

**CREATING AN ALTERNATIVE DEVELOPMENTAL MATH PATHWAY  
AT DELAWARE TECHNICAL COMMUNITY COLLEGE**

by

John Patrick Bradley, Jr.

An education leadership portfolio 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

Spring 2017

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## **ABSTRACT**

Developmental mathematics pass rates at Delaware Technical Community College (DTCC) have remained the same or decreased for a number of years despite two different math curriculum redesigns. They hover around 50 percent or below at each campus, even after the implementation of a second redesign this past Fall 2016 semester. The first redesign switched from a face-to-face style of developmental math instruction to an Emporium model. After a lack of significant improvements in pass rates, the math courses were redesigned again.

To further investigate the problem of low developmental math pass rates at DTCC, several strategies were employed. A literature review was conducted regarding developmental education, andragogy, high school tracking, alternative models of developmental course redesign, and the corequisite model of instruction. Furthermore, surveys of faculty and students at DTCC were conducted to determine the perception of developmental math education at DTCC, to determine perceived barriers from both faculty and students for low student pass rates, and to gauge the support for the implementation of a corequisite model of developmental math instruction. Some faculty did not believe a redesign was necessary, while others did. Students offered strong support for developmental math course redesign. Both faculty and students identified several common perceived barriers that they believe result in lower pass rates for students in these math classes.

In addition, interviews were conducted at three different institutions that redesigned their developmental course curriculum. The purpose was to discover how the institutions targeted the courses for redesign, to find the rationale for choosing the corequisite model, and to identify recommendations they had for institutions who want

to redesign their developmental math curriculum. Two redesign leaders at two four-year public colleges were interviewed along with a redesign leader from a community college in the area. The results of these interviews indicated that while redesigning the developmental math curriculum was difficult in all cases, the results of each corequisite implementation suggested improved pass rates that transcended several major demographics. I used the survey and interview results, coupled with the literature review and feedback from DTCC peers, to design samples of a corequisite math course with a syllabus, schedule of classroom activities, a Blackboard Learning Management system course, and a corequisite advisement sheet for students and academic counselors. Additionally, I outlined a strategic plan for implementing the corequisite model for developmental math courses at DTCC.

Throughout the process of completing the artifacts for this ELP, feedback was solicited, obtained, and incorporated into each artifact from members of this ELP committee. The Dean of Instruction at the Stanton and Wilmington campuses, along with two math instructors, and two math chairs, also provided feedback on the proposed strategic plan. Their feedback enabled both a macro and micro approach to the investigation of the problem, helped craft a potential solution to solve it, and offered final recommendations for implementing a corequisite model of math redesign at DTCC. The final recommendation is that the corequisite model of developmental math instruction be piloted at DTCC beginning with the steps outlined in the ELP proposal and subsequent artifacts.

## **Chapter 1**

### **INTRODUCTION**

At DTCC, remediation is a problem that must be addressed within the current curriculum to save students' time, academic resources, and to allow them to earn their degree in a reasonable interval. It is important to improve student learning outcomes and decrease the time between when a student enters developmental courses at DTCC and when students begin taking college-level courses. Students often take multiple attempts to pass their developmental math courses, which can lead to issues of retention. Research from Miller, Janz, and Chen (2007) states that in the US, roughly 73 percent of first-year students return to college to take courses in their second year (p. 52). DTCC's retention rate, which will be discussed later, is below the national average.

In addition, DTCC faculty devote a disproportionate amount of time and resources to teaching developmental courses, and the college allocates substantial academic resources to them. DTCC addressed the problem via learning communities, which are corequisite by definition, and in both the math and English departments there have been several course redesigns over the past few years. While these efforts are commendable, the issue of developmental math curriculum and the low pass rates associated with it are major problems that needed to be investigated. Despite the redesigns, there have been marginal improvements in pass rates. That lack of improvement could be attributed to the fact that this fall, a new math redesign was deployed with substantial curriculum changes, where students need time to adjust.

However, the intent of this ELP is to argue that through improvement of the current math curriculum, DTCC can advance pass rates in math classes.

The problem of low developmental math pass rates was investigated through the creation of nine artifacts whose purpose was to clarify the problem, create strategies designed to solve the problem, and make recommendations for how to improve developmental math pass rates at DTCC. The first artifact discusses the general problem of developmental math pass rates not only at DTCC but also nationwide. The second artifact discusses six possible course redesign models as offered by the National Center for Academic Transformation (NCAT) to gain a greater understanding of what each model tries to accomplish. The third artifact explores a potential solution to the problem of low developmental pass rates at DTCC, which is called the corequisite model. The fourth artifact investigates the state of developmental math education at DTCC via faculty and student surveys and analysis. The fifth artifact seeks to understand the other developmental course redesign options at three institutions that have implemented their own versions.

The sixth artifact is a syllabus and course schedule specifically created as if DTCC were running a corequisite model. The seventh artifact is a course created in the Blackboard Learning Management System that demonstrates how a corequisite course would look in practice. The eighth artifact is an advisement sheet to help students better understand the corequisite model, and the ninth artifact is a strategic plan created to implement this corequisite math model. The ninth artifact was shaped by feedback from the Dean of Instruction at the Stanton and Wilmington campuses, math department chairs, and other math instructors. Every artifact seeks to help me better understand the problem, find alternative methods to solving it, and create a

picture of what the selected model would look like for DTCC's developmental math courses. Each section of this portfolio includes information about the problem, how it was addressed in this ELP, and the recommendations for the future of developmental math education at DTCC.

## Chapter 2

### PROBLEM ADDRESSED

#### Background Information

DTCC is a two-year educational institution with rural, urban, and suburban campuses that serve different populations of students (*Mission*, 2016). It is an open enrollment institution with four campuses (Dover, Georgetown, Stanton, and Wilmington) that provides education and workforce training to any student who seeks it. Its original slogan was “a job for every graduate, a graduate for every job” (*History*, 2017). Even though economic and labor market conditions have changed since DTCC’s inception, its mission, values, and vision have remained the same. DTCC’s mission is to offer cost-efficient higher education that is pertinent and adaptable to the needs of Delaware’s labor markets and the greater community (*Mission*, 2016). One of the college’s goals is to provide developmental instruction that will enable students to succeed in college-level courses, to prepare for future employment, to prepare for educational and workforce training to meet varied labor market demands, and to complete continuing education for the community. DTCC also seeks to cultivate an inclusive atmosphere that enhances student success and learning, and seeks both community and private means to forward its mission (*Mission*, 2016).

At DTCC, students come from varied socioeconomic backgrounds at the four campuses, so it is important to offer instruction that suits an array of needs. Overall, the college has a total enrollment as of July 2016 of 13,471 students, 62 percent of whom are female. Its overall retention rate is 61 percent (*History*, 2017). The most

recent records available from the Office of Institutional Advancement indicate that the Stanton and Wilmington campuses have an enrollment of 6,700 students, 2,188 of whom are full-time. Of these students, approximately 60 percent are female and the population is fifty percent (*History, 2017*). Retention rates are an important metric. The retention rate at the Stanton and Wilmington campuses is 57 percent among first time, full-time degree seeking students and approximately 40 percent for first-time, part-time degree seeking students. Its retention rate for first-time, full-time degree seeking students is 61 percent for first-time, full-time degree seekers and 37 percent for first-time, part-time degree seekers (*History, 2017*).

### **Problem Statement**

At DTCC, the problem of low developmental math pass rates has been addressed through two math redesigns, the first of which was through the emporium model. DTCC's developmental math sequence has three courses: Mat 005 ("Basic Math"), MAT 010 ("Review of Math Fundamentals") and MAT 020 ("Introductory Algebra"). Initially, DTCC's math curriculum was more lecture-based, which was different from the emporium. The emporium model requires that students complete coursework completely online. Faculty and tutors offer immediate real-time assistance, students can finish more than one course per term, and more than one course can be taught at the same time in the Emporium model (*Six models, 2005*). Artifact two offers a more in-depth exploration of the emporium model, along with alternative redesign models. At DTCC, the semester before the emporium model was implemented, the Wilmington campus had a pass rate of 46.62 percent in MAT 020.

During the first semester of the emporium model, the pass rate dipped slightly to 45.14 percent (*Course success metrics*, 2016). Initially, these results could be attributed to growing pains of the model.

However, during the course of six semesters using the emporium model, the average pass rate of MAT 020 at the Wilmington campus stood at 46.98 percent (*Course success metrics*, 2016). This increase is only 0.36 percent above the average pass rate for the previous few years before the emporium model. In the same time period, the average pass rate at the Stanton campus was 52.2 percent, Georgetown was 57.3 percent, and Dover was 48.97 percent (*Course success metrics*, 2016). Sections of MAT 020 traditionally have 24 students in them at maximum and usually 12 at minimum. When one multiplies those numbers times 44 sections collegewide, there are approximately 1056 students in just these math sections, and 50 percent are not passing. Pass rates for the past four years for the developmental math sequence, not including the second redesign, can be found in Tables 1-3 on the following two pages.

Table 1: *MAT 005 pass rates at DTCC, 2012-2016, as percent*

Campus	Fall 2012	Spring 2013	Fall 2013	Spring 2014	Fall 2014	Spring 2015	Fall 2015	Spring 2016
Dover	64.84	59.18	63.81	44.68	51.90	52.27	51.69	68.52
Georgetown	45.35	53.70	55.43	41.86	54.76	49.25	53.47	51.52
Stanton	37.14	45.83	45.71	49.49	57.63	57.14	54.46	58.33
Wilmington	60.81	29.27	47.44	34.38	58.41	57.63	49.38	80.95*

*Note.* Only 21 students took MAT 005 in the spring 2016 semester at the Wilmington campus and it is now a 1-credit, 4-week course.

Table 2: *MAT 010 pass rates, 2012-2016, as percent*

Campus	Fall 2012	Spring 2013	Fall 2013	Spring 2014	Fall 2014	Spring 2015	Fall 2015	Spring 2016
Dover	53.07	33.93	55.75	42.33	49.13	48.81	64.20	65.82
Georgetown	41.18	43.37	54.42	48.78	55.22	49.48	55.69	54.95
Stanton	37.14	45.83	49.49	35.82	54.31	48.44	56.67	42.52
Wilmington	49.43	43.11	47.81	41.39	47.44	43.28	43.85	48.26

Table 3: *MAT 020 pass rates at DTCC, 2012-2016, as percent*

Campus	Fall 2012	Spring 2013	Fall 2013	Spring 2014	Fall 2014	Spring 2015	Fall 2015	Spring 2016
Dover	36.24	49.04	54.29	53.91	42.44	45.90	39.29	37.96
Georgetown	39.56	45.27	50.00	39.30	56.52	50.00	55.69	66.67
Stanton	32.87	46.12	45.71	40.13	41.78	48.93	54.00	49.26
Wilmington	47.74	51.75	50.18	43.37	47.44	43.28	43.85	48.26

### **Organizational Role**

Currently, I have two different positions at the college. I am the Academic Support Assistant for the Wilmington campus language lab. I am also the International Education Coordinator (IEC) for the Wilmington campus. First, as IEC I am responsible for study abroad advisement and recruiting, international campus programming, and scholarship fundraising through our Oktoberfest study abroad scholarship fundraiser event. My experience as international education coordinator means that I also assist with advisement for many students who are in majors that vary widely across all campuses of the college. Furthermore, my language lab position exists to provide ongoing instructional as well as technical support to students and faculty in the English as a Second Language (ESL), Spanish, and American Sign Language (ASL) programs at my campus. This job entails carrying out functions including placement evaluation and diagnosis of all new students entering the ESL program.

I also provide departmental-level front-door services and information for potential or new language students. My current position in the language lab did not exist full-time previously, and I have essentially created, added to, and expanded my responsibilities over the years. I continue to work to hone the position, which contains several responsibilities built into it related to tutoring and testing for both English and math. Prior to my position as Academic Support Assistant, I was an adjunct math instructor at the college level and also in the pre-college TRIO/Upward Bound math program at the Wilmington campus. The TRIP/Upward Bound programs afford low-income students the opportunity to take college-level math classes for enrichment purposes. In addition to teaching upper-level courses, I have taught the DTCC developmental math courses several times.

Besides teaching math courses in the classroom, I have taught math review sessions for arithmetic, algebra, and college-level math specifically for ESL students in preparation for the math placement test. Furthermore, I have previously taught MAT 020 in several formats, including lecture and emporium. I am intimately familiar with the curriculum, its place as a prerequisite for the purposes of advisement, and its redesigns. I also have created four different learning communities blending ESL and math. I have worked with the math department chair at my campus, along with math instructors at both the Stanton and Wilmington campuses to promote original learning communities that bolster student success in developmental math. In fact, the three different learning communities I helped create and which were approved by the Learning Communities Coordinator at the Wilmington campus relate to one of

DTCC's developmental courses, MAT 010. These learning communities can be changed to suit our students' needs and I think they would serve as an excellent way to pilot a math course with the corequisite model.

In fact, research suggests students who are part of learning communities perform better in a number of metrics, including homework and tests; they also continually work together to better their grades (Hanson & Heller, 2009). Since I already have created three learning communities, it would be relatively easy to modify the course structure and composition. It might even be possible to pilot a developmental learning community and a new corequisite one to see any differences in student achievement and retention rates. Even though these learning communities were set up for me to teach the ESL component, I still have the credentials to teach as an adjunct math instructor. I have maintained my math skills by tutoring and teaching math in my department. Since developmental math courses at DTCC are a burden on time and academic resources for not only students but also the college, I want to make an impact for DTCC by investigating alternatives to the current developmental math structure.

## **Chapter 3**

### **IMPROVEMENT STRATEGIES**

This ELP's improvement goal is twofold: place developmental students into college-level courses and a math support course to a) quicken time to degree and b) to increase math pass rates. To investigate this problem, it was necessary to conduct research to determine if a corequisite model of developmental math instruction would be appropriate for DTCC. Feedback was sought along the way from the ELP committee as well as colleagues; all of it was incorporated to craft a potential solution to raise developmental and college-level math class pass rates here.

The improvement strategies I chose were varied and are reflected in the nine ELP artifacts. As evidenced by Table 4 below, pass rates from all four campuses did not improve as much as desired through the second math redesign that was underway at the time I began my work on this ELP.

To understand the problem better, it is first necessary to discuss the two math redesigns that have been implemented at DTCC since 2011. There are several differences between the first redesign, which used the emporium model, and the new Fall 2016 redesign that must be noted to see what makes them different. First, the emporium model was completely computer-based. While students were able to seek help from tutors and instructors in the Math Success Center, where the emporium classes took place, the onus fell on the individual students to complete their tasks and modules. The curriculum order and coverage of material remained the same when

DTCC switched from face-to-face classes to the emporium model in 2012. Yet, pass rates did not improve as much as hoped.

In the second redesign that launched in the fall of 2016, there was a substantial rearrangement of the instructional delivery and of the curriculum. In the fall 2016 redesign, the emporium model was no longer used and the style of the course was face-to-face and lecture-based; the new redesign was also less dependent upon technology use. In addition, the curriculum of the developmental math sequence was rearranged as well. MAT 005, the most basic developmental math course at DTCC, was condensed from four credits to one. It was also condensed from 16 weeks into four or eight week courses.

In addition, the curriculum of MAT 010 and MAT 020 also changed substantially. Some algebra curriculum from MAT 020 was placed in MAT 010, and similarly, some introductory material from college-level algebra classes was placed into MAT 020 in the hope of better preparing students for their college-level math classes. As a result, there is also more material to cover in MAT 010 and MAT 020 before students can begin taking their college-level algebra classes. Likewise, there is more material that instructors must teach students, many of whom are at different levels of math maturity and development. This ELP investigated the previous and new math redesigns through a series of artifacts to understand the problem and to see what solutions could be implemented to improve math pass rates at DTCC. Table 4 shows the pass rates as a result of the second Fall 2016 redesign.

Table 4: *Fall 2016 math pass rates, as percent*

Course type	MAT 005	MAT 010	MAT 020
Dover	89.11	60.93	30.07
Georgetown	74.18	54.10	66.06
Stanton	70.09	42.63	51.31
Wilmington	78.09	48.64	57.74
Average pass rate	77.87	51.58	51.30

*Note.* MAT 005 was reduced from four credits to one.

*Data Analytics.* (2016). Retrieved from <https://deltechreporting.dtcc.edu/RM/Pages/Folder.aspx?ViewMode=List>

### **Artifacts 1 - 3**

I first chose to do a literature review (Artifact 1) to set up the reader with both national and local data, history, curriculum redesign, and strategies employed to improve pass rates for developmental courses. It was important to set up the problem's context globally and locally not only to demonstrate that it is a common issue among two and four-year institutions, but also to offer a rationale for why developmental math curriculum at DTCC should be changed to a different model.

The second artifact is a literature review on the six different models of course redesign available, many of which were born out of a desire to improve not just developmental math pass rates but also student retention rates. The survey of the six models of course redesign (Artifact 2) evaluated the history of, use of, results of, and future implications of redesigning developmental courses according to best practices from the NCAT. The six "best practices" for course redesign from the NCAT are fully online, emporium, buffet, linked-workshop, supplemental, and replacement. Each of these models was used to some degree of success at a variety of two and four-year institutions. DTCC used the emporium model, and I discovered it shares similar

characteristics to the replacement, buffet, and fully online models. Therefore, I wanted to use the other models to compare and contrast different methods of course redesign and their results. The results rely heavily on the context of each institution, but one appeared to have great potential to improve pass rates while also reducing the time students spend in remedial courses: the corequisite model of course redesign places students into college-level math classes regardless of placement score. Those who are deemed to need remediation based on their placement score also take a corequisite support class to help them succeed in their college-level math class. Data from institutions with different examples of the corequisite model in place, coupled with a desire to implement such a model at DTCC, led to my exploration of this particular model of developmental course redesign more in depth because I felt implementing this model could benefit students.

To determine if this model would be the most effective to improve developmental math pass rates at DTCC, I wanted to explore it more in depth, which I did through Artifact 3. The third artifact explored the concept of the corequisite model in addition to several examples of the corequisite model in use, namely Structured Learning Assistance (SLA), the linked-workshop model, and the Accelerated Learning Program (ALP). The artifact also explored limitations to this model, namely that it is a newer model and has not been fully evaluated; rather, it has only been evaluated at individual institutions. However, despite the limitations I found with the model, it seemed that it could work within DTCC's context and would be beneficial to students and faculty based on the three major cases explored.

