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The Techniques of Studying and Other Variables Impact on Initial Drug Card Exam Pass Rates

Kyle Shapcott

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The Techniques of Studying and Other Variables Impact on Initial Drug Card

Exam Pass Rates

Kyle Shapcott

South Dakota State University, College of Pharmacy and Allied Health

Professions

Advisor: Dr. Dan Hansen

Table of Contents

Section Title	Page number
Abstract.....	2
Introduction.....	3
Literature Review and Project Framework.....	6
Methodology.....	7
Data Analysis & Results.....	17
Discussion of Findings.....	19
Conclusion and Recommendation.....	21
References.....	24
Appendix.....	25
Survey Questions.....	27
Quiz Question Example.....	31

Abstract

The Techniques of Studying and Other Variables Impact on Initial Drug Card Exam Pass Rates is a study performed on the Top 200 Drug Card Exams presented to professional pharmacy students at South Dakota State University. The study utilized Fisher's exact test with a 0.05 significance value to find statistical significance in a variety of categories relating to different variables that were suspected to impact the pass rate of the exams. These variables included pharmacy work experience, place of work, first exposure to the exam content, and others. Data for this study was collected through a survey that 93 current professional students participated in and via a series of optional quizzes provided to P1 standing students, created by a P2 student. The study found that there was statistical significance in a difference of pass rates of students with first exposure 2 or more weeks from the exam compared to the pass rates of those with less than 2 weeks of exposure from the exam. It also found statistical significance in an increase of pass rates between students that took 2 or more optional quizzes on a drug card exam compared to those who took 1 or fewer optional quizzes and an increase in those who took any optional quizzes compared to those who did not take any optional quizzes. Results support evidence that additional information in form of quiz-style questions, that are either mandatory or optional, to students could increase students' likelihood of increasing the pass rate of Top 200 Drug Card Exams and in turn, increase knowledge of the tested material. It also shows trends that could have the potential to yield statistical significance if analyzed in a study with a large sample size.

Introduction

Professional students in the South Dakota State University (SDSU) pharmacy program are required to take two exams each semester in their first three years of the four-year program, which are better known as the Top 200 Drug Card Exams. These exams consist of a wide range of information over the 200 most prescribed medications in the United States and are anywhere from 35 to 50 questions in length. For a student to pass their drug card exams, they must obtain an 80% or retake the exam until the grade is achieved. Questions on the exam are broken down to 80% new material and 20% being cumulative material from any and all drug card exams prior to the current exam they are taking. The only exception is the first exam in the fall of a student's first year of the program. The information for this exam comes from *McGraw-Hill's Top 300 Pharmacy Drug Cards*¹. The information accessed on these exams, along with a breakdown of the logistics of that information can be seen in Table 1I at the end of the Introduction. The table was modified from information on a syllabus provided to students in the course in which the grade of drug card exam impacted.

These exams have caused some dissatisfaction amongst professional students in the SDSU pharmacy program for a number of reasons. They are the only exams in the pharmacy program, besides calculation practicums (a review of calculations that are seen on the NAPLEX that are done annually), where a specific grade must be obtained on that specific exam to pass the course and therefore proceed through the program. However, the exams are able to be retaken until the student receives a passing score of 80%. Additionally starting in Fall 2021, students keep the average of their first two attempts, rather than taking what their score on the initial attempt was. There is a cap to the grade a student can get of 80% after the retakes to avoid

students retaking exams receiving a better grade than those who passed on their first attempt.

Additional projects are assigned to students if they need more than two attempts on any one drug card exam. These projects are intended to increase the knowledge of students' drug card exam material. A few examples include creating study guides for the exam or creating a PowerPoint over a certain component of the exam that the student is struggling to grasp, such as brand name or dosage forms.

The reason research on this topic was completed is due to professional pharmacy students not studying for drug cards in the way that they were intended to be. The information on these exams is also not directly taught in lectures leading up to drug card exams, however, some information may be presented in other lectures through the progression of the program. Although students generally dislike these exams compared to others in the program, they are designed to improve students' experience in the pharmacy setting. The curriculum committee sees these exams as a benefit to students' education and improves their skills as student pharmacists. Additionally, these exams contain information that the curriculum committee of the professional program has acknowledged as the most important for pharmacy students to learn in order to understand and supplement other material taught through other courses in the program. It also enables students to work at a higher quality in a pharmacy setting in a variety of ways. Some examples of these include counseling patients effectively and safely and helping fill medications correctly.

Some students choose to study a couple of days before the exam or cram in the information the night before. This leads to them taking the exam without retaining the information, eliminating the intention for the exams. Others choose not to study at all knowing that they are going to get additional chances to pass the exam and in turn pass the course.

Additionally, this study is intended to find the most optimal ways to present information on drug card exams, techniques to study for this exam, and other various variables so future generations of students can benefit from techniques and variables that are deemed beneficial and avoid those that are not helpful.

The objective of this study is to uncover studying techniques and variables that are related to higher pass rates on drug card exams and increase knowledge of the material presented on drug card exams. Some of the studying techniques and variables that were explored included working in a pharmacy setting, different pharmacy settings students work at, the average first exposure of studying the material in correlation to the exam, and completing optional quizzes leading up to drug card exams. Other information gathered in this study was included in the Appendix that may be used to help with future changes to logistics and presentations of drug card exams.

