EVALUATION OF DELAWARE TECH’S EMPORIUM PROGRAM FOR
DEVELOPMENTAL MATH STUDENTS

by

Lauren Patson

An executive position paper submitted to the Faculty of the University of Delaware in partial fulfillment of the requirements for the degree of Doctor of Education in Educational Leadership

Fall 2014

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ACKNOWLEDGEMENTS

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ABSTRACT

The emporium model has recently been adopted by several colleges throughout the country in order to improve their math programs, and literature reports that these colleges experienced an increase in learning and a decrease in costs. As a result, Delaware Technical Community College decided to redesign its developmental mathematics courses based on this model in the hopes that their students will benefit. The purpose of this study is to determine the success of Delaware Tech’s emporium program, the effectiveness of particular program features, and the patterns withdrawal (WU) students exhibit in order to provide recommendations for improvement.

The main research questions for this study are:

1. How successful is the emporium program as compared to the pre-emporium program?
2. What do emporium students identify as program features that promote or hinder their progress through their developmental math courses?
3. What patterns do WU students exhibit in the emporium program?

To answer the first question, pass rates of emporium and pre-emporium students were calculated and a chi-square analysis was performed. The results showed that
emporium students had significantly lower pass rates than pre-emporium students for developmental courses.

For the second question on program features, survey responses were analyzed and means and standard deviations were calculated. Then, ANOVA and t-tests were performed on demographic items to determine if results varied for different groups. In addition, open-ended items in the survey were coded to identify recurring themes. Results showed emporium students felt that, overall, the program features encouraged them to keep working, with MyLabsPlus and participation points being the most encouraging and the Math Success Center and the videos and workbooks being the least. Age, number of hours worked outside of school, and part-time or full-time status seemed to have no effect on responses.

Finally, data from existing student records, scanner data from the Math Success Center, and log in data from MyLabsPlus were analyzed to determine patterns of WU students. Points where students typically stopped attending the Math Success Center and stopped working on MyLabsPlus were identified, and the average number of hours spent in the Math Success Center each week was calculated. Results showed that WU students tended to spend less time in the Math Success Center right from the start, and they tended to stop working on MyLabsPlus near the beginning and in the middle of the course.

Implications of these findings are discussed and eight recommendations for improvement are made.
Chapter 1

INTRODUCTION

The weak performance of students in mathematics has been a hot topic in education for many years and numerous efforts have been made to make improvements. In the last fifteen years, the emporium model has been a popular choice of college math departments to help generate these improvements. Since the emporium model is composed only of a few core concepts, the many details of implementation have been left to the institutions. Unfortunately, this means that emporium-based programs can vary significantly from one institution to another, making it difficult for new institutions to figure out the best way to implement their own programs. Consequently, there is a critical need for an investigation into the specific details of these programs, and the program at Delaware Technical Community College (Delaware Tech) provides such an opportunity.

In this paper, I study Delaware Tech’s emporium program, which focuses on developmental math courses and was first implemented in the fall of 2012. The aim of this study is three-fold. First, it is important to determine if the program is meeting its goal of better providing developmental math students with the skills they need to quickly
move onto college-level math courses and to successfully complete them. Are more students passing their developmental math courses and their subsequent college-level math courses than previously? Second, since emporium programs can vary significantly from one college to another, I investigate which specific program features help students to be successful. Finally, it is important to determine what is happening in the cases where students stop attending the course. What patterns do these withdrawal students exhibit? By better understanding the degree of success of the program, the effectiveness of different program features, and the patterns of withdrawal students, Delaware Tech can strengthen the program for future students.

Background

The educational goal for many students in community college is to complete a one-year certificate program or a two-year degree program, so that they can either transfer to a four-year institution to continue their education or enter the workforce with the necessary skills to obtain well-paid jobs. Unfortunately, fewer than half of all community college students achieve that goal (Achieving the Dream, n.d.).

One barrier that prevents these students from reaching their goal is developmental education. The role of developmental education (also called remediation) is to help underprepared students learn the basic skills, often in English and math, necessary to be successful in college-level courses. But, as de Vise (2011) states, “Remediation is a pedagogical bottleneck, and it’s a key reason that less than half of all community college students ever finish their studies” (p. 5).
One reason why developmental education acts as a bottleneck is due to the fact that the majority of community college students have to take at least one developmental course. Based on data from the National Educational Longitudinal Study, known as the NELS:88, Attewell, Lavin, Domina, and Levey (2006) found that 58% of NELS students at two-year colleges enrolled in developmental education. Similarly, Bailey (2009), who analyzed data from Achieving the Dream: Community College Counts, found 59% of students in the study took at least one developmental education course. Another report suggests that the actual percentage of students who need developmental education may be higher. The National Center for Public Policy in Higher Education and Southern Regional Education Board (2010) claimed the percentage of entering community college students who need developmental education to be 75%.

Another reason for the bottleneck is that for those students who take developmental math courses, only a small percentage successfully complete their developmental education. Attewell, Lavin, Domina, and Levey (2006) found that only 30% pass all of their developmental math courses. Again, Bailey (2009) found similar results with Achieving the Dream data at 31%. In addition, Bailey found that the percentage gets worse as students need more than one developmental math course. He found that only 16% of students who start three levels below college level complete their developmental math sequence.

Since many students are placed into developmental math courses, but less than a third of these students are able to move on to college-level math, it is important for
community colleges to find ways to improve their developmental math programs. As Bailey (2009) states, “This bleak picture of the developmental education landscape justifies a broad-based effort to reform and rethink the endeavor” (p. 12).

The National Center for Academic Transformation (NCAT) believes that reform should be made by redesigning entire courses through the use of technology to improve learning and to decrease costs (Twigg, 2011). Since 1999, NCAT has conducted extensive research in course redesigns in mathematics at thirty-seven colleges and universities throughout the country. These course redesigns were based on the following six principles, which NCAT believes were the key to their success (“Redesigning developmental and college-level math”, n.d.):

- Redesign the whole course
- Encourage active learning
- Provide students with individualized assistance
- Build in ongoing assessment and prompt (automated) feedback
- Ensure sufficient time on task and monitor student progress
- Modularize the student learning experience, especially in developmental math

NCAT asserts that the emporium model, first developed at Virginia Polytechnic Institute and State University (better known as Virginia Tech), embodies these principles, and therefore should be a main model for course redesign in mathematics.
What is the Emporium Model?

According to NCAT (“Six models of Course Redesign”, n.d.), the emporium model “replaces lectures with a learning resource center model featuring interactive computer software and on-demand personalized assistance” (The Emporium Model, para. 1). This suggests that there are two main components that must be implemented for a program to be considered an emporium program. First, instead of having traditional lecture, students spend a majority of their time working on interactive computer software where they receive immediate feedback as to whether their answers are correct. The second main component is the learning resource center, which is a computer lab staffed by a combination of faculty, graduate assistants, and tutors. In these computer labs, students work on the computer software, and when they encounter difficulties, they can get help from the staff. Since Virginia Tech’s computer lab was located in an old department store, it was called the Emporium, which led to the name of the model.

It is important to note that not all emporium programs are the same. Although the model necessitates the constant use of interactive computer software and learning resource center, there are many other implementation decisions that must be made. As Twigg (2011) writes, “Each institution makes design decisions in the context of the constraints it faces” (p. 26). For example, one must decide which computer software to use, the arrangement of the computer lab, how grades should be calculated, the format of the course, and how the students should be assessed. As a result, one emporium program can vary significantly from another.
Despite the differences in the programs, the origins are the same. Institutions have implemented the emporium model with the goal of increasing learning, while decreasing costs. In the following section, I discuss studies that suggest that the emporium model achieves this goal.

*Increasing Learning and Decreasing Costs*

Research suggests that the emporium model has increased learning at several institutions including Virginia Tech, the University of Alabama, and Cleveland State Community College. In the two fall semesters before Virginia Tech started the emporium model for its linear algebra course, the average percentage of students achieving a D or greater was 80.5%. This increased to 87.25% (which is statistically significant) in the two fall semesters immediately following the redesign (Twigg, 2011). Similar results occurred at the University of Alabama, which redesigned its intermediate algebra course and implemented it college-wide in the fall of 2000. Their success rate for the course, defined as the percentage of students earning a C- or above, increased from 40.4% in fall 1999 to 50.2% in fall 2000 (Witkowsky, 2008). This success also translated to community colleges. Cleveland State Community College, which redesigned its developmental math courses, found that 72% of students in any redesigned developmental math course earned a final grade of C or better as compared to 55% before the redesign (Twigg, 2011). On average, NCAT’s executive director Carol Twigg (2011) found that with the emporium model, students successfully completing a developmental
math course increased by 51% and students successfully completing a college-level math course increased by 25%.

Research suggests that the emporium model has also been successful at reducing costs. As Sines (2012) states, “One of the main reasons community colleges and four-year schools are so eager to try variations of the math emporium model is saving money” (The Results, para. 1). One explanation for these cost savings is that the emporium model reduces the number of hours faculty members spend on the course. This allows the faculty members to handle more sections and more students, which reduces the number of full-time and adjunct instructors that are needed. For example, during the first seven years of their implementation of the emporium model, the University of Alabama found that enrollment had increased by about 1000 students in the fall and 1300 students in the spring, but they only had to hire one full-time instructor, two graduate students, and some undergraduate tutors. This is a significant savings since prior to the emporium model, the math department had to hire a new instructor for every 40 students (Witkowsky, 2008).

Another explanation for the cost savings is that the emporium model frees up classroom space. By the second year of using the emporium model, Virginia Tech had freed up space in 64 classrooms with a 40 student capacity as well as another 12 classrooms with a 100 student capacity (Mills, 2005). That amounts to 3760 more seats that are available to new students.
In general, this combination of reduced faculty hours and increased classroom space has resulted in reduced costs. Virginia Tech found that the cost per student taking the linear algebra course went from $77 to $24, which results in a savings of $97,000 a year (Olsen, 1999). Similarly, the University of Alabama found that for their Math 100 course, the cost per student went from $116 in the traditional format to $83 with the emporium model (Witkowsky, 2008). On average, Twigg (2011) found that with the emporium model, the total cost of instruction was reduced by 30% and 37% percent for developmental and college-level math courses respectively.

These positive results have encouraged several institutions, including Delaware Tech, to adopt the emporium model. In the following section, I describe Delaware Tech’s implementation of the emporium model.

*Delaware Tech’s Emporium Program*

In 2012, Delaware Tech, Stanton Campus, redesigned its developmental math program by implementing a new program based on the emporium model. This new program, which I will call the emporium program, replaced a program that featured a variety of different models. Although developmental courses differed significantly from each other in the old program, I will collectively refer to the old program as the pre-emporium program.

First, as is always the case when evaluating an educational program, it is important to understand the learning goals. Since the developmental courses are supposed to be a quick review of the mathematical skills needed for college-level math
courses, the main goal is for students to gain skill efficiency, which is the “accurate, smooth, and rapid execution of mathematical procedures” as defined by Hiebert and Grouws (2007, p. 380). In their review of literature, Hiebert and Grouws found, teaching that facilitates skill efficiency is rapidly paced, includes teacher modeling with many teacher-directed product-type questions, and displays a smooth transition from demonstration to substantial amounts of error free practice. Noteworthy in this set of features is the central role played by the teacher in organizing, pacing, and presenting information to meet well-defined learning goals. (p. 382)

These characteristics are present in Delaware Tech’s emporium program with the interactive computer software providing the smooth transition from demonstration to substantial amount of error free practice. Also, the main role of the teacher in the program is to help students with their own organizing and pacing as well as to answer questions when students are experiencing difficulties. These resources combine to meet the well-defined learning goals that are outlined in the syllabus that is made available to the students.

Now I discuss the implementation of Delaware Tech’s emporium program, which required many decisions to be made. First and foremost were those decisions that related to the two major components of the model, the interactive computer software and the learning resource center. Since Delaware Tech was already using the interactive computer software MyLabsPlus, it was natural to consider adopting it for the emporium program. Previously, MyLabsPlus was mainly used for homework purposes where students could get automated feedback as well as see sample problems that could act as a
guide; however, in the emporium program, the chosen computer software would need to play a bigger role of replacing the traditional lecture. Fortunately, MyLabsPlus already had a template specifically designed for emporium-based developmental math courses that features videos and workbooks from John Squires and Karen Wyrick, nationally recognized experts in using technology to improve learning. The idea is that for each topic, students watch a video on MyLabsPlus while simultaneously completing workbook pages that correspond with the video. Then the students continue working with MyLabsPlus to complete a concept check, which is usually a quick check of the new vocabulary learned in the video, and to complete the associated homework, which is usually about ten to fifteen questions allowing students to practice the new procedures. This process is repeated until they complete a section, called a mini-module or a mini-mod for short. At the end of each mini-mod, the students then take a quiz on MyLabsPlus and after enough mini-mods are complete, they take a test, again all on MyLabsPlus. Thus with Delaware Tech’s familiarity of the software and the emporium-based template that was available, MyLabsPlus was officially chosen as the software for the emporium program.