## **Artifacts 4 - 9**

To further gain knowledge about the model and to understand its implementation, usage, and results, I did both internal and external research. For Artifact 4, I created two different surveys, one for faculty and one for students, all teaching or taking MAT 005, MAT 010, MAT 020, and MAT 140 (“Essentials of college algebra”). The goal of these surveys was to analyze the perceptions of both the current developmental math curriculum at DTCC as well as if there is a desire among faculty and students to change the current developmental math course sequence in favor of the corequisite model. The faculty survey asked respondents to share their demographic information, information about their instructional history with math, current math teaching assignments, perceived barriers to student success, and an open-ended question about what could be done to improve developmental math instruction at DTCC, along with a series of questions about their awareness of other developmental math curriculum models. The student survey asked respondents to share demographic information, math course history, current math course information, perceived barriers to their success, ideas about what could be done to improve their developmental math experience at DTCC, along with a series of questions that asked them about their support for changing the developmental math curriculum to a corequisite model of instruction.

Concurrently with the internal research, I also conducted interviews, which comprised Artifact 5. To have a better understanding of the corequisite model’s usage, implementation, and implementation results at other institutions, I selected three

different people who ran the redesign at those institutions. I interviewed someone from Ferris State University (which uses SLA) in Michigan, Austin Peay State University (which uses the linked-workshop model) in Tennessee, and someone from the Community College of Baltimore County (which uses the ALP) in Maryland. The point of these interviews was to determine how the institution selected the course(s) to target in the redesign, the rationale for choosing the model ultimately used, and the recommendations for other institutions looking to do a similar redesign of developmental courses. In addition, it was important to find out the demographics of each institution in addition to the context of each school to determine if the corequisite model would be appropriate for use at DTCC. The information yielded from the interviews was very enlightening, will be discussed in the results section, and further strengthened my case that the corequisite model would be appropriate to use at DTCC.

The information I learned from creating the five artifacts, along with my knowledge of DTCC's 50 percent average pass rate collegewide, provided sufficient evidence to move forward to create examples of materials to illustrate a corequisite model for DTCC. I created a support math class syllabus (Artifact 6) that complements the curriculum found in MAT 180 (College Algebra). The support course is called MAT 100: Support for College Algebra. The syllabus created for the MAT 100 course also contains a schedule of learning activities that would mirror the curriculum of MAT 180. Students who place into developmental math would take MAT 100 as a corequisite with MAT 180, allowing them to complete both courses in

the same semester. These artifacts were necessary to demonstrate the instructional design of the math support course.

Once the syllabus and support activities were created, I built the MAT 100 support course in the Blackboard Learning Management System (Artifact 7). It contains videos, games, manipulatives, and extra resources that students could use to improve their performance in both the support course and MAT 180. In addition, I created a corequisite advisement sheet (Artifact 8) to notify students of their options and the rationale for being placed in a corequisite math course. This advisement sheet also outlined the potential pathways students have regarding their math placement and was designed for the benefit of DTCC's faculty, staff, students, and academic counselors. Lastly, for Artifact 9 I created a strategic plan for how to implement the corequisite model. This strategic plan was presented to the collegewide math chairs, two colleagues in the math department at the Wilmington campus, and the Dean of Instruction at the Stanton and Wilmington campuses. Feedback from all of those stakeholders was incorporated into the planned action steps for implementation of the corequisite model at DTCC.

The rationale for choosing these strategies has its roots in the personal statement I wrote for admission into the Ed. D. program. I wanted to research alternative developmental math course redesign models because I hoped to solve the problem of low pass rates and retention through the course of the Ed. D. program. I initially found a model I thought would fit at DTCC (the linked-workshop model) and wanted to use the Ed. D. program to explore how to implement it here. I used my

artifacts to gradually build a case for implementing this model, which is why I chose varied improvement strategies. As part of the strategic plan, I also included steps for implementation based on feedback from the DTCC stakeholders mentioned above.

## **Chapter 4**

### **IMPROVEMENT STRATEGIES RESULTS**

This goal of this ELP was to create an alternative developmental math course structure that would benefit students and faculty. Through this proposed redesign, students should be able to succeed in their developmental math requirements and begin coursework in their major more quickly. The faculty and student survey results indicate that there is some support for a different type of developmental math course structure and that there are barriers perceived by both faculty and students that are detrimental to student success. Faculty support for a different model appears to be mixed: 40 percent strongly agreed or agreed that pass rates could be improved with different math instruction; however, 30 percent disagreed and 30 percent were neutral on the issue. This data had a large spread. From the open-ended questions, students appear frustrated with the pathway they must take through developmental math courses and often have situational (so-called “life”) problems that prevent them from completing their developmental math courses in a timely manner. Faculty have picked up on some of these barriers and stated so in their answers to the open-ended survey questions. In addition, faculty indicate that they believe students are simply not prepared for their college-level course work.

#### **Surveys**

The results from the faculty survey also demonstrate that faculty have a lack of awareness of alternative developmental math course structures that do not involve supplemental instruction (see Table 5). (DTCC is piloting a supplemental instruction

model this academic year, which involves optional tutoring for students enrolled in sections of MAT 010 and BIO 120 (Anatomy and Physiology I). This program may account for the higher response rate for supplemental instruction as opposed to the other models). In addition, student survey results indicate that many would be willing to take a math support class if it meant they could concurrently take the college-level math class for their major. The available data from the surveys indicate that the improvement goal effort would be welcome, albeit not overwhelmingly. The fall data indicating that students have not done as well as hoped with this new math redesign also supported this idea.

Table 5: *Faculty knowledge of developmental math course structures*

Generally aware	Percent	Mean	Mode	Std. dev.
Aware of supplemental instruction	73.69	2.75	4.00	1.22
Aware of corequisite	83.33	3.42	5.00	0.75
Aware of linked-workshop model	36.85	2.80	1.00	1.60
Aware of structured-learning assistance	15.79	0.75	1.00	0.99

*Note.* Percent means percent of faculty who strongly agreed they were aware of the different structures; mean, median, and mode are in Likert scale units.

Furthermore, students strongly agreed (46.15 percent) or agreed (28.21 percent) that they would prefer to be placed in a credit-level course rather than a developmental math course in their first semester of college. More importantly, almost 47 percent of students strongly agreed and almost 25 percent of students agreed that they would be willing to take a support class if they were placed into a credit bearing math class in their first semester.

### **Interviews**

For the interviews, the data I gathered indicates several important ideas about the improvement effort goal. First, the course redesign selected depends on the institution, and the context of each institution included in the interview results indicate that one or all of those programs might work at DTCC as the context is similar: there are courses with low pass rates, low retention rates, and a diverse population of students is having a difficult time passing these math courses. These results offer hope for a new math redesign and I will share the interview results with the administration, the faculty, and students at DTCC. Another important result of the interview data is that in all three cases, the corequisite model's successes transcend demographics. In other words, the improvement efforts at these institutions led to increased pass rates regardless of the type of student who took this structure of math classes. If more people at DTCC were aware of these successes, then hopefully a conversation could be started and a plan of action put in place to change DTCC's current developmental math course structure and make it more in line with SLA, LWM, or ALP.

## **Artifacts 6 - 8**

Artifacts six through eight were also beneficial to the improvement goal of the ELP. These artifacts were necessary to bolster the case for the corequisite model because it is important to see what course interface and material a math support course would be covering. Faculty need to see exactly how the course is laid out and how it matches with MAT 180 (“College algebra”) so they can determine what supports students are receiving. The course I created via artifacts six through eight reflects both the learning material and structure of the course (six and seven) and the characteristics of the corequisite model compared to the prerequisite one (eight). In Artifact 6, is a syllabus with learning activities for a math support course at DTCC. Those objectives mirror those of MAT 180 and help demonstrate the types of activities and math immersion students would receive in the corequisite support course. Artifact 7 is the math support course “MAT 100: College algebra support” that was created in Blackboard. The course demonstrates the resources and activities available to students and how they could be used for DTCC’s 16-week course structure in conjunction with the syllabus and classroom activities. Artifacts 6 and 7 were devised to demonstrate what students would do in their math support course on a weekly basis in parallel with their college-level math course. Artifact 8 specifically addresses questions students might have about the model and how it will help them achieve their academic goals at DTCC. In addition, it addresses questions about the corequisite model and how it compares to the prerequisite model. It was designed as an advisement piece to help students, faculty, staff, and academic counselors understand the corequisite model so that students could ultimately choose their classes more easily. They would also better understand the intent of the model.

## **Artifact 9**

Lastly, Artifact 9 was extremely helpful to the improvement goal of the ELP because it allowed me to create a corequisite model plan of implementation and a timeline for its use at DTCC. Of particular use was the feedback I received from the Dean of Instruction, math chairs, and math instructors. I was able to incorporate that feedback and revise the plan of action for corequisite model. In addition, the Dean of Instruction mentioned that getting buy-in for the new redesign would be the most difficult part. With that feedback, I was able to revise the steps in the strategic plan to reflect how I could get buy-in for the model from faculty, staff, and students. The strategic plan is more comprehensive than it was as a result of receiving feedback, and the path to corequisite model implementation is clearer as a result.

## **Implementation assessment**

The improvement strategies were successfully implemented: I completed the steps I set out to do in my original ELP proposal. Though the math department recently launched a redesign in Fall 2016, if the math pass rates continue to be flat or to decrease, another redesign will likely happen. The Dean of Instruction confirmed this fact. However, as a result of this ELP, the Dean of Instruction at the Stanton and Wilmington campuses, the Assistant Dean of Instruction at the Stanton campus, the math chairs and other math instructors are now aware of this alternative pathway that has been created for developmental math students. I have laid the groundwork for a different redesign should the current one not have its intended effect of improving student pass rates over the next few semesters. These improvement strategies did have

the intended outcomes because I have a plan of action for the future and I, along with others at the Wilmington and Stanton campuses, see what a potential corequisite model implementation looks like as a process and a product.

## Chapter 5

### REFLECTION ON IMPROVEMENT EFFORT RESULTS

While several aspects of this ELP worked well, other areas could have been improved. In this chapter, I first provide a reflection of the artifacts and their contributions to the improvement goal. Second, I discuss considerations for curriculum redesign. Next, I examine the fit of Knowles' theoretical framework to the DTCC context. Finally, I consider future steps for developmental math at DTCC.

#### **Reflection on Artifact Results**

On the one hand, the artifacts worked particularly well in addressing the problem because the results enabled me to start a conversation with the Dean of Instruction of the Stanton and Wilmington campuses, the Assistant Dean of Instruction at the Stanton campus, along with two instructors in the Wilmington campus math department and two math chairs, about how to change developmental math course redesign. However, if I were to do this ELP over again, I would have a few recommendations for those attempting to do the same thing.

**Surveys.** There were several limitations with the administered surveys that could have affected the results. If I administered the surveys again, I would do some things differently. First, I would pilot the survey (I did not have time due to time constraints) since some faculty contacted me and pointed out small errors that required fixing. Also, I would redesign the surveys to make them shorter. Each survey had 34 questions with two short-answer questions, they were still long overall. This made them quite long, and the length could have deterred students, which could explain the low response rate of 35 percent. In addition, the timing of the surveys could have been better. While I intended to administer them at the beginning of the semester, they

actually were sent out during the antepenultimate week of the semester. Students at that point may have been focusing on their current math experience rather than being reflective about their past math experience, as many questions in the survey asked students to think about that aspect of their math careers. Similarly, had the faculty surveys been administered earlier, faculty might have had the chance to be more reflective in their responses. Some of the responses about student unpreparedness and unwillingness to learn might have been different had the survey not been administered towards the end of the semester rush. However, faculty answered the survey questions completely suggesting that they want to improve pass and retention rates in math courses, and to share their ideas: I received a 100 percent response rate. The responses were valuable in determining barriers perceived by faculty about student success, support for changing the developmental math program at DTCC, and awareness of alternative developmental math course structures.

In retrospect, I wish I surveyed a larger faculty sample because it might have yielded a wider spread of responses. In addition, I would have been able to disaggregate the response information to draw more comparisons between the responses of full-time and part-time faculty members. At the same time, I would have been able to make more comparisons of faculty by campus to determine if campus culture or context affected the responses. This limitation was not too damaging to my results; however, more data could have been useful.

**Interviews.** I would not change the interviews as they went extremely well and the people with whom I spoke were very willing to offer insight into the demographics and context of their institution, the unique nature of each of their course redesigns, and the recommendations they have for changing the developmental curriculum to

improve pass and retention rates. If I were to do these interviews again, I would interview one or two more people at institutions with different corequisite models to gather more data to inform the improvement strategy. One of the themes I discovered in the interviews is that students need to be held accountable if they are placed into a corequisite model-based math class. Students need to understand that they must do the work in the courses, attend, and participate in all classroom activities. If the corequisite model were to be implemented, this element of accountability would have to be intrinsic to the course. Building in the element of accountability, coupled with the motivation students may find as part of a cohort, would be an essential component for the corequisite model to be more effective.

Lastly, I would interview the head of the NCAT to gain expertise on redesign models and the contexts in which they have worked. In particular, I would focus on the contexts of different institutions that used the corequisite model and the successes and/or drawbacks of using such a model compared to the other five models of course redesign.

**Supporting the strategic plan.** I would not change the types of artifacts I created because each artifact built upon the previous one. I laid the groundwork for solving the problem at a local and global level, conducted internal research among faculty and students, and conducted external research to gain outside perspectives about developmental math course redesign. In addition, the course I created is ready to pilot if DTCC chooses to use the corequisite model. I have also determined a series of action steps to be followed once the initial pilot program is complete. Essentially, I have created a pathway for DTCC to follow should they use the corequisite model in their developmental math classes. However, I would have sought feedback sooner

from various collegewide administrators and from the math chairs about DTCC and their thoughts about the current math redesign to make a more informed decision about the appropriateness of the corequisite model for DTCC's students.

Furthermore, I would like to survey faculty and students once more during the next semester to determine if any perceptions of barriers to student success have changed or if their thoughts about the latest math redesign had changed. This step will now be part of my strategic plan. Additionally, after the second set of surveys are administered in the next semester, I would like to meet with faculty and students in small focus groups to gain more information about the redesign and to educate students and faculty about alternatives, namely, the corequisite model. This step of the strategic plan is extremely important because it can help build an understanding of the corequisite model and increase the chances of buy-in for it should DTCC decide to use it. Also, I would like to host professional development sessions for faculty to educate them on alternative models of course redesign. The Dean of Instruction indicated that gaining buy-in from the math faculty might be the most difficult hurdle I would face in attempting to implement the corequisite model in the math departments collegewide. This step would allow me to interact with the faculty on a collegial level and also explain the benefits of the corequisite model over other models.

Lastly, as part of the strategic plan, it would be useful to add a cost-benefit analysis comparing the corequisite and prerequisite models to determine if the corequisite model has a lower per student and per faculty member cost. In this difficult economy, redesign implementation costs can drive decisions of whether to use one model over another. If it is discovered that the cost of implementation of the

corequisite model is lower, this result could increase the likelihood of its implementation.

### **Reflection on Curriculum Redesign**

One of the major benefits of the corequisite model is that students who place into developmental courses would be taking a college-level math course at the same time. They would then have a cohort, or learning community, which could increase self-motivation and inspire the students to motivate each other to succeed. The emporium model lacks this characteristic, and to a lesser extent, so does the newest math redesign. The experience can be disjointed as students work at their own pace, which could affect their self-motivation if they are struggling with the material.

**Learning in community.** The sense of camaraderie and community that students experience in the corequisite model is something that is lacking in the emporium model, online courses, and hybrid courses because students are largely on their own to succeed in the course. In addition, a sense of community is lacking in the Fall 2016 math redesign; students would have to be motivated to create their own study groups to continually motivate each other. If students were a part of a cohort, as the corequisite model creates, they might find the self-motivation that DTCC faculty indicated in the survey that students lack.

In the emporium and current face-to-face math redesign, it is difficult to balance students' ability to accomplish the task of passing the course and actually learning from it. These redesigns are based on moving through the material and the pace cannot be altered lest students fall behind. The corequisite model offers students just-in-time assistance necessary to pass their college-level math course. Additionally because they would be in a group with students for an extra four hours per week, they

would have a cohort which could foster camaraderie and increase individual and group motivation. Furthermore, students would be working with the same peer group both in their college-level course and their support course.

Students could be assigned problem sets that they would have to work on in groups and then present the results to the class. If students knew they had to present their work to the class, they might be motivated to learn the material because they would be trying to teach it to others.

**More individualization and intensity.** The corequisite course would be designed such that students would be able to learn what they needed but also have opportunities to do so through different modalities, including but not limited to computer work, individual time with the instructor, and group work with other students. In the Blackboard course I created, there are discussion boards, math wikis, and problem solvers that give students an intense math experience as they will be completing the activities and watching the videos in each module. Another issue to consider is whether the type of “math immersion” associated with the corequisite model holds the potential to increase student knowledge and possibly math pass rates. As a limited example of this, the increase in math intensity seemed to work for MAT 005, which went from a four-credit, sixteen-week course to a one-credit, four or eight week course and resulted in the elevated pass rates presented in Table 4. In the corequisite model, students are together an additional four hours per week working with the same math concepts as in their college-level math class. Therefore, they have

more opportunities to practice what they have learned with both their instructor and with their fellow students. They are essentially immersed in math because they are taking eight hours of math per week as opposed to four.

### **Fit of the Theoretical Framework**

Part of the reason I initially selected the corequisite model had to do with best practices and the literature regarding andragogy, especially as described in the work of Knowles. In Knowles' view, there are five assumptions to be made about adult learners presumed to help them learn more effectively. Those assumptions include the idea that adults are self-directed learners, their past knowledge is a resource for their current academic pursuits, they exhibit a readiness to learn, they are motivated, and they would prefer a problem-based approach to learning (Pappas, 2013). These assumptions are relevant to DTCC's adult learners, but not as much as I initially thought given the results of my ELP artifacts. Specifically, the assumptions about motivation and self-direction do not seem to apply completely to the population of adult students at DTCC.

**Diverse population.** The disparity between part of Knowles' framework and DTCC's population was surprising, but there are several reasons that could account for it. First, Knowles' theory of andragogy is only a theory. Like any theory, it cannot necessarily be applied generically to adult student populations because there are differences in the social, cultural, and maybe even political contexts of how adults learn, where they learn. The theory may not be applied exactly to learners at DTCC given the different life experiences and prior knowledge adult students bring to their classes. Knowles' theory does not completely match DTCC's context because of the wide range of adult learners in its population.