Table 11 - Breakdown of Material covered on Drug Card Exams by Semester						
Topic	P1 Fall	P1 Spring	P2 Fall	P2 Spring	P3 Fall	P3 Spring
Generic and Trade Name	N	R & N	R	R	R	R
Controlled Substance Schedule	N	R & N	R	R	R	R
Therapeutic Class	N	R & N	R	R	R	R
Dosage Forms	N	R & N	R & N	R & N	R	R
FDA Indications	N	R & N	R & N	R & N	R	R
Adverse Effects	N	R & N	R & N	R & N	R & N	R & N
Patient Consultation	N	R & N	R & N	R & N	R & N	R & N
Dosages	X	X	R & N	R & N	R & N	R & N
Pharmacology/Pharmacokinetics	X	X	R & N	R & N	R & N	R & N
Drug Interactions	X	X	R & N	R & N	R & N	R & N
Contraindications, Precautions	X	X	R & N	R & N	R & N	R & N
N - New Material; R - Review Material; X - No Material						

Literature Review and Project Framework

With these exams being institutionally-derived there are no other studies that have been performed on them. However, I was able to look through other academic-based studies that look at an increase in exam success and retention through different variables that are not related to the field of pharmacy. One of the ideas that could be correlated with this study is the idea of interleaving². This is an idea of integrating other noncorrelated information into your studying regimen while studying for exams. This idea is supported by a variety of different studies and can be applied to pharmacy school since there is usually an average of at least an exam every week in the pharmacy program and information is constantly being taught to students.³ Information of different classes should be studied in alternation and intertwined rather than in blocks of time over a longer period of time. In the study, *When less of the same is more: Benefits of variability of practice in pianists*, it shows a significant increase in performance in individuals that incorporate learning other series of notes than those that only study one series of notes. The first group would practice jumping to notes on opposite ends of the instrument and practicing a series of notes that are closer to one another in alternation while the other group would only practice the note series that was farther apart from each other.

To practice in the field of pharmacy people must pass the North American Pharmacist Licensure Examination (NAPLEX). The exam requires baseline knowledge of drugs to be understood in order to be successful.⁴ There is also research that passing the NAPLEX is correlated to the GPA of a student's third professional year in professional programs.⁵ A study from Texas Tech University looked at different variables that may impact the NAPLEX success rate from preadmission characteristics. One of these that stood out to me was preadmission

GPA had a strong correlation to success in NAPLEX scores.⁶ Another study from Xavier University showed that not having any unsatisfactory grades in pre-pharm or the professional program has a positive significance toward NAPLEX success. This could be correlated to not passing a drug card exam and receiving an unsatisfactory grade in the course.⁷

With the approach of how drug card material is presented, it is similar to a flipped classroom. A meta-analysis over flipped classrooms compared to lectures found that neither of the approaches to teaching provided a significant difference in the outcome of students' success.⁸ Other pharmacy-specific studies showed that students increased their knowledge retention in exam scores when participating in a flipped classroom setting. The exact correlation to the flipped classroom observed in these studies and the SDSU drug card exams can not be applied due to the time for a flipped classroom benign given to students while the drug card exam material is not allotted a specific time to learn it.^{9,10,11}

Methodology

There are a few different terms in this study that need to be clarified to ensure interpretation and understanding of the data. Exposure defines the time between a student first studying for an exam and when the exam is administered. Community pharmacy is the terminology for a pharmacy setting that is accessible by patients that are located throughout the “community”. Some examples of these would be Walgreens pharmacies or individually-owned pharmacies. An abbreviation of “P1” stands for a first-year professional pharmacy school student with the number representing the year of the program they are currently in. Advanced Pharmacy

Practice Experiences (APPEs) are rotations performed by fourth-year pharmacy students in order to be immersed in different pharmacy settings and may better be known as rotations.

There were two study formats in this manuscript that were analyzed separately. The first was a case sectional study that was in the form of a survey. The second was a cohort study that looked at data of completion of optional quizzes by P1 students.

The target population for this research is the professional students of the PharmD Program at South Dakota State University. This population is limited to start with an average of 63 to 67 students enrolled in each of the classes (P1, P2, P3, and P4). The survey data was collected via a QuestionPro survey sent to P1s, P2s, and P3s. Questions are listed after the Appendix under Survey Questions. Ninety-three students completed the survey; the responses of the survey were broken down to 23 P1 students, 42 P2 students, and 28 P3 students. P4s were excluded from participating in the survey. This decision was made due to six months passing since this group of students' last drug card exam from when the surveys were sent out and their current participation in APPEs occurring in that time as well. This makes it more difficult to get accurate, if any, data from these students.

The survey consisted of 14 total questions and had an average completion time of under 3 minutes in which the majority of questions were multiple choice with the remaining being questions with fill-in-the-blank options. This was done to help expand an idea on some questions or if there was not an answer that accurately represented the participant's answer. It first became available to students on November 19th, 2021, and was closed on December 13th, 2021.

A few assumptions were made in this data set. Participants that selected that they typically began to study for exams a few days before exams were marked assumed to have 0.5 weeks of exposure from the drug card exam, those claiming one week were marked at 1.5 weeks

of exposure, 2 weeks were marked at 2.5 weeks, and three or more weeks were marked at 4 weeks of exposure. These values were selected to best match the averages of the options available for the question given. The three or more week option was set at 4 weeks due to the time between either the start of the semester and the first drug card exam and the time between the two drug card exams in a semester average to about five to seven weeks. This adjustment proved to not have an impact on the study due to the statistical test selected to determine the significance in the different groups, however, these values are still used in the study in order to represent the different groups categorically.