The second major decision in the redesign related to the learning resource center. It was determined that an old computer lab that was previously used as both a classroom and a tutoring room would be converted into the learning resource center called the Math Success Center. The Math Success Center, staffed by multiple tutors and instructors, would serve as a place for students to work on MyLabsPlus, to get help, and to take quizzes and tests.
Once all of the other details were finalized, it became clear that the emporium program is significantly different than the pre-emporium program; however, there are also some similarities. To better understand these differences and similarities, I will compare and contrast the two programs according to three categories: grading procedures, format, and assessments.

The first category to compare the two programs is grading procedures, and one of the main differences occurs in the requirements for passing the course. For the emporium program, a student must pass each quiz with at least an 80% and each test with at least a 75% in addition to having an overall average of at least 75%. That is, students in the emporium program (emporium students) experience mastery learning by demonstrating understanding of the current topic before they can move onto the next topic. In contrast, students in the pre-emporium program (pre-emporium students) only had to have an overall average of at least 75% to pass the course. This means they could have a complete lack of understanding of certain topics in the course, but still be able to pass if their overall average was high enough.

Another difference in the grading procedures is uniformity. For the emporium program, every instructor must have exactly the same grading procedures: tests count as 60%, quizzes count as 20%, homework counts as 10%, and participation counts as 10%. The participation category is also very specific. Each week, a student can achieve ten points toward their participation grade. Four of these points come from attending class and spending the required time in the Math Success Center. Another four points comes
from meeting the recommended deadlines for assessments. The final two points comes from having an organized and complete workbook and notebook. The pre-emporium program, on the other hand, was quite different, since instructors had more control over how their individual courses would be graded. Although it was recommended that the common final exam would count between 10% and 20% of the final grade, it was up to the instructor to decide whether to have attendance, homework, and quizzes count as part of the grade.

The next comparison category is the format of the programs. Although both programs use MyLabsPlus, there are many other differences in their format. First, since the emporium program uses mastery learning, students have to be able to go at their own pace and they control when they are ready to take an assessment. For the pre-emporium program, pacing varied from class to class. Some classes were self-paced, while others had designated days where the students would take a certain quiz or test.

Second, in the emporium program, videos and workbooks serve as the main form of instruction. On the other hand, since the pre-emporium program had a variety of different formats, pre-emporium students may have received traditional lectures, mini-lectures, or no lecture at all depending on the instructor.

Another difference in the format is how time is spent in class. Since the developmental math courses are four credits, the students have four hours of class each week. Emporium students spend either one designated hour with their instructor and three “anytime” hours in the Math Success Center or two designated hours with their
instructor and two “anytime” hours in the Math Success Center. During these instructor-based hours, students continue to work on the computer while instructors hold mini conferences with each student to discuss progress, check workbooks/notebooks, and help with any questions. Pre-emporium students, on the other hand, would spend all four hours with their instructor.

Finally, in terms of having the opportunity to get additional help, emporium students have a lot more flexibility. In addition to their required hours in the Math Success Center, emporium students can spend as much extra time as they like in the center, which is open Monday through Saturday with evening hours available Monday through Thursday. Pre-emporium students had fewer options. Instead of going to a large computer lab that is staffed with several tutors and instructors, they could only go to a small tutoring table Monday through Thursday and evening hours were more limited; however, Friday mornings did offer a little more flexibility by having a computer lab similar to the Math Success Center available.

The last category for the comparison of the two programs is assessments. The first main difference is in the number of required assessments throughout the course. Emporium students have to take a total of 15 assessments (11 quizzes and 4 cumulative tests) and 18 assessments (14 quizzes and 4 cumulative tests) for the arithmetic and algebra developmental courses respectively. In contrast, pre-emporium students only had to take 11 assessments (10 tests and 1 final) and 7 assessments (6 tests and 1 final) for the arithmetic and algebra developmental courses respectively.
Another difference in the assessments is whether students can take them multiple times. Because of the mastery learning requirement in the emporium program, students must pass each quiz with at least an 80% and each test with at least a 75%. Hence, it is necessary for students who do not achieve that score to be able to study and take the assessment as many times as needed. Pre-emporium students were not allowed to take an assessment multiple times. Whatever they scored was what they got and as long as their overall average was at least a 75%, they would pass the course.

The mastery learning feature of the emporium program also lends itself to the requirement for students to be allowed to take an assessment. That is, emporium students must show that they are prepared to take a quiz or test by having mastered their homework at 100%. Again, since the pre-emporium program was not uniform, pre-emporium students may or may not have had a requirement to take an assessment. This typically depended on whether the instructor allowed the students to go at their own pace, so students would have to demonstrate that they were prepared, or whether the instructor chose to keep the class together, so students had to take an assessment regardless if they were ready.

Finally, the programs differed on how, where, and when the assessments were taken. For the emporium program, students had to take their assessments on MyLabsPlus in the Math Success Center and they could take it anytime the center was open. For the pre-emporium, assessments were taken either on MyLabsPlus or without the computer.
using only paper and pencil and these assessments were given in the classroom during class time.

In summary, it is clear that these two programs have many differences with respect to grading procedures, format, and assessments. For ease of reference, I have condensed these differences in Table 1 below.

Table 1

*Program Feature Comparison*

<table>
<thead>
<tr>
<th>Features</th>
<th>Emporium</th>
<th>Pre-emporium</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Grading Procedures</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Requirement to pass course</td>
<td>Pass each quiz with at least an 80% and each test with at least a 75% (mastery learning) and have an overall average of at least 75%</td>
<td>Have an overall average of at least 75%</td>
</tr>
<tr>
<td>Uniform grading procedures across course</td>
<td>Yes: Tests = 60%</td>
<td>No, although final exam should count between 10% and 20% of total grade</td>
</tr>
<tr>
<td>sections</td>
<td>Quizzes = 20%</td>
<td>Homework = 10%</td>
</tr>
<tr>
<td></td>
<td>Participation = 10%</td>
<td></td>
</tr>
<tr>
<td>Participation points given</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>----------------------------</td>
<td>-----</td>
<td>----</td>
</tr>
<tr>
<td>for meeting recommended deadlines for assessments</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Participation points given</td>
<td>Yes</td>
<td>Depends on instructor</td>
</tr>
<tr>
<td>for attendance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Participation points given</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>for organized and completed workbooks and notebooks</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Homework counts toward grade</td>
<td>Yes</td>
<td>Depends on instructor</td>
</tr>
<tr>
<td>Quizzes included as part of course</td>
<td>Yes</td>
<td>Depends on instructor</td>
</tr>
</tbody>
</table>

### Format

<table>
<thead>
<tr>
<th>Class structure</th>
<th>Students go at their own pace</th>
<th>Varies from students being able to go at their own pace to students staying together as a class with pacing set by instructor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instruction</td>
<td>Provided by videos with corresponding workbooks</td>
<td>Varies from no instruction to traditional lecture provided by instructor</td>
</tr>
<tr>
<td>Homework</td>
<td>Completed on computer software MyLabsPlus</td>
<td>Completed on computer software MyLabsPlus</td>
</tr>
<tr>
<td>---------------------</td>
<td>------------------------------------------</td>
<td>------------------------------------------</td>
</tr>
<tr>
<td>Class time</td>
<td>Students spend 1 or 2 hours with instructor and 3 or 2 hours in Math Success Center</td>
<td>Students spend all 4 hours with instructor</td>
</tr>
<tr>
<td>Place to get extra help</td>
<td>Math Success Center, a computer lab with tutors and instructors available to help students when they get stuck, available Monday through Thursday and computer lab similar to the Math Success Center available Monday through Saturday</td>
<td>Small tutoring table available Monday through Friday</td>
</tr>
</tbody>
</table>

**Assessments**

<table>
<thead>
<tr>
<th>Number of assessments</th>
<th>MAT012 (basic arithmetic course) – 11 quizzes and 4 cumulative tests</th>
<th>MAT012 (basic arithmetic course) – 10 tests and cumulative final</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MAT015 (basic algebra course) – 6 tests and 4 cumulative tests</td>
<td>MAT015 (basic algebra course) – 14 quizzes and cumulative final</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Multiple attempts allowed</th>
<th>Yes, necessary for mastery learning</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Requirements to take an assessment</td>
<td>Homework must be complete at 100%</td>
<td>Varies from no requirements if students had to stay together as a class to homework being complete at 100% if students were able to go at their own pace</td>
</tr>
<tr>
<td>-----------------------------------</td>
<td>----------------------------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>How taken</td>
<td>On the computer using MyLabsPlus</td>
<td>Varies from being on the computer in MyLabsPlus to being paper and pencil</td>
</tr>
<tr>
<td>Where taken</td>
<td>In the Math Success Center</td>
<td>In the classroom</td>
</tr>
<tr>
<td>When taken</td>
<td>Anytime outside designated class time with instructor</td>
<td>During class</td>
</tr>
</tbody>
</table>

The results of this study, discussed below, support the idea that specific program features can affect student success. Therefore, it is important to provide further descriptions of Delaware Tech’s program features, which can be found in Appendix A.

**Research Questions**

As mentioned previously, the purpose of this study is three-fold. How successful is Delaware Tech’s emporium program, what program features aid in student progress,
and what patterns do withdrawal students exhibit? Consequently, I examine three major questions, along with several sub-questions.

In order to determine whether the emporium program is successful at helping students quickly complete their developmental math courses and their subsequent college-level math courses, it is natural to examine pass rates. But what pass rates are necessary for the program to be viewed as a success? This is a tough question to answer, but perhaps it is best answered through the lens of improvement. The program can be viewed as a success if the pass rates of emporium students are significantly higher than the pass rates of pre-.emporium students. Therefore, I investigate the following question. How successful is the emporium program as compared to the pre-emporium program? In order to truly answer this question, I must examine both the pass rates of the developmental courses and the college-level courses. Hence I examine the following sub-questions. How do the pass rates of emporium students compare to the pass rates of pre-emporium students in developmental math courses and how do the pass rates of emporium students compare to the pass rates of pre-emporium students in college-level math courses?

In addition, it is important to study the effectiveness of specific program features. Although emporium programs can vary from one institution to another, current literature does not dissect the different features that were implemented. In fact, the literature tends to leave most of the details of the programs obscured. However, as John Squires said when he visited Delaware Tech to give advice on their emporium program, “the devil is
in the details”. Thus I examine which program features emporium students identify as helping or hurting their progress throughout their course.

Finally, I explore the question related to student withdrawals. Specifically, I examine the emporium students who received either a W grade or a U grade (WU students) in their math courses. At Delaware Tech, a W grade stands for an official withdrawal and a U grade stands for an unofficial withdrawal. For both the W grade and the U grade, the student stops attending the course before it is finished; however, a W grade means that the student completed paperwork that lets the college know the student has stopped attending, whereas the more negative U grade means that the student has simply disappeared without warning. In either case, these emporium students make a decision to quit the course. Therefore, it is crucial to determine at what point these students give up, so Delaware Tech faculty can provide timely interventions in order to encourage these students to continue. Hence, the final question in this evaluation is the following. What patterns do WU students exhibit in the emporium program?

This question is broken into four sub-questions. First, I compare the percentages of WU students in the emporium program with the percentages of WU students in the pre-emporium program. This is important because it will determine whether there is a significant change in the withdrawal rates indicating whether emporium students are more likely to persist in their developmental math courses.

Next, I examine whether WU students received a W grade or U grade in only their developmental math courses or in their other courses as well. This will determine
whether the behavior of the WU students is specifically related to the emporium program. For example, if WU students received W grades or U grades in all of their classes, it is reasonable to assume that factors other than the emporium program affected their decision to stop attending the course. On the other hand, students who received a W grade or U grade in only their developmental math courses may be directly impacted by the program, and it is these students who are most likely to benefit from improvement.

Third, since the Math Success Center is critical to the emporium program, it is necessary to see when WU students stopped working in the center as well as how often they worked in the center before they stopped attending. Perhaps WU students spend a lot of time in the Math Success Center in the beginning of the course, but their attendance starts to fade throughout the semester until they stop coming at all. On the other hand, WU students may simply decide not to take advantage of the center by not attending it right from the start. Also, in order to better understand the patterns of WU students in the Math Success Center, I must understand the patterns of other students. Hence, I examine how often WU students worked in the Math Success Center as compared to non-WU students.

Finally, in addition to identifying when WU students stop taking advantage of the Math Success Center, it is helpful to determine when students stop working on course material in MyLabsPlus. Is there a particular week throughout the semester where they feel that passing the course is hopeless? Are there certain content roadblocks they hit and
then just give up? Therefore, the fourth sub-question is: To what extent do WU students progress in MyLabsPlus?

In summary, in this evaluation I examine the following questions:

1. How successful is the emporium program as compared to the pre-emporium program?
   - How do the pass rates of emporium students compare to the pass rates of pre-emporium students in developmental math courses?
   - How do the pass rates of emporium students compare to the pass rates of pre-emporium students in college-level math courses?

2. What do emporium students identify as program features that promote or hinder their progress through their developmental math courses?