At DTCC, adults are learning at a community college, which includes traditional and nontraditional learners. Traditional learners come to DTCC fresh out of high school and are generally younger and less mature than their nontraditional counterparts. They also may be less motivated. Nontraditional learners in a DTCC context are older (24 or higher), often have families, work full-time, and go to school full-time. Many of them have some of the situational problems (work-life balance, lack of transportation, or other obligations) mentioned in the interviews and in the surveys. These problems often do not allow them to learn under the set of assumptions that Knowles posits. While the adult learners at DTCC may be intrinsically motivated to succeed, the reality of their daily lives can affect the amount of time devoted to their courses, their attendance, and performance in class. Knowles' framework does not give a total picture of how adults learn and it cannot be applied as a one-size-fits-all solution. It promotes the idea of adult learners having certain characteristics, but it fails to consider social, cultural, and demographic factors that could affect how adults learn. Critics have suggested that Knowles builds his theory of andragogy as a way to describe what an "adult learner" should look like, but it is not an accurate representation of 'what and how adults learn' (Andragogy, 2010). Knowles fails to take into account an adult's experience and changes in cognitive processes (Andragogy, 2010) in his theoretical framework which pigeonholes adult learners into strictly North American ideas about adult learners (Andragogy, 2010). His framework does not reflect the diverse learners at DTCC who come from all corners of the globe and have varying life experiences and abilities.

**Connecting Knowles and co-requisite.** DTCC can improve how adults learn by trying to apply some aspects of Knowles' keys to effective andragogy, which

involve the preparation and assessment of adults' learning. For example, Knowles says that experiential learning should be part of the adult learning experience. Adults are most interested in learning things of immediate use to themselves and their job, and adult learning is problem-centered. The emporium model and the current redesign lacks these experiential aspects to student learning. The corequisite model, via the support class developmental students would take alongside the college-level math class, could allow for further, independent exploration of math applications relevant to students' lives and careers. Knowles goes on to say that adult learners want to understand why they are learning, are interested in task-oriented problems, instructional methods that accommodate a wide range of learning backgrounds, and want to play a role in constructing their own knowledge in a course. The corequisite model is an excellent way to incorporate this aspect of Knowles' theory because DTCC students would be given a forum for sharing and incorporating their experiences into their coursework. In addition, being part of a cohort could increase their motivation to succeed and give them a sense of camaraderie, which would give them buy-in to the corequisite model. Knowing that there are students like them who may have similar situational problems and problems with being successful in their math courses could increase the motivation to succeed.

In addition, DTCC's diverse population must be able to learn in a supportive environment that adapts to different learning strategies and backgrounds. One of the ways to accomplish this task is to use a developmental math redesign model that has demonstrated success in the past. There are several to choose from including the supplemental, buffet, emporium, fully-online, replacement and the linked-workshop model (LWM), but the LWM may work best for DTCC's context based on past

successes at other institutions and the success of a similar redesign in English department. Also, research suggests that accelerated learning, interaction of content, and a learning cohort -- which are elements of this model – have benefits for adult learners (Edgecombe, 2011).

### **Future Steps**

A theoretical framework cannot be taken at face value. It needs to be considered in light of the reality of the context and the types of learners to whom it is being applied. Some parts of Knowles' theory fit DTCC, while others do not. Some of the parts that do not fit adult learners at DTCC as much as I had initially thought, such as self-motivation, may be increased if there is a different course structure. DTCC's population is unique and there is no one-size-fits-all solution to increasing math pass rates. However, DTCC has seen success with learning communities in terms of building a cohort, fostering camaraderie, and increasing student motivation to succeed; students often best motivate each other. Furthermore, I would like to do more research on the effects of how camaraderie, being part of a cohort, and how other course structures such as learning communities could increase motivation in adults. This research could be helpful in bolstering the case for selecting a corequisite model of instruction.

The next steps that DTCC should take to address this problem are to do further research to determine if using the corequisite model is appropriate to DTCC and its context. This ELP is the first step to accomplish this task and the strategic plan presented offers a way to see the problem of lower developmental math pass rates from a different perspective. However, it is also necessary to gain buy-in from both faculty and students regarding the characteristics and potential results of the

corequisite model's implementation. The ultimate goal of the implementation of a corequisite model is not simply to produce students who can pass developmental coursework. Rather, its goal is to help students pass their concurrent college-level math class and subsequent courses. It is important to keep track of students in the corequisite model courses to determine if there are longitudinal benefits such as higher pass rates in the one or two college-level math courses and improved retention and graduation rates.

To accomplish this goal, a complete switch to the corequisite model would not be feasible at first. Rather, it should be run parallel with some developmental math sections under DTCC's current prerequisite model of developmental math instruction. Comparisons could then be made to determine whether it is feasible to scale-up the model in all developmental math classes college-wide and to allow for the potential of applying the corequisite model to other subject areas. Since one of the criticisms of the corequisite model is the lack of longitudinal studies to determine whether student success persists after students complete their developmental and college-level math, it is beneficial to track student performance in the long-term. This tracking would give a better idea of whether the corequisite model was effective in DTCC's context.

Regardless of whether DTCC selects this model, any new math course redesign and implementation must be done thoughtfully and in consideration about what is known and unknown about both adult learners in general and specifically those adult learners at DTCC. Such information can be found in theory, but one must be wary of how strictly to apply the theory. It may not fit the context of the school and its student population. I learned this lesson through the improvement efforts I tried, which led me to finding a mismatch between the theoretical framework and DTCC's context.

As a result, however, I find myself even more motivated based on the results and what I have learned from them. I am eager to continue to hone this ELP so that it can be useful for DTCC in the future.

## Chapter 6

### REFLECTION ON LEADERSHIP DEVELOPMENT

#### Introduction

DTCC expects me to investigate this problem thoroughly and to make recommendations for a path forward. DTCC is interested in seeing what a corequisite model of developmental math instruction would look like here. However, to accomplish this task the implementation must be deliberate and purposeful. As two of the interviewees recommended, the implementation should have a cap of three years in order for it to be successfully implemented and analyzed. If DTCC gets this far, groundwork must be laid to make sure this implementation is possible within the recommended timeframe. To begin this process, it is necessary for me to lead in several ways. This ELP is a first step in that direction.

#### Scholar

Personally, my skills as a scholar have changed in several ways since I started the Ed. D. program. When I began, I had never taken an education course and was not sure what to expect. I did not know what the ELP was and I was not sure if I would stick with the topic I had written about in my entrance essay (the LWM at APSU) or how I would construct my ELP. Once I began to read several scholarly articles and do several literature reviews, I quickly understood the ELP's purpose: to be a critical and discerning thinker to make a difference in my organization. I have been better able to recognize biases and I am less likely to take one point of view; rather, I have found myself beginning to look more critically and actively at both sides of an argument about developmental course redesign. For example, with my ELP, I actively sought out criticisms of the model I had chosen (corequisite model) to understand its potential

drawbacks. Reading the literature about the corequisite model implementation, with both pros and cons, is necessary to understand whether the cost of implementation is worthwhile. In addition, a scholar seeks feedback and welcomes criticism; therefore, I needed to receive feedback on the strategic plan and other artifacts in the ELP to understand the problem at hand, the potential solutions available, and be able to choose the most effective solution. The most effective solution needs to have evidence-based decision-making. To make a final decision about whether the corequisite model is truly the best solution, I need to educate myself about it. Once a solution is determined, it is then necessary to obtain buy-in from the people you are trying to convince to implement it.

Secondly, as a result of completing research in my classes and for this ELP, I have become much more critical of data that is published. I have also become more critical of my own work and have been more willing to take and accept criticism. A scholar needs to be able to see a great number of perspectives at once before reaching any conclusion.

### **Problem-solver**

My skills as a problem-solver have greatly improved. I had many chances throughout the course of this curriculum to analyze problems through case studies, simulations, and group discussion/projects. In addition, through this ELP I have become particularly adept at analyzing and solving problems. I accomplished this task by crafting nine unique artifacts that informed the problem of low developmental math pass rates at DTCC, laid out potential solutions, and presented a path as an improvement goal through the full investigation of the corequisite model. In addition,

I learned that a problem-solver needs to include stakeholders to craft a viable solution and path forward to implement the corequisite model. A problem, in this case low developmental math pass rates that beget issues of retention, needs to be analyzed holistically to understand any possible solution. This task can be accomplished through collaboration, research, and discussion among stakeholders.

The artifacts I created to solve this problem were based on the secondary data and information at hand about developmental education in general, andragogy, pedagogy, developmental math education, and the corequisite model. In addition, I gathered primary data in the form of surveys and interviews which helped inform the problem and the potential solution of corequisite model implementation at DTCC. The data was gathered and analyzed, both locally from DTCC faculty and staff (the data was quantitative and qualitative) and from outside interviews. The results presented multiple perspectives about perceived barriers to student success in developmental math courses as well as potential solutions. Through the interview process, I learned how to more easily determine common themes and other differences between the information gathered. For the surveys, I was better able to assess the potential implementation of the improvement effort (a corequisite model of developmental math education) through my analysis of faculty and student responses. Going forward, I embrace the opportunity to survey faculty and students again along with continuing to try to gain outside knowledge from other institutions that would give me more information about the problem and potential improvement efforts. This ELP process gave me firsthand experience in what I hope will be my involvement in several improvement efforts at DTCC.

## **Partner**

As a partner, my skill set has changed since entering the Ed. D. program. One of the most important ways my skills as a partner have changed is that I am less shy of approaching people I do not know at DTCC and outside of it for assistance with projects. I learned that if there is some information one wants to share, or if there is information someone needs from another person in the organization, regardless of power differential, it is necessary to engage those people because they are stakeholders in the problem and solution. Through a constant fostering of relationships, both old and new, I have learned more about the history, mission, and need to gain buy-in for the implementation of not just a corequisite model but also any change to DTCC's curriculum that could benefit students and faculty.

The contacts I have built at DTCC and outside of it via the interviews have resulted in willing partners who are ready to assist me in improving math curriculum and pass rates. In addition, actively seeking feedback from major stakeholders both inside and outside DTCC can help reframe the problems to see a more global picture. Implementing the corequisite model, while one goal of this ELP, is not the ultimate leadership improvement goal. The other important goals involve working to solve the problem on a micro and macro level to understand it completely and assess all potential solutions within the context of DTCC, which is unique to our institution in terms of our diverse population of both students and faculty/staff.

Overall, this program has taught me to be a better leader by being a critical thinker and an active problem-solver. It has also taught me that many problems in education are not always solved quickly but rather take time. The progress can be slow, as evidenced by the ten years it took the Community College of Baltimore

County to scale up its ALP redesign. However, despite that length of time, the results have been excellent and their student pass rates and retention rates have increased substantially in almost any demographic one analyzes. While I hope that DTCC selects the option of a corequisite model of developmental math education and that the results happen more quickly, I realize that it is not the only option and that other avenues may need to be explored before settling on the implementation of the corequisite model. The problem-solving process is ongoing and as a leader it is necessary to involve all stakeholders and work towards a solution that is beneficial to DTCC. This ELP is a stepping stone to improving developmental pass rates and while the strategic plan outlines specific steps using a proposed solution, engagement of stakeholders and a long view of the results aside from increases in developmental math pass rates is necessary to understand how to constantly improve the institution and forward its mission. I hope that this ELP will spark a conversation, and lead to meaningful change. This change will take time, but I want the change to be beneficial for both our faculty and most importantly, our students.

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**Appendix A**

**PROPOSAL**

## **Overview**

Nationally, approximately 70 percent of first-year college students test into developmental courses (Smith, 2016). Developmental courses are “defined as classes or coursework below college level offered at a postsecondary institution” (Calcagno, 2007). At Delaware Technical Community College (DTCC), students struggle with their coursework in mathematics, particularly in developmental courses like MAT 010 (Review of Math Fundamentals) and MAT 020 (Elementary Algebra). A major problem at DTCC is the large number of students who must take developmental math courses before they enter a degree program. Students deemed to need developmental or remedial coursework are not college-prepared according to their math and/or English skills assessment and must take courses that prepare them for college-level work (Bailey & Cho, 2010). They are delayed in obtaining their diploma because of developmental course requirements and often students must take the same developmental course two or more times. Moreover, many faculty hours are devoted to these classes, particularly in mathematics.

Mathematics remediation takes resources away from other academic areas and students who need those resources just as much; this problem must be addressed to decrease the time gap between when students take developmental courses and when they enroll in college level courses in math. The corequisite model, sometimes called the linked workshop model (LWM) or structured learning assistance (SLA), has been

an effective solution to solve math remediation issues at other institutions. It could be useful to DTCC. This proposal seeks to eliminate developmental math courses at DTCC and will present a plan of action to accomplish this task via a corequisite model course redesign.

### **Organizational Context**

DTCC is a two-year educational institution with rural, urban, and suburban campuses that serve different populations of students (*Mission*, 2016). It is an open enrollment institution with four campuses (Stanton, Wilmington, Dover, and Georgetown) that provides education and workforce training to any student who seeks it. Its original slogan in 1967 was “a job for every graduate, a graduate for every job” (*History*, 2017). Even though economic and labor market conditions have changed since DTCC’s inception, its mission, values, and vision have remained the same. DTCC’s mission is to offer cost-efficient higher education that is pertinent and flexible to the needs of Delaware’s labor markets and the greater community (*Mission*, 2016). One of the college’s goals is to provide developmental education that will enable students to succeed in college-level courses, to prepare for future employment, to prepare for educational and workforce training to meet varied labor market demands, and to provide continuing education for the community. DTCC also seeks to cultivate an inclusive atmosphere that enhances student success and learning (*Mission*, 2016).

Most relevant in its mission is the provision of developmental education DTCC offers to prepare students for success in courses at the college level. DTCC is

committed to offering instruction that is cutting-edge and engaging and that supports student success. DTCC also seeks to design pathways that will enhance students' careers and transfer education opportunities (*Mission, 2016*). If DTCC is to serve as an economic engine for the state of Delaware, it must continue to employ strategies that foster a culture of student success. This idea syncs with DTCC's recent strategic directions report, which indicates that DTCC will employ a student-centered focus enabling student success in their courses. This way, learners can complete a degree and either enter the workforce or transfer to a four-year educational institution (*College directions, 2016*). Furthermore, the strategic directions of the college aspire to prepare graduates who will be competitive in the labor market. This is done using assessment of instruction, pathways, and practices to improve the status quo and support the school's mission and vision (*College directions, 2016*).

### **Diverse Student Body and Retention**

To provide college-level course preparation, pathways responsive to labor market needs, and innovative instruction, DTCC must act within the context of its diverse student body. At DTCC, students come from varied socioeconomic backgrounds, so it is important to offer instruction that suits an array of needs, particularly with regard to developmental mathematics courses. Overall, the college has a total enrollment as of July 2016 of 13,471 students, 62 percent of whom are female. Its overall retention rate is 61 percent (*Delaware Technical Community College, 2016*). The most recent records available for FY15 from the Office of Institutional Advancement indicate that the Stanton and Wilmington campuses have

an enrollment of 6,700 students, 2,188 of whom are full-time. Of these students, approximately 60 percent are female and the population is evenly split between Caucasians and several minority group populations (*History*, 2017). Retention rates are another important metric that drives DTCC towards innovation to keep the students who enroll. The retention rate at the Stanton and Wilmington campuses is 57 percent among first time, full-time degree seeking students and approximately 40 percent for first-time, part-time degree seeking students. Its retention rate for first-time, full-time degree seeking students is 61 percent for first-time, full-time degree seekers and 37 percent for first-time, part-time degree seekers (*History*, 2017).

At the Dover campus, enrollment stands at 2,939 total students, 1,285 of whom are full time. This population is approximately 60 percent female, and approximately 57 percent of the population is Caucasian compared with 43 percent among minority group populations. The retention rate at the Dover campus is 60 percent among first-time, full-time degree seeking students while it is 35 percent for first-time, part-time degree seeking students. Its graduation rate for first-time, full-time degree seeking students is 15.4 percent overall (*History*, 2017). Lastly, at the Georgetown campus, 4,296 students are enrolled; 1,803 are full-time. Of these students, about 63 percent of the students are female compared. Furthermore, approximately two-thirds of the population is Caucasian compared to roughly one-third who are from various minority groups. The retention rate at the Georgetown campus is 60 percent among first time, full-time degree seeking students while about half that for first-time, part-time degree

seeking students. Its graduation rate is first-time, full-time degree seeking students is 17.7 percent overall (“Fact book,” 2014).

Several factors can contribute to lower retention rates at a given college, which in turn affect graduation rates. In addition to cost, one of the major factors involves developmental courses. Students in developmental classes have a higher chance of leaving college without obtaining their diploma. Fewer than half of students in developmental courses finish them, and less than one quarter of community college students finish their certificate or major to earn a diploma in fewer than approximately 10 years (Bautsch, 2013). Furthermore, research indicates that students taking developmental courses in math have an even lower probability of success: the U.S. Department of Education reports that almost 60 percent of students who do not take developmental courses earn a four-year diploma; however, only 27 percent of students enrolled in remedial math go on to earn a bachelor’s degree (Bautsch, 2013).

### **Developmental Mathematics at DTCC**

At DTCC, developmental math is one of the first courses many students must take to begin college-level mathematics work in their major. The number of students placed into developmental math courses is high. In researching this proposal, I found that for the Fall 2016 semester DTCC ran 23 sections of MAT 005 (Basic Math) collegewide. DTCC ran 103 sections collegewide of MAT 010 (Pre-Algebra) and 44 sections of MAT 020 (Elementary Algebra). This problem does not exist just at DTCC. In fact, nationwide, almost 60 percent of students take at least one course in

developmental math or English, and slightly over one-third of students placed into developmental math move on to college-level math classes (Redden, 2010).

DTCC has addressed this problem with developmental math over the past few years, mainly by using the emporium model of course redesign. The emporium model requires that students complete coursework completely online. Faculty and tutors offer real-time assistance, students can finish more than one course per term, and more than one course can be taught at the same time in the emporium model (*Six models*, 2005). (For a more thorough explanation of the emporium, and other models of course redesign for comparison, please see <https://sites.google.com/a/udel.edu/redesign-101/and Artifact 2>). The semester before the emporium model was used, the Wilmington campus had a pass rate of 46.62 percent in MAT 020. During the first semester of the emporium model, the pass rate dipped slightly to 45.14 percent (*Course success metrics*, 2016).

Despite this curriculum and math formatting redesign, during the course of six semesters using the emporium model the average pass rate of MAT 020 at the Wilmington campus stands at 46.98 percent (*Course success metrics*, 2016). This figure represents a mere increase of 0.36 percent student performance over two years, which is another indicator that pass rates are a problem for this course. In the same time period, the pass rate at the Stanton campus was 52.2 percent, Georgetown was 57.3 percent, and Dover was 48.97 percent (*Course success metrics*, 2016). These low pass rates are evidence that many students are still not successfully completing their developmental math courses.