The second data set, coined the quiz data set, looked at the correlation in the number of optional quizzes attempted by P1 students to pass rates on the drug card exams. All P1 students (n=65) were given access to a series of optional quizzes of 10-16 multiple-choice, true or false, and matching questions. The quizzes were available through the Desire-to-Learn (D2L) class page of PHA 363L, better known as Pharmacy Skills Lab I which is the same page that their drug card exams are administered on₁₂. The completion or lack of completion of these quizzes did not provide any incentive or punishment for the students. The questions on the optional quizzes were created by Kyle Shapcott, a P2 standing student, and were designed to present material as it would be presented on a drug card exam. The questions were not provided to Dr. Jim Clem, who was in charge of writing the P1 students' drug card exams, nor were the exam questions provided to Kyle Shapcott. This was done to avoid any bias in the question writing process of both parties. The optional quiz questions were proofread by P4 students that were doing their academia APPE on campus in order to ensure questions were clear and answers were correctly marked on the D2L page in order to minimize errors on the quizzes. There were a total

of 5 optional quizzes leading up to their 1st drug card exam of the semester and 7 optional quizzes leading up to the 2nd drug card exam.

The optional quizzes were only available for one week at a time and would no longer be available to students after the announced deadline of the quiz. Besides the exception of the first week of the semester, there was only a single quiz available at any given time. This exception was made due to a shortened time frame between the P1s' first exam and the beginning of the semester. Individuals only needed to complete one of the quizzes in the first week to receive credit for completing a quiz in that first week. Only two of thirty-four students only completed one of the quizzes in that first week with the other thirty-two students doing both quizzes.

The logistics of delivering the optional quizzes were done for two reasons. The first is to avoid students cramming all of the quizzes during the last day or week leading up to the exam and the second was to collect data on when students were beginning to study to allow the possibility of looking at exposure in this data set, which was not a variable that ended up being tested and was instead analyzed from the survey data set. These optional quizzes had questions that were related to either a single, few, or all components of the drug card exam (column one of Table 11), such as a quiz that was solely over brand/trade name material. Additionally, after the first quiz, all subsequent quizzes had review questions from any material that had already been assessed on previous quizzes. This was done to mirror the logistics of material on the drug card exams. Each student was only given one attempt at a quiz and was given questions, but not answers, that were incorrectly answered once the quiz was submitted. The first quiz was available to students starting August 25th, 2021 and the final quiz was available until November 18th, 2021. The first quiz given to the students is provided in the *Appendix* under *Quiz Question Examples*.

Measures taken to protect the identity of participants in this study under the stipulation of the guidelines of the Institutional Review Board at South Dakota State University included anonymous submissions of surveys and consent from participants to have their answers collected and analyzed. Additionally, data was received on completed optional quizzes and pass/fail status of the P1's two exams via de-identified data from my Dr. Dan Hansen. The analyzer was able to see which students (marked as Student 1, Student 2, ..., Student 65) completed specific quizzes, how many quizzes, and what their pass/fail status was on their first attempt on the two exams, but no information regarding the identity of the student was available to view.

The credibility of this study relied on the accuracy of the information given via the responses of the survey by participants. All questions that are included in this study were analyzed before and after the collection of the data to ensure they were expressed clearly and were given appropriate and fair answers for participants to select from. One question (#9) was thrown out due to one answer choice being left out of the survey. Data analysis in this retrospective cohort study was performed by Dr. Teresa Seefeldt using statistical software named *GraphPad Prism*. She performed Fisher's exact test with a significance level of 0.05.

The first calculation from the survey data was to find the average pass rate of students on their initial drug card attempts. This was calculated using the participants' responses to question 14 which asked how many drug card exams did they not receive a passing grade on the first attempt. From this, a percentage of passed drug cards was found by dividing the total number of drug card exams the participant had by the total number of drug cards attempted by that student. The total number of drug card exams was determined based on what class the student was in. P1's were out of two drug card exams, P2's were out of six, and P3's were out of ten. This average was used as the threshold for determining if a student was put in the "passing student"

group for the “failing student” group with those being higher than the average being in the “passing student” group and those below in the “failing student” group

Table 1 - Distribution of Passing Participants and Failing Participants	
Average pass rate of sample	82.1%
Overall passing	65
Overall failing	28
P1 passing	15
P1 failing	8
P2 passing	30
P2 failing	12
P3 passing	20
P3 failing	8

Three different tests were run to find differences in drug card exam pass rate in participants based on place of work and work experience in the pharmacy setting. These included hospital vs no hospital experience, community vs no community experience, and any work experience in a pharmacy setting vs no work experience in the pharmacy setting. Then within those groups, they were split into a passing participant or a failing student. This was done by looking at the answer to the different questions in the survey, including what type of experience they had and the students’ passing rate, and splitting them into separate groups. For example, when analyzing the work vs no work, all students that said they have working experience in a pharmacy setting were put in one group, while those who did not were put into a second group. Then they were further split into passing or failing participants within that group. The same was performed for the other group comparisons. Demographics from these groups are presented in Tables 2 through 6. Important information to acknowledge is that any experience in a community

pharmacy or hospital pharmacy warranted a yes answer on the survey and time elapsed from starting the job was not a factor in these answers. The survey also did not allow to observe when a specific experience began compared to a student's pharmacy school experience or if they were actively working at that workplace. Additionally, some students were able to mark both options.