3. What patterns do WU students exhibit in the emporium program?
   - How do the percentages of WU students in the emporium program compare to the percentages of WU students in the pre-emporium program in the developmental math courses?
   - How do WU students in developmental math courses perform in their other courses?
   - How often do WU students work in the Math Success Center as compared to non-WU students?
   - To what extent do WU students progress through MyLabsPlus?
It is clear that a direct link exists between the features of the emporium program and the resulting pass rates. Features that aid in student progress would tend to increase the pass rates of the developmental courses, which in turn would hopefully increase the pass rates of the college-level courses. Similarly, features that hinder student progress would result in lowering the pass rates of the developmental courses, although it would be hard to determine how it would affect pass rates of college-level courses since the unsuccessful students may never make it to that point.

From my experience during the first year of implementation, I predict that Delaware Tech’s emporium program has a combination of features that both promote and hinder student progress. Although this combination would make it difficult to predict the exact influence on pass rates, it seems that the net effect depends on which features are more powerful.

The first features to consider are the ones that every emporium program has: the interactive computer software and the learning resource center. Since the literature suggests the emporium model significantly increases pass rates, I would expect that Delaware Tech’s use of MyLabsPlus and the Math Success Center has a strong positive effect on pass rates.

Now I consider the program features specific to Delaware Tech's emporium program. Again, I examine these features by the following categories: grading procedures, format, and assessments. For features related to grading procedures, I believe that the one that affects pass rates the most is the mastery learning requirement to
pass the course. Since emporium students not only have to achieve an overall average of at least 75%, but also pass each quiz with at least an 80% and each test with at least a 75%, it will be harder for students to pass. This is because students may get stuck on a particular topic and not be able to move forward. Thus it seems that the mastery learning component would have a negative effect on developmental pass rates. On the other hand, since students are now required to master topics in their developmental courses, they should have a better understanding of the prerequisite topics needed for college-level courses. So although the mastery learning component may decrease the pass rates of developmental courses, it may in fact increase the pass rates of college-level course.

Another grading procedure feature that may have a significant effect on pass rates is the participation points. It is natural to assume that by encouraging students to meet recommended deadlines, attend class and their required Math Success Center hours, and have organized notebooks and workbooks, they would be better prepared to succeed. Thus, one would think that the participation points would have a positive effect on pass rates; however, my experience with the emporium program makes me a little unsure of whether the participation points for meeting recommended deadlines actually ended up being positive. In the emporium program, it seemed that there were more WU students than in the pre-emporium program, and I think this may be due to the fact that if students got behind the recommended deadlines, they would lose points every week until they caught up to where they were expected to be. Unfortunately, catching up often proved to be very difficult for students, and although they would be working, they would keep getting zeroes for that part of the participation grade. I believe this would have been very
discouraging, and the students would start to think that they could never get back on pace. As a result, they would decide to give up on the course. Hence, I believe that while the participation points for attending class and the lab and having organized workbooks and notebooks would have a positive effect on pass rates, the discouraging aspect of not being able to meet recommended deadlines would overpower the others and ultimately have a negative effect.

For the format category, I think the feature that has the most powerful effect on pass rates is instruction. Unlike with traditional lecture, by having the videos with the corresponding workbook, students have the ability to pause the video to write extra notes as well as the ability to replay the video to gain a better understanding of the topic being presented. I believe this, in combination with the fact that many students in the pre-emporium program received little to no lecture at all, would result in the videos and workbook having a positive effect on pass rates.

Finally, I think that the most powerful feature in the assessment category is the number of required assessments. The emporium program requires significantly more assessments than the pre-emporium program, and since Delaware Tech's semester is sixteen weeks long, this means that emporium students in the arithmetic course need to pass almost one assessment per week and emporium students in the algebra course need to pass more than one assessment per week. This leaves basically no wiggle room for when a student struggles with a particular topic. Essentially, students have a lot to
accomplish and not that much time to do it. Therefore, I believe that the number of required assessments have a negative effect on pass rates.

So the question becomes, are the potential positive effects of MyLabsPlus, the Math Success Center, the participation points for class and lab attendance and having an organized workbook and notebook, and the instruction provided by the videos and workbook enough to overcome the potential negative effects of mastery learning, the participation points for recommended deadlines, and the large number of required assessments? Hopefully, the results from the research questions provide insight.
Chapter 2
METHODOLOGY

Sample

Delaware Tech is the only community college in the state of Delaware and it consists of four campuses: Wilmington, Stanton, Terry, and Owens, with a college-wide enrollment of about 15,000 students. It is an open admission institution, meaning that any prospective student can enroll in the college.

Although the emporium program was implemented at all four campuses, I only evaluated the program at the Stanton campus, which mostly draws students from a suburban area. It has an enrollment of about 4,000 students, of which about 62% are white, about 21% are black or African American, about 6% are Hispanic or Latino, and about 4% are Asian.

A total of 1,876 students were enrolled in developmental math courses at Delaware Tech Stanton campus in the fall of 2012 and the spring of 2013; however, some of these students were enrolled in course sections that were not part of the emporium program. These sections, which adopted the same MyLabsPlus assignments and the same videos and workbook as the emporium program, did not include mandatory hours in
the Math Success Center, a core component of the emporium program. As a result, students enrolled in these sections were excluded from the sample leaving a total of 1,283 students who were enrolled in the emporium program. One of these emporium students was enrolled as a listener and since a listener does not count as either passing or failing, she was not used in the evaluation. Thus, I used the remaining 1,282 students as the sample, and of these, 406 were classified as WU students.

**Data Collection Procedures**

In order to determine the success of the emporium students as compared to the pre-emporium students, I examined pass rates based on student records held by the college registrar. As grading policies change from one institution to another, it is first necessary to define a passing grade. According to Delaware Tech’s grading policy, a student earns a passing grade if she receives an A, B, or C in the course. Since Delaware Tech does not have a D grade, a student must earn at least a 75% (the minimum C grade) in the course to pass. A student earns a failing grade if she receives an F, W, or U. (For developmental courses, Delaware Tech actually uses the grades AE, BE, CE, FE, W, and UE where the E stands for exempt; however, for convenience, I adopt the more standard notation above.)

To analyze the pass rates of the developmental math courses (MAT012 - Review of Math Fundamentals and MAT015 - Elementary Algebra), I compared student records of emporium students from the 2012-2013 school year to pre-emporium students from the 2011-2012 school year. Since student characteristics tend to vary from fall to spring, I
compared the fall 2012 cohort to the fall 2011 cohort and the spring 2013 cohort to the spring 2012 cohort.

In addition, since the redesign was implemented in the fall of 2012, the first opportunity to determine whether emporium students enrolled in a subsequent college-level math course (college-level emporium students) passed was in the spring of 2013. Therefore, in order to analyze the pass rates of the college-level math course (MAT120 - Math for Behavioral Sciences), I compared student records of college-level emporium students from the spring of 2013 to college-level pre-emporium students from the spring of 2012. To ensure that students were relatively matched in their math background, only students who passed a developmental math course in the fall semester and enrolled in MAT120 in following spring semester were analyzed.

For the research question on the program features that emporium students identify as promoting or hindering their progress, a survey was used. Near the end of the fall 2013 semester, a brief survey was emailed to all emporium students from the fall 2012 and the spring 2013 cohorts. Some of these students were in both cohorts, either from passing MAT012 in the fall and taking MAT015 in the spring or from failing MAT012/MAT015 in the fall and having to retake the same course in the spring. Therefore, out of the 1,282 students in the sample, 1,064 of them were unique and the survey was sent to the 1,064 unique email addresses. A follow-up email was sent one week later to remind students to complete survey. Only 151 students opened the emails and 75 fully completed the survey, resulting in a 7% response rate.
The survey contained five demographic questions involving which emporium course respondents took, their enrollment status as either full-time or part-time, the number of hours worked outside of school each week, their age, and whether they were able to finish the course in one semester. It was important to identify which course respondents took to determine if program features were viewed differently depending on the different course material. For example, the algebra videos in MAT015 may have been harder for students to follow than the arithmetic videos in MAT012. The enrollment status and number of hours worked outside of school were also included in the survey since they were indicators of how much time students were able to focus on schoolwork. Part-time students or students who worked many hours outside of school may have found the mastery learning component frustrating, because they may not have had the time to take assessments over and over again until they mastered them. Another demographic that may have affected students’ views on program features was age. Older students may have found it difficult to learn and work on the computer, while younger students may have found it difficult to manage their time and meet recommended deadlines. The final demographic of whether students were able to finish the course in one semester indicated whether they were successful, which may have affected their views. Students who finished the course in one semester would have passed the course and may have had a more positive view of the program features, whereas students who took more than one semester to finish the course would have received an F, W, or U grade in their first attempt and may have had a more negative view.
In addition to the demographic questions, the survey asked students to rate whether certain program factors greatly encouraged, somewhat encouraged, somewhat discouraged, or greatly discouraged them to keep working. Then they were asked in two open-ended questions to identify which program features encouraged and discouraged them the most and why. A copy of the survey appears in Appendix B.

Lastly, in order to determine the patterns that WU students exhibit, I collected several types of data from both the fall of 2012 and the spring of 2013. First, existing data from student records were used to determine the percentages of WU students and whether these WU students received W grades or U grades in their other simultaneous courses. Then, I gathered data about time spent in the Math Success Center. Since students must scan in and out of the Math Success Center, I was able to use that existing data to compare the amount of time WU students spent in the Math Success Center as opposed to non-WU students. Finally, I determined the extent of WU students’ progress in MyLabsPlus. Every time a student logged into MyLabsPlus to watch videos or work on homework assignments, the date and time spent was recorded. This information was then used to determine when WU students stopped working and on what topic.

Data Analysis Procedures

To answer the first question of the success of the emporium model as compared to the pre-emporium model, I calculated pass rates for each cohort by dividing the number of passing grades by the total number of passing and failing grades. Then I used a chi-
square test to determine if there was a significant difference between pass rates of comparison cohorts.

Next, analysis of the program features that emporium students identify as promoting or hindering their progress was based on data from the survey. I calculated the weighted mean of each program feature where responses of “greatly encouraged,” “somewhat encouraged,” “somewhat discouraged,” and “greatly discouraged me to keep working” were given the values of 4, 3, 2, and 1 respectively. Thus the higher the mean, the more the program feature encouraged students to keep working. Then I used the demographic data to determine if there was a significant difference between means of different groups. Significance was determined either using a t-test for data that split into two groups or a one-way ANOVA for data that split into more than two groups. For results showing significant differences, post hoc analyses using Tukey’s test were completed. If Tukey’s test was inconclusive, Fisher’s LSD test was completed. For the two open-ended questions in the survey asking which features encouraged or discouraged them the most, I initially studied the responses to determine patterns, which later developed into codes. Then, responses were coded and the frequency of each code was recorded. Codes that only appeared once or responses that were too vague to analyze were recoded as “Other”. A second coder coded 15% of the data and inter-rater reliability was calculated by determining the number of agreements and dividing it by the number of codes applied. Inter-rater reliability was 90%. A list of the finalized codes appears in Appendix C.
Finally, the analysis of the third question of the patterns that WU students exhibit is a little more complicated and is broken down by sub-question. For the first sub-question on comparing the percentages of WU students in the emporium program with the pre-emporium program, I calculated the percentages for each cohort by dividing the number of W or U grades by the total number of passing and failing grades. Then I used a chi-square test to determine if there was a significant difference between comparison cohorts.

The second sub-question is related to how the WU students performed in their other courses. I broke the WU students who were enrolled in multiple courses into one of two groups, single WU or multiple WUs, and determined the percentage in each group. A WU student with a single W grade or U grade (SWU student) is one that received a W grade or U grade in only the developmental math course. On the other hand, a WU student with multiple W grades or U grades (MWU student) is one that received a W grade or U grade in the developmental math course and in at least one other course. The assumption is that SWU students are more likely than MWU students to have gotten their W grade or U grade as a result of their developmental math course and not other outside factors. Thirty-three of the 406 WU students were only enrolled in one course, namely one of the developmental math courses, and were not included in the analysis since it was difficult to determine whether their W grades or U grades were mostly due to their math course or due to other circumstances.
Next, I analyzed data from the Math Success Center. For each WU student, I determined which week the student last scanned into the Math Success Center. I will refer to the week of this last scan as the lab stopping point or LSP. Thus the LSP is an integer ranging from 0 (never attending the Math Success Center) to 16 (the length of a full semester) or the code SB for spring break which only occurs during the spring semester. Then by compiling these results, I determined which weeks had the highest percentage of being the LSP. In addition, I calculated the average number of hours each week that “active” WU students spent in the Math Success Center as compared to non-WU students. (“Active” WU students are WU students who had not yet stopped attending the lab completely.) After WU students reached their LSP, they were no longer considered active in the lab and were not counted in the average. This was done in order to determine how much time WU students worked in the Math Success Center before they gave up. Independent samples t-tests determined whether the difference between the average number of lab hours of “active” WU students and non-WU students lab was significant for that week.

