferences. Students were encouraged to give feedback on how they learn best and what educative practice methods they prefer. Second, students received instructions on how to utilize the deliberate practice framework and were instructed to intentionally repeat the exercise in order to start transitioning newly acquired knowledge into long term memory. This exercise was graded each time the student completed the task showing an increase in knowledge base, an increase in overall classroom performance, and increased information into long term memory. Third, the previous survey was administered again to assess students' perspectives, confidence levels, and engagement preferences after the exercise was completed. Survey results showed that students overwhelming reported an increase in classroom confidence levels, engagement preferences, and a marked increase in retained long term memory information. The deliberate practice framework method for prescription writing was perceived as an effective experience for the majority of the students who completed the survey. These teaching techniques were applied with successful results in our class. All of the techniques can be applied in a variety of classes while enhancing student engagement and educative practices.

Introduction

The scientific study of human learning and memory is now more than 125 years old (Roediger, 2013). Roediger stated, "Psychologists have conducted thousands of experiments, correlational analyses, and field studies during this time, in addition to other research conducted by those from neighboring fields. A huge knowledge base has been carefully built up over the decades" (2013, p.1). One of the major

influencing factors of assignment design should consist of the student's point of view and their acceptance for the activity. Teaching techniques assume the learner is motivated, wants to learn and is fully on board with the technique of choice. Students learn differently and preferences vary from one phase of life to another. When educators design a lecture or classroom exercise, they often overlook the student's perspective and preference. Leaving out the student input will often spell disaster for any activity in the classroom and less than desirable outcomes.

According to Eastern Kentucky University's strategic goal, students succeed when educators devote energy to continuously improving their experiences in and out of the classroom (2019, https://strategicplanning.eku.edu). An educator plays a vital role in a student's education; however, the sole responsibility for student success weighs ultimately on the student. Research identifies the contributions of positive psychology to higher education success with an emphasis on student focused strengths (Williams, Horrell, Edmiston & Brady 2018). According to The William & Mary Educational Review, "when students focus on their strengths, they can exercise positive psychology to enhance their growth by thriving and flourishing in their personal and professional lives." Students should take an active role in their educative process, while allowing the educator to guide and influence them in and out of the classroom.

 The authors' institution, a university in the U.S., which is committed to student engagement and success, has adopted a strategic plan to guide their students through the academic process. All of the authors witness students struggling with patient care in the clinic and wish to enhance the learning process while considering student preferences. Engaging the student and understanding their perspective helps educators guide students to transform newly acquired knowledge into long term memory while the student utilizes the deliberate practice framework. Using a reference guide with prescription writing and deliberate practice, the authors attempted to show an increase in student confidence levels, encourage engagement, increase long term memory, and improve patient quality of care. A confident motivated student is the vital factor in patient care success, while the student's point of view and preferences is the vital factor with education success.

Literature Review

When devising classroom projects, it's recommended for educators to work collaboratively with each student attempting to incorporate their learning preferences and engagement opportunities into the assignment. During these collaborative sessions, educators need to allow the student time to voice their perspective and allow time for feedback. Encouraging feedback during engagement sessions with the student will enhance interpersonal communication skills and construct an assignment both the educator and student will learn from, while accomplishing project goals and objectives.