Tables 2-5							
Table 2 - Hospital Experience				Table 3 - No Hospital Experience			
Class	Participants that passed	Total number of participants that are in the class	Average Class/Overall pass rate	Class and Pass/Fail status	Participants that passed	Total number of participants that are in the class	Average Class/Overall pass rate
P3	7	9	0.856	P3	13	19	0.832
P2	8	11	0.848	P2	22	31	0.855
P1	2	6	0.33	P1	11	17	0.764
Overall	19	26	0.809	Overall	46	67	0.825
Table 4 - Community Experience				Table 5 - No Community Experience			
Class and Pass/Fail status	Participants that passed	Total number of participants that are in the class	Average Class/Overall pass rate	Class and Pass/Fail status	Participants that passed	Total number of participants that are in the class	Average Class/Overall pass rate
P3	18	26	0.835	P3	2	2	0.917
P2	26	36	0.856	P2	4	6	0.828
P1	8	11	0.864	P1	7	12	0.625
Overall	52	73	0.849	Overall	13	20	0.715

Table 6 - Work Experience vs No Work Experience	
Average pass rate of work experience participants	0.831
Average pass rate of no work experience participants	0.722

The next series of tests performed involved analyzing first exposure of students studying for the drug card exams and if there is statistical significance in pass rates of drug exams between the different exposure groups. In tables 7 through 11, demographics for these tests are presented along with statistical test results. In order to keep the test in the parameters of Fisher's exact test, the tests analyzed a comparison of those with low exposure (those with 0.5 weeks and

1.5 weeks) and high exposure (2.5 weeks and 4 weeks) overall. That was done by splitting the data of the participants into four different groups with each representing the answer they selected in question 3 of the survey. They were then further divided into those who were passing students are those that were failing students. It is important to remember that the test looked at the difference in the percentage of people that were considered passing students in each group. It did not look at the average pass rate of the different exposure categories. That means the statistical significance was looking at a difference in the likelihood of an individual having an above-average pass rate of exams between a low exposure group member and a high exposure group member.

Tables 7 - 10

Table 7 - Average Pass Rate of 0.5 weeks at 1st Exposure				Table 8 - Average Pass Rate of 1.5 weeks at 1st Exposure			
Class and Pass/Fail status	Participants that passed	Total number of participants that are in the class	Average Class/Overall pass rate	Class and Pass/Fail status	Participants that passed	Total number of participants that are in the class	Average Class/Overall pass rate
P3	5	7	0.814	P3	10	16	0.819
P2	8	18	0.815	P2	12	15	0.878
P1	2	3	0.667	P1	3	8	0.563
Overall	17	28	0.799	Overall	25	39	0.789

Table 9 - Average Pass Rate of 2.5 weeks at 1st Exposure				Table 10 - Average Pass Rate of 4 weeks at 1st Exposure			
Class and Pass/Fail status	Participants that passed	Total number of participants that are in the class	Average Class/Overall pass rate	Class and Pass/Fail status	Participants that passed	Total number of participants that are in the class	Average Class/Overall pass rate
P3	3	3	0.933	P3	2	2	0.95
P2	4	5	0.8	P2	4	4	1
P1	5	7	0.786	P1	5	5	1
Overall	12	15	0.82	Overall	11	11	0.991

Table 11 - Significant Values for Exposure Data		
Comparison	p-value	Significance
Low vs high exposure - Overall	0.0220	Yes
Low vs high exposure - P1	0.0894	No
Low vs high exposure - P2	0.2475	No
Low vs high exposure - P3	0.2808	No

The statistical tests from the quiz data set, evaluated the number of quizzes taken and the correlation to an increased chance of passing the exam in students who took more quizzes than another student. Table 12 shows the demographic of the data from the P1s' second drug card exam while Table 13 provided test results. Statistical tests performed on both, exam 1 and exam 2 data looked at the pass rate of students taking 2 or more quizzes compared to those who did a single quiz or did not attempt a quiz. The information on exam 1 was not presented due to not reaching statistical significance. Additionally, participants who attempted any quizzes compared to those who did not attempt a quiz did not have statistical significance. Statistical tests results were found by breaking down the students into different groups that were determined by the number of quizzes that the student completed. Exam one had five groups (four quizzes completed, three quizzes completed, ... through zero quizzes completed) and exam two had eight groups (seven quizzes completed, six quizzes completed, ... through zero quizzes completed). They were then split further depending on the test being performed and compared the percentage of students that passed the given drug card exam to find the likelihood of a student passing the exam to increase if they took a certain number of attempted quizzes. For example, when comparing those that took any quizzes to those that did not take any, those in the group of seven

completed quizzes through the group that completed one quiz were all combined to perform the statistical analysis.

Table 12 - Exam 2 Quiz Completion			
Number of quizzes completed	Number of students who passed	Number of total students	Pass Rate
7	2	2	1.0
6	1	1	1.0
5	1	1	1.0
4	4	5	0.8
3	3	3	1.0
2	6	8	.75
1	11	14	.7857
0	14	31	.451

Table 13 - Significant Values for Quiz Completion Data		
Comparison	p-value	Significance
Exam 2 quiz number 2+ vs 0-1	0.0263	Yes
Exam 2 quiz number any quizzes vs no quizzes	0.0021	Yes

Data Analysis and Results

After analysis of data and statistical tests were performed it was found that the average pass rate on exams of students with hospital experience was 0.809 and those who do not have experience was 0.825 pass rate and did not reach statistical significance. Tables 4 and 5 showed the pass rates of students with community experience vs students with no community experience. These students' average pass rates were 0.849 (with) and 0.715 (without) with the p-value of 0.5924, resulting in no statistical significance being found. Table 5 shows the average pass rate between those who had work experience in any pharmacy setting vs those who did not have work experience in a pharmacy setting. These average pass rates were 0.831 (with) and 0.722 (without) respectively and when compared had a p-value of >0.9999 resulting in no statistical significance.