For the last sub-question on the extent of WU students’ progress through MyLabsPlus, I determined the MyLabsPlus stopping point, or MSP, which is similar to the LSP for the Math Success Center data. The MSP is an integer ranging from 0 to 16 or the code SB for spring break to identify the last week that a WU student spent at least fifteen minutes working on MyLabsPlus. In order to be counted as working on MyLabsPlus, a student must have completed at least one problem or watched a video. I chose to use these criteria to prevent artificial MSPs from students who simply logged in
only for a few minutes periodically throughout the semester in an attempt to appear that they were actively working. Then I determined which weeks had the highest percentage of being the MSP. In addition, I determined the content stopping point, or CSP. Since the goal of calculating the CSP is to determine if there were specific points in the content that acted as roadblocks to the WU students, the CSP is defined as the first quiz or test after the last *successful* quiz or test. Thus the CSP is really the first time where the student had not demonstrated mastery of that content. The CSP is denoted as a 0 if the student never logged in or did not work for at least 15 minutes on MyLabsPlus or is denoted as a Q or T followed by a number if the student got stuck on that number quiz or test. For example, a CSP of Q3 means that the student did not pass (or take) quiz 3, but did pass the previous assessment. Then I determined which quizzes or tests had the highest percentage of being the CSP.
Chapter 3

RESULTS

Pass Rates

Contrary to previous studies which found that pass rates of courses that adopted the emporium model significantly increased, the pass rates of Delaware Tech’s emporium-based developmental courses actually decreased (see Table 2). For the basic arithmetic course MAT012, pass rates dropped from 59.6% to 42.3% for the fall cohorts and from 48.1% to 38.6% for the spring cohorts ($\chi^2 = 33.1, p < 0.01$ and $\chi^2 = 6.32, p < 0.05$ respectively). A similar result was found for the basic algebra course MAT015 where pass rates dropped from 45.6% to 26.8% for the fall cohorts and 49.7% to 42.0% for the spring cohorts ($\chi^2 = 21.64, p < 0.01$ and $\chi^2 = 4.49, p < 0.05$ respectively).
Table 2

*Pass Rates of Developmental Math Courses*

<table>
<thead>
<tr>
<th>MAT012 – Review of Math Fundamentals</th>
<th>MAT015 – Elementary Algebra</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Emporium Students</strong></td>
<td><strong>Emporium Students</strong></td>
</tr>
<tr>
<td>Emporium</td>
<td>Pass</td>
</tr>
<tr>
<td>------------</td>
<td>------</td>
</tr>
<tr>
<td>Fall 2012</td>
<td>189</td>
</tr>
<tr>
<td>Spring 2013</td>
<td>119</td>
</tr>
</tbody>
</table>

**Note.** * indicates p < 0.05 and ** indicates p < 0.01.

While the pass rates of the developmental math courses decreased significantly, there was no statistically detectable difference in the pass rate for the college-level course, MAT120 – Math for Behavioral Sciences (see Table 3).
Table 3

*Pass Rates of College-level Math Courses for Students who had Previously Taken Developmental Math Courses*

<table>
<thead>
<tr>
<th></th>
<th>MAT120 – Math for Behavioral Sciences</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>College-Level Pass Total Percent</td>
</tr>
<tr>
<td>Emporium Students</td>
<td>Spring 2013 11 23 47.8</td>
</tr>
<tr>
<td>Pre-emporium Students</td>
<td></td>
</tr>
</tbody>
</table>

The significant decrease in the pass rates of the developmental courses suggest that the emporium program’s first year of implementation was not successful at helping developmental math students quickly gain the skills necessary to move onto college-level math courses. Furthermore, college-level emporium students performed the same as college-level pre-emporium students indicating that the emporium program was no better than the pre-emporium program at preparing students for college-level math. As a result, it is clear that improvements to the emporium program need to be made.

**Program Features**

The second research question focuses on identifying which program features promote or hinder student progress. The results from the survey found that all program features have mean responses of at least 3, suggesting the program features were at least somewhat encouraging students to keep working (see Table 4). The features that encouraged students the most were getting points for attendance, getting points for
meeting the recommended deadlines, and using MyLabsPlus. The features that encouraged students the least, although they were still encouraging overall, were watching the videos, attending the Math Success Center, and completing the workbook. The fact that the videos and the workbook were viewed least favorably and that they were the major instructional components of the emporium program suggests that changes need to be made to the academic portion of the program.

Table 4

*Summary of Survey Responses of Program Features (N = 75)*

<table>
<thead>
<tr>
<th>Program Features</th>
<th>Greatly Encouraged</th>
<th>Somewhat Encouraged</th>
<th>Somewhat Discouraged</th>
<th>Greatly Discouraged</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Getting points for attendance</td>
<td>56.0%</td>
<td>32.0%</td>
<td>9.3%</td>
<td>2.7%</td>
<td>3.41</td>
<td>0.77</td>
</tr>
<tr>
<td>Getting points for meeting the recommended deadlines</td>
<td>46.7%</td>
<td>36.0%</td>
<td>10.7%</td>
<td>6.7%</td>
<td>3.23</td>
<td>0.89</td>
</tr>
<tr>
<td>Using MyLabsPlus*</td>
<td>44.6%</td>
<td>39.2%</td>
<td>9.5%</td>
<td>6.8%</td>
<td>3.22</td>
<td>0.88</td>
</tr>
<tr>
<td>Having to pass each quiz with at least an 80% and each test with at least a 75%*</td>
<td>40.5%</td>
<td>41.9%</td>
<td>13.5%</td>
<td>4.1%</td>
<td>3.19</td>
<td>0.82</td>
</tr>
</tbody>
</table>
Getting points for having an organized workbook/

Notebook*

<table>
<thead>
<tr>
<th></th>
<th>Percent</th>
<th>Percent</th>
<th>Percent</th>
<th>Percent</th>
<th>Percent</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Getting points for</td>
<td>41.9%</td>
<td>39.2%</td>
<td>10.8%</td>
<td>8.1%</td>
<td>3.15</td>
<td>0.92</td>
</tr>
<tr>
<td>Taking the required</td>
<td>41.3%</td>
<td>37.3%</td>
<td>16.0%</td>
<td>5.3%</td>
<td>3.15</td>
<td>0.88</td>
</tr>
<tr>
<td>number of quizzes and</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>tests (MAT012 - 11</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>quizzes and 4 tests;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MAT015 - 14 quizzes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>and 4 tests)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Completing the</td>
<td>38.7%</td>
<td>37.3%</td>
<td>18.7%</td>
<td>5.3%</td>
<td>3.09</td>
<td>0.89</td>
</tr>
<tr>
<td>workbook</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Attending the Math</td>
<td>40.0%</td>
<td>36.0%</td>
<td>13.3%</td>
<td>10.7%</td>
<td>3.05</td>
<td>0.98</td>
</tr>
<tr>
<td>Success Center</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watching the videos</td>
<td>42.7%</td>
<td>26.7%</td>
<td>18.7%</td>
<td>12.0%</td>
<td>3.00</td>
<td>1.05</td>
</tr>
</tbody>
</table>

* indicates percentages based on 74 respondents

Surprisingly, results from the analysis of demographic data revealed that whether students were full-time or part-time, how often they worked outside of school, and how old they were did not have a significant effect on how they viewed program features. On the other hand, which course students took and whether they were able to finish the course in one semester did have a significant effect on their view of some of the program features, but not others.
For the data based on which course students took, a one-way ANOVA revealed significant differences with respect to whether they were encouraged by watching the videos, completing the workbook, and getting points for having an organized workbook/notebook ($F(2, 72) = 4.77, p = 0.01$; $F(2, 72) = 3.35, p = 0.04$; and $F(2, 71) = 3.33, p = 0.04$ respectively). Specifically, students who took both the arithmetic and algebra developmental courses were significantly more likely than students who took only the algebra developmental course to report that watching the videos encouraged them to persevere ($M = 3.48, M = 2.66, p = 0.01$). Similar results were obtained for completing the workbook and for getting points for having an organized workbook/notebook ($M = 3.40, M = 2.81, p = 0.03$; $M = 3.40, M = 2.84, \text{LSD} = 0.47$ for $\alpha = 0.05$ respectively). Thus the three features of watching videos, completing the workbook, and getting points for having an organized workbook/notebook were significantly more encouraging for those who took both MAT012 and MAT015 than for those who took just MAT015. One possible explanation for these findings is that emporium students who only took MAT015 either were directly placed into that course without having to take MAT012 or took MAT012 as pre-emporium students. In either case, their knowledge of arithmetic was not obtained through mastery learning, resulting in content gaps that would make it difficult to understand the material presented in the videos and the workbook for the algebra course.

Unsurprisingly, for the data based on whether students were able to finish the course in one semester, two-tailed t-tests revealed that students who were able to finish the course in one semester were significantly more likely to rate program features more
favorably than students who were not able to finish in one semester, with the exception of one feature, getting points for attendance. For all other features, those students who were able to finish the course in one semester were significantly more encouraged by the feature to keep working than those who did not finish the course in one semester (see Table 5).

Table 5

*Program Feature Ratings for Students who finished their Developmental Math Course in One Semester versus Students who did not*

<table>
<thead>
<tr>
<th>Program Features</th>
<th>Mean Response of Those Able to Finish the Course in One Semester</th>
<th>Mean Response of Those Unable to Finish the Course in One Semester</th>
<th>Two-tailed t-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Getting points for attendance</td>
<td>3.49</td>
<td>3.30</td>
<td>1.04 (df = 73)</td>
</tr>
<tr>
<td>Getting points for meeting the</td>
<td>3.53</td>
<td>2.77</td>
<td>3.99** (df = 73)</td>
</tr>
<tr>
<td>recommended deadlines</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Using MyLabsPlus</td>
<td>3.5</td>
<td>2.80</td>
<td>3.28** (df = 41.25)</td>
</tr>
<tr>
<td>Having to pass each quiz with at</td>
<td>3.43</td>
<td>2.83</td>
<td>3.27** (df = 72)</td>
</tr>
<tr>
<td>least an 80% and each test with at</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>least a 75%</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Getting points for having an organized workbook/notebook  | 3.39 | 2.80 | 2.83**  
(Total df = 72)

Taking the required number of quizzes and tests (MAT012 - 11 quizzes and 4 tests; MAT015 - 14 quizzes and 4 tests)  | 3.53 | 2.57 | 5.50**  
(Total df = 73)

Completing the workbook  | 3.31 | 2.77 | 2.71**  
(Total df = 73)

Attending the Math Success Center  | 3.33 | 2.63 | 3.00**  
(Total df = 49.00)

Watching the videos  | 3.31 | 2.53 | 3.11**  
(Total df = 47.02)

*Note.* ** indicates p < 0.01 and non-integer degrees of freedom indicate unequal variances.

The open-ended questions in the survey asked students to identify which features encouraged them or discouraged them the most. The features that encouraged them the most were MyLabsPlus, the Math Success Center, mastery learning (which includes comments about working at their own pace), and getting points, which includes attending class and the Math Success Center, having an organized workbook/notebook, and meeting deadlines (see Table 6). The features that discouraged students the most were the amount of time the course required, the Math Success Center, mastery learning, the
workbook/notepad, the videos, and the rigid rules (see Table 7). It is important to note that 8 of the 75 students responded that they found none of the features to be discouraging.

Table 6

*Responses to the open-ended question: Which of these features encouraged you to keep working the most?*

<table>
<thead>
<tr>
<th>Features of the program</th>
<th>Percent who reported this feature encouraged them the most (N = 57)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MyLabsPlus</td>
<td>29.8</td>
</tr>
<tr>
<td>Math Success Center</td>
<td>26.3</td>
</tr>
<tr>
<td>Mastery Learning</td>
<td>15.8</td>
</tr>
<tr>
<td>Getting Points</td>
<td>15.8</td>
</tr>
<tr>
<td>Self-Motivation</td>
<td>8.8</td>
</tr>
<tr>
<td>Instructor</td>
<td>7.0</td>
</tr>
<tr>
<td>Meeting Deadlines</td>
<td>5.3</td>
</tr>
<tr>
<td>Other</td>
<td>10.5</td>
</tr>
</tbody>
</table>
Table 7

*Responses to the open-ended question: Which of these features discouraged you to keep working the most?*

<table>
<thead>
<tr>
<th>Features</th>
<th>Percent who reported this feature discouraged them the most (N = 58)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amount of Time Course Required</td>
<td>17.2</td>
</tr>
<tr>
<td>Math Success Center</td>
<td>15.5</td>
</tr>
<tr>
<td>None</td>
<td>13.8</td>
</tr>
<tr>
<td>Mastery Learning</td>
<td>12.1</td>
</tr>
<tr>
<td>Workbook/Notebook</td>
<td>10.3</td>
</tr>
<tr>
<td>Videos</td>
<td>10.3</td>
</tr>
<tr>
<td>Rigid Rules</td>
<td>10.3</td>
</tr>
<tr>
<td>No Traditional Instructor</td>
<td>8.6</td>
</tr>
<tr>
<td>Meeting Deadlines</td>
<td>8.6</td>
</tr>
<tr>
<td>Getting Points</td>
<td>6.9</td>
</tr>
<tr>
<td>Too Much Work</td>
<td>6.9</td>
</tr>
<tr>
<td>MyLabsPlus</td>
<td>5.2</td>
</tr>
<tr>
<td>Class Time Unhelpful</td>
<td>3.4</td>
</tr>
<tr>
<td>Instructor</td>
<td>3.4</td>
</tr>
<tr>
<td>Other</td>
<td>6.9</td>
</tr>
</tbody>
</table>
These results are mostly consistent with previous results from Table 4, except the Math Success Center and mastery learning are at both extremes. The results suggest that students tended to either love or hate the Math Success Center and mastery learning. For example, for the Math Success Center, one student wrote, “Going to the math center was the most helpful to me because I got instruction from a number of different people. If I didn't understand what one instructor or tutor was explaining, there was always another person there that might relate to me.” On the other hand, another student wrote of the Math Success Center, “I found it was not helpful at all. When I tried to ask for help, some of the staff did not know how to do what I needed help on. Also, it was very distracting to be surrounded by so many people. It was very difficult for me to concentrate with all the movement and people talking.”