## **Problem Statement**

Developmental courses, coupled with the time students spend taking them, sometimes multiple times, are a national issue. Data collected from the National Educational Longitudinal Survey (NELS) indicate that 58 percent of students are placed into one developmental course in their first year of community college, nearly 45 percent take between one and three developmental courses, and 14 percent take over three developmental courses (Bailey, 2009). Furthermore, the cost of remediation at institutions of higher education across the country is staggering. Expense estimates from the NELLS survey exceed the \$2 billion mark for community colleges alone, and spending approaches one-half billion dollars at four-year institutions (*Diploma*, 2008). Many students' financial and time resources, along with college academic resources, are devoted to developmental math education.

At DTCC, remediation is a problem that must be addressed within the current curriculum to save students time and to allow them to attain their degree in a reasonable interval. It is important to improve student learning outcomes, better allocate academic resources, and decrease the time between when a student enters developmental courses at DTCC and when they begin taking college-level courses. Unfortunately, students often need multiple attempts to pass their developmental math courses, which can lead to issues of retention. Research from Miller et al. (2007) establishes that in the US, roughly 73 percent of first-year students return to college to take courses in their second year (Miller, Janz, & Chen, 2007); DTCC's retention rate averages 58.36 percent (*Delaware Technical Community College*, 2016) which is

significantly below that figure. In addition, DTCC faculty devote a great amount of time and resources to teaching developmental courses, and the college has instructional costs associated with them.

DTCC addressed the problem via learning communities, and in both the math and English departments, course redesigns have occurred over the past few years. While these efforts are commendable, the issue of developmental curriculum is a major problem. Pass rates have improved marginally. Tables 1, 2, and 3 show the pass rates for MAT 005, MAT 010, and MAT 020 at DTCC since the course redesigns, which will be explained in detail later.

Table A.1: *MAT 005 pass rates at DTCC, 2012-2016 as percent*

Campus	Fall 2012	Spring 2013	Fall 2013	Spring 2014	Fall 2014	Spring 2015	Fall 2015	Spring 2016
Dover	64.84	59.18	63.81	44.68	51.90	52.27	51.69	68.52
Georgetown	45.35	53.70	55.43	41.86	54.76	49.25	53.47	51.52
Stanton	37.14	45.83	45.71	49.49	57.63	57.14	54.46	58.33
Wilmington	60.81	29.27	47.44	34.38	58.41	57.63	49.38	80.95*

*Note.* Only 21 students took MAT 005 in the spring 2016 semester at the Wilmington campus and it is now a 1-credit, 4-week course.

Table A.2: *MAT 010 pass rates at DTCC, 2012-2016*

Campus	Fall 2012	Spring 2013	Fall 2013	Spring 2014	Fall 2014	Spring 2015	Fall 2015	Spring 2016
Dover	53.07	33.93	55.75	42.33	49.13	48.81	64.20	65.82
Georgetown	41.18	43.37	54.42	48.78	55.22	49.48	55.69	54.95
Stanton	37.14	45.83	49.49	35.82	54.31	48.44	56.67	42.52
Wilmington	49.43	43.11	47.81	41.39	47.44	43.28	43.85	48.26

Table A.3: *MAT 020 pass rates at DTCC, 2012-2016*

Campus	Fall 2012	Spring 2013	Fall 2013	Spring 2014	Fall 2014	Spring 2015	Fall 2015	Spring 2016
Dover	36.24	49.04	54.29	53.91	42.44	45.90	39.29	37.96
Georgetown	39.56	45.27	50.00	39.30	56.52	50.00	55.69	66.67
Stanton	32.87	46.12	45.71	40.13	41.78	48.93	54.00	49.26
Wilmington	47.74	51.75	50.18	43.37	47.44	43.28	43.85	48.26

DTCC's math curriculum underwent two collegewide redesigns in the past few years that were intended to increase pass rates. Most recently, all three courses underwent major curriculum changes this year and were piloted in the Fall 2016 semester. This was the second redesign to take place in developmental math at DTCC. Initially, these courses were primarily taught through lecture, with some sections completely online or hybrid. Appendix C contains syllabi for the developmental math courses. However, with support from the Trade Adjustment Assistance for

Community College Career Training (TAACCCT) grant that DTCC received, the first math redesign began in 2011, and this first change to the math curriculum and course format was piloted in the fall 2012 semester. The grant paid for the computers since the emporium model was computer-based. The first semester pilot program used the TAACCCT grant; all developmental math courses would now be offered using the emporium model of course redesign. One good result was that students who successfully complete their developmental math classes have higher completion rates in credit-level math courses (K. Schutte, personal communication, January 24, 2017).

However, developmental math pass rates still remained flat or decreased. Low pass rates in developmental math courses are problematic to DTCC's mission. The mission statement says that the school will prepare students for college-level coursework. Data indicates that the emporium model was not working as effectively as it should have been. Students at DTCC need to be ready not only for college-level mathematics courses, but also for transfer to four-year institutions and for entry into the workforce. However, they struggle with developmental math courses; action needs to be taken to improve not only developmental math pass rates but also ultimately retention rates and success in subsequent college-level courses.

### **Organizational Role**

In my role, I have the ability to help bring about change. Currently, I am the Academic Support Assistant for the Wilmington campus language and culture department. For the past year, I have also served in the role of International Education Coordinator. First, as International Education Coordinator, I am responsible for study

abroad advisement and recruiting, international campus programming, scholarship fundraising through our Oktoberfest event, and updating the campus on study abroad issues. My broad experience as support assistant and international education coordinator means that I also do impromptu advisement for many of my students who are in a variety of majors. I also have experience in math advisement in my current position and in my previous positions as an adjunct math instructor, math tutor, TRIO/Upward Bound math instructor and tutor, and Division of Vocational Rehabilitation (DVR) tutor at Wilmington and Stanton.

Additionally, my language lab position exists to provide necessary and ongoing instructional as well as technical support to both students and faculty in the English as a Second Language (ESL), Spanish, and American Sign Language (ASL) programs at my campus. This job involves carrying out key departmental functions including placement evaluation and diagnosis of all new students entering the ESL program. I also provide departmental-level front-door services and information for potential or new language students, many times in the languages I speak and write fluently: English, Spanish, French, and Italian. My current position in the language lab did not exist full-time previously, and I have essentially created, added to, and expanded my responsibilities over the years. My new supervisor and I continue to work to hone the position whose specifications include a mix of responsibilities I built into it related to tutoring and placement testing for English and math. Prior to my current position, I taught mathematics as an adjunct instructor for five and one-half

years in courses ranging from basic math to Precalculus. I have taught MAT 005, 010, and 020 several times and in varied formats, including emporium.

In addition, I conduct individual, small group, and large group tutoring sessions for ESL students. I also have taught math review sessions for arithmetic, algebra, and college math specifically for ESL students in preparation for the math placement test. Furthermore, I have previously taught our developmental math curriculum in several formats including lecture, hybrid, and emporium. I am intimately familiar with the curriculum, its place as a prerequisite for the purposes of advisement, and its redesigns. I have created four different learning communities blending ESL and math. I worked with the math department chair at my campus to promote various learning communities that bolster student success in developmental math. In fact, I helped create learning communities that were approved by the learning communities coordinator at the Wilmington campus relate to the MAT 010 developmental math courses.

These learning communities can be changed, though, and I think they could serve as a way to pilot a math course with the corequisite model. In fact, research shows that students who are part of learning communities perform better in a number of metrics, including homework and tests; they also continually work together to better their grades (Hanson & Heller, 2009). The idea of these linked courses, which DTCC already has in several programs, is the basis for solving low pass rates in developmental math could be solved. Since learning communities are corequisite by nature, it would be possible to pilot a developmental math learning community and a

new corequisite one side-by-side to see any potential differences in student achievement and retention rates. This endeavor would allow first-hand exploration of the corequisite model of developmental math instruction by using the learning community structure DTCC already has in place.

While the math department has tried to address issues of student success and retention by rolling out its new redesign this past Fall 2016 semester, doubts persist as to whether this redesign is the best way to increase student success and retention in developmental and subsequently college-level math courses. (The redesign is described in more detail in the improvement goal.) Observing the new redesign classes would be a valuable experience that would help with attaining the improvement goal I propose. Since developmental math courses at DTCC are a strain on time and academics for both students and instructors, I want to use my unique organizational positions to help fix the problem of low pass rates. However, first it is necessary to think about the redesign process in the context of curriculum changes at DTCC.

### **Change Process at DTCC**

The Assistant Dean of Instruction at the Stanton campus explained the curriculum change process, which is based on collegewide agreement among the department chairs. The first step is that the program lead will give the proposed new syllabi to the Dean of Instruction's Office. Here, the Assistant Dean of Instruction and the Campus Administrative Assistant go over the proposal, clarify the changes, and then submit them to the Assistant for Curricular Integrity (ACI).

The ACI then reviews the proposed changes and adds them to the agenda of the Curriculum Committee, which the Curriculum Committee reviews. Upon approval, the ACI informs both the Vice President of Academic Affairs and the Deans of Instruction. In the last two steps in the process, the ACI, Information Technology (IT), and the registrars make all necessary changes in DTCC's Banner Web system; once changes are made, the Dean of Instruction contacts and informs the department chairs.

Syllabi are then put on the college intranet's E-files page for future reference (M. Doody, personal communication, August 25, 2016). This background should give an idea about the redesign process and the academic structure of DTCC; in both of my positions I am under the division of Instruction. In terms of the campus structure at DTCC, I report to my supervisor, who is chair of my department. We both ultimately fall under the supervision of the assistant deans and dean of instruction at the Stanton and Wilmington campuses, who head the instructional division. (Please see Figure 1 for the organizational structure of the college.)

### **Improvement Goal**

As previously stated, developmental math courses have undergone two redesigns: one with a curriculum and format switch to the emporium model and the second with a departure from the emporium model and much larger curriculum redesign that ran this past fall. The instructional coordinator in the math department, said that the newer redesign actually returned to the way developmental math courses were before the emporium; these math courses now contain a larger lecture

component. Some of the courses will have an hour lecture and an hour of computer lab time per week, while others will have two hours of lecture and less computer time (T. Mukerji, personal communication, July 6, 2016). There will be some emporium component, but they indicated there is a need to teach students in a traditional classroom setting rather than rely on the computer and My Labs Plus software. Essentially, this redesign focuses more on class time and less online instruction and is a significant departure from the previous math course structure. The redesign also included changes in the number of credit hours and the content of each course. However, I am not sure that returning to the old ways of teaching developmental math is the answer to solve the problem of low pass rates. However, determining the feasibility of changing the developmental math curriculum again would require an analysis of this redesign, which will be accomplished as part of this ELP.

### **Other Models**

Several models of course redesign could theoretically improve pass rates in developmental math courses at DTCC. Six redesign models are defined and described by the National Center for Academic Transformation (NCAT), “an independent non-profit organization dedicated to the effective use of information technology to improve student learning outcomes and reduce the cost of higher education” (*Welcome, 2005*). Those six models are supplemental, replacement, emporium, fully online, buffet, and linked workshop.

The supplemental model keeps the original course structure the same, but enhances course lectures with materials ranging from textbooks to computer software;

these activities are done outside of class (*Six models*, 2008). The replacement model decreases the number of in-class meetings, substitutes class time with online learning activities, or makes substantial changes to the traditional course structure (*Six models*, 2008). The emporium model “replaces lectures with a learning resource center model featuring interactive computer software and on-demand personalized assistance” (*Six models*, 2008). This model was used in the first math redesign at DTCC. The fully online model is just how it sounds: it moves all of the traditionally face-to-face aspects of a course completely online. Students work outside the classroom with computer software or other multimedia to accomplish their coursework (*Six models*, 2008).

The buffet model of redesign customizes the learning environment, teaching, and learning strategies in the course to meet the needs of individual students (*Six models*, 2008). The last is the linked-workshop model, also known as the corequisite model, is the model I would like to implement at DTCC. This model “provides remedial/developmental instruction by linking workshops that offer students just-in-time supplemental academic support to core college-level courses” (*Six models*, 2008). Each of these models attempts to redesign developmental courses in various ways. As further discussed in Artifact 2, I have determined that the supplemental, buffet, and linked-workshop model could be used for developmental course redesign at DTCC. Based on the research I have read, the primary way to increase pass rates and to begin to save time and other resources is to implement a corequisite model for developmental math education.

## **Pedagogical Considerations**

The conceptual framework I will use for adopting this approach is in line with Malcolm Knowles' views on adult learning. He views andragogy as similar to pedagogy and it is a valid framework that holds at DTCC. While andragogy is the practice of teaching adults, he believes that “is simply another model of assumptions about learners to be used alongside the pedagogical model of assumptions, thereby providing two alternatives models for testing out the assumptions as to their ‘fit’ with particular situations,” (Knowles, 1980). DTCC has both traditional and nontraditional students, so it is important that instruction is relevant to the needs of traditional and nontraditional, or adult, students.

Research shows this type of model holds up well for both adults and young adults. First, “Scott and Conrad found in 1992 in their research literature review that adults appreciate the efficiency of accelerated learning formats” (Wlodkowski, 2003). Edgecombe (2011) also found that learners “at colleges where developmental and college-level courses are co-requisites, students who take the courses separately do not benefit from the interaction of content or the cohort effect, which may diminish their likelihood of successful completion” (Edgecombe, 2011). These two examples demonstrate that adults not only have an appreciation for a course format that will enable them to finish their degree more quickly but also they do not benefit from taking two separate classes as is the current case at DTCC.

Another argument for the use of a corequisite model has to do with high school tracking, sometimes called “ability grouping.” This process separates high school

students into low, medium, or high ability groups (or their equivalents) but has been shown by several studies to be ineffective and deleterious to student learning. John Hattie, who conducted a meta-analysis of more than 300 studies of ability grouping that included all grade levels and areas of curriculum, concluded that “tracking has minimal effects on learning outcomes and profound negative effects on equity outcomes” (Edgecombe, 2011). Hattie also examined the effects on subgroups of students and concluded that “no one profits” (Edgecombe, 2011), including high achievers, from ability grouping (Strauss, 2013).

In fact, the American College Test (ACT) released a report that, despite tracking, “found that only 39 percent of the 2014 graduating seniors who took the test met at least three of the benchmarks for English, reading, math, and science. Those are the students...that have a ‘strong likelihood’ of succeeding in first-year college courses” (Mangan, 2015). If high school students are being tracked and yet 61 percent of students are not prepared for college-level work, the burden is placed on community colleges and four-year schools to provide effective developmental education for students. Schools like DTCC are providing these options; however, students placed in developmental math are still not succeeding at high rates within the current developmental math course structure.

### **Moving Forward at DTCC**

With DTCC’s emporium model, students are working individually and as evidenced by Edgecombe (2011), they lack the camaraderie and interaction with the course content that would allow them to pass the class; the emporium model at DTCC

is in conflict with what the research says about adult learners. For this reason, exploring the linked-workshop model (synonymous with “corequisite model”) as an alternative to developmental math education at DTCC is important. While the NCAT lists the linked workshop model of course redesign on its website, this model has become synonymous with the term corequisite model, which I will use going forward. The corequisite model enrolls students in need of remediation into a college-level class and a corequisite course at the same time. In the corequisite course, “students receive targeted support to help boost their understanding and learning of the college-level course material” (*Transform remediation*, n.d.). For DTCC, its goal is manifold: place developmental students into college-level courses to shorten time to degree, increase math pass rates, and help the college reallocate academic resources.

One example of developmental math course redesign using the corequisite model is at Austin Peay State University (APSU) in Tennessee. APSU redesigned its math courses in response to poor student success rates in developmental courses. Essentially, APSU eliminated developmental math courses altogether in elementary and intermediate algebra in favor of a corequisite model. It preserved the same number of classroom hours but substituted developmental courses with just-in-time workshops. At these workshops, students performed many activities both in small groups and individually (*Tennessee Board*, 2009). Students who test into developmental math courses now are placed into credit-earning core mathematics classes alongside their peers who did not require remediation; however, this smaller group of newly placed students took a corequisite (*Tennessee Board*, 2009). Students

in the corequisite class attend required workshops, are given a first-day diagnostic assessment, and receive a customized report on their deficiencies so they can improve their performance. These workshops consist of computerized assessments and individualized tutoring assistance from trained staff to help students who struggled with various concepts (*Tennessee Board*, 2009).

In fact, APSU saved classroom time and space, and it was able to reallocate its educational resources to other departments. Before the redesign, about one-third of students successfully completed the developmental math courses. After its implementation, the pass rate increased substantially from 33 percent to 70.5 percent (*Tennessee Board*, 2009). In addition, in some states such as Florida, legislatures are eliminating community college remedial courses altogether and replacing them with the corequisite model (Mathewson, 2016). Bringing such reform to DTCC would be impactful if well-researched and carried out thoughtfully. This program and my position will prepare me to lead such an effort. Implementing course redesign at DTCC would save our students and institution valuable academic resources.

However, to redesign these math courses, a process must be created to bridge the gap between what is (lower pass rates in developmental math classes and subsequent college-level math classes) and what should be (higher pass rates). I propose to abolish MAT 010 and MAT 020 courses in favor of placing students, regardless of developmental status, into college-level math courses for their major with the understanding that they would take a corequisite course to help them be successful in their college-level math course. I also agree with the Assistant Dean of

Instruction at the Stanton campus, who believes that MAT 005 should be offered through DTCC's Workforce Development and Community Education division rather than on the credit side of the institution (M. Doody, personal communication, May 2, 2016).

While the overall vision I have is to use the corequisite model in DTCC's math classes, the purpose of this proposal is to lay the groundwork for what a corequisite model could look like if implemented at DTCC. Table 4 lists the action steps I will be taking in this ELP. It also offers future steps that could theoretically be completed after this ELP to implement the corequisite model in DTCC's developmental math classes. I propose piloting a corequisite with MAT 180, a college-level algebra course. (See Appendix C.) MAT 180 is a college-level algebra class. If the background research I do through this proposal proves of interest to DTCC, then the post-ELP steps could be completed, and the corequisite model could be piloted and evaluated.