When analyzing and testing data of the different exposure groups it was found that the low exposure group had 62.7% of students being passing students, and the high exposure group had 88.5%. This group was able to find statistical significance with a p-value of about 0.02. Tests were also performed for each of the different classes of students (P1, P2, and P3s), but statistical significance was not found. Tests were not able to be found between each of the different groups individually due to the 4-week exposure group having all eleven members being passing students. This meant that Fisher's exact test was not able to be used to find statistical significance.

With the quiz data set, the percentage of P1 students who passed the 2nd exam who took 2+ quizzes was 85% and those who took one or fewer quizzes was 55.6%. The percentage of P1

students who passed the 2nd exam who took any quiz was 88.2%, while those who did not take any were 45.1%. Both of the tests performed on exam 2 found statistical significance. There were not any statistically significant differences found from the tests performed on the data correlated to the first exam.

The data from this study found a statistical significance that individuals who have their first exposure farther from the exam date are on average going to have a higher passing rate on drug card exams than those with 1st exposure being closer to the date of the exam. No other information from the survey data provided statistical evidence for studying techniques and other variables to impact the average pass rate of drug card exams. The quiz data set did provide statistical significance showing that there was a higher pass rate among students that attempted at least two optional quizzes that were provided prior to a typical drug card exam compared to students that took one or fewer optional quizzes. It also found the same correlation among students who attempted any number of optional quizzes versus students that did attempt any optional quizzes

There was no statistical significance found in the pass rate being different in students that had work experience in pharmacy settings vs those who did not have work experience in a pharmacy setting. There also was no correlation of changes in pass rates on any of the work-related tests.

Discussion of Findings

This study has a multitude of layers to dissect and distinguish to have a fair and accurate interpretation of the data. Starting with the average number of exams passed by students in the professional program. This was found to be 82.1%. This translated as on average a student will not pass a drug card exam one out of five exams or will pass 82.1% of drug card exams. It should be mentioned that some students will go their whole pharmacy school career without failing a drug card exam, while others will fail more than half of their exams on their first attempt in their career. This average may also be skewed due to not having the second half of exams from the participants' years. That was due to the time the survey was given to students. Remembering that exams slowly correlate more and more information that may be presented on the exam, the last two P3 exams have the most review material on them and are not being assessed in this study. Theoretically, this may lead to a decrease in the average pass rate for the drug card exams due to the increase of difficulty and information on the exams.

In regards to the workplace data, an “experience” warranted an individual working at the specific type of practice site (community, hospital, long-term care, or etc.). The question in the survey did not specify what time they began to work at that site compared to their timeline on their pharmacy school career or the number of hours a student worked at that pharmacy setting. For example, a student with 4 years of community pharmacy experience was not interpreted any differently than a student who had started working in a community one week before the survey was sent out to them. A primary reason why I decided to conduct this study was due to P1 students disliking drug card exams referencing that the lack of them working in a pharmacy

setting directly impacted their pass rates on exams. Although this information was not found to be statistically significant in this correlation, the average difference between those that had experience in community pharmacy and those that did not was about 11%. The likelihood of increasing the sample size of this study is slim, but this difference in pass rate average in multiple different work-related groups is still something that may still have a “clinical” significance even with the lack of statistical significance.

Exposure data only looked at the first time that the student began studying the information on the given drug exam. One caveat to this test was the assumption that once a student begins studying they will continue to study throughout the time between exposure and the time of the exam. However, determining how much time they put into studying is more challenging to interpret and apply to this data. This data can not be looked at and provide a correlation to the amount of time studying to a higher pass rate because of this. For example, if student A studies for 20 hours over the course of the two days over the course of the exam and student B studies for 10 hours over the two weeks before the exam, you can only take into account the time of first exposure and not the number of hours performed to correlate pass rates to these students. This is a limitation that can potentially be evaluated in a future study of these exams. The question on the survey may also have been interpreted incorrectly by students and may have answered questions based on their own judgment of what studying is.

In the quiz data set, there was a statistical significance found in the correlation that there is an increased chance of passing drug card exams if you took two or more of the quizzes compared to a participant that took one or none of the quizzes. There was also statistical significance in an increased passing rate for participants that took any quiz compared to those who did not. These correlations were found on the data leading up to the second drug card exam

but were not found leading up to the first drug card exam. Data leading up to the second drug card exam is more representable data of a typical studying experience prior to a drug card exam for a few reasons. One rationale was that this was the P1 students' first semester of drug card exams. With drug exams being a ratio of 80-to-20% new-to-old material on the exam, their first exam does not represent the other 11 exams that a student will take in their progression of the program. It also was the first drug card exam that the students took. Another rationale is that there was a seven-week time period between exams compared to the first exam that had a four-week time period between the start of classes and the time of the exam. Typically there is a six-week period between either the start of the semester to the first drug card exam or from the first to the second drug card exam. P1 students had a better understanding of what the expectations for these exams were with the experience of the first drug card exam behind them. This data also supports the first exposure data due to the stipulation of the optional quizzes being available for one week at a time meaning that students that took 2 or more quizzes began to study 8 to 14 days prior to the exam.