For mastery learning, students were most encouraged by the fact that they could go at their own pace. One student wrote, “It allowed me to work at my own pace and set up my own study, homework, and quiz schedule.” On the other hand, students were most discouraged by the fact that they could not move onto the next topic if they did not get the required grade. One student wrote, “I would have to take a quiz over at least 3 times just to pass.”

**WU Students’ Patterns**

First, I discuss the percentages of WU students in the emporium and pre-emporium program. As noted in Table 8, chi-square analysis revealed there were no significant differences between the percentages of WU students in the emporium and the
pre-emporium. Thus, although the pass rates of emporium students decreased significantly, the percentages of students who gave up on their developmental math courses remained the same. One possible explanation is that since struggling emporium students could take assessments multiple times, they may have been more likely to believe they could pass the course and thus continued to keep working.

Table 8

*Percentages of WU Students*

<table>
<thead>
<tr>
<th></th>
<th>MAT012 – Review of Math Fundamentals</th>
<th>MAT015 – Elementary Algebra</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Emporium Students</td>
<td>Number of WU Students</td>
</tr>
<tr>
<td>Fall 2012</td>
<td>125</td>
<td>447</td>
</tr>
<tr>
<td>Spring 2013</td>
<td>127</td>
<td>308</td>
</tr>
</tbody>
</table>

Second, I discuss emporium WU students’ patterns in how they performed in their other courses by examining the percentage of WU students taking multiple courses who received a single W grade or U grade in only their math course (SWU) or who received
multiple W grades or U grades (MWU). For MAT012, the percentages of SWU students were 34% and 43% for the fall and spring semesters respectively (see Figures 1 and 2). For MAT015, the percentages of SWU students were 52% and 41% for the fall and spring semesters respectively (see Figures 3 and 4). Thus, approximately a third to half of all emporium WU students were students who stopped working in their math course, but continued to work in their other courses. This suggests that a significant portion of WU students were specifically affected by the emporium program as opposed to school in general.

**Figure 1. MAT012 SWU versus MWU for Fall 2012.** This figure illustrates the percentage of WU students (out of N = 116) taking multiple courses that are SWU or MWU.

**Figure 2. MAT012 SWU versus MWU for Spring 2013.** This figure illustrates the percentage of WU students (out of N = 120) taking multiple courses that are SWU or MWU.
Figure 3. MAT015 SWU versus MWU for Fall 2012. This figure illustrates the percentage of WU students (out of N = 56) taking multiple courses that are SWU or MWU.

Figure 4. MAT015 SWU versus MWU for Spring 2013. This figure illustrates the percentage of WU students (out of N = 81) taking multiple courses that are SWU or MWU.

Now I discuss WU students’ patterns related to the Math Success Center, which includes which weeks they stopped attending the lab (LSP) and the average number of hours spent in the lab per week as compared to non-WU students.

For both developmental courses, the week with the highest percentage of being the LSP was week 0, meaning the students never attended the lab at all. For MAT012, week 0 accounted for 19% and 21% of the LSP for the fall and spring semesters respectively. Similarly, for MAT015, week 0 accounted for 19% and 16% of the LSP for the fall and spring semesters respectively.
Additionally by looking at Figures 5 and 6, it is clear that for MAT012, the
distribution of the LSP was similar from fall to spring. Immediately after week 0, the
percentage dropped dramatically, but then tended to rise until it reached a peak at week 5,
which had the second highest percentage of being the LSP at 14% and 13% for the fall
and spring semesters respectively. Then after week 5, the percentage tended to drop
gradually with a few smaller peaks along the way.

![Figure 5. MAT012 LSP for Fall 2012.](image1)
This figure illustrates each week’s
percentage of being the LSP.

![Figure 6. MAT012 LSP for Spring 2013.](image2)
This figure illustrates each week’s
percentage of being the LSP where SB
stands for Spring Break.

Unlike for MAT012, after week 0, the distribution of the LSP from fall to spring
for MAT015 seems to be quite different (see Figures 7 and 8). During the fall semester,
there were small peaks at weeks 2 and 5 and then a large peak at week 9. On the other
hand, during the spring semester, the LSP percentage dropped dramatically during weeks
1, 2, and 3, and then a peak occurred at week 4. After week 4, the percentage tended to decrease gradually.

Since week 0 had the highest percentage of being the LSP, it is clear that many WU students had never even attended the Math Success Center. Thus, these students were not experiencing the emporium program as it was intended. In addition, for MAT012, if the WU students did start out attending the Math Success Center, they would most likely stop attending around week 5. So, it seems that these WU students were willing to try, but quickly discovered, for whatever reason, that attending the lab did not work for them. Unfortunately, for MAT015, the results were unclear and more research needs to be completed to gain a clearer picture.
The second investigation relating to the Math Success Center is the average number of hours spent in the lab per week. In general, “active” WU students spent less time than non-WU students. For MAT012, this difference was extremely significant for weeks 1 through 9 for both the fall and spring semesters and significant for week 10 for the spring semester and week 11 for the fall semester (see Table 9). These results suggest a certain consistency from fall to spring. The results for MAT015, on the other hand, were very different from fall to spring. For the fall semester, the difference in the average number of hours spent in the Math Success Center was significant for weeks 2 and 6. For the spring semester, the difference was extremely significant for weeks 4, 5, 6, and 9 and significant for weeks 1, 2, 7, 8, and 13 (see Table 10).

Table 9

Average Number of Lab Hours per Week for MAT012

<table>
<thead>
<tr>
<th>Week</th>
<th>Fall 2012</th>
<th>Spring 2013</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Average time in hours spent by non-WU students (n = 322)</td>
<td>Average time in hours spent by “active” WU students (n = 181)</td>
</tr>
<tr>
<td>1</td>
<td>1.63 (n = 101)</td>
<td>5.40** (df = 421)</td>
</tr>
<tr>
<td>2</td>
<td>2.67 (n = 101)</td>
<td>7.21** (df = 421)</td>
</tr>
<tr>
<td>3</td>
<td>3.39 (n = 94)</td>
<td>5.32** (df = 414)</td>
</tr>
<tr>
<td>4</td>
<td>3.24 (n = 85)</td>
<td>5.04** (df = 405)</td>
</tr>
<tr>
<td>5</td>
<td>3.23 (n = 71)</td>
<td>4.35** (df = 391)</td>
</tr>
<tr>
<td>Week</td>
<td>Average time in hours spent by non-WU students (n = 158)</td>
<td>Average time in hours spent by “active” WU students (n = 215)</td>
</tr>
<tr>
<td>------</td>
<td>-------------------------------------------------</td>
<td>-------------------------------------------------</td>
</tr>
<tr>
<td>1</td>
<td>2.14 (n = 50)</td>
<td>1.62 (n = 50)</td>
</tr>
</tbody>
</table>

*Note:* * indicates p < 0.05 and ** indicates p < 0.01.
<p>| | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>3.40</td>
<td>2.44</td>
<td>2.29*</td>
<td>2.41</td>
<td>1.84</td>
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<td>(df = 205)</td>
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<td>(df = 289)</td>
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<tr>
<td>3</td>
<td>3.50</td>
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<td>1.83</td>
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<td>2.30</td>
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<td>(df = 199)</td>
<td>(n = 74)</td>
<td>(df = 287)</td>
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<tr>
<td>4</td>
<td>3.28</td>
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<td>1.76</td>
<td>2.96</td>
<td>1.89</td>
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<td>(n = 40)</td>
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<tr>
<td>5</td>
<td>3.28</td>
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<td>1.30</td>
<td>2.90</td>
<td>1.44</td>
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<td>3.14</td>
<td>2.21</td>
<td>1.34</td>
<td>2.51</td>
<td>1.31</td>
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<tr>
<td>10</td>
<td>1.71</td>
<td>2.05</td>
<td>0.41</td>
<td>2.80</td>
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<td>(df = 166)</td>
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<td>(df = 243)</td>
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<td>11</td>
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<td>0.89</td>
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<td>1.91</td>
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<td>N/A</td>
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<td>(df = 217)</td>
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</table>

*Note.*  * indicates p < 0.05 and ** indicates p < 0.01.

These results suggest for MAT012, “active” WU students spent significantly less time in the lab starting from the beginning of the semester as compared to non-WU students. Therefore, although these “active” WU students were willing to attend the lab, they did not commit themselves to spending a sufficient amount of time to be successful.
For MAT015, the pattern, once again, is more difficult to discern since the results were not as consistent from the fall to the spring; however, it is clear that “active” WU students spent less time in the lab compared to non-WU students, although not necessarily significantly less.

Lastly, I discuss WU students’ patterns related to their progression through MyLabsPlus, which first includes which weeks they stopped working (MSP), and then which assessments became content stopping points (CSP).

For both semesters of MAT012, week 5 had the highest percentage of being the MSP at 13% and 12% for the fall and spring semesters respectively. Additionally, for the fall, weeks 0 and 7 had the second highest percentage at 12%, followed by week 12 at 10%. For the spring, week 0 had the second highest percentage at 11%, followed by weeks 6 and 7 at 9% (see Figures 9 and 10).
For MAT015, during the fall, the weeks with the highest percentage of being the MSP were weeks 6, 7, and 9, at 11%, 11%, and 10% respectively. During the spring, the weeks with the highest percentage of being the MSP were weeks 11, 5, and 9 at 11%, 10%, and 9% respectively (see Figures 11 and 12).
Now, I turn to the CSP. For MAT012, the assessment with the highest percentage of being the CSP was Quiz 1 at 42% and 23% for the fall and spring semesters respectively. For the fall semester, the percentage started low, peaked at Quiz 1, and then tended to drop. By Test 2, WU students had already stopped working. For the spring semester, the percentage again started low, peaked at Quiz 1, and then tended to drop; however, there was another small peak at Quiz 7, and then it dropped again (see Figures 13 and 14).
Figure 13. MAT012 CSP for Fall 2012.
This figure illustrates each assessment’s percentage of being the CSP where Q stands for quiz and T stands for test.

For the fall semester of MAT015, Quiz 1 had the highest percentage of being the CSP at 26% and Quizzes 3 and 6 had the second highest percentage at 15%. Also, by Quiz 9, all WU students had stopped working on MyLabsPlus.

Figure 14. MAT012 CSP for Spring 2013. This figure illustrates each assessment’s percentage of being the CSP where Q stands for quiz and T stands for test.

For the spring semester, Quiz 6 had the highest percentage of being the CSP at 23%, followed by Quiz 1, Quiz 7, and Quiz 3 at 13%, 12%, and 10% respectively (see Figures 15 and 16).
Figure 15. MAT015 CSP for Fall 2012. This figure illustrates each assessment’s percentage of being the CSP where Q stands for quiz and T stands for test.

Figure 16. MAT015 CSP for Spring 2013. This figure illustrates each assessment’s percentage of being the CSP where Q stands for quiz and T stands for test.

Combining the results from MSP and CSP yields several patterns for WU students’ progression in MyLabsPlus. For MAT012, WU students most often stopped working on MyLabsPlus during weeks 0, 5, and 7 and before successfully completing Quiz 1, which involved working with whole numbers including multiplication, division, and order of operations. For MAT015, WU students most often stopped working on MyLabsPlus during the second quarter of the semester somewhere around weeks 5 though 7 as well as during week 9 and also before completing Quiz 1, Quiz 3, and Quiz 6. Quiz 1 involved working with real numbers including graphing on a number line, translating expressions into algebraic inequalities, and understanding absolute value.
Quiz 3 involved working with signed numbers including multiplication, division, and order of operations. Finally, Quiz 6 involved solving linear equations and inequalities including equations or inequalities with fractions and decimals as well as application problems.