Table A.4  
*Action steps*

ELP Related Steps	<p>1) Cull and analyze data for past emporium model use in all developmental math courses collegewide.</p> <p>2) Conduct surveys with math faculty and students to assess barriers to developmental math success and to test perceptions of alternative developmental math redesign models.</p> <p>3) Contact and write report on three institutions who use the corequisite model; report results.</p> <p>4) Create syllabus, measurable objectives, and classroom activities for corequisite model.</p> <p>5) Design support course for MAT 180 in Blackboard using the corequisite model; share course with math departments at each campus.</p> <p>6) Create policy advisement sheet for corequisite math model to be distributed to academic counselors, math instructors, and department chairs.</p> <p>7) Present strategic plan for the implementation of a pilot program for corequisite model math courses in limited sections; use feedback to generate improved strategic plan.</p>
Post-ELP Steps	<p>8) Administer NCAT Course Readiness Criteria (see Appendix B for a link) to all math departments. Analyze and share results with math departments.</p> <p>9) Convene task force at each campus to determine best approach to corequisite redesign. Task force will be composed of math chair, three math faculty, and one faculty member each from the Business and Computer Information Systems departments.</p> <p>10) Task force convenes, analyzes results of NCAT survey, and writes recommendations for redesign.</p> <p>11) Committees at each campus meet to proceed with corequisite redesign.</p> <p>12) Task forces meet collegewide to determine measurable competencies and objectives for new course.</p> <p>13) Task force at each campus completes course curriculum, syllabus, activities, summative, and formative assessments for the corequisite course.</p> <p>14) Four corequisite sections are piloted at each campus in parallel to MAT 180: College Algebra (see Appendix C for syllabus).</p> <p>15) Each campus committee tracks, analyzes and writes a report to be shared collegewide with all committees based on data from pilot program.</p> <p>16) Task forces meet collegewide to share and discuss results.</p>

17) Standardized, aligned collegewide corequisite courses are implemented parallel to all MAT 180 courses.

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18) Pass rates are compared with parallel MAT 180-only courses; results are shared collegewide.

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19) Task forces meet collegewide to prepare program evaluations.

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20) Redesign expands to other college math courses if successful.

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Finally, Table 5 on the following page lists the artifacts that I intend to use to support the research-based decision making for my proposal.

Table A.5  
*Artifacts*

Number	Artifact	Type	Audience	Description	Status	Timeline
1	Curriculum issue analysis	Enhanced white paper based on EDUC 897	Committee	Explores issues of developmental education at DTCC and discusses why they are important	Make committee revisions	Finished
2	Redesign 101	Website and supplemental paper	Committee	Explores the six models of redesign from the National Center for Academic Transformation (NCAT)	Make committee revisions	Finished
3	The Corequisite model	Expanded literature review and analysis from EDUC 866	Committee	Explores the corequisite model along with three different program examples	Make committee revisions	Early January 2017

4	Past and current practice analysis	Survey analysis	Math faculty, Deans of Instruction, and committee	Faculty and students will be surveyed to answer research questions about barriers to success, pros, and cons of developmental math program	In progress	Finished by end of December 2016
5	Analysis of institutions that use corequisite or linked workshop model	Interview analysis	Math faculty, Deans of Instruction, and committee	Three pertinent members of other institutions with different examples of the corequisite model will be interviewed ; results will be analyzed.	In progress	Finished by end of December 2016
6	Course objectives and measurable performance objectives	Syllabus and classroom activities	Math faculty, Deans of Instruction, and committee	The syllabus and classroom activities are the basis for a hypothetical math support course at DTCC.	Make committee revisions	Finished by end of February 2017

7	Blackboard course	Website	Math faculty, Deans of Instruction, and committee	Will serve as an example of how the hypothetical math support course would look and be laid out	Make committee revisions	Finished by end of February 2017
8	Corequisite policy advisement sheet	Policy brief	Math faculty, Deans of Instruction, and committee	Will describe the math placement options and procedures for all new students under the corequisite model	Make committee revisions	Finished by end of February 2017
9	Strategic Plan	Blueprint for future	Math faculty, Deans of Instruction, and committee	Will serve as the strategic plan for use of redesigned course in the future. Its outline has already been created in the action steps in Table 9.	Make committee revisions and revisions per Deans of Instruction	Finished by end of February 2017

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**DELAWARE**  
TECHNICAL  COMMUNITY  
**COLLEGE**

Georgetown | Dover | Stanton | Wilmington

<b>Campus Location:</b>	Georgetown, Dover, Stanton, Wilmington	<b>Effective Date:</b> 201751
<b>Course Number and Title:</b>	MAT 005 – Basic Mathematics	
<b>Prerequisite:</b>	SSC 100 or concurrent	
<b>Course Credits and Hours:</b>	1 credits 1 lecture hours/week 0 lab hours/week	
<b>Course Description:</b>	This course is a review of whole number arithmetic.	
<b>Required Text(s):</b>	Obtain current information at <a href="https://www.dtcc.edu/student-resources/bookstores">https://www.dtcc.edu/student-resources/bookstores</a> , or visit the bookstore. (Check your course schedule for the course number and section.)	
<b>Additional Materials:</b>	None	
<b>Method of Instruction:</b>	Face-to-Face, Hybrid	
<b>Disclaimer:</b>	None	

**Core Course Performance Objectives (CCPOs):**

1. Solve applied problems using whole numbers. (CCC 7)
2. Perform order of operations using whole numbers. (CCC 7)

*See Core Curriculum Competencies and Program Graduate Competencies at the end of the syllabus. CCPOs are linked to every competency they develop.*

**Measurable Performance Objectives (MPOs):**

Upon completion of this course, the student will:

1. Solve applied problems using whole numbers.
  - 1.1 Read and write whole numbers.
  - 1.2 Add, subtract, multiply, and divide whole numbers.
  - 1.3 Round whole numbers to a specified place value.
  - 1.4 Estimate sums, differences, and products of whole numbers by rounding.
  - 1.5 Identify factors of whole numbers.
  - 1.6 Classify a number as prime or composite.

<https://efiles.dtcc.edu/Syllabi/collegewide/MAT%20005%20201751.docx>

**DELAWARE**  
TECHNICAL  COMMUNITY  
**COLLEGE**

Georgetown | Dover | Stanton | Wilmington

<b>Campus Location:</b>	Georgetown, Dover, Stanton, Wilmington	<b>Effective Date:</b> 201751
<b>Course Number and Title:</b>	MAT 010 – Pre-Algebra	
<b>Prerequisite:</b>	MAT 005, SSC 100 or concurrent	
<b>Course Credits and Hours:</b>	3 credits 3 lecture hours/week 0 lab hours/week	
<b>Course Description:</b>	This course is a review of integers, fractions, decimals, ratios and proportions, percentages, measurement, and an introduction to algebra that includes solving linear equations and inequalities.	
<b>Required Text(s):</b>	Obtain current information at <a href="https://www.dtcc.edu/student-resources/bookstores">https://www.dtcc.edu/student-resources/bookstores</a> , or visit the bookstore. (Check your course schedule for the course number and section.)	
<b>Additional Materials:</b>	Basic calculator	
<b>Method of Instruction:</b>	Face-to-Face	
<b>Disclaimer:</b>	None	

**Core Course Performance Objectives (CCPOs):**

1. Perform arithmetic operations, and apply the order of operations to simplify mathematical expressions involving integers. (CCC 7)
2. Perform arithmetic operations, and solve applied problems using fractions and mixed numbers. (CCC 2, 7)
3. Perform arithmetic operations, and solve applied problems using decimals. (CCC 2, 7)
4. Manipulate algebraic expressions, and solve simple linear equations. (CCC 7)
5. Solve applied problems using rates, ratios, and proportions. (CCC 2, 7)
6. Solve application problems involving percentages. (CCC 2, 7)
7. Calculate conversions using dimensional analysis between and within the United States (U.S.) customary system and the metric system. (CCC 2, 7)

<https://efiles.dtcc.edu/Syllabi/collegewide/MAT%20010%20201751.docx>

**DELAWARE**  
TECHNICAL  COMMUNITY  
**COLLEGE**

Georgetown | Dover | Stanton | Wilmington

**Campus Location:** Georgetown, Dover, Stanton, **Effective Date:** 201751  
Wilmington

**Course Number and Title:** MAT 020 – Elementary Algebra

**Prerequisite:** MAT 010, SSC 100 or concurrent

**Course Credits and Hours:** 4 credits  
4 lecture hours/week  
0 lab hours/week

**Course Description:** This elementary algebra course is a review of solving and graphing linear equations and inequalities as well as systems of linear equations and inequalities, polynomials, factoring, rational expressions, radical expressions, and quadratic equations as applied to a variety of applications, including geometry.

**Required Text(s):** Obtain current information at <https://www.dtcc.edu/student-resources/bookstores>, or visit the bookstore. (Check your course schedule for the course number and section.)

**Additional Materials:** Basic calculator

**Method of Instruction:** Face-to-Face

**Disclaimer:** None

**Core Course Performance Objectives (CCPOs):**

1. Solve linear equations and inequalities algebraically and graphically. (CCC 2, 7)
2. Solve systems of linear equations and inequalities algebraically and graphically. (CCC 2, 7)
3. Perform arithmetic operations on polynomial expressions. (CCC 7)
4. Apply factoring techniques to simplify rational expressions. (CCC 7)
5. Solve quadratic equations. (CCC 2, 7)
6. Evaluate functions graphically and algebraically. (CCC 2, 7)

*See Core Curriculum Competencies and Program Graduate Competencies at the end of the syllabus. CCPOs are linked to every competency they develop.*

<https://efiles.dtcc.edu/Syllabi/collegewide/MAT%20020%20201751.docx>

**DELAWARE**  
TECHNICAL  COMMUNITY  
**COLLEGE**

Georgetown | Dover | Stanton | Wilmington

<b>Campus Location:</b>	Georgetown, Dover, Stanton, Wilmington	<b>Effective Date:</b> 2017-51
<b>Course Number and Title:</b>	MAT 180 College Algebra	
<b>Prerequisite:</b>	MAT 020, SSC 100 or concurrent	
<b>Course Credits and Hours:</b>	4 credits 4 lecture hours/week 1 lab hours/week	
<b>Course Description:</b>	This course includes the algebra of functions, graphs and applications, absolute value equations and inequalities, polynomial, rational, radical, quadratic and piecewise functions, and the application of basic right triangle trigonometry.	
<b>Required Text(s):</b>	Obtain current information at <a href="https://www.dtcc.edu/student-resources/bookstores">https://www.dtcc.edu/student-resources/bookstores</a> , or visit the bookstore. (Check your course schedule for the course number and section.)	
<b>Additional Materials:</b>	Graphing calculator	
<b>Method of Instruction:</b>	Face-to-Face	
<b>Disclaimer:</b>	None	

**Core Course Performance Objectives (CCPOs):**

1. Solve triangles using right triangle trigonometry. (CCC 2, 7)
2. Use functional definitions and the algebra of functions to graph and solve application problems. (CCC 2, 7)
3. Solve problems involving absolute value equations and inequalities and polynomial, rational, and piecewise functions. (CCC 7)
4. Analyze rational functions and their graphs. (CCC 7)
5. Analyze radical functions and their graphs. (CCC 7)
6. Solve application problems using quadratic functions and their graphs. (CCC 2, 7)

<https://efiles.dtcc.edu/Syllabi/collegewide/MAT%20180%20201751.docx>

**Delaware Technical Community College**  
**Organization Chart**  
 October 2015

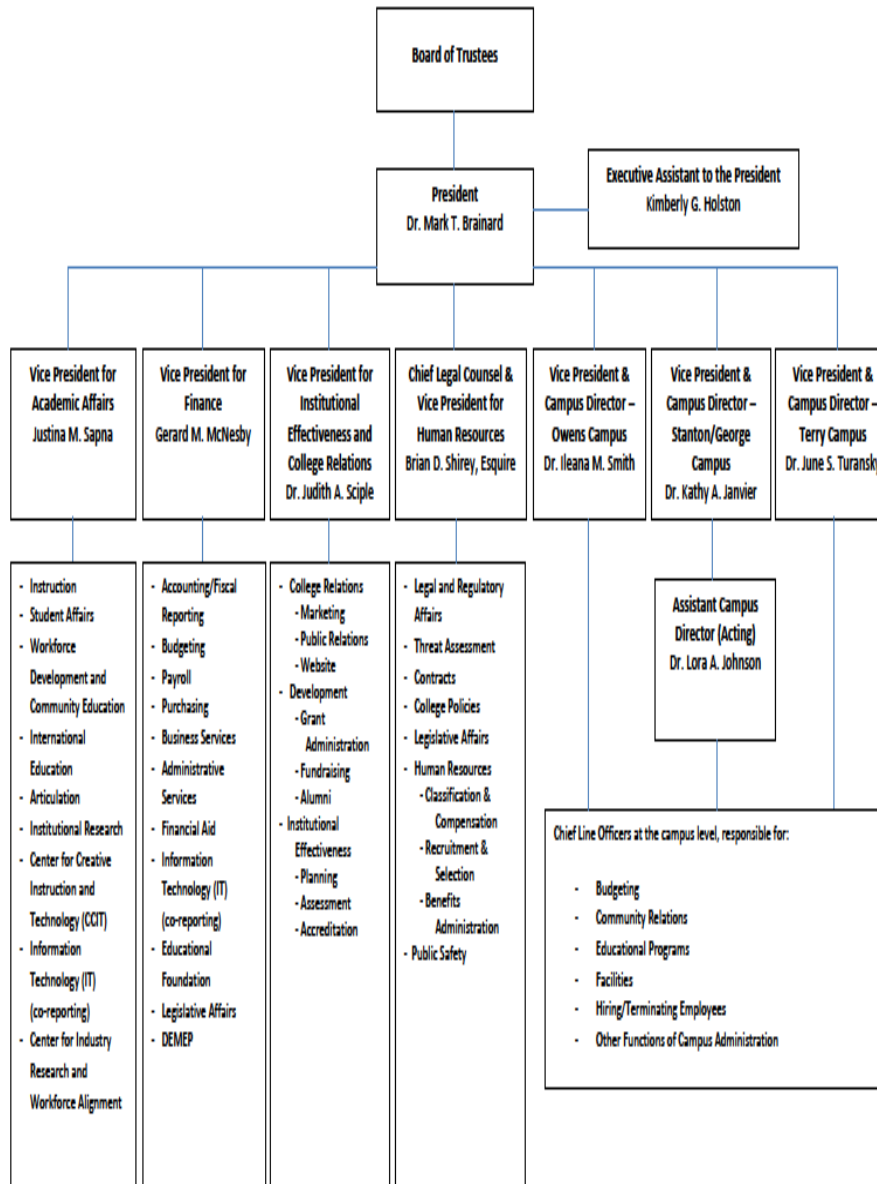


Figure 1. DTCC organizational chart.

**Appendix B**

**ARTIFACT 1: CURRICULUM ISSUE OF REMEDIATION**

## **Problem in Brief**

At Delaware Technical Community College (DTCC), developmental education is a problem that must be addressed to save students time and resources while also allowing them to attain their degree in a reasonable interval of time. Research from Miller et al. (2012) establishes that in the US, roughly 73 percent of first-year students return to college to take courses in their second year (Miller, et. al., 2012). Unfortunately, DTCC's retention rates are lower than the national average, averaging 58.36 percent (Fact Book, 2013). Further, many students are failing developmental math classes, which prevents them from progressing into courses needed for their intended academic programs. According to an Instructional Coordinator in the math department at the Wilmington campus, a failure rate was 68 percent in one twenty-four student basic math class (K. Schutte, personal communication, February 24, 2015). This paper will describe the extent of the problem with developmental math course pass rates at DTCC and propose that through the redesign of the current developmental curriculum, DTCC can improve pass rates in developmental math classes.

### **Background: Developmental Education**

Historically, developmental education has been a component of higher education. In the eighteenth century, the lack of uniformity of secondary educational requirements prior to student attendance at college highlighted the importance of developmental education. In the nineteenth century, the desire to enroll as many

students as feasible in developmental courses to keep colleges buoyant was an important reason for developmental education. In the twentieth century, the need for students to remain competitive in an increasingly global economy showed the necessity of developmental education (Parker, Bustillos, & Behringer, 2010). In the twenty-first century, developmental education is still an issue that must be addressed to prepare students for their careers and for further post-college study.

Data collected from the National Educational Longitudinal Survey (NELS) indicate that 58 percent of students are placed into one developmental course in their first year of community college. Nearly 45 percent take between one and three developmental courses, and 14 percent take over three developmental courses (Bailey, 2009). Furthermore, the cost of remediation at institutions of higher education across the country is staggering. Expense estimates from the NELS survey exceed the \$2 billion mark for community colleges alone, and spending approaches one-half billion dollars at four-year institutions (Strong American Schools, 2008). The money spent by students and colleges on developmental education, whose purpose is to make students college-ready, also ties up academic resources that could be allocated differently.

At DTCC, where developmental math pass rates are below 50 percent at some campuses, questions must be asked about whether the format of the courses or other pedagogical or andragogic issues need to be considered. At its core,

developmental education incorporates human development theories, is intended to bring together academic and human support services to assist students in preparing to make choices appropriate to their current stage of development, and is viewed as being appropriate for all

students. (Kozeracki, 2005)

Kozeracki's (2005) point about developmental education and its appropriateness for all students is relevant to DTCC because its learners come from all corners of the globe and walks of life. DTCC has assisted men, women, young, old, people of all races, creeds, nationalities, and physical and mental abilities. The most recent records available for FY15 from the Office of Institutional Advancement indicate that the Stanton and Wilmington campuses has an enrollment of 6,700 students, 2,188 of whom are full-time. Of these students, approximately 60 percent are female, and the population is evenly split between Caucasians and several minority group populations (*Stanton/Wilmington*, 2016). Retention rates are another important metric that drives DTCC towards innovation to keep the students who enroll. The retention rate at the Stanton/Wilmington campus is 57 percent among first time, full-time degree seeking students and it is approximately 40 percent for first-time, part-time degree seeking students. Its graduation rate for first-time, full-time degree seeking students is 9.3 percent overall (*Stanton/Wilmington*, 2016).

At the Dover location, enrollment stands at 2,939 total students, 1,285 of whom are full time. This population is approximately 60 percent female and approximately 57 percent of the population is Caucasian compared with 43 percent among minority group populations. The retention rate at the Dover campus is 60 percent among first time, full-time degree seeking students while it is 35 percent for first-time, part-time degree seeking students. Its graduation rate for first-time, full-time degree seeking students is 15.4 percent overall (*Terry campus*, 2016).

Lastly, at the Georgetown location, 4,296 students are enrolled with 1,803 being full-time. Of these students, about 63 percent of the students are female compared with approximately 37 percent who are male. Furthermore, approximately two-thirds of the population is Caucasian compared to roughly one-third who are from various minority groups. The retention rate at the Georgetown campus is 60 percent among first time, full-time degree seeking students while about half that for first-time, part-time degree seeking students. Its graduation rate is first-time, full-time degree seeking students is 17.7 percent overall (*Owens campus, 2016*).