Student Engagement

The relationship between a student and teacher is one reason an educator decides to commit their career to the education profession. This close relationship is important in finding out what makes the student excited to learn. "If you want people to be interested, committed, and willing to devote effort to learning, mastering, and using these skills for the long haul, then you can't avoid the initial step of stimulating excitement", according to the psychologist Kashdan (2019). The first step in the successful learning process is to engage the student. Allowing the student to have an active role in the learning process gives the student a voice of how they envision their environment for learning. When the student has a sense of control over the material, it allows them to explore their abilities and set the foundation for a positive learning environment (Cavanagh, 2019). How a student feels about learning drastically affects their ability to complete the task assigned. If students have a positive opinion with the assignment, then students will explore engagement possibilities and seek optimal results. Cavanagh's Advice Guide states, "When educators fail to appreciate the importance of students' emotions, they fail to appreciate a critical force in students' learning" (2019, https://www.chronice.com/interactives/advice-teaching). The second step in successful learning in the classroom is to understand the strong correlation between student engagement and student achievement (Dyer, 2015). According to Dyer, "The level of student attentiveness to classroom activities and engagement in peer conversations about appropriate academic material correlated to positive performance" (2015). If an educator can keep the student engaged and excited with the assignment expectations, the student will most likely embrace the task at hand and complete the project to their cognitive ability. Maximizing student engagement with learning preferences positively influences student perspectives and reinforces the learning process. As the student increases their positive perception regarding a project they will seek additional opportunities to acquire new knowledge and build a framework to enhance individual learning. The third step in successful learning considers student preferences. Students learn in a variety of ways such as seeing, hearing, memorizing, rereading, taking notes, visualizing, and reasoning among many others (Rinaldi & Gurung, 2008). Rinaldi & Gurung states, "The style a student prefers to learn isn't always the technique that will yield superior achievement of assignment goals or objectives" (2008). An educator can aspire to choose the learning technique required to achieve the maximum potential for each project, while considering the student learning preferences. Students may choose learning techniques based on the commitment level it requires and not the accomplishment of project goals. Students mostly prioritize their steps during project completion with the mindset of getting to the end as fast as they can with the least amount of work. An educator has the obligation of guiding the student to choose the technique that encourages personal growth and wise investment of the students time (May, 2018). Finding a balance between time commitment and optimal results is vital to student success with learning in the classroom.

Transforming Knowledge to Long-Term Memory

Students face the task of processing large quantities of information from a variety of classes on a daily basis. Successful transition of information into long term memory takes time and practice. Simply reviewing lecture notes isn't enough. Understanding how the brain processes and stores information is the first step in transforming knowledge into long term memory. According to Dr. Wolfe, "Learning is the act of making connections between thousands of neurons forming neural networks or maps. While memory is the ability to reconstruct or reactivate the previously made connections" (2018). The human brain has three memory storage systems: sensory memory, short-term memory and long term memory (Brabeck, Jeffrey & Fry, 2018). Sensory memory is where information is received from sight, sound, smell, taste and touch. Your reticular activating system (RAS), located in the brain stem, acts like a filter to discard information it deems not important. According to Wolfe (2018), "because we are so over-stimulated by what comes through our senses, it is believed that we drop about 99% of what comes into the brain and only 1% is sent on to our working memory". Working memory holds information temporarily in the short term memory and makes sense of what it is learning before sending the information to long term memory (MeTEOR Education, 2019, http://meteoredu-cation.com/long-term-memory/). Learning occurs when we move information from working memory to long term memory, and practice helps with this process (Brabeck et al., 2018). Deliberate practice keeps the information in our short-term memory long enough for it to be moved into long term memory. Brabeck states, "Once information is transferred to long term memory it can be retrieved at any time." When stored information is needed the brain receives triggers to retrieve the information from long-term memory and transfer the information back in the working memory to be used and continue to create more complex deep rooted associations (Wolfe, 2018).

Deliberate Practice

Deliberate practice (DP) occurs when an individual intentionally repeats an activity in order to improve performance (Braebeck et al., 2018). The DP framework creates a foundation on which future information can improve student skills. "Without any reinforcement or connections to prior knowledge, information is quickly forgotten-roughly 56 percent in one hour, 66 percent after a day, and 75 percent after six days" (Terada, 2017, p.2). According to Terada, "Repeatedly accessing a stored but fading memory rekindles the neural network that contains the memory and encodes it more deeply" (2019). Research states that even elite performers in sporting events incorporate DP to optimize performance and that individual differences are closely related to the assessed amounts of DP (Ericcson, Krape, &Tesch-Romer, 1993). Just like in sports, the medical profession searches for ways to improve healthcare and DP appears to be the technique practitioners prefer the most. The complex interactions of the brain works no differently with medical issues as compared with any

other issues. Choosing the correct learning technique with medical topics is vital to success when transferring medical knowledge for students into long term memory. The learning strategy called interleave concepts can be applied in patient centered exercises to improve patient care quality, decrease student mistakes and increase student performance. According to Rohrer, Dedrick, and Stershic (2015), solving problems involves identifying the correct strategy to use and then executing the strategy. When similar problems are grouped together, students don't have to think about what strategies to use-they automatically apply the same solution over and over until the automatic learning technique transfers information into long term memory. This process frees up the working memory space. The interleaving concept forces the student to think on their feet, and encodes learning more deeply (Rohrer, 2012).