Next, I discuss the implications of the results, make recommendations for future revisions of the emporium program, and examine the limitations of the study.
Chapter 4

DISCUSSION

Implications of Results

The first research question was aimed at determining the success of the emporium program as compared to the pre-emporium program. Unfortunately, in this version of the emporium program, emporium students actually performed worse in their developmental math courses than pre-emporium students. In addition, the cost-saving benefits did not occur since faculty hours were not reduced due to the need of extensive record keeping from the weekly participation points and mini-conferences for each individual student. Thus, Delaware Tech’s emporium program provides an important counterexample to the literature that suggests emporium-based programs increase learning and decrease costs.

The results of decreased pass rates in Delaware Tech’s program strongly suggest that particular program features can affect student success. Because the Math Success Center and the videos and workbooks were identified in the survey on program features as being among the least encouraging, they point to possible explanations as to why pass rates decreased. This is significant because I had hypothesized that these program features would actually increase pass rates, while other features such as mastery learning, participation points for meeting recommended deadlines, and the large number of
assessments, which I hypothesized would tend to decrease pass rates, actually were viewed as more encouraging.

Finally, WU students’ patterns also may explain why pass rates decreased. Many of the WU students did not follow the emporium program as was intended. Results from the Math Success Center data show that many WU students never came to the lab in the first place, or if they did, they did not spend as much time per week as non-WU students. In addition, many WU students did not make it past the first quiz in MyLabsPlus. Hence, the two core components of the emporium model were not being used to their fullest extent.

Despite the decrease in pass rates, I believe that it is still too soon to abandon the emporium program altogether. It is important to remember that this was the first year of implementation of the program and as with any new program there is a learning curve. Literature suggests that this program can be successful, so I believe we should focus on making changes to the program and then, after more data is collected, make a decision about whether to continue with the program.

**Recommendations**

In this section, I look to my results in order to make recommendations to improve the emporium program. First, I closely examine the program features that were viewed as least encouraging: the Math Success Center, and the videos and the workbook. Then I reflect on additional themes that appeared in the open-ended questions in the survey. Finally, I examine WU students’ patterns.
As mentioned previously, one possible explanation as to why pass rates decreased is due to the program features that were viewed as least encouraging. I believe the Math Success Center to be the most significant of these features, since it is one of the core components of the emporium model. Students who found the Math Success Center discouraging most often stated reasons concerning staffing. Comments included, “most of the time I became more confused then [sic] when I came in”, “some of the staff did not know how to do what I needed help on”, and “the math tutors circled you like a hawk and I felt very pressured”. Although the staff has already received training on the entire emporium program, I recommend training that focuses specifically on tutoring in the Math Success Center. First, it is important to ensure that all staff members are comfortable tutoring students for both developmental courses, since MAT012 and MAT015 students use the lab simultaneously. Staff members who are uncomfortable with developmental algebra should be required to take MAT015 so they would be better prepared to answer questions. Also, a general training session should be provided to all staff members to discuss ways to make the Math Success Center more welcoming and relaxing for the students.

In addition to the staffing, students found the physical environment of the lab discouraging because they found it distracting and too small. One student wrote that it is “loud and hard to concentrate” and another wrote that there is “not enough room to work”. Therefore, I recommend that the lab be expanded so students have more space and less noise. In the meantime, we must work with the space we have. One temporary
fix is to move the computers from the tops of the tables to cages underneath so that students have more room to work.

The other program features that were viewed as least encouraging were the videos and workbooks. Since pre-emporium students often received little to no instruction, I hypothesized that having at least some instruction, especially instruction that could be controlled by the student by being able to stop and replay the videos, would be an improvement. However, that did not seem to be the case. Responses from the survey revealed that students found the videos “time consuming and monotonous”, “grueling”, “VERY boring”, and “slowly paced”. As for the workbook, one student wrote that it “didn’t help as much as I figured it would” and another wrote that she “didn’t like the fact that that you had to have your workbook checked everytime [sic] you came in for a test”. With these main means of instruction being viewed as tedious and unhelpful, students may not pay close attention to them and just try to complete the homework without really understanding the procedures. Therefore, I recommend looking into providing different videos and investigating the usefulness of the workbook.

Finally, two themes appeared in the survey responses to the open-ended question on the most discouraging feature that did not fall into the program features I originally identified. The first feature, that the program takes too much time, was identified as the most discouraging feature, especially for students with additional commitments. One student wrote, “All the steps were too time consuming in addition to being a full time student and working adult”. Therefore, I recommend that at the beginning of the
semester, instructors stress how much time these courses will take, so students will have a better understanding of what to expect.

The second theme that did not fall into the original program features, but was identified as discouraging was the rigid rules. These are rules that were viewed by the students as unnecessarily, and perhaps unfairly, strict. For example, two students wrote that they had to miss class due to medical reasons and they lost attendance points. One wrote further that her instructor was “really unwilling to help” and the other stated, “spending 15 plus hours in the math lab” should make up for missing class. Another example of rigid rules is related to completing the workbook. One student wrote, “Some answers did not require a long answer but that teachers would make you fill stuff in just to do it”. Hence I recommend changing existing rules to allow for more flexibility. For example, the current rule on attendance is that if a student misses class for any reason, even an excused absence, she loses the attendance points for that day. I propose that we allow students with excused absences to make up the lost time in the Math Success Center without losing points. Another rule that should be changed is the workbook policy. During the first year of implementation, students were required to show completed workbook sections in order to take a quiz or a test. If it was not filled out completely, they were turned away. This rule was changed for the second year of implementation. Students no longer had to have the workbooks checked in order to take an assessment, but they were still being checked every week by the instructor. Survey responses showed that students did not find their workbooks to be very helpful, so I propose that we do not check workbooks at all. Some students may like the notes that are
already outlined in the workbook, while other students may like to take their own notes from scratch. That decision should be theirs.

Lastly, I look to WU students’ patterns to make recommendations. Results showed that approximately a third to half of WU students taking multiple courses were SWU students as opposed to MWU students. SWU students are students who gave up on their math course, but continued to work in their other courses, suggesting that improvements to the emporium program could have a very positive effect on this portion of the population. On the other hand, MWU students are students who gave up on more than just their math course, suggesting that personal factors, such as time or motivation, were coming into play and improvements to the program may not significantly affect this portion of the population. Therefore, while improvements to the emporium program would hopefully keep all students from becoming WU students, we can realistically only expect the improvements to increase our retention of a portion of them, although the portion is quite significant.

For the Math Success Center, the results showed for both developmental courses that week 0 had the highest percentage of being the LSP, meaning the majority of WU students never came to the lab in the first place. In addition, those “active” WU students who did come to the lab tended to spend less time per week than non-WU students right from the beginning of the semester. Thus it is extremely important to encourage students to get into the lab immediately and to spend more time each week. I mentioned previously that emporium students were required each week to spend either two or three
“anytime” hours in the Math Success Center depending on how much class time they had. This concept of “anytime” hours has dominated emporium programs from four-year institutions, but two community colleges found that having at least some fixed hours in the lab worked better for their students (Twigg, 2011). For Delaware Tech, I believe these “anytime” hours give emporium students too much freedom, making it easy to procrastinate and can often lead to “barely anytime” hours in the lab. Also, when emporium students registered for their course, their schedule only showed their class time. Hence, students may not have been aware that they would be required to spend another two to three hours per week in the Math Success Center to account for the four credit course. As a result, some students, when building their schedule, may have created a heavier course load or agreed to work more hours outside of school making it even more difficult to meet their hours in the lab. Therefore, I recommend that the required lab hours not be “anytime” hours, but fixed hours that explicitly appear in the course catalog. Since students would now know upfront exactly when and how much time they are required to spend each week, this recommendation circles back to my previous recommendation that students be made more aware of the time commitment these courses take.

The results of the LSP and MSP suggest that for MAT012, week 5 is an important week. It had the second highest percentage of being the LSP and the highest percentage of being the MSP. Therefore, if WU students made it past start, they were most likely to give up working in the lab and on MyLabsPlus at week 5. Also, results from the CSP
showed that the majority of WU students did not progress beyond Quiz 1. Consequently, it is clear that early intervention is crucial.

For MAT015, the results were not as consistent from one semester to another. This may be due to the fact that since the fall of 2012 was the very first implementation of the emporium program, the fall 2012 MAT015 cohort’s prerequisite course, MAT012, was pre-emporium; however, the spring 2013 cohort would have had students who took the emporium MAT012 from the previous fall. As a result, more research will need to be conducted to have a better understanding of the results for MAT015. However, it is clear that these students would also benefit from intervention. Combining the results from the LSP and the MSP, there seem to be two main points where students tended to stop working: one near the beginning of the semester and one near the middle of the semester. The CSP seems to point to a similar result with the highest percentages occurring at Quiz 1 and Quiz 3, which occur near the beginning of the semester, and Quiz 6, which occurs near the middle of the semester.

Hence, for both developmental courses, I recommend that at weeks 3 and 7, instructors conduct conferences with students who are at risk of becoming WU students. Indicators include spending little to no time in the lab or on MyLabsPlus each week, and not getting past Quiz 1 for MAT012, or Quiz 1, Quiz 3, and Quiz 6 for MAT015. Therefore, as the semester approaches weeks 3 and 7, instructors should look at their records to determine which of their students are at risk of becoming WU students based on these indicators. Then instructors should meet with these students in a private setting.
to discuss ways to increase their time in the lab or on MyLabsPlus or to help them with material that would appear on the corresponding quizzes.

Finally, I recommend that more research be completed. As I mentioned previously, since the emporium program was only in its first year of implementation when the data were collected, it is too early to abandon it. We must see how these recommendations and other changes that were made in the second year of implementation affect pass rates. Because we do not want to have to wait entire semesters to see if changes are positive, it is important that we develop ways to study small incremental changes. For example, since I have recommended looking into providing alternate videos, perhaps a small group of students would watch a set of alternate videos for the first couple of weeks. Then, depending on feedback and results on the first assessments, we would continue using these alternate videos or make another change.

In summary, I make the following recommendations.

1. Provide staff training that focuses specifically on tutoring in the Math Success Center.
2. Expand the size of the Math Success Center.
3. Investigate whether to provide alternate videos and evaluate the usefulness of the workbook.
4. Stress to students how much time they should expect to spend per week.
5. Change the existing rules to allow more flexibility.
6. Require fixed Math Success Center hours that are explicitly listed in the course catalog.

7. Hold instructor-student conferences at weeks 3 and 7 with students who are at risk of becoming WU students.

8. Conduct additional research.

While I believe that each recommendation is important, perhaps the most important recommendation is the one on conducting additional research. One of the primary results of this study is that the details of implementation matter. In the next couple of years, we will need to make a decision on whether to continue with the emporium program or to abandon it. As a result, we need to make sure that we continue to gather data based on small tweaks to the program to see if pass rates are improving. Only then can we make an informed decision on where to go next.

**Limitations of the Study**

It is important to remember that these data were collected from the first year of a new program, and with any new program, there are often a lot of bugs to work out. There is a learning curve for students and staff and tweaks have been made along the way. The second year of implementation, which had just been completed at the time this paper was written, had some significant changes from the first year. These changes include allowing students to pass a quiz by scoring at least a 75% instead of an 80%, and allowing students to take quizzes at home instead of in the Math Success Center.
Therefore, the recommendations I make may be more or less effective than expected due to the recent changes in the program.

Another limitation arises from the college-level data. Since most of the students enrolled in MAT120 either did not need to take a developmental math course or had already completed their developmental math course several semesters earlier, they had to be excluded from the data, resulting in a small sample. In addition, the college-level data are not representative of all the college-level courses. Due to the fact that the emporium program was in its first year of implementation and the prerequisite requirements of math courses, there was only one college-level math course containing college-level emporium students that could be analyzed. However, there are several other college-level math courses that would be of interest and further research must be done in order to get a more accurate understanding of the effect of the emporium program on college-level emporium students.

The last limitation is related to the survey on program features. First, the survey had a low response rate of 7% and so the data collected from the survey may not be representative of all students. Second, the survey was distributed to emporium students in November 2013. Therefore, emporium students from the fall 2012 cohort would have completed the survey almost a whole year later and their views may have changed during that time. Finally, at the time of the survey, some respondents may have been currently enrolled in the emporium program, which was beginning its second year of implementation. Although the directions in the survey stated that students should
formulate their responses based on the fall 2012 or spring 2013 courses, some students’ responses may have been based on the fall 2013 courses in which significant changes were enacted.
Although literature suggests that emporium programs increase pass rates, the decrease in the pass rates of Delaware Tech’s emporium program provides insight to the importance of studying particular program features. Institutions cannot simply ask whether their emporium program is effective or ineffective. Instead, institutions should focus on determining the effectiveness of particular program features in the context of the institution. Therefore, it becomes crucial for institutions to be able to make small incremental changes to their particular program features and to study and report their effects on pass rates. It is also crucial that future studies on the emporium model include detailed descriptions of particular program features, so that readers may better understand the context of the program, allowing more opportunities to learn from each other.
REFERENCES


National Center for Public Policy in Higher education and Southern Regional Education Board. (2010). *Beyond the rhetoric: improving college readiness through coherent state policy.* Washington, DC: NCPPHE.


Appendix A

DETAILED DESCRIPTION OF DELAWARE TECH’S EMPORIUM PROGRAM

Since emporium programs can vary significantly from one institution to another, it is important to provide context to Delaware Tech’s program. The details of particular program features are discussed below.