Furthermore, community colleges are stewards of developmental education and it is

the singular invention and ongoing refinement of Developmental Studies that has allowed community colleges to provide the essential underpinning to the American learner landscape. (Mellow & Heelan, 2008)

This mission is important to DTCC, and its diverse learners in developmental education vary in age and experience; however, many share worries about their education, especially adults. They have concerns about technology, the perception they are too old to learn something new, finding a work-life balance, school cost, and fear of performing poorly in school (Deschenes, 2014). To address these concerns, andragogy expert Malcolm Knowles believes there are five assumptions to be made about adult learners. Those assumptions include the idea that adults are self-directed learners, their past knowledge is a resource for their current academic pursuits, they exhibit a readiness to learn, they are motivated, and they would prefer a problem-

based approach to learning (Pappas, 2013). These assumptions are relevant to DTCC's adult learners, many of whom fit one, some, or all of these characteristics.

Moreover, DTCC is always looking for ways to improve how its adult students learn. DTCC can continue to accomplish this task by applying Knowles' keys to effective andragogy, which involves adults in the preparation and assessment of their learning. Knowles also says that experiential learning should be part of the adult learning experience, adults are most interested in learning things of immediate use to themselves and their job, and adult learning is problem-centered (Pappas, 2013). Reevaluating the developmental math curriculum at DTCC, which will be discussed later, and trying to better incorporate Knowles' assumptions about adult learners, could help improve instructional methods, pass rates, and retention rates in those classes.

Knowles goes on to say that adult learners want to understand why they are learning. They are interested in task-oriented problems, instructional methods should account for a wide range of learning backgrounds, and adults should play a role in constructing their own knowledge in a course (Pappas, 2013). Adult learners at DTCC constantly question what they are learning and since there is such a diverse student population. Different instructional techniques are necessary to keep the students engaged to help them learn. At DTCC, students appear to prefer a collaborative, interactive approach where they are gaining practical knowledge from their courses. To accomplish this task, it is first necessary to understand developmental education at the college.

## **Developmental Mathematics Education at DTCC**

Developmental education is a pertinent issue at many colleges and universities across the country. DTCC needs to implement a different model of developmental math education to improve its pass rates to better serve the needs of younger and older adult learners. Currently, DTCC offers three developmental (Pre-tech) math courses. The first is MAT 005 (Basic Math) and its topics include the four basic mathematical operations, fractions, decimals, and percents. The second is MAT 010 (Pre-algebra), which is a sequel to MAT 005. The same topics are covered in the first half of the course, and later topics including geometry, pre-algebra, and basic statistics are covered. The third course, and the one with which students have the most difficulty, is MAT 020 (Introductory Algebra), whose topics include solving linear equations, factoring polynomials, and solving quadratic equations. While students struggle the most with this course, the pass rates for all three developmental math courses are not as high as they should be. Over the years, both math and English courses have undergone redesigns. While English courses have had more success, math pass rates have remained flat or decreased.

### **Redesign Efforts in Mathematics**

Prior to looking at pass rates of these developmental math courses, it is first necessary to review some context of DTCC's previous developmental math course redesign effort. DTCC's math curriculum underwent a major collegewide redesign in 2011 that was intended to increase pass rates. The redesign focused in particular on MAT 020 (Introductory Algebra), which had been notoriously difficult for many

students. MAT 005 (Basic Math) and MAT 010 (Prealgebra) also underwent redesigns. The redesigns switched from a primarily face-to-face format to the emporium model. In conjunction with the Trade Adjustment Assistance for Community College Career Training (TAACCCT) grant DTCC received, math redesign began in 2011 and the first change to the math curriculum was piloted in the fall 2012 semester (Bradley, 2013). The first semester pilot program used the TAACCCT grant; all developmental math courses would now be offered using the emporium model of course redesign. The tables below show the math pass rates for MAT 005, 010, 020 pre- and post-emporium. (Presentation of the tables for each course is followed by a brief discussion of the data.)

Table B.1: *Pre-emporium MAT 005 pass rates at DTCC, 2008-2012, as percent*

Campus	Fall 2012	Spring 2013	Fall 2013	Spring 2014	Fall 2014	Spring 2015	Fall 2015	Spring 2016
Dover	45.94	50.07	48.92	38.15	47.15	36.50	37.93	36.49
Georgetown	61.64	75.18	67.53	63.58	60.36	74.07	58.09	56.90
Stanton	-	-	-	-	-	-	-	-
Wilmington	63.65	63.32	69.60	63.73	59.77	72.89	65.35	55.99

Table B.2: *Emporium MAT 005 pass rates at DTCC, 2012-2016 as percent*

Campus	Fall 2012	Spring 2013	Fall 2013	Spring 2014	Fall 2014	Spring 2015	Fall 2015	Spring 2016
Dover	64.84	59.18	63.81	44.68	51.90	52.27	51.69	68.52
Georgetown	45.35	53.70	55.43	41.86	54.76	49.25	53.47	51.52
Stanton	37.14	45.83	45.71	49.49	57.63	57.14	54.46	58.33
Wilmington	60.81	29.27	47.44	34.38	58.41	57.63	49.38	80.95*

*Note.* Only 21 students took MAT 005 in the spring 2016 semester at the Wilmington campus.

The MAT 005 course covers very basic mathematical concepts including addition, subtraction, multiplication, and division; it also covers those four operations with the topics of fractions, decimals, and percents. Before the emporium, the average pass rate for the Dover campus was 42.64 percent, while at the Georgetown campus the average pass rate was 50.67 percent. At the Stanton campus, MAT 005 was not offered so this data is unavailable. At the Wilmington campus, though, the MAT 005 average pass rate was 64.29 percent. Post-emporium redesign, the Dover campus pass rates for MAT 005 averaged 57.1 percent over the course of five years. For the Georgetown campus, 50.7 percent of students pass MAT 005. The Stanton campus had the same average, and the Wilmington campus had an average pass rate of 52.3 percent. However, without the outlier from spring 2016, the average dropped to 48.2 percent, which is the lowest. Not even half of the class, on average, passed MAT 005 at the Wilmington campus from 2012-2016. One can draw the conclusion that the math redesign is not working well enough to ensure that more students succeed in this

course, which can affect DTCC's retention rates. Overall, the Dover campus improved with the emporium model, Georgetown remained almost the same, Stanton is not comparable, and the Wilmington campus went down approximately 12 percent. Next, Tables 3 and 4 show the math pass rates for MAT 010, which is the sequel to MAT 005.

Table B.3: *Pre-emporium MAT 010 pass rates at DTCC, 2008-2012, as percent*

Campus	Fall 2008	Spring 2009	Fall 2009	Spring 2010	Fall 2010	Spring 2011	Fall 2011	Spring 2012
Dover	50.07	55.53	49.42	44.68	42.62	42.48	51.06	43.07
Georgetown	67.53	70.72	70.16	41.86	60.53	65.03	62.12	60.95
Stanton	67.05	57.77	45.71	68.97	55.46	48.98	65.33	58.33
Wilmington	67.06	64.99	80.71	77.36	65.80	72.89	65.14	55.08

Table B.4: *Emporium MAT 010 pass rates at DTCC, 2012-2016, as percent*

Campus	Fall 2008	Spring 2009	Fall 2009	Spring 2010	Fall 2010	Spring 2011	Fall 2011	Spring 2012
Dover	53.07	33.93	55.75	42.33	49.13	48.81	64.20	65.82
Georgetown	41.18	43.37	54.42	48.78	55.22	49.48	55.69	54.95
Stanton	37.14	45.83	49.49	35.82	54.31	48.44	56.67	42.52
Wilmington	49.43	43.11	47.81	41.39	47.44	43.28	43.85	48.26

MAT 010 covers the same topics as MAT 005 but adds application problems with percents and proportions, basic linear equations, and US/metric measurement

conversion and application problems. This course was taught with the emporium model, which is done completely via computer software in the Math Success Center with no official classroom lecture meetings. Students complete their work in the Math Success Center under the supervision of tutors and faculty. Pre-emporium, the average MAT 010 pass rate was 47.37 percent and the Georgetown campus had an average pass rate of 62.36 percent. For the Stanton and Wilmington campuses, the average MAT 010 pass rate pre-emporium was 58.45 and 68.62 percent respectively. Post-emporium, the average pass rates for the Dover campus was 51.6 percent, the average pass rate for the Georgetown campus was 50.4 percent, the average pass rate for the Stanton campus was 46.3 percent, and the average pass rate for the Wilmington campus was 45.6 percent. Comparatively, the Dover campus improved slightly over four percent, but the Georgetown, Stanton, and Wilmington campuses' average pass rates decreased after the emporium model was implemented. Next, we will explore tables 5 and 6, which show the pass rates for MAT 020.

Table B.5: *Pre-emporium MAT 020 pass rates at DTCC, 2008-2012 as percent*

Campus	Fall 2008	Spring 2009	Fall 2009	Spring 2010	Fall 2010	Spring 2011	Fall 2011	Spring 2012
Dover	42.52	37.74	47.71	41.46	42.48	48.64	48.74	46.95
Georgetown	70.30	65.92	44.50	54.13	54.76	49.25	-	53.75
Stanton	60.07	45.83	45.71	49.49	57.63	54.10	54.71	54.76
Wilmington	65.12	55.64	54.59	65.66	55.06	60.67	50.33	53.45

Table B.6: *Emporium MAT 020 pass rates at DTCC, 2012-2016 as percent*

Campus	Fall 2008	Spring 2009	Fall 2009	Spring 2010	Fall 2010	Spring 2011	Fall 2011	Spring 2012
Dover	36.24	49.04	54.29	53.91	42.44	45.90	39.29	7.96
Georgetown	39.56	45.27	50.00	39.30	56.52	50.00	55.69	66.67
Stanton	32.87	46.12	45.71	40.13	41.78	48.93	54.00	49.26
Wilmington	47.74	51.75	50.18	43.37	47.44	43.28	43.85	48.26

MAT 020 is a course that reviews some of the topics of MAT 010 and then covers graphing linear equations, solving word problems in two variables, factoring polynomials, and solving quadratic equations. This course is difficult for many students and they can become caught up in a cycle of failing the class and taking it several times. DTCC may lose students who are frustrated with the course and these losses affect our retention rates. Prior to the emporium, the average MAT 020 pass rate was 44.53 percent at the Dover campus and it was 56.10 percent at the Georgetown campus. At the Stanton and Wilmington campuses, the average MAT 020 pass rate was 52.79 percent and 57.57 percent.

Post-emporium implementation, the average pass rate for MAT 020 at the Dover campus was 44.9 percent. The average pass rate at the Georgetown campus was 50.4 percent, the average pass rate at the Stanton campus was 44.9 percent, and the average pass rate at the Wilmington campus was 47.0 percent. Yet again, average pass rates indicate that half of students who take MAT 020 are not passing it. In addition, it

is important to note that the pass rate decreased, on average for MAT 020 at the Georgetown, Stanton, and Wilmington campuses while only increasing less than four-tenths of a percentage point for the Dover campus over the course of five years. Clearly, the emporium model is not as effective as it should be.

Prior to the emporium model, students took their developmental math courses in a classroom setting with an instructor as a lecture-based course. With the emporium model, students take their developmental courses separately and do not have time to collaborate with other students in their class while working in the emporium. They complete course work individually and as suggested by Edgecombe (2011), lack the camaraderie and facilitated interaction with the course content that could allow them to pass the class. It appears at DTCC that the emporium model, where students work alone at a computer with occasional interactions with faculty, is in conflict with what research says about adult learners. While adults like to be self-directed, they also like structure and problem-based learning. To better incorporate these characteristics of adult learners into math instruction, it is necessary to explore other options for course redesign to see what they could offer to help DTCC's context.

### **Potential Routes to Solve the Problem**

DTCC's diverse population needs to be able to learn in a supportive environment and one which adapts to different learning strategies and backgrounds. One of the ways to accomplish this task is to use a developmental math redesign model that has demonstrated success in the past. There are several to choose from including the supplemental, buffet, emporium, fully-online, replacement and the

linked-workshop model (LWM), but the LWM may work best for DTCC's context based on past successes at other institutions and with a similar redesign in English previously occurring here. Also, research suggests that accelerated learning, interaction of content, and a learning cohort -- which are elements of this model -- have benefits for adult learners (Edgecombe, 2011; Wlodkowski, 2003).

### **LWM at Austin Peay State University**

Austin Peay State University (APSU) used the LWM in response to poor student success rates in developmental math courses. APSU eliminated developmental math courses in elementary and intermediate algebra in favor of this type of model. It preserved the same number of classroom hours, but it substituted developmental courses with just-in-time workshops. The college-level course and the support course were linked via the workshops. There, students performed many activities both in small groups and individually (*Tennessee Board, 2009*). Students who previously placed into developmental math courses were instead placed into credit-earning core mathematics classes alongside their peers who did not require remediation; however, this smaller group of newly placed students took a linked course as a corequisite (*Tennessee Board, 2009*).

Students in the linked course attended required workshops, were given a diagnostic assessment the first day of class, and received customized reports on where their deficiencies were so they could improve their performance. These workshops included computerized assessments and individualized tutoring assistance from trained staff to help students who struggled with various concepts (2009). While it is not the

only solution, an important aspect about APSU's program is that through the developmental redesign, students have the opportunity to earn their degree in the same time frame as their non-remediated peers. In addition to APSU, there are several examples of evidence-based practice from other colleges and universities that have implemented six different course redesign models to tackle the issue of remediation. In almost all cases, pass rates increased, which highlights the value of using these redesign models to tackle the expensive and time-consuming issue of remediation.

### **DTCC's Version of the LWM: English ALP**

DTCC employed a version of the linked-workshop model called the English Accelerated Learning Program (ALP). The ALP was implemented here in 2012 through 2014 with a small number of sections. In DTCC's ALP model, students took ENG 051 (Developmental English) concurrently with ENG 121 (Composition). The English ALP was designed to accelerate students' paths to completing ENG 121, according to the chair of the Wilmington campus English department. They believe that it was successful during its short run and that students adapted well to the accelerated format. The ALP ended when DTCC decided to start from a blank slate and work on collegewide alignment of the English curriculum. The chair indicates they would be interested in reinstating the ALP and perhaps tweaking the format to increase the amount of students who take the class. Anecdotal evidence from the Wilmington English department chair suggests the ALP could have been more successful if it were given more time (L. Kelleher, personal communication, October 6, 2016). While there is some data that exists about students pass rates in the ALP

sections, it is limited. For those reasons, there is not yet enough evidence to indicate whether this model would lead to higher pass rates as compared with students who were not in the ALP at DTCC.

### **Limited Research and Evaluation**

As with all newer models of course redesign, there are some limitations to the research on the Linked Workshop Model. Context matters, and one criticism of this model centers on what Austin Peay State University (APSU) in Tennessee did. Belfield, Jenkins, and Lahr (2016) argue that “the corequisite model has not yet been subjected to rigorous evaluation. Tennessee community colleges were in the process of implementing an array of very substantial reforms that may have had a bearing on student outcomes” (Belfield, Jenkins, & Lahr, 2015). As previously mentioned, DTCC tried this approach as well, but has not conducted a systematic evaluation in the limited number of years it has been effect. In addition, given the newness of the model and limited research, further investigation is necessary into it and other types of course redesign models. To determine if this model worked only in the context of Tennessee or if it is applicable to a broader base of institutions, further research into other developmental course redesigns is necessary.

### **Conclusion**

Developmental education is an issue that needs to be confronted at DTCC. Unfortunately, many DTCC students are limited by academic deficiencies, particularly in math. Several students who want to earn a degree have no other choice but to take developmental math classes because they are underprepared. Because they are

underprepared, students often take the same developmental class multiple times only to receive a failing grade. Therefore, DTCC has lower retention rates. The emporium model, which was intended to address this issue, seems to be less effective at increasing pass rates.

Therefore, some kind of redesign is necessary to improve DTCC's math pass rates and college retention rates. Through a comprehensive analysis and developmental math redesign, the issue of developmental education can be more effectively explored. Developmental studies and student success in college-level courses are important at DTCC and they must continue to be refined. DTCC needs to prepare both young and older adults to not only reach their career goals but also to enter or expand their presence in the workforce. While the bulk of the research available about corequisite models relies on institutional self-evaluation, only recently has research begun to evaluate such newer models of redesign. Given the apparent successes of the corequisite model at APSU and the ALP program at DTCC, it is necessary to investigate them further to see if they would benefit the diverse population at DTCC. It will also be necessary to investigate other course redesign models to see what they might contribute to DTCC's developmental math education courses.

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**Appendix C**

**ARTIFACT 2: REDESIGN 101 SUPPLEMENT**

## **The NCAT models**

The National Center for Academic Transformation (NCAT) lists six different course redesign models on its website. The six models of course redesign from the NCAT site are the fully online, replacement, emporium, supplemental, buffet, and the linked workshop model. I summarized them and created a Redesign 101 website for EDUC 818, Educational Technology Foundations. The link to the website is here: <https://sites.google.com/a/udel.edu/redesign-101/>. I would like to discuss the models more deeply to give a better understanding of what characteristics they possess. I listed six major features from the redesign models and organized them in tabular form (see Table 1).

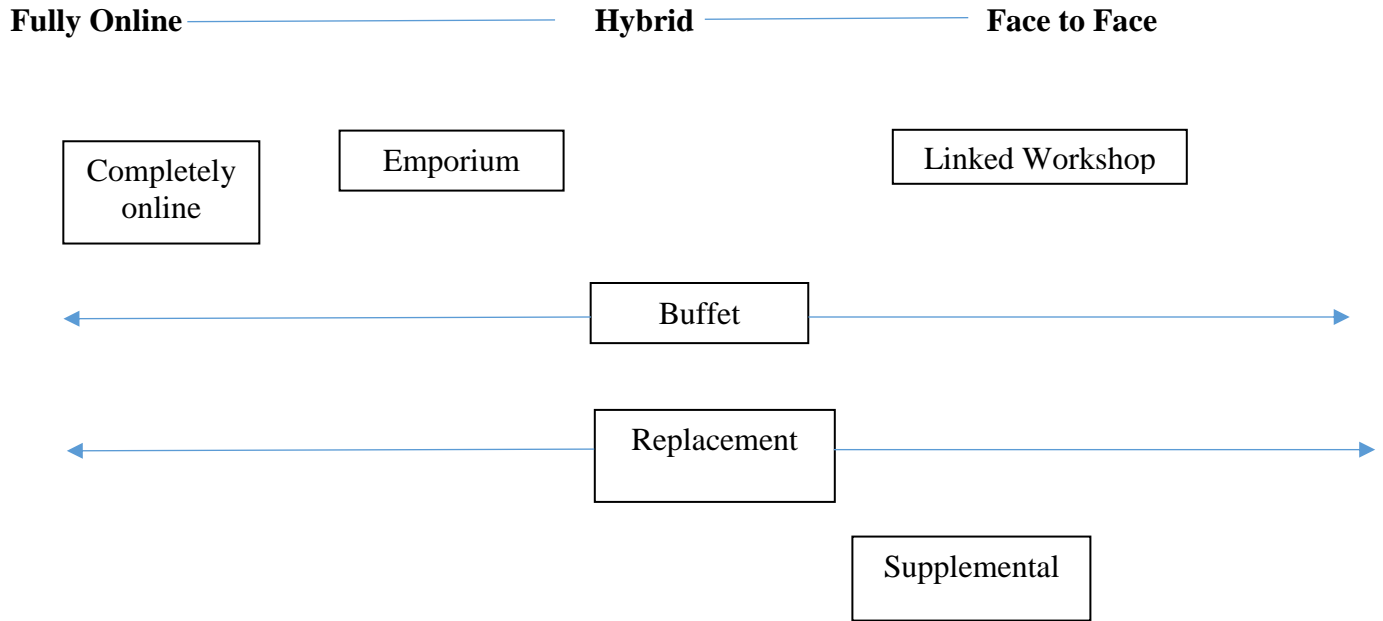
Those features are: an online component, a face-to-face component, availability of real-time assistance, presence of student pathways, ability of students to finish more than one course in a semester, and model customizability. I also created a graphical representation of where the models fall along the spectrum of course redesign, which ranges from completely online to completely face-to-face (see Figure 2). For this figure, the buffet model and the replacement model could fall anywhere along the spectrum, depending on the structure of those courses; therefore, they have lines extending from them in both directions. While each of these redesign models can be applied to both developmental and college-level courses, the focus here will primarily be on the pros and cons of these models in developmental courses. Before exploring the models, please read over Table 1 and Figure 1. These are here for

reference purposes.