Methods

Study Objective

The objective of this study was to implement the deliberate practice framework with patient clinical cases and to obtain student feedback on the effectiveness of utilizing a condensed manual while writing medication prescriptions. With students and faculty working collaboratively in the clinic while writing prescriptions, we explored ways to engage our students, make effective use of class time and improve patient quality of care.

Study Design

This study design included pre-post survey questions, lecture and pre-post exam components to assess student perspective, confidence level, engagement preference and memory retention while utilizing the deliberate practice framework technique. All students had the opportunity to ask questions, provide feedback, and provide future suggestions.

Participants

The survey, lecture, and exam components were offered to the D1-D4 student body at the end of the academic year, with a projected maximum sample size of N=480. Participation in the study was anonymous and voluntary. No grade was attached to either the survey or exercise.

Instruments

This study began with the student completing three case specific medication prescriptions. Each student was then asked to complete a brief survey consisting of 17 questions. The case prescriptions and survey were followed by a one hour traditional classroom instruction utilizing a condensed 11 category reference manual.

The student received guidance and feedback with writing prescription medications during their 4 years in dental school. The teaching techniques utilized for the classroom lecture included the deliberate practice framework technique and how to use the condensed prescription writing manual. Following the lecture, the student completed the same three blank case prescriptions and survey questions taken in the beginning of class. Pre- and post-survey responses of "strongly disagree", "disagree", "neither agree nor disagree", "agree" to "strongly agree" were converted to percentages for comparison. The prescription case pre and post exam was graded and converted to a percentage for comparison with 100% the maximum achievable score. There are no demographic information questions asked on the survey, so students are not identified and the study carries minimal risk to the student.

Data Analysis

Data analysis was completed on the pre- and post-survey results of "strongly disagree, disagree, neither agree nor disagree, agree, strongly agree" and compared. The agree and strongly agree responses were combined to reflect the student attitude of agreeing with the question content. The positive combined results were converted to an overall percentage for comparison with a 100% maximum scale. Data analysis was completed on the pre and post exam with prescription writing. Each prescription case had 5 points possible, with a total of 15 points per student per prescription exam. Percentages reported of class average test scores with 100% the maximum attainable grade for each class.