Math Success Center

The lab was open Monday through Thursday from 8:30 am to 9:00 pm, Friday from 8:30 am to 4:00 pm, and Saturday from 9:00 am to 1:00 pm. It was usually staffed by two to three faculty members and two to three tutors and was overseen by an Education Lab Specialist, who would handle unexpected problems and assist staff.

Students were required to scan in and out of the lab using their student ID cards. This allowed faculty to determine if their students were meeting the required amount of “anytime” hours in the lab each week, although students were welcome to spend additional time if they wanted. Lab time was spent working on homework, watching videos (headphones required) and completing the corresponding workbook pages, getting help from staff, and taking assessments.
The lab contained around 60 computers arranged in rows in order to maximize the number of computers in the space. The computers rested on the tops of the tables leaving only a small amount of room for students to use when completing their workbooks or solving homework problems in their notebooks. Each computer space was equipped with two plastic cups, one blue and one red. If a student had a question, she placed the blue cup on her monitor and a faculty member or tutor would assist her. If the student wanted to take a quiz or a test, she placed the red cup on the monitor and she would be directed to the testing area of the lab.

The testing area was usually one of the rows of computers in the main room; however, if it got really busy, a staff member would move the testing area to a smaller room inside the lab. In order for a student to be able to test, a proctor would first verify that the relevant workbook pages were properly completed and then would enter the appropriate password into the computer. Once the quiz or test was completed, the student was able to review it with a staff member, and then continue working.

**MyLabsPlus**

Students spent almost all of their time working in MyLabsPlus, because it contained all of the videos, concept checks, homework assignments, optional review assignments, and mandatory review assignments if they did not demonstrate mastery on an assessment, as well as all of their quizzes and tests. Fortunately, since MyLabsPlus can be accessed over the internet, students were able to work at home, in the Math Success Center, or any other place that was convenient for them.
For students, the most useful characteristics of MyLabsPlus involved homework assistance. For each homework problem, a student would have three chances to input the correct answer. A correct answer would result in an encouraging message, such as “good job”. On the other hand, an incorrect answer on the first or second attempt would result in an error message providing a hint as to where a mistake might have been made. After a third incorrect answer had been submitted, the question would be marked wrong. At that point, students would have the ability to ask for a similar problem, and if they successfully completed it, the question would then be marked as correct. In addition, when students had trouble understanding how to solve the problem, they had two resources they could use: Help Me Solve This and View an Example. If the students clicked on Help Me Solve This, they would be given step-by-step instructions that would help them complete the exact problem they were attempting. Then they would have to complete a similar problem on their own in order to have that question marked as correct. If the students clicked on View an Example, they would be shown the solution to similar problem, so they could apply similar steps to the problem they were attempting.

For instructors, the most useful characteristics of MyLabsPlus involved record keeping. Every time a student worked in MyLabsPlus, the instructor was able to see what date and time the student logged in, how much time was spent on each assignment, and what score was achieved. In addition, all quizzes and tests were automatically graded. In order to keep uniformity with the grading and because students were allowed to take assessments multiple times, instructors were not allowed to give partial credit.
**Student Routine**

Each course in the emporium program was broken into four units, and each unit was composed of two to five mini-modules, or mini-mods, which contained several topics. Students would start each topic by watching a video and simultaneously completing the corresponding workbook pages. After the video, students would complete a quick concept check, which was usually three or four questions that checked understanding of new vocabulary presented in the video. Then, students had to complete a homework assignment for that topic. This cycle was repeated until all topics in the mini-mod were completed, and an optional review assignment was available for students who wanted extra practice. Once students had met all of the prerequisites of watching the videos, completing the concept checks and homework assignments at 100%, and completing the workbook, they were allowed to take a quiz on that mini-mod. Students who scored at least an 80% on the quiz were able to start the next mini-mod, although they had the option of retaking the quiz at any point throughout the course to get an even higher score. On the other hand, students who scored less than 80% were required to retake the quiz. While no extra assignment was required for a second attempt on a quiz, a required review had to be completed at 100% in order to have a third attempt. If a student still had not demonstrated mastery after the third attempt, a mandatory conference was held with the instructor to create an action plan. Lastly, once students completed all of the mini-mods in a unit, they were allowed to take a unit test, where they were required to score at least a 75%. If the minimum score was not achieved, then a similar procedure to the quizzes was followed.
MAT012 Content

- Unit One
  - Mini-Mod 1: Whole Numbers
    - Topic 1.1: Whole Numbers
    - Topic 1.2: Rounding
    - Topic 1.3: Adding Whole Numbers and Estimation
    - Topic 1.4: Subtracting Whole Numbers and Estimation
    - Topic 1.5: Basic Problem Solving
    - Topic 1.6: Multiplying Whole Numbers and Estimation
    - Topic 1.7: Dividing Whole Numbers and Estimation
    - Topic 1.8: More With Multiplying and Dividing
    - Topic 1.9: Exponents
    - Topic 1.10: Square Roots
    - Topic 1.11: Order of Operations and Whole Numbers
    - Topic 1.11.1: Oder of Operations with Square Roots*
    - Topic 1.12: More Problem Solving
  - Mini-Mod 2: Factors and Fractions
    - Topic 2.1: Factors, GCF by List and Divisibility Tests
    - Topic 2.2: Prime Factorization
    - Topic 2.2.1: GCF by Prime Factorization*
    - Topic 2.3: Understanding Fractions
    - Topic 2.4: Simplifying Fractions – GCF and Factors Method
    - Topic 2.5: Simplifying Fractions – Prime Factors Method
    - Topic 2.6: Multiplying Fractions
    - Topic 2.7: Dividing Fractions
  - Mini-Mod 3: LCM and Fractions
    - Topic 3.1: Finding the LCM – List Method
    - Topic 3.2: Finding the LCM – Prime Factor Method
    - Topic 3.3: Writing Fractions with an LCD
    - Topic 3.4: Adding and Subtracting Like Fractions
    - Topic 3.5: Adding and Subtracting Unlike Fractions
    - Topic 3.6: Order of Operations and Fractions
    - Topic 3.6.1: Comparing Fractions*
  - Mini-Mod 4: Mixed Numbers
    - Topic 4.1: Changing a Mixed Number to an Improper Fraction
    - Topic 4.2: Changing an Improper Fraction to a Mixed Number
    - Topic 4.3: Multiplying Mixed Numbers
    - Topic 4.4: Dividing Mixed Numbers
    - Topic 4.5: Adding Mixed Numbers
    - Topic 4.6: Subtracting Mixed Numbers
    - Topic 4.7: Adding and Subtracting Mixed Numbers – Improper Fractions
- Topic 4.7.1: Application Problems with Fractions and Mixed Numbers*

- Unit Two
  - Mini-Mod 5: Operations with Decimals
    - Topic 5.1: Decimal Notation
    - Topic 5.2: Comparing Decimals
    - Topic 5.3: Rounding Decimals
    - Topic 5.4: Adding and Subtracting Decimals
    - Topic 5.5: Multiplying Decimals
    - Topic 5.6: Dividing Decimals
    - Topic 5.6.1: Application Problems with Decimals*
    - Topic 5.7: Order of Operations and Decimals
    - Topic 5.8: Converting Fractions to Decimals
    - Topic 5.9: Converting Decimals to Fractions
  - Mini-Mod 6: Ratios, Rates, and Percents
    - Topic 6.1: Ratios
    - Topic 6.2: Rates
    - Topic 6.3: Proportions
    - Topic 6.4: Percent Notation
    - Topic 6.5: Percent and Decimal Conversions
    - Topic 6.6: Percent and Fraction Conversions
    - Topic 6.7: The Percent Equation
    - Topic 6.8: The Percent Proportion
    - Topic 6.9: Percent Applications
    - Topic 6.10: Similar Figures
    - Topic 6.11: Finding Unknown Lengths

- Unit Three
  - Mini-Mod 7: U.S. and Metric Measurements
    - Topic 7.1: U.S. Length
    - Topic 7.2: U.S. Weight and Capacity
    - Topic 7.3: Metric Length
    - Topic 7.4: Metric Mass and Capacity
    - Topic 7.5: Converting Between U.S. and Metric Units
    - Topic 7.6: Time and Temperature
  - Mini-Mod 8: Introduction to Geometry
    - Topic 8.1: Lines and Angles
    - Topic 8.2: Figures
    - Topic 8.3: Perimeter – Definition and Units
    - Topic 8.4: Finding Perimeter
    - Topic 8.5: Area – Definition and Units
    - Topic 8.6: Finding Area
    - Topic 8.7: Understanding Circles
    - Topic 8.8: Finding Circumference
    - Topic 8.9: Finding Area – Circles
- Topic 8.10: Volume – Definition and Units
- Topic 8.11: Finding Volume
  - Mini-Mod 9: Statistics
    - Topic 9.1: Bar Graphs and Histograms
    - Topic 9.2: Line Graphs
    - Topic 9.3: Circle Graphs
    - Topic 9.4: Mean
    - Topic 9.5: Median
    - Topic 9.6: Mode
- Unit Four
  - Mini-Mod 10: Signed Numbers
    - Topic 10.1: Signed Numbers and Absolute Values
    - Topic 10.2: Adding Signed Numbers
    - Topic 10.3: Subtracting Signed Numbers
    - Topic 10.4: Multiplying and Dividing Signed Numbers
    - Topic 10.5: Order of Operations and Signed Numbers
  - Mini-Mod 11: Introduction to Algebra
    - Topic 11.1: Variables and Algebraic Expressions
    - Topic 11.2: Like Terms
    - Topic 11.3: Distributing
    - Topic 11.4: Simplifying Algebraic Expressions
    - Topic 11.5: Equations and Solutions
    - Topic 11.6: Solving Equations by Adding or Subtracting
    - Topic 11.7: Solving Equations by Multiplying or Dividing
    - Topic 11.8: Solving Equations Using Both Properties of Equality
    - Topic 11.9: Solving Equations with Multiple Steps

* indicates custom topics added by Delaware Tech

**MAT015 Content**

- Unit One
  - Mini-Mod 1: Real Numbers and Variables
    - Topic 1.1: Introduction to Real Numbers
    - Topic 1.2: Graphing Real Numbers Using a Number Line
    - Topic 1.3: Translating Phrases into Algebraic Inequalities
    - Topic 1.4: Finding the Absolute Value of a Real Number
    - Topic 1.12: More Problem Solving
  - Mini-Mod 2: Adding and Subtracting with Real Numbers
    - Topic 2.1: Adding Real Numbers with the Same Sign
    - Topic 2.2: Adding Real Numbers with Different Signs
    - Topic 2.3: Finding the Opposite of a Real Number
- Topic 2.4: Subtracting Real Numbers
- Topic 2.5: Addition Properties of Real Numbers
  - Mini-Mod 3: Multiplying and Dividing with Real Numbers
    - Topic 3.1: Multiplying Real Numbers
    - Topic 3.2: Finding the Reciprocal of a Real Number
    - Topic 3.3: Dividing Real Numbers
    - Topic 3.4: Exponents and the Order of Operations
    - Topic 3.5: The Distributive Property
    - Topic 3.6: Multiplication Properties of Real Numbers
  - Mini-Mod 4: Variables and Expressions
    - Topic 4.1: Introduction to Expressions
    - Topic 4.2: Evaluating Algebraic Expressions
    - Topic 4.3: Simplifying Expressions
    - Topic 4.4: Simplifying Expressions with Parentheses
    - Topic 4.5: Translating Words into Symbols
  - Mini-Mod 5: Introduction to Solving Linear Equations
    - Topic 5.1: Translating Words into Equations
    - Topic 5.2: Linear Equations and Solutions
    - Topic 5.3: Using the Addition Property of Equality
    - Topic 5.4: Using the Multiplication Property of Equality
    - Topic 5.5: Using the Addition and Multiplication Properties Together
- Unit Two
  - Mini-Mod 6: Solving More Linear Equations and Inequalities
    - Topic 6.1: Solving Equations with Variables on Both Sides
    - Topic 6.2: Solving Equations with Parentheses
    - Topic 6.3: Solving Equations with Fractions
    - Topic 6.4: Solving a Variety of Equations
    - Topic 6.5: Solving Equations and Formulas for a Variable
    - Topic 6.6: An Introduction to Applications of Linear Equations
    - Topic 6.7: Solving and Graphing Inequalities
  - Mini-Mod 7: Introduction to Graphing Linear Equations and Inequalities
    - Topic 7.1: The Rectangular Coordinate System
    - Topic 7.2: Graphing Linear Equations by Plotting Points
    - Topic 7.3: Graphing Linear Equations Using Intercepts
    - Topic 7.4: Graphing Linear Equations of the Form $x = a$, $y = b$, and $y = mx$
    - Topic 7.5: Graphing Linear Inequalities in Two Variables
  - Mini-Mod 8: Slope and the Equation of a Line
    - Topic 8.1: The Slope of a Line
    - Topic 8.2: Slope-Intercept Form
    - Topic 8.3: Graphing Lines Using the Slope and y-Intercept
    - Topic 8.4: Writing Equations of Lines Using a Point and Slope
    - Topic 8.5: Writing Equations of Lines Using Two Points
- Topic 8.6: Writing Equations of Parallel and Perpendicular Lines