Conclusions and Recommendation

This study showed statistical significance for an increased likelihood of passing a drug card exam when the number of optional quizzes taken by students increases compared to those who took fewer or zero optional quizzes. Even though these quizzes were only 10-16 questions in length, provided no additional information to students, and were written by another student, the P1s were still willing to do them even with no academic incentive to do them. The study also proved that the earlier students expose themselves to drug card information the greater likelihood of increasing their pass rate. Even with the size of the sample in this study, these findings were

able to find statistical significance in the differences in the pass rates of the exposure groups. There was also data that had great trends in the difference in the pass rates among each of the broader groups (4+ weeks, 2.5 weeks, etc.) that did not reach statistical significance but are worth considering conducting a study with a large sample size to find significance in the future.

“Clinical” significance of work-related data was found from these studies. Again, the sample size limited these tests from finding statistical significance, but the trend in the data is in support of those with working experience to have an edge in a student's average drug card exam pass rate. This data shows that representing small optional quizzes to students prior to drug exams in any regard would prove to be beneficial to help increase the pass rate of drug card exams and knowledge in the Top 200 Drug Card Exam material. Between these two benefits helps enable students to overall be more well-rounded pharmacy professionals throughout schooling and in their future professional pharmacy careers.

This was the first official research done on the drug card exams at South Dakota State University. It did not have answers to every question that was initially given in the study, but it was a great first stepping stone for research that can be done in the future on this topic. Future studies will benefit by avoiding mistakes and limitations that were created through the design of this study. Some barriers that this study had were not having complete data on all possible drug card exams, lack of some work-related data, lack of precise exposure times for students, and the P1 students being new to the drug card exams. Specific changes could be made to find out more precise data, including when participants began working in correlation to their exam attempts or when drug card exams were given. This would allow for information such as “work years experienced” to be analyzed along with other possible variables. The study also was not able to find precise results on some variables due to being impacted by confounders, the first exposure a

student has, and if there is a direct correlation to the number of hours spent studying on the exams. Further subjective data that is present in the appendix may also prove to be useful in order to help optimize drug card exam experiences for students.

References

1. Kolesar, J. M., & Vermeulen, L. C. (2019). *McGraw-Hill's 2020/2021 Top 300 Pharmacy Drug Cards* (5th ed.). McGraw-Hill.
2. Rohrer, D., Dedrick, R. F., Hartwig, M. K., & Cheung, C.-N. (2020). A randomized controlled trial of interleaved mathematics practice. *Journal of Educational Psychology*, *112*(1), 40–52. <https://doi.org/10.1037/edu0000367>
3. Bangert, M., Wiedemann, A., & Jabusch, H-C. (2013). When less of the same is more: Benefits of variability of practice in pianists. In A. Williamon, & W. Goebel (Eds.), *Proceedings of the International Symposium on Performance Science 2013* (pp. 117-122). Utrecht: European Association of Conservatoires (AEC).
<http://www.performancescience.org/ISPS2013/Proceedings/>
4. National Association of Boards of Pharmacy. The North American Pharmacist Licensure Examination (NAPLEX) Competency Statements. 2021.
<https://nabp.pharmacy/programs/examinations/naplex/competency-statements-2021/>.
Accessed March 18, 2022.
5. Daugherty KK, Malcom DR. Assessing the relationship among PCOA performance, didactic academic performance, and NAPLEX scores. *Am J Pharm Educ*. 2020;84(11):Article 847712. doi:10.5688/ajpe847712.
6. McCall KL, MacLaughlin EJ, Fike DS, Ruiz B. Preadmission predictors of PharmD graduates' performance on the NAPLEX. *Am J Pharm Educ*. 2007;71(1): Article 05

7. Allen RE, Diaz C. Use of preadmission criteria and performance in the doctor of pharmacy program to predict success on the North American Pharmacists Licensure Examination. *Am J Pharm Educ.* 2013;77(9):Article 193. doi:10.5688/ajpe779193.
8. Gillette, C., Rudolph, M., Kimble, C., Rockich-Winston, N., Smith, L., & Broedel-Zaugg, K. (2018). A meta-analysis of outcomes comparing flipped classroom and lecture. *American journal of pharmaceutical education, 82(5)*.
9. Koo, C. L., Demps, E. L., Farris, C., Bowman, J. D., Panahi, L., & Boyle, P. (2016). Impact of flipped classroom design on student performance and perceptions in a pharmacotherapy course. *American journal of pharmaceutical education, 80(2)*.
10. Pierce, R., & Fox, J. (2012). Vodcasts and active-learning exercises in a “flipped classroom” model of a renal pharmacotherapy module. *American journal of pharmaceutical education, 76(10)*.
11. Goh, C. F., & Ong, E. T. (2019). Flipped classroom as an effective approach in enhancing student learning of a pharmacy course with a historically low student pass rate. *Currents in Pharmacy Teaching and Learning, 11(6)*, 621-629.
12. Pharm D. Curriculum. 2021. <https://www.sdstate.edu/pharmacy-allied-health-professionals/doctor-pharmacy-pharmd/pharmd-curriculum> Accessed March 22, 2022.