Results

Out of the 17 survey questions, 3 survey questions compared student confidence levels, 2 questions compared student perception of patient quality of care and one question compared the utilization of deliberate practice framework. A pre-post exam measured existing knowledge and retained long term knowledge with students utilizing a condensed reference manual and DP. Of the 28 items measured, 27 items showed a significant positive difference from pre scores to the post scores, indicating that knowledge and confidence levels of the majority of items improved overtime.
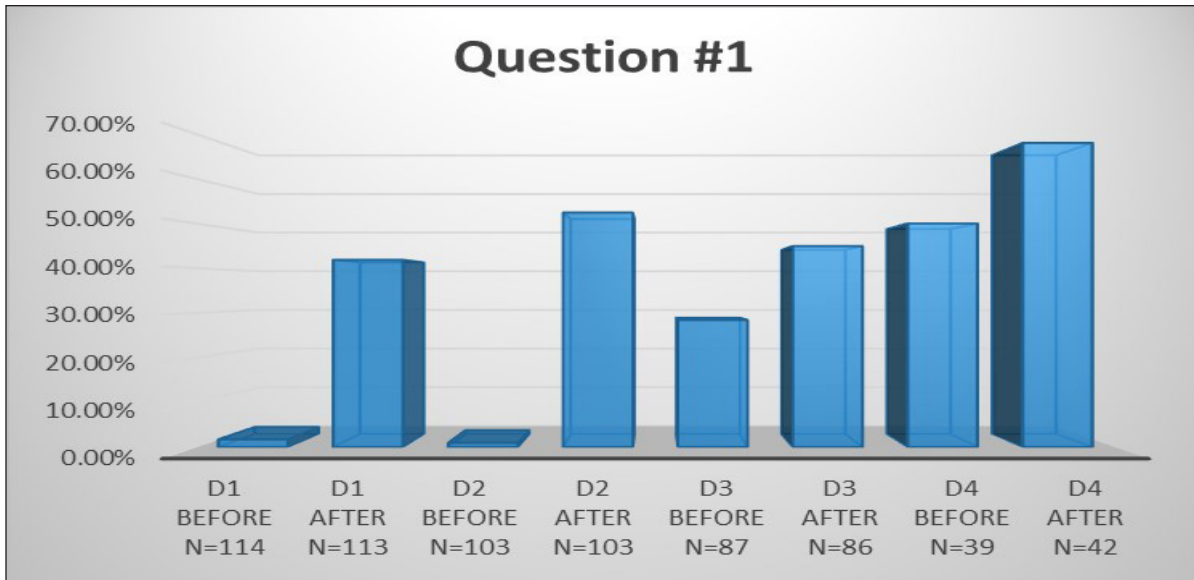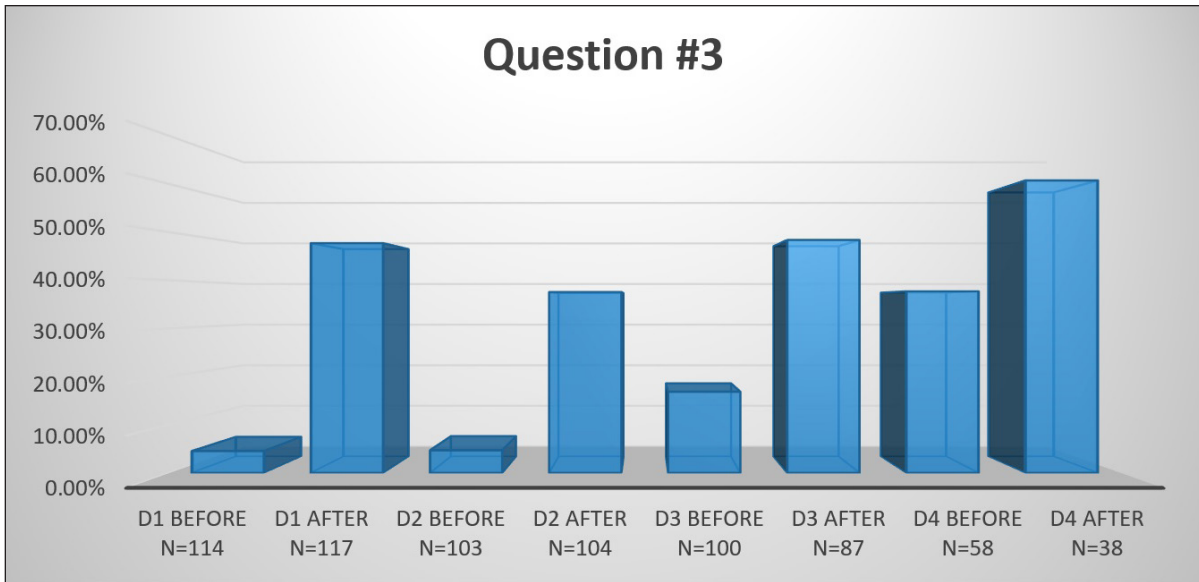
Figure 1. Question #1: I feel comfortable with writing an analgesic prescription in a clinical setting?

*Student Confidence Level- Strongly Agree/Agree Answers Combined for Positive Response
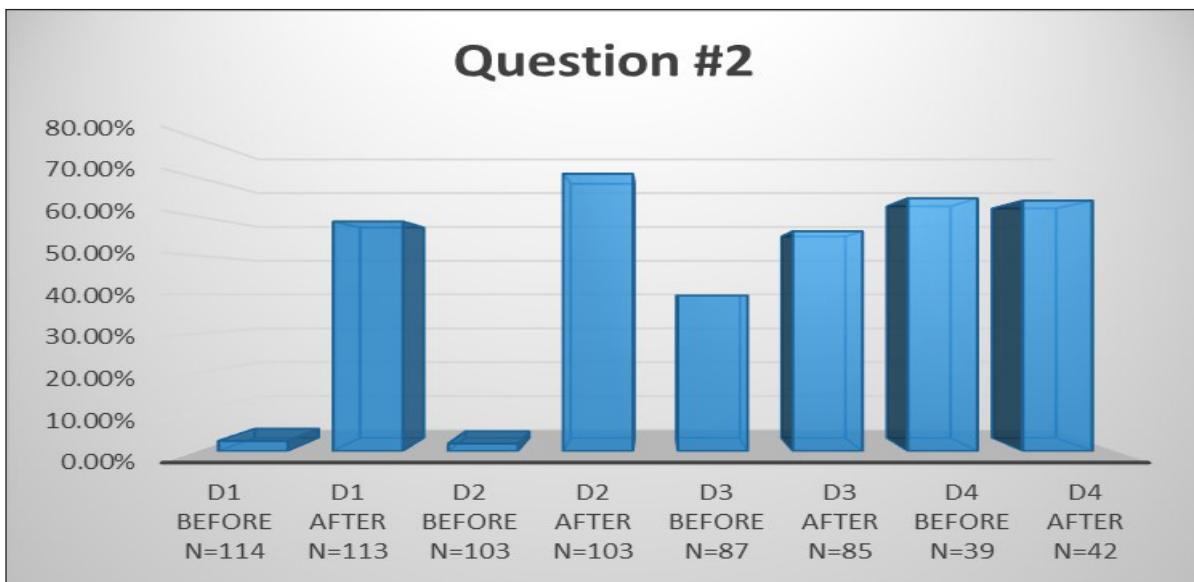
Figure 2. Question #2: I feel comfortable with writing an antibiotic prescription in a clinical setting?