- Unit Three
  - Mini-Mod 9: Solving Systems of Linear Equations
    - Topic 9.1: Introduction to Systems of Linear Equations
    - Topic 9.2: Solving by the Graphing Method
    - Topic 9.3: Solving by the Substitution Method
    - Topic 9.4: Solving by the Elimination Method
    - Topic 9.5: Applications of Systems of Linear Equations
    - Topic 9.6: Application of Linear Systems Part 2
  - Mini-Mod 10: Introduction to Polynomials and Exponent Rules
    - Topic 10.1: Introduction to Polynomials
    - Topic 10.2: Addition of Polynomials
    - Topic 10.3: Subtraction of Polynomials
    - Topic 10.4: Product Rule for Exponents
    - Topic 10.5: Power Rule for Exponents
  - Mini-Mod 11: Multiplying Polynomials
    - Topic 11.1: Multiplying by a Monomial
    - Topic 11.2: Multiplying Binomials
    - Topic 11.3: Multiplying Polynomials
    - Topic 11.4: Multiplying the Sum and Difference of Two Terms
    - Topic 11.5: Squaring Binomials

- Unit Four
  - Mini-Mod 12: Dividing Polynomials and More Exponent Rules
    - Topic 12.1: The Quotient Rule
    - Topic 12.2: Integer Exponents
    - Topic 12.3: Scientific Notation
    - Topic 12.4: Dividing a Polynomial by a Binomial
  - Mini-Mod 13: Factoring Polynomials
    - Topic 13.1: Greatest Common Factor
    - Topic 13.2: Factoring by Grouping
    - Topic 13.3: Factoring Trinomials of the Form $x^2 + bx + c$
    - Topic 13.4: Factoring Trinomials of the Form $ax^2 + bx + c$
    - Topic 13.5: More Factoring of Trinomials
  - Mini-Mod 14: More Factoring and Quadratic Equations
    - Topic 14.1: Special Cases of Factoring
    - Topic 14.2: Factoring Polynomials
    - Topic 14.3: Solving Quadratic Equations by Factoring
    - Topic 14.4: Applications
Videos

A video was available for each topic and was usually about ten to fifteen minutes long. It usually started with definitions of new vocabulary as well as reminders of previous procedures. Then it was followed by about four to eight examples. In the first couple of examples, John Squires would quickly develop rationale for each step of the example. Then he would summarize what happened by introducing a new procedure that would be repeatedly referred to from that point forward. For example, for the video on adding real numbers with different signs (topic 2.2 in MAT015), Squires used positive and negative chips to show how \(-7 + 3 = -4\). Then he summarized with the procedure: “To add two numbers with different signs, subtract the absolute values, or numerical parts, of the numbers and give the answer the same sign as the larger numerical part.” Then, several more examples were completed referring to each step in the procedure that was developed.

Notebook Sample

The notebook pages associated with the video from topic 2.2 in MAT015 can be seen below.
Adding and Subtracting with Real Numbers  
Topic 2.2 Adding Real Numbers with Different Signs

Vocabulary  
different signs • numerical part • common denominator

1. When adding add two numbers with __________________, subtract the absolute values, or numerical parts, of the numbers and give the answer the same sign as the larger numerical part.

Step-by-Step Video Notes  
Watch the Step-by-Step Video lesson and complete the examples below.

<table>
<thead>
<tr>
<th>Example</th>
<th>Notes</th>
</tr>
</thead>
</table>
| 1 & 2. Use chips to add the following.  
6 + (−4)  
⊕ ⊕ ⊕ ⊕ ⊕  
+ ⊕ ⊕ ⊕ ⊕  
Answer:  
−7 + 3  
⊕ ⊕ ⊕ ⊕ ⊕ ⊕ ⊕ ⊕ ⊕  
+ ⊕ ⊕ ⊕ ⊕ ⊕ ⊕ ⊕ ⊕ ⊕  
Answer: |
| 3. Add −6 + 9.  
Subtract the numerical parts.  
Give the answer the same sign as the larger “numerical part.”  
Answer: |
Example

4. Add \( \frac{3}{7} + \left( -\frac{5}{7} \right) \).

Answer:

5. Add 3.7 + (−10.5).

Answer:

Helpful Hints
Remember that the absolute value of a number is the distance between that number and zero on a number line.

Try to determine the sign of the answer before calculating. You’re less likely to forget to give the answer the correct sign.

Concept Check

1. What will be the sign of the sum of \( 5 + \left( -\frac{2}{9} \right) \)?

Practice

Add.

2. \( 6 + (−13) \)

4. \( -7.7 + 8.7 \)

3. \( \frac{4}{7} + \left( -\frac{2}{7} \right) \)

5. \( \frac{7}{8} + \frac{2}{3} \)
Changes to the Program in its Second Year

A list of the changes made to Delaware Tech’s emporium program from the first year to the second year of implementation can be seen below.

- The minimum grade to demonstrate mastery on homework changed from 100% to 75% and the minimum grade to demonstrate mastery on quizzes changed from 80% to 75%.
- Quizzes are no longer proctored, so students can take them at home.
- If students believe they already know the material in a mini-mod, they can take a proctored pre-quiz and if they pass it with at least a 75%, they can skip that mini-mod and move onto the next one.
- Students in MAT015 can take a diagnostic test to test out of mini-mods 1-5 (unit 1), since that is material that was already covered in MAT012.
- For MAT015, since mini-mods 1-5 (unit 1) is a refresher of MAT012 material, the course does not really start until students start mini-mod 6. This means that any quizzes or tests in the first unit does not count toward the grade.
- Instructors are now providing mini-lectures during class time to supplement the videos. The instructors are supposed to assume that the students have already watched the videos and their job is to show a couple of the more difficult problems.
- Workbooks are no longer checked in order to be able to take an assessment, although they are still checked by the instructor.
• For participation points, instead of getting four points each week for meeting the recommended deadline, students get four points for completing an assessment. Therefore, even if a student is behind, but is making progress, she can still get these participation points.

• Sections that met only one hour with their instructor and three hours in the lab each week were no longer offered. All emporium students now meet two hours with their instructor and two hours in the lab.
Research has shown that many community college students have to take at least one developmental math course; however, less than a third of these students continue on to college-level math courses. As a result, last year Delaware Tech implemented a redesign of their developmental math courses, MAT012 and MAT015, in order to help students better achieve their academic goals. As a student who participated in this program, we would like to hear about your experience because it could help us improve the program. You can provide essential information of how we can better meet the needs of our students.

I am writing to invite you to participate in a short survey examining the features that encouraged or discouraged you from progressing through MAT012 or MAT015 during the 2012-2013 school year. The survey should take less than 5 minutes of your time.

My research goal is to help students like you successfully complete their math requirements for graduation and your opinions on your experiences are the best information available to make this happen.

To gather this information, I am conducting a study in mathematics education at the University of Delaware, under the supervision of my advisor, Dr. Anne Morris. The survey
results will be completely anonymous, and I will not be able to connect your responses with your identity.

I know that you are very busy, but I ask you to consider sparing 5 minutes of your time to share your valuable experience. If you would like to participate or to see more details of the study, please click on the link below. Thank you.

Lauren Patson

You have been chosen to complete this survey because you were enrolled in MAT012 or MAT015 during the 2012-2013 school year. Please answer the following questions based on your experiences during that school year.

1. Which math course were you enrolled in during the 2012-2013 school year?
   a. ____ MAT012
   b. ____ MAT015
   c. ____ Both MAT012 and MAT015

2. Were you enrolled at Delaware Tech as a full-time student or a part-time student?
   a. ____ Full-time
   b. ____ Part-time
3. How many hours did you work per week in addition to school?
   a. _____ 40 or more hours per week 
   b. _____ 20 – 40 hour per week 
   c. _____ 1 – 19 hours per week 
   d. _____ 0 hours per week 

4. How old were you?
   a. _____ 21 or under 
   b. _____ 22 – 30 
   c. _____ 31 – 50 
   d. _____ 51 or above 

5. Where you able to finish the course in one semester?
   a. _____ Yes 
   b. _____ No 

6. Please rate whether the following features encouraged or discouraged you to keep working in the course.

<table>
<thead>
<tr>
<th></th>
<th>Greatly encouraged</th>
<th>Somewhat encouraged</th>
<th>Somewhat discouraged</th>
<th>Greatly discouraged</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>me to keep working</td>
<td>me to keep working</td>
<td>me to keep working</td>
<td>me to keep working</td>
</tr>
<tr>
<td>Using MyLabsPlus</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Attending the Math Success Center</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Having to pass each quiz with at least an 80% and each test with at least a 75%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Getting points for meeting the recommended deadlines</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Getting points for attendance</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Getting points for having an organized workbook/notebook</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watching the videos</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Completing the workbook</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Taking the required number of quizzes and tests</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

7. Which of these features encouraged you to keep working the most? Please explain.
8. Which of these features discouraged you to keep working the most? Please explain.

9. Would you be willing to participate in a focus group? If so, please include your email address so that I may contact you.
Appendix C
SURVEY CODES

Codes for Open-ended Question on Features that Encouraged Students the Most:

- M = MyLabsPlus: Ability to work (homework, practice tests, assessments) online and get instant feedback
- L = Lab (Math Success Center): Getting help in the lab from tutors/instructors
- Mas = Mastery Learning: Requirement of passing each assessment before moving on, being able to take an assessment multiple times, and being able to go at own pace
- P = Points: Points for attending the lab or class, having an organized workbook/notebook, and meeting deadline
- V = Videos: John Squires video lectures
- S = Self: Internal/personal motivation
- I = Instructor: Getting help from their individual instructor, not a generic tutor/instructor from the lab
- D = Deadline: Trying to meet each week’s deadline
- O = Other: Does not fit into any of the codes above or statement can be interpreted in multiple ways that makes it too vague to code
Codes for Open-ended Question on Features that Discouraged Students the Most:

- **T = Time**: Course takes too much time or they are busy outside of school so cannot spend enough time working on the course
- **L = Lab (Math Success Center)**: Lab is distracting, tutors/instructors not helpful, being required to take assessments in Lab
- **None = None**: Respondents did not find any feature discouraging
- **MAS = Mastery Learning**: Requirement of passing each assessment before moving on, having to take an assessment multiple times, and being able to go at own pace
- **WN = Workbook/Notebook**: Requirement of completing workbook/notebook
- **V = Videos**: John Squires videos
- **R = Rules**: Feeling that certain rules are unfair or silly
- **NI = No Instructor**: Not getting a traditional lecture from instructor and students having to teach themselves
- **D = Deadline**: Trying to meet each week’s deadline
- **P = Points**: Points for attending the lab or class, having an organized workbook/notebook, and meeting deadline are actually hurting grade
- **TMW = Too Much Work**: There is too much material to cover in one semester
- **M = MyLabsPlus**: The computer program or having to work on the computer
- **C = Class**: Class time with instructor is unhelpful or a waste of time
- **I = Instructor**: Individual instructor is not helpful
• O = Other: Does not fit into any of the codes above or statement can be interpreted in multiple ways that makes it too vague to code
Appendix D

IRB APPROVAL LETTER

DATE: November 27, 2013

TO: Lauren Patson
FROM: University of Delaware IRB

STUDY TITLE: [523971-1] Delaware Tech’s Emporium Program for Developmental Math Students

SUBMISSION TYPE: New Project

ACTION: APPROVED

APPROVAL DATE: November 27, 2013

EXPIRATION DATE: November 26, 2014

REVIEW TYPE: Expedited Review

REVIEW CATEGORY: Expedited review category # 7

Thank you for your submission of New Project materials for this research study. The University of Delaware IRB has APPROVED your submission. This approval is based on an appropriate risk/benefit ratio and a study design wherein the risks have been minimized. All research must be conducted in accordance with this approved submission.

This submission has received Expedited Review based on the applicable federal regulation.

Please remember that informed consent is a process beginning with a description of the study and insurance of participant understanding followed by a signed consent form. Informed consent must continue throughout the study via a dialogue between the researcher and research participant. Federal regulations require each participant receive a copy of the signed consent document.

Please note that any revision to previously approved materials must be approved by this office prior to initiation. Please use the appropriate revision forms for this procedure.

All SERIOUS and UNEXPECTED adverse events must be reported to this office. Please use the appropriate adverse event forms for this procedure. All sponsor reporting requirements should also be followed.

Please report all NON-COMPLIANCE issues or COMPLAINTS regarding this study to this office.

Please note that all research records must be retained for a minimum of three years.

- 1 -
Based on the risks, this project requires Continuing Review by this office on an annual basis. Please use the appropriate renewal forms for this procedure.

If you have any questions, please contact Nicole Farnese-McFarlane at (302) 831-1119 or nicolefm@udel.edu. Please include your study title and reference number in all correspondence with this office.