Appendix

Question 13 of the survey data asks if students believe there should be time taken out of class or lab to go over material on drug card exams. Table 1A-4A shows the overall responses and a breakdown of the P1s, P2s, and P3s. This question showed that a majority (81.72%) of students believe that there should be time dedicated in class or lab to go over this material. The trend of students wanting a change decrease as you progress from P1s to P3s. This may be due to a lack of exposure to some content in classes due to the lack of progression that has been made through the pharmacy program. An answer to these findings could include having APPE students provide biweekly SIs to go over unfamiliar topics at the Brookings campus (P1 and P2 class site), or encouraging the student to create a self-taught SI with help from professors or upperclassmen.

Tables 1A - 4A					
Table 1A - Overall Class Time			Table 2A - P3 Class Time		
Do you think there should be time taken out of class and /or lab to be used for professors to present (teach) information regarding drug card exams?			Do you think there should be time taken out of class and /or lab to be used for professors to present (teach) information regarding drug card exams?		
	Responses	Percent		Responses	Percent
Yes	76	81.72%	Yes	18	64.29%
No	17	18.28%	No	10	35.71%
Table 3A - P2 Class Time			Table 4A - P1 Class Time		
Do you think there should be time taken out of class and /or lab to be used for professors to present (teach) information regarding drug card exams?			Do you think there should be time taken out of class and /or lab to be used for professors to present (teach) information regarding drug card exams?		
	Responses	Percent		Responses	Percent
Yes	35	83.33%	Yes	23	100.00%
No	7	16.67%	No	0	0.00%

Question 12 of the survey asked students about their preferred format of the drug card exams. This question asked if the format that information of drug card exams should stay as it is,

The Techniques of Studying and Other Variables Impact on Initial Drug Card Exam Pass Rates
 Shapcott, Kyle

be changed to weekly quizzes, or have a combination of both the current format and weekly quizzes. There was not a fill-in-the-blank option for this question. There could be answers that could be desired for students that were not made an option, but answering the question was not required by any student. There also could have been more clarity of the answers in order to ensure that the interpretation of the question was the same for all students. Table 5A - 8A provides the demographic of the data for all participants as well as broken down into P1s, P2s, and P3s. Overall this sample size of students in the pharmacy program (excluding P4s) is divided on if they should keep the material the same or change in the format from this sample population. P3s had a vast majority, 75%, of students, that think it should stay the same, while the P2s and P1s are slightly leaning towards change at 38.10% and 47.83% saying that they would not want to change the format. P3s have a heavier workload in their semesters which leads may be a contributing factor to the lack of wanting additional quizzes added to their workload. Based on the outcome of the exposure and the quiz data set evaluated in this study there is potential for students to increase their scores and knowledge of the material if there were weekly or periodic quizzes over the material.

Tables 5A - 8A																																					
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th colspan="3" style="text-align: center;">Table 5A - Overall Format</th> </tr> <tr> <th colspan="3" style="text-align: left;">Which of the following would be your preference on how we as students are accessed on drug card information?</th> </tr> <tr> <th></th> <th style="text-align: center;">Responses</th> <th style="text-align: center;">Percent</th> </tr> </thead> <tbody> <tr> <td>As it is now. Two exams each semester.</td> <td style="text-align: center;">48</td> <td style="text-align: center;">51.61%</td> </tr> <tr> <td>Weekly quizzes that are the same style as the Top 200 drug card exams where material accumulates each week.</td> <td style="text-align: center;">16</td> <td style="text-align: center;">17.2%</td> </tr> <tr> <td>A combination of A and B</td> <td style="text-align: center;">29</td> <td style="text-align: center;">31.18%</td> </tr> </tbody> </table>	Table 5A - Overall Format			Which of the following would be your preference on how we as students are accessed on drug card information?				Responses	Percent	As it is now. Two exams each semester.	48	51.61%	Weekly quizzes that are the same style as the Top 200 drug card exams where material accumulates each week.	16	17.2%	A combination of A and B	29	31.18%	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th colspan="3" style="text-align: center;">Table 6A - P3 Format</th> </tr> <tr> <th colspan="3" style="text-align: left;">Which of the following would be your preference on how we as students are accessed on drug card information?</th> </tr> <tr> <th></th> <th style="text-align: center;">Responses</th> <th style="text-align: center;">Percent</th> </tr> </thead> <tbody> <tr> <td>As it is now. Two exams each semester.</td> <td style="text-align: center;">21</td> <td style="text-align: center;">75.00%</td> </tr> <tr> <td>Weekly quizzes that are the same style as the Top 200 drug card exams where material accumulates each week.</td> <td style="text-align: center;">5</td> <td style="text-align: center;">17.86%</td> </tr> <tr> <td>A combination of A and B</td> <td style="text-align: center;">2</td> <td style="text-align: center;">7.14%</td> </tr> </tbody> </table>	Table 6A - P3 Format			Which of the following would be your preference on how we as students are accessed on drug card information?				Responses	Percent	As it is now. Two exams each semester.	21	75.00%	Weekly quizzes that are the same style as the Top 200 drug card exams where material accumulates each week.	5	17.86%	A combination of A and B	2	7.14%
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Table 7A - P2 Format			Table 8A - P1 Format		
Which of the following would be your preference on how we as students are accessed on drug card information?			Which of the following would be your preference on how we as students are accessed on drug card information?		
	Responses	Percent		Responses	Percent
As it is now. Two exams each semester.	16	38.10%	As it is now. Two exams each semester.	11	47.83%
Weekly quizzes that are the same style as the Top 200 drug card exams where material accumulates each week.	9	21.43%	Weekly quizzes that are the same style as the Top 200 drug card exams where material accumulates each week.	2	8.70%
A combination of A and B	17	40.48%	A combination of A and B	10	43.48%

Survey Questions

1. The following survey is to gather information for a research study titled, The Effectiveness and Techniques of Studying for Drug Card Exams. The purpose of this study is to explore different variables that may impact how prepared a student is for drug card exams and to help find ways to help improve the readiness of students in the future. All answers to the survey are anonymous. This survey is 13 questions and the estimated completion time is 5-10 minutes. If any questions regarding the survey or study are desired you may contact the researcher, Kyle Shapcott via email (kyle.shapcott@jacks.sdstate.edu).