*Student Confidence Level- Strongly Agree/Agree Answers Combined for Positive Response

Figure 3. Question #3: I feel comfortable with writing a preventative prescription in a clinical setting?

*Student Confidence Level- Strongly Agree/Agree Answers Combined for Positive Response
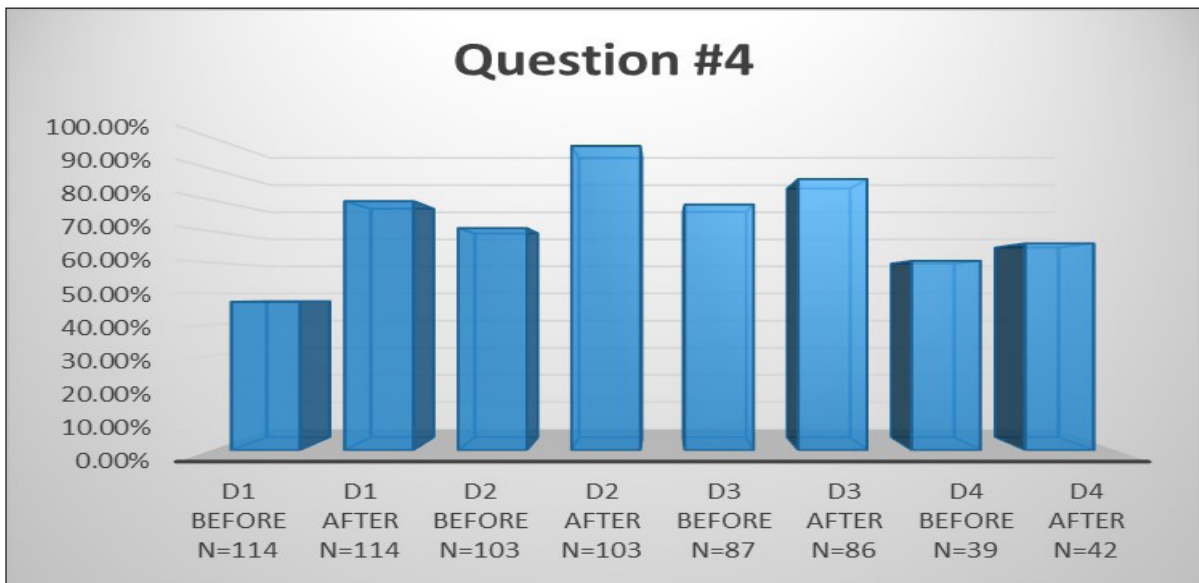

Figure 4. Question #4: I feel confident a condensed version of prescribed medications utilized in clinic would decrease patient chair time?