Table C.1  
*Characteristics of each model*

	Online component	Face-to-face component	Real-time instructor assistance available	Pathways	Student finishes 1+ per semester	Customizable	Prereq. or Coreq.
Completely Online	X						Both
Replacement	X	X	X				Both
Emporium	X		X		X		Prereq.
Supplemental	X	X	X			X	Coreq.
Buffet	X	X	X	X		X	Both
Linked Workshopped	X	X	X	X	X	X	Coreq.

*Note.* “Pathways” means there are several ways for students to reach the same outcome; “Customizable” means that the course can be tailored to students’ individual learning styles.



*Figure 1.* Course redesign spectrum. The buffet and replacement models are fluid and can be changed to suit the needs of the entire class. For example, if the instructor determines a face-to-face course is better suited to an online learning environment based on student preferences after the course has started, it can be changed.

### Fully Online Model

The first redesign model is the fully online model. Here, students do not meet face-to-face as a class and all instruction occurs online through multimedia or web-based software (*The fully online model*, 2008). The NCAT cites some successes with this model at institutions like Rio Salado, which saw a modest increase of 5.8 percent in student pass rates for its college algebra class. At the same time, the average grade for students in that college algebra class was 79 percent, which was approximately the same as in lecture-based sections of the same course (*Impact on students*, 2008).

Another example of a school using the fully online model is the University of Southern Mississippi (World Literature), which saw a two percent increase in

retention rates versus faculty-taught sections and a 10 percent reduction in the amount of D's and F's students received for this course (*Impact on students*, 2008). Other examples can be found on the website, but gains in retention and improved grades appear to be modest at best for this model. That being said, this model relies highly on students to be motivated to finish their work. In addition, there is no face-to-face component and immediate, real-time assistance from the instructor is not available for students; however, they could go to any math tutoring centers that are available to them.

There are some benefits to implementing the fully online model of redesign, and those include accessibility and flexibility, the potential for greater student involvement via group collaborative activities, the elimination of instructional tasks such as lecture or grading, and the potential to enrich the student experience by bringing together students of different backgrounds and even geographic areas (*Benefits and challenges*, 2016). However, the course does not use differentiated instructional methods because all processes and pathways for students are one size fits all. In addition, there are several other challenges to implementing the model, which include increasing comfortability with technology on the part of students and faculty, attempts to build a collaborative group of online learners, and enabling communication between students and faculty (bringing together students of different backgrounds and even geographic areas (*Benefits and challenges*, 2016).

## **Replacement Model**

A second model of course redesign is the replacement model. The replacement model contains elements of online and face-to-face instruction, and there is real-time instructor assistance available. Its goal is to decrease the number of in-class meetings, substitute class time with online learning activities. It operates under the assumption “that certain activities can be better accomplished online--individually or in small groups--than in a face-to-face class.” It also questions why (and for what amount of time) classes need to meet face-to-face at all (*The replacement model*, 2008).

Examples of the replacement model are in use at Penn State University, the University of Wisconsin-Madison, and the University of Tennessee at Knoxville. Each school reduced the number of in-class lectures substantially and replaced many facets of the courses with online instruction or tutoring.

For example, Tallahassee Community College decreased the number of course lectures per week for its English composition course from 3 to 1. It replaced the class meeting times with online tutorials (*The replacement model*, 2008). While there was a moderate pass-rate increase of 3.8 percent (*Tallahassee Community College*, 2008) in the composition class, the selling point of this model in the literature is framed around the idea that “reduced classroom time creates opportunities to substitute expensive faculty labor for electronic exercises” (Miller, 2010). According to the NCAT, 14 institutions used the replacement model in their course redesign, but the increase in pass rates for the redesigned courses were moderate at best and similar to Tallahassee Community College (*The replacement model*, 2008). There is little literature that

exists about the replacement model, however. Furthermore, assumptions it makes are in direct conflict with DTCC historical developmental math data since DTCC attempted to use one of the more computer-heavy models and pass rates still hovered around 50 percent.

As with all models of redesign, there are benefits and challenges to implementation. For the replacement model, students report feeling more engaged, the courses using this model appear to be more learning-centered since they combine face-to-face and distance learning elements, and faculty say such courses lead to greater collaboration (Bravo & Hutt, n.d.). However, the challenges associated with implementing this model include student lack of comfortability and understanding of the course format, the dearth of classes that lend themselves to this type of redesign, and the amount of time faculty spend inuring students to the format (n.d.). However, the course does have both online and face-to-face components along with real-time instructor assistance.

### **Emporium Model**

A third model of course redesign is the emporium model. The emporium model contains an online component, has real-time instructor assistance, and allows students to finish more than one course per semester. I have personal experience as an instructor with the emporium model at DTCC. The emporium model eliminates lecture from the classroom and students work on computer software to meet their course objectives. The learning is modularized and students must receive a certain percentage correct on homework questions for each module (only after watching

videos and doing practice questions prior) to move on to the next topic or module.

Students and tutors must be present in the emporium to assist students with problems as they make their way through the modules.

Scheduling time in the emporium can be done in three ways: the students choose the time to be in the emporium, they are scheduled by the institution to be in the emporium, or they are scheduled as a class to be in the emporium at certain required times (*The emporium model*, 2008). It is a form of mastery learning, but at the same time it is easy for students to get stuck on a topic or module they do not understand. At DTCC, though the emporium model does not take a corequisite approach, a student can finish more than one developmental math course in the same semester. I saw this done a few times, but it is extremely difficult to finish both developmental courses and begin the third course because the semesters are too short and our students often have a busy work-life-school balance. That benefit is useful for students because it lowers their personal tuition expenses. However, the cost outlay is large because the institution is buying computers and it requires a reallocation of academic resources since tutors and instructors need to be scheduled to assist students in the emporium. DTCC instituted this model six years ago.

This model may have been effective at larger institutions such as LSU and the University of Idaho (*The emporium model*, 2008), but it is not a good fit for DTCC. It has been in use since 2012 and pass rates, especially for the Wilmington campus, remain low and relatively flat. As was described in the proposal and

in Artifact 1, there is direct evidence that the emporium is not effective here as pass rates in all three developmental math courses are lower than the national average:

Table C.2: *MAT 005 pass rates at DTCC, 2012-2016 as percent*

Campus	Fall 2012	Spring 2013	Fall 2013	Spring 2014	Fall 2014	Spring 2015	Fall 2015	Spring 2016
Dover	64.84	59.18	63.81	44.68	51.90	52.27	51.69	68.52
Georgetown	45.35	53.70	55.43	41.86	54.76	49.25	53.47	51.52
Stanton	37.14	45.83	45.71	49.49	57.63	57.14	54.46	58.33
Wilmington	60.81	29.27	47.44	34.38	58.41	57.63	49.38	80.95*

*Note.* Only 21 students took MAT 005 in the spring 2016 semester at the Wilmington campus.

Table C.3: *MAT 010 pass rates at DTCC, 2012-2016*

Campus	Fall 2012	Spring 2013	Fall 2013	Spring 2014	Fall 2014	Spring 2015	Fall 2015	Spring 2016
Dover	53.07	33.93	55.75	42.33	49.13	48.81	64.20	65.82
Georgetown	41.18	43.37	54.42	48.78	55.22	49.48	55.69	54.95
Stanton	37.14	45.83	49.49	35.82	54.31	48.44	56.67	42.52
Wilmington	49.43	43.11	47.81	41.39	47.44	43.28	43.85	48.26

Table C.4: *MAT 020 pass rates at DTCC, 2012-2016*

Campus	Fall 2012	Spring 2013	Fall 2013	Spring 2014	Fall 2014	Spring 2015	Fall 2015	Spring 2016
Dover	36.24	49.04	54.29	53.91	42.44	45.9	39.29	37.96
Georgetown	39.56	45.27	50.00	39.30	56.52	50.00	55.69	66.67
Stanton	32.87	46.12	45.71	40.13	41.78	48.93	54.00	49.26
Wilmington	47.74	51.75	50.18	43.37	47.44	43.28	43.85	48.26

### Supplemental Model

This model contains online and face-to-face components, real-time instructor assistance, and has a customizable approach. The supplemental model keeps the original course structure the same, but appends course lectures with materials ranging from textbooks to computer software (*Six models*, 2008). While the NCAT lists several examples of institutions that use the supplemental model, many of these models are not corequisite. Some institutions, like the University of New Mexico, added course activities that “were supplemented by interactive hybrid Internet/CD-ROM activities, quizzes, and programmed self-instruction offered on a 24/7 schedule” (*University of New Mexico*, 2008). The University of Colorado at Boulder, meanwhile, delivered course content through an electronic textbook and used several online and computerized activities (*University of Colorado*, 2008).

However, it appears the ways in which many of these institutions implemented the supplemental instruction model strays too far from its original purpose. Almost all of the schools using the supplemental model redesign rely heavily on computerized

instruction and feedback. I did find one use of the supplemental model at the University of California at Davis, which was actually a corequisite model. Students took a one-credit, hybrid supplemental course with their college-level math course. The hybrid course had five components: “online individualized remediation of prerequisite skills, interactive lectures using materials shared across all course sections, facilitated group work in a weekly supplemental contact hour, online homework with instant feedback, and common student assessment tools shared across all course sections” (Stevenson & Zweier, 2011).

This example shows that the supplemental model could be used in a corequisite way to help students pass their math classes. Before their redesign, math class rates averaged 34 percent pass rates. After the implementation, the pass rates increased to 66 percent and most importantly, these results have been replicated (Stevenson & Zweier, 2011). UC-Northridge’s supplemental model could work at DTCC and also offers support for a corequisite approach to developmental math remediation based on the data. Furthermore, UC-Northridge’s customized supplemental model (which, in practice, uses a corequisite approach) has spread to other campuses in the California State University system (Stevenson & Zweier, 2011).

There are also both benefits and challenges to implementing the supplemental model of course redesign. Some of the benefits include the research suggesting that the model benefits several sectors of the student population, students have the opportunity to interact with the learning materials in a different way, and faculty members indicate they can better understand student learning styles and requirements

to be successful in the course (McGuire, 2006). One of the biggest challenges to implementing the supplemental model of course redesign is to get students to attend the sessions (McGuire, 2006). McGuire's (2006) findings about supplemental instruction show that students only attend SI sessions if there is an upcoming quiz or test (McGuire, 2006). Other challenges to supplemental instruction include getting instructors to embrace supplemental instruction and reaching students who do not feel comfortable with such a course structure (McGuire, 2006).

### **The Buffet Model**

A fifth model of redesign is the buffet model, which can be conducted as a class online or face-to-face. It offers real-time instructor assistance and offers different pathways for different students in one class to achieve the same goal. In the buffet model, student learning is customizable based on individual academic background and previous experience in the course. The course itself meets either face-to-face or online, and students complete their work how they choose, such as attending lectures from their instructor, working in a math lab, or working in groups to complete their objectives. The buffet model hinges on students knowing how they best learn and complete their course objectives. Furthermore, if during the course an instructor thinks the course structure should change from one format to another (i.e., face-to-face to online or vice versa), then the instructor can make this change if it is what the students want (*The buffet model*, 2008). In this model, students are offered a range of options for learning depending and the course content is completed in modules. Students also receive a learning contract to inform them of the objectives they must accomplish;

faculty use the outcomes students have in the course to determine what learning styles and opportunities work best in future buffet model course offerings (*The buffet model*, 2008). One example of a successful buffet model comes from the Ohio State University in their statistics class, where the institution saw a slight decrease in withdrawals, failure rates, and a slight increase in retention (*The Ohio State University*, 2008).

However, there are both benefits and drawbacks to implementing this model. Some of the benefits include the ability to evaluate each student's preferred method of learning to tailor the course to their own experience, create customized learning plans, and offer real-time instruction if applicable (Twigg, 2013). The model does have a critic in Salman Khan, who argues that "the buffet approach to curriculum...leaves graduates with general impressions about many topics but few applicable skills" (Kolowich, 2011). In addition to being difficult to implement for faculty, students reported disliking the experiential learning aspect of the course. If students are told they are constructing their own learning, it is an unattractive prospect (Polly, 2012). That would present a major challenge to both instructors and students, especially at DTCC where students are used to being told what to do and how to do it.

### **The Linked-Workshop Model**

The sixth model of course redesign is called the linked-workshop model. This contains, to some extent, all six elements from Table 1. The term linked-workshop model has evolved over time to be used interchangeably with the corequisite model based on the literature and a discussion I had with someone who works at NCAT. The

linked-workshop model is listed on the website and is a corequisite model by nature. When I contacted the NCAT to ask why, I spoke with NCAT Vice President Carolyn Jarmon. She said the corequisite approach is a newer term coined by the non-profit organization Complete College America and that the linked-workshop model was the specific type of corequisite redesign model developed by Austin Peay State University (APSU). The terms have come to be interchangeable over the years (C. Jarmon, personal communication, September 27, 2016).

In the linked-workshop model, which is a corequisite model, students who are placed into developmental classes are instead placed into college level classes with those students who do not need remediation. The difference is that students who are deemed to need remediation must attend just-in-time workshops that help keep them current with their college level math class (*The linked workshop model*, 2008). This model was one of the original versions of the corequisite model, which derived from Mary Dimon's supplemental course instruction model at California State University-San Bernardino (1988); she studied the model for six years with her colleagues. Moreover, the linked-workshop model was used at Austin Peay State University (APSU) where they eliminated their developmental math classes in favor of the linked-workshop model. They experienced success with the model and saw pass rates in one of their college math classes increase from 33 to 70.5 percent (*Tennessee Board*, 2009).

This success rate was excellent for a four-year college, and the Board of Regents took it one step farther by piloting it at other community colleges as well. The

results were similar when 1,019 students from ten community college campuses were placed directly into college-level statistics in addition to a mandatory support class; the pass rate increased 50 percent from the first semester to the second (Denley, 2015). In addition, the pilot was run at seven other community colleges in English with similar results and a 30 percent greater pass rate from the first to the second semester (Denley, 2015). This evidence demonstrates that the model is transferrable to community colleges as well. More importantly, students who were a part of the linked-model mathematics classes had an almost 15 percent greater fall-to-fall retention rate and a higher level of credit compared with students who were not a part of the math pilot along with a higher level of credit hour completion (Denley, 2015).

However, there are some drawbacks to this newer model, which indicate that “even to the extent that corequisite remediation is effective, it is not clear precisely what practices work best for different subject areas and students” (Belfield, Davis, & Lahr, 2016). Furthermore, the authors suggest that there are implementation issues regarding how to change the culture of a college to embrace the linked-workshop model so there is buy-in from not only students but also faculty and the administration (Belfield, Davis, & Lahr, 2016).). Since the model is newer, there may be more challenges that come to light in the future.

### **Conclusion**

The six models of course redesign from the NCAT have points of commonality and are also different from each other. Some of them move the instruction out of the classroom to online (fully online, replacement, and emporium), while others are more

adaptable to student learning needs (supplemental, buffet, linked-workshop). Part of the difficulty for DTCC lies in its context. It seems students are not as motivated and self-directing in courses with heavy online components, and studies have shown that “because online education programs are non-traditional learning formats, students do not have access to support resources available to those enrolled in traditional programs” (*Online education*, 2013). Furthermore, Peters’ study determined that the absence of peer-to-peer and teacher-to-peer interaction “accounts for 27.3 percent of the reasons for dropout” (Lee, 2000). Lockett also found that when students interact with their peers on a regular, social basis, there is less chance of attrition from the course and a higher likelihood that students will continue to remain strongly motivated” (Lee, 2000). All of those factors are extremely important when considering which model of course-redesign to use. However, it all depends on the context of the school, which is why the issue of redesign will be explored further.

Table C.5  
*Pass rate comparison of the six models*

School	Model	Course	Outcomes
<a href="#"><u>Carnegie Mellon University</u></a>	Supplemental	Introduction to Statistical Reasoning	95 percent pass rate
<a href="#"><u>Portland State University</u></a>	Replacement	Introductory Spanish	Higher pass rate
<a href="#"><u>University of Idaho</u></a>	Emporium	Precalculus	More As and Bs Fewer Cs and Ds
<a href="#"><u>University of Southern Mississippi</u></a>	Fully Online	World Literature	10 percent fewer Ds or Fs
<a href="#"><u>Ohio State University</u></a>	Buffet	Introductory Statistical Concepts	Fail rate now just 3 percent
<a href="#"><u>Austin Peay State University</u></a>	Linked Workshop	Mathematical Thought and Practice	Pass rate increase: 33 percent to 70.5 percent

*Note.* Click on school names to see links.