2. What class are you in
 1. P1
 2. P2
 3. P3

3. Which of the following most closely relates to your study habits for a typical Top 200 drug cards exam?
 1. Studied multiple weeks (3 or more) out from the exam.
 2. Start studying a couple of weeks (2) out from the exam.
 3. Started studying one week out from the exam.
 4. Started studying a few days before the exam.

4. Which of the following are ways that you studied for the Top 200 drug card exams?
 1. Flashcards
 2. Quizzing classmates
 3. Getting quizzed by classmates
 4. Teaching others information
 5. Creating practice questions
 6. I did not study for exams
 7. Other

5. If other was selected on the previous question, what way did you study?

6. Which of the following statements best represents your view on the Top 200 drug card exams?
 1. I see no value in the Top 200 drug card exam and do not understand why they are needed in our curriculum.
 2. I understand the value of the Top 200 drug card exam, but I do not understand why they are needed in our curriculum.
 3. I understand the value in the Top 200 drug card exam and understand why they are needed in our curriculum.

7. Which statement do you agree with the most with your current experience in the SDSU pharmacy program?
 1. I think all of the material on the drug card exam is taught in other classes and therefore Top 200 drug card exams are not needed

2. I think all of the material on the drug card exam is taught in other classes, but the Top 200 drug card exams are needed to help reinforce the material
 3. I do not think all of the material on the drug card exam is taught in class, but the majority of the material is, which is why the Top 200 drug exams are helpful in learning all necessary material on the drug.
 4. I do not think most of the material on the drug card exam is taught in class, which is why the Top 200 drug exams are helpful in learning all necessary material on the drug.
-
8. Which of the following best relates to your work experience?
 1. I have never worked in a pharmacy.
 2. I currently work in a pharmacy setting.
 3. I have previously worked in a pharmacy setting, but no longer do.
-
9. If you have previous/current work experience, please mark which of the following applies to your work experience.
 1. I only work in the summer and long breaks.
 2. I only work during the school year about a weekend about once a month.
 3. I only work during the school year about a weekend once a month.
 4. I work in the summer, and a weekend a month.
 5. I work in the summer and more than a weekend a month.
-
10. What kind of pharmacy setting do you/have you work/ed in?
 1. Hospital
 2. Community
 3. Clinic
 4. Long Term Care
 5. Other

5. 4
6. 5
7. 6
8. 7
9. 8
10. 9
11. 10

Quiz Question Examples

This was the first optional quiz that was available to P1 students in this study.

1. Matching

- a. Baclofen
- b. Carisoprodol
- c. Ibuprofen
- d. Oxycodone
- e. Hydrocodone

- f. Soma
- g. Hysingla
- h. Motrin
- i. Lioresal
- j. Oxycontin

2. Matching

- a. Cefdinir
- b. Cefuroxime
- c. Cephalexin
- d. Levofloxacin
- e. Mupirocin

- f. Ceftin
- g. Keflex
- h. Bactroban
- i. Levaquin
- j. Omnicef
- k. Tamiflu

3. Matching

- a. Nystatin
- b. Cephalexin
- c. Meloxicam
- d. Tramadol
- e. Nitrofurantoin

- f. Macrobid
- g. Ultram
- h. Nyamyc
- i. Mobic
- j. Keflex

4. Which of the following is the brand name of diclofenac?

- a. Voltaren
- b. Zipsor
- c. Zubsolv
- d. Cambia
- e. A and B
- f. C and D

- g. A, C and D
 - h. A, B and D
5. Ortho-Novum is the brand name of
- a. Conjugated estrogens
 - b. Thyroid
 - c. Oral contraceptive - monophasic
 - d. Oral contraceptive - triphasic
6. Macrochantin is the brand name of mupirocin.
- a. True
 - b. False
7. Tamiflu is the generic name for Cefdinir.
- a. True
 - b. False
8. Morphine sulfate is the generic name for which of the following brand names?
- a. Azinza
 - b. Kadian
 - c. MS Contin
 - d. A and B
 - e. B and C
 - f. All of these
9. Tramadol is the generic name for Zipsor.
- a. True
 - b. False
10. Zubzolv is the brand name for buprenorphine with naloxone.
- a. True

b. False

11. Naproxen is the generic name for Baclofen.

a. True

b. False

12. What is the brand name for the drug Levaquin?

a. Carisoprodol

b. Levofloxacin

c. Ciprofloxacin

d. Nitrofurantoin

e. None of the above

13. Robaxin is the brand name for _____.

a. Celecoxib

b. Meloxicam

c. Hydrocodone

d. Methocarbamol

14. Sumatriptan is the generic name for which of the following drugs?

a. Soma

b. Keflex

c. Imitrex

d. Omnicef

e. A and B

f. B and C

g. B and D

15. Diflucan is the generic name for the drug Oseltamivir.

- a. True
- b. False