*Patient Quality of Care- Strongly Agree/Agree Answers Combined for Positive Response
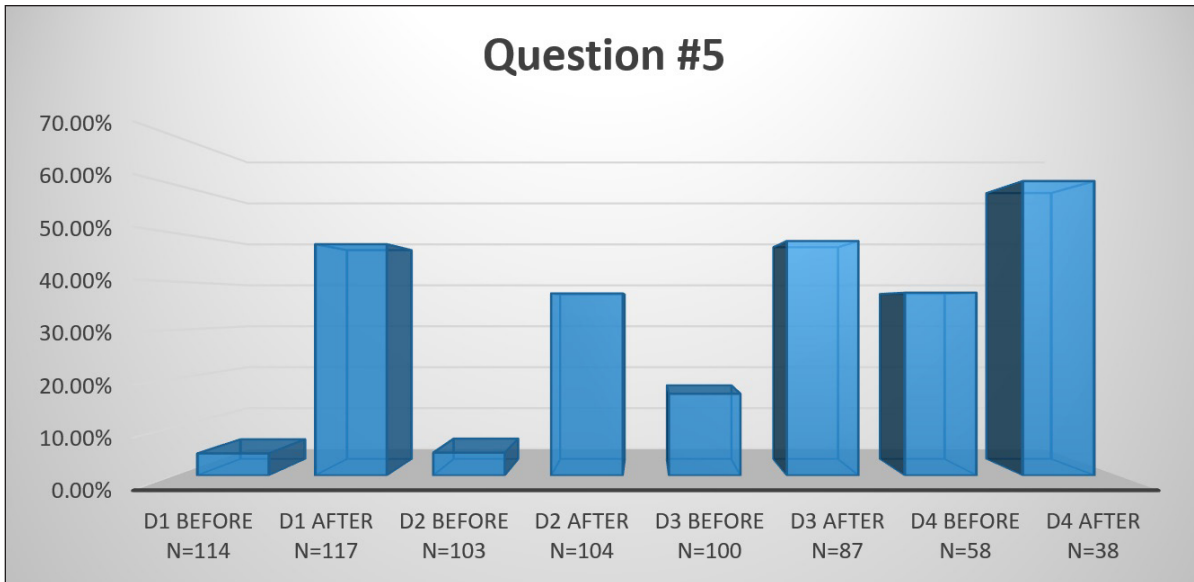
Figure 5. Question #5: I feel a condensed version of clinic prescription writing for clinic would decrease errors made by students during prescription writing?

*Patient Quality of Care- Strongly Agree/Agree Answers Combined for Positive Response
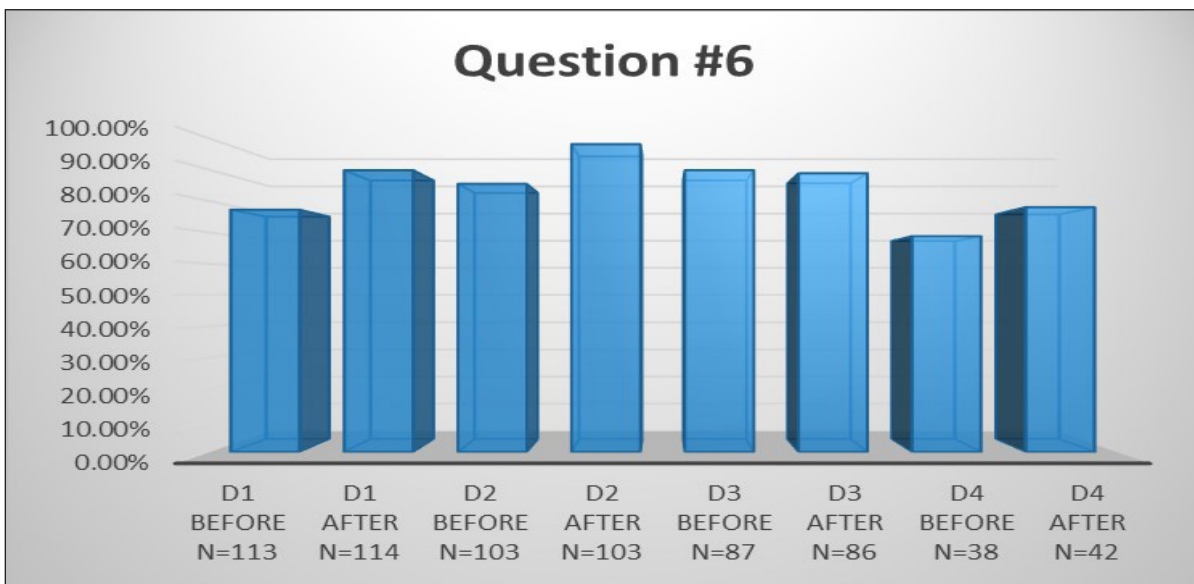
Figure 6. Question #6: Practice writing prescriptions makes me feel more comfortable with prescribing in the clinic?