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## **Appendix D**

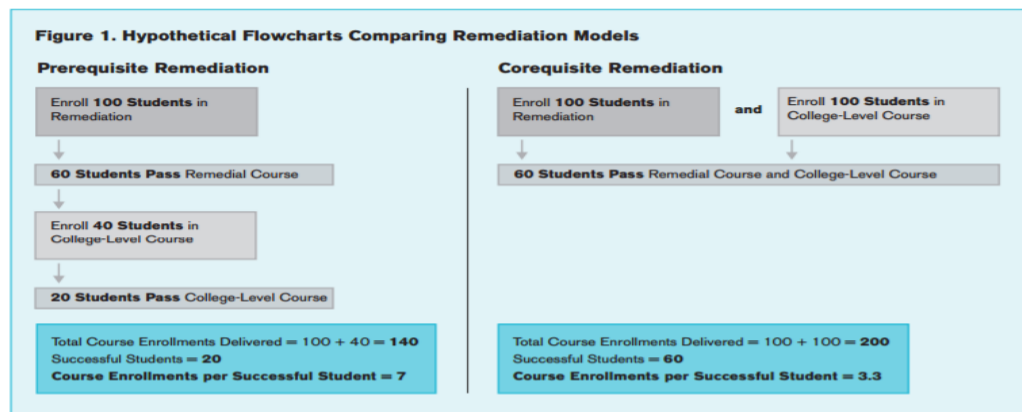
### **ARTIFACT 3: THE COREQUISITE MODEL**

## **Problem Statement**

A major problem at Delaware Technical Community College (DTCC) is the large number of students who take and subsequently fail developmental math courses before they enter a degree program. The tuition cost of a degree for students who take these classes is higher, and they take longer to earn their diploma because they must take one or more developmental classes before starting their college-level work. Moreover, many faculty hours and academic resources are devoted to developmental classes. Developmental math classes take resources away from various academic areas and students who need those resources just as much. Developmental pass rates could be improved at DTCC by using the corequisite model; this logic is based on previous research about the corequisite model coupled with statistics from several institutions. While there is no formal definition of the corequisite model in the literature that I was able to find, I have seen the term used often and in many different sources. Based on research, the corequisite model could be an effective solution to solve math low math pass rates at DTCC. I will discuss how the corequisite model differs from a pre-requisite model, the three generations of corequisite models, several examples of the corequisite model in action and related evaluations, and then, other criticisms and other considerations of the model. Finally, I will discuss why the corequisite model might work in DTCC's context and possible implications for implementing a corequisite model at DTCC.

## Different Ways to Deliver a Corequisite Model

For an overview of three corequisite models, please first see Figure 1, which describes the differences between the prerequisite and corequisite models. All examples discussed later (pathways, accelerated, and linked-workshop) are corequisite, but it is first important to see the difference between this model and a prerequisite one to understand what the corequisite model tries to accomplish. All of the examples of the corequisite model later described in this artifact have different names but are designed to accomplish the same goal.



*Figure 1.* Source: Belfield, C., Jenkins, D., and Lahr, H. *Is corequisite remediation cost-effective? Early results from Tennessee.* Retrieved from <https://ccrc.tc.columbia.edu/media/k2/attachments/corequisite-remediation-cost-effective-tennessee.pdf>

The corequisite model is a recent strategy that has been used more often colleges and universities over the past few years. Many schools have implemented it to improve developmental education for their students. The corequisite model places students who need remediation into credit-bearing college courses provided they take a corequisite course. This corequisite course offers students assistance through just-in-

time instruction, supplemental computer activities, and other practice designed to support the course. Such activities have required attendance (*Complete College America*, 2012). Through this model, supplemental academic assistance is offered in the form of a corequisite course rather than a pre-requisite one (*Complete College America*, 2012). In fact, the corequisite model can be offered to developmental students in several ways. While there are different implementations of the corequisite model, the goal is to support and encourage shared learning (*Complete College America*, 2012).

Research indicates that a corequisite model of developmental instruction can lead to better grades, increased levels of student course completion, and a higher level of retention from year to year (Mullins, 2016). In fact, regardless of the type of implementation, the corequisite model is working well at several institutions and statistical evidence supports those claims. For example, Complete College America, a national non-profit, reports that West Virginia's and Tennessee's different implementations of the corequisite model led to pass rates in English courses that are twice the rate of students who are enrolled in traditional developmental education. Moreover, in math courses, the pass rate in corequisite courses was almost six times greater than those of students in non-corequisite math courses at the developmental level (Vandal, 2015). In addition, national research, as well as preliminary evidence from Trade Adjustment Assistance for Community College and Corporate Training (TAACCCT) grantees, indicates that both concurrent remediation and

contextualization can have a major impact on adult learners. (*Accelerated strategies series*, 2016).

### **Corequisite Model Background**

Before it was officially called the corequisite model, some colleges matched credit-bearing college mathematics courses and introductory science courses with a corequisite developmental mathematics course required for those students who did not initially place into college-level courses. This model is considered the first-generation corequisite model in the literature. Developmental-level students who take these courses receive credit for not only the corequisite course but also the college-level course (Edgecombe, 2011). Two different instructors traditionally taught these courses but worked closely with each other to make sure the material and terminology being taught was the same. One instructor taught the college-level course and another instructor was responsible for the corequisite course where developmental and just-in-time instruction occurred (Cullinane, 2012). Laughlin, Nelson, and Donaldson (2011) suggest that team teaching is a best practice that can benefit adult learners in particular (Laughlin, Nelson, & Donaldson, 2011).

A second generation of the corequisite model has evolved over time. In this model, the structure and delivery is more fluid. Sometimes, peer tutors are involved and the college-level and corequisite courses may also be synced with a student success course or other required components that students must complete to pass (Cullinane, 2012). As a result, students can complete both courses in the same amount time as their non-remediated peers, and earning college credit.

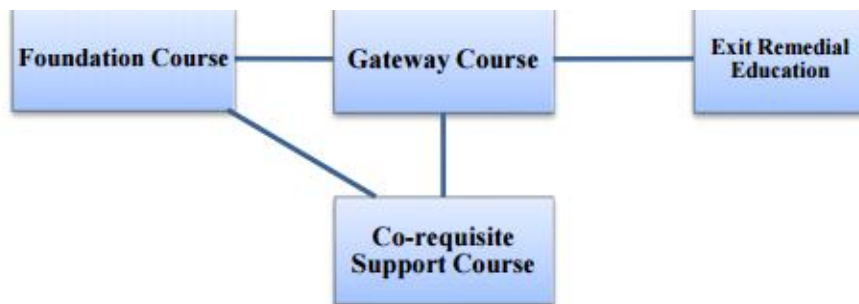
Finally, a third generation of the corequisite model involves quickened learning to help students complete their developmental education. Despite the word “accelerated” in the title, the courses themselves are not necessarily sped-up to support the students’ work in their college-level class to which the corequisite course is tied. Rather, accelerated learning is the idea that students who would normally place into developmental classes are able to accelerate the time in which they complete them; therefore, students exit remediation more quickly. While the developmental course is rigorous, the goal is to enable students to complete their developmental requirements in fewer semesters while at the same time earning college credit (Bailey, Jaggars, & Scott-Clayton, 2013). Several of these accelerated programs involve educational assistance for not only students but also instructors, in the form of professional development activities and other collaborative undertakings that help teachers to stay energetic and mentally stimulated in this endeavor (Bailey, Jaggars, & Scott-Clayton, 2013).

### **Three Specific Program Examples**

To further illustrate the corequisite model, three specific program examples will be discussed: pathways, accelerated learning, and linked-workshops.

**Pathways.** One example of the corequisite model is found in the University of Georgia’s state college system. In this example, students who place into more than one developmental course are given a way to exit remediation and/or developmental education to accelerate the rate at which they earn their degree (Abbott, 2014). Here, students take their developmental course with their college-level course. The

difference is that the University of Georgia is creating specific pathways for students to follow to exit remediation. Each pathway depends on the math courses the students need for their major. The sample chart below from Abbott (2014) shows how a student is enrolled in a basic course (such as a student success course) and a college-level course supported by a corequisite:

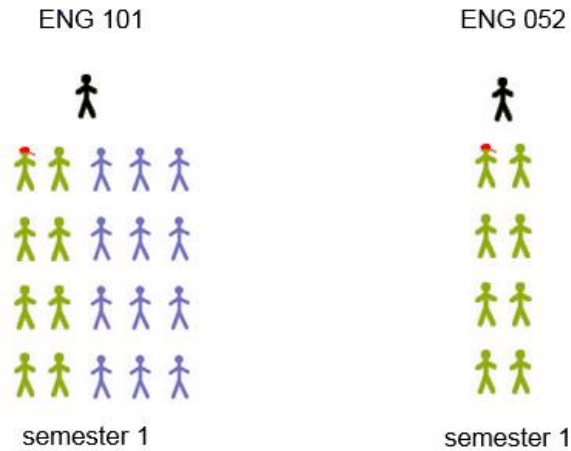


*Figure 2. Pathways.* Source: Abbott, A. *Issues in remedial education: Special focus on the state of Georgia.* (2014). Retrieved from <http://www.abac.edu/wp-content/uploads/2014/07/Issues-in-Remedial-Math-EducationFocusing-on-the-State-of-Georgia.pdf>.

The objective is that by creating pathways, students can increase the rate at which they earn their degree. On the other hand, “some critics fear that defining pathways does not allow students to make their own choices and deters them from figuring out what they want to do,” (*Group: Students need ‘pathways,’* 2016). While this criticism may be valid, the fact that students have a way to exit remediation is still important.

**The accelerated learning program.** A second example of the corequisite model is used at The Community College of Baltimore County (CCBC). Starting in 2007, students who initially placed into developmental classes were able to enroll in both ENGL 101 and a three-credit corequisite (ENGL 052) that students attend right

after ENGL 101 (Cho, Kopko, Jenkins, & Jaggars, 2012). This program is known as the Accelerated Learning Program (ALP). Please see figure 3 and the accompanying description below to understand how it works.



*Figure 3. CCBC accelerated learning program.* Source: Cho, S.-W., Kopko, E., Jenkins, D., & Jaggars, S. S. (2012). *New evidence of success for community college remedial English students: Tracking the outcomes of students in the Accelerated Learning Program (ALP)* (CCRS Working Paper 53). New York: Community College Research Center.

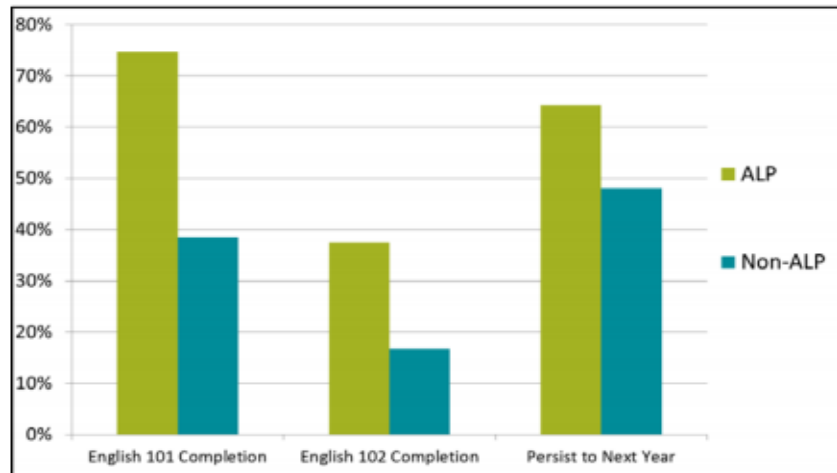
With the above illustration, eight students co-enroll in ENG 052 while simultaneously being enrolled in ENGL101 at CCBC; therefore, a cohort of students who are taking these classes can concurrently fulfill their developmental and college-level English requirements. To determine if there was actually any benefit to this type of model, Cho, et. al. (2012) conducted a study where they analyzed three different cohorts of ALP students in consecutive semesters beginning in the fall of 2007 and followed them through to the fall of 2011. They contrasted their results to a comparison group of non-ALP students. The final sample consisted of 592 ALP students enrolled in ENGL052 and ENGL101, and 5,545 students who were enrolled

only in ENGL052 (Cho, et al., 2012). They used descriptive statistics and multivariate regression to make their comparisons while controlling for demographic, socioeconomic, and enrollment traits along with placement test results (Cho, et. al., 2012).

The study reached several conclusions that support this example of the corequisite model as having positive effects on developmental students' passing rates and rates of retention. First, ALP students exceeded the performance of students enrolled in just ENGL052 in several measures, including ENGL101 and ENGL102 completion rates, persistence into the next academic period subsequent to taking ENGL052, and the number of credit-bearing, college-level courses attempted and completed after ENGL052 (Cho, et. al., 2012).

These results demonstrate that a corequisite model may be a good alternative to current academic models of developmental education because, if it is effective in both an urban and suburban community college setting, it may be transferrable to DTCC. CCBC uses this model in both urban and suburban settings, and it has a diverse population (Cho, et. al., 2012) just like DTCC. Based on this analysis and that of other subgroups, the researchers conclude participation in the ALP model led to much improved outcomes for students enrolled in it via ENGL101 and ENGL102, which was the original purpose of the ALP. The researchers' results are presented in Figure 4. Furthermore, the positive correlations noticed in the descriptive statistical analyses hold true across demographic and earnings levels (Cho, et al., 2012).

**Figure 1**  
**Selected Raw Outcomes of ALP and Non-ALP Students Through Fall 2011**



*Figure 4. ALP outcome results.* Source: Cho, S.-W., Kopko, E., Jenkins, D., & Jaggars, S. S. (2012). *New evidence of success for community college remedial English students: Tracking the outcomes of students in the Accelerated Learning Program (ALP)* (CCRS Working Paper 53). New York: Community College Research Center. Figure 1 was from the graphic itself and could not be eliminated; this figure is number 6 for the purposes of this paper.

**ALP Concerns.** However, some concerns have been raised over this ALP model, namely that the nature of CCBC’s instruction in ENGL052 would lead to lower pass rates. They posit that instructors would set their expectations low so that a large number of students do not fail as a result of the quickened pace (Cho, et al., 2012). In addition, the college-prepared students sharing the ENGL101 classroom could be affected by the mere attendance of having remedial students in the same classroom (Cho, et. al., 2012). However, based on the results of ALP and non-ALP peers, both groups performed equally well regarding concerns one and two, yet there was a dip in performance by non-ALP students in ENGL 102. The authors attribute this concern to the possibility that the instructor spends more time in class catering to the underprepared students, but that is only a guess (Cho, et. al., 2012). Furthermore,

the results in this study also confirm those in a similar study by Jenkins, Speroni, Belfield, Jaggars, and Edgecombe (2010) about CCBC's ALP. The results of this study found that over 80 percent of ALP students passed ENGL 101 within one year, while nearly 70 percent of non-ALP students succeeded, a net difference of 10 percent.

In addition, almost 35 percent of the previously mentioned ALP students passed ENGL 102, a 20 percent increase when compared to students not enrolled in the ALP (Jenkins, Speroni, Belfield, Jaggars, and Edgecombe, 2010). Moreover, the results demonstrate that, when compared to the conventional approach, ALP increases the amount of cost savings for students in terms of succeeding in ENGL101 and ENGL102 (Jenkins, Speroni, Belfield, Jaggars, and Edgecombe, 2010). The study also noted that the positive outcomes associated with the ALP are greater than twice the costs of the program (Jenkins, Speroni, Belfield, Jaggars, and Edgecombe, 2010). The overall point of both of these studies is to demonstrate the positive correlation between the ALP approach to corequisite developmental education and improved outcomes in a variety of areas important to community colleges like CCBC, which has a diverse student population and success with the English ALP.

**The linked workshop model.** A third example of the corequisite model was implemented at Austin Peay State University (APSU) in Tennessee. While APSU officially called it the linked-workshop model (LWM), it is still a corequisite model. They used this model in response to poor student success rates in developmental courses. As a result, APSU eliminated developmental math courses in elementary and

intermediate algebra in favor of the linked-workshop approach. This approach preserved the same number of classroom hours as the traditional course, but it substituted developmental courses with extra, required just-in-time workshops. At these workshops, students performed activities both in small groups and individually (*Tennessee Board, 2009*). Students previously placed in developmental math courses now were placed into credit-earning core mathematics classes alongside their peers who did not require remediation; however, the students requiring remediation took a corequisite as well (*Tennessee Board, 2009*).

Developmental students attended required workshops, were given a diagnostic assessment the first day of class, and received a customized report on where their deficiencies were so they could improve their performance. These workshops included computerized assessments and individualized tutoring assistance from trained staff to help students who struggled with various concepts (*Tennessee Board, 2009*). Through the redesign, students have the opportunity to earn their degree in the same time frame as their peers who do not require remediation.

By removing its developmental math classes, APSU saved classroom time, space, and it was able to reallocate its educational resources to other departments (*Tennessee Board, 2009*). Before the redesign, about one-third of students successfully completed the developmental math courses. After its implementation, the pass rate increased substantially from 33 to 70.5 percent (*Tennessee Board, 2009*). APSU's model improved student achievement, and it is now recognized by the National Center for Academic Transformation (NCAT) as an official course redesign best practice.

This corequisite model appears to be an effective form of course redesign for improving pass rates, retention rates, and increasing the number of credits attempted (and passed) by developmental students. Please see [http://www.thencat.org/States/TN/TN percent20Outcomes percent20Summary.htm](http://www.thencat.org/States/TN/TN%20percent20Outcomes%20Summary.htm) for a snapshot of successes as a result of implementing the corequisite redesign model at several colleges and universities in Tennessee based on data collected from the Tennessee Board of Regents.

One limitation of this model was noted, however. Belfield, Jenkins, and Lahr (2015) argue that “the corequisite model has not yet been subjected to rigorous evaluation . . . Tennessee community colleges were in the process of implementing an array of very substantial reforms that may have had a bearing on student outcomes” (Belfield, Jenkins, & Lahr, 2015). From this perspective, the improvements could be the result of a variety of policy changes and other reforms. However, APSU still has the increased pass and retention rates to demonstrate that in its case, its implementation of the corequisite model worked well.

### **Other Criticisms and Considerations**

While the corequisite model and examples described above have data that support their use, critics voice concern about it. One criticism circles back to the academic preparation and needs of students. Smith (2016) argues that the corequisite model may not necessarily serve students with the highest levels of need, and as such, the corequisite model is not viewed as an adaptable, one-size-fits-all for all students

(Smith, 2016). The model is new and further research is needed based on other institutions and at DTCC to determine if implementing a model is recommended.

Kentucky is another state with a corequisite model of remediation in its state university system; however, Steve Newman (2015) argues that since there is little to no collaboration between K-12 and the state university system such that many questions remain unanswered about the corequisite model (Newman, 2015). Despite promising data, Newman has concerns such as the academic integrity of corequisite courses, the lack of graduation rate data compared with other underprepared students who did not undergo corequisite remediation, and the lack of longitudinal data on students who were a part of the corequisite cohort initially. Newman also wants to know what happens after successful completion of the corequisite cohort in other courses that are not set up using a corequisite model (Newman, 2015).

Although the research is limited, there are pedagogical and andragogic reasons that the corequisite model may have value. Adult learners are a distinct population, and Pappas (2013) indicates Knowles believes that adult learners