*Deliberate Practice Framework- Strongly Agree/Agree Answers Combined for Positive Response
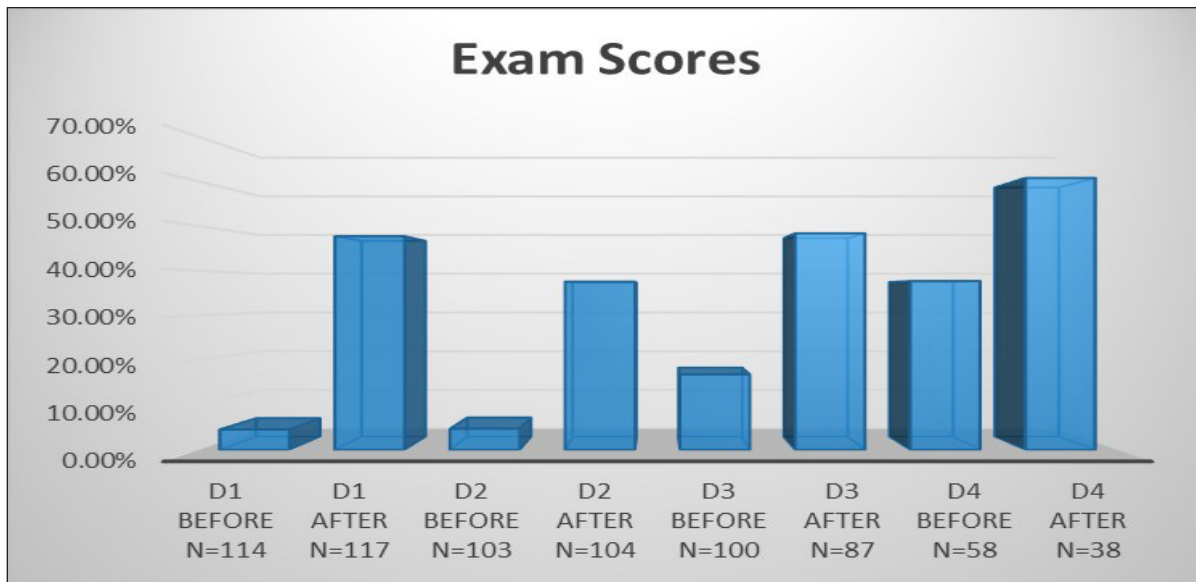
Figure 7. Exam Scores.

*Existing Knowledge (Before) and Long Term Knowledge Retention (After) , each prescription case had 5 points possible with a total of 15 points per student per prescription exam. Percentages reported of average test scores with 100% the maximum attainable grade for each class.

Discussion

The findings of this study reinforced that extensive DP makes it possible for students to access and apply complex information by increasing automaticity (Ericcson, 2008). Automaticity then leaves a student's working memory free to process new information (Kotovsky, Hayes, & Simon, 1985; Brabeck et al., 2018). This study also showed the influence of student engagement and perception on outcomes with a positive approach yields positive optimal results (Brabeck et al., 2018). Comparison of the 3 pre and post survey questions measuring student confidence levels showed an overall improvement in all 4 years of dental students, with a significant improvement in the first and second year dental curriculum. When comparing the two pre & post survey questions measuring patient quality of care, students showed improved awareness and understanding of the importance when using a reference manual during complex assignments to decrease mistakes and increase patient quality of care. Most notable were the results showing significant positive differences in pre and post exam scores and the pre and post survey question addressing DP. Students demonstrated consistent positive improvement in test scores practicing writing prescriptions over time and reported increased confidence levels in the clinic. As Brabeck, Jeffrey, and Fry (2018) states, "long term learning is enhanced by a distribution process in which information is repeated, allowing time in between practice sessions". Our findings revealed this to be accurate for all four years of dental students. Most

surprising results came from our fourth year dental students. They also showed a profound increase in knowledge retention and confidence levels, even though they were set to graduate and become independent practitioners in a few short months. Study results with our students confirmed the importance of a positive student perspective, repeated DP, and student engagement to improve long term memory and maximize optimal outcomes in difficult assignments.

Considerations

One limitation of this study was the long term information retention results, these long term results were limited to one year of the dental curriculum. Further testing of students with the same information in future dental school years, would yield information for comparison for long term retention of greater than one year. Future testing proposed would include the results for comparing a dental student during all four years, revealing the results of the DP framework and long term memory retention. Another limitation of the study was related to our data collected was only from this institution and not compared to other dental schools across the area or country. This information would benefit educators and academic institutions to monitor trends and learning techniques utilized throughout all dental schools. We can use this information to isolate the successful techniques that would yield maximum results in the classroom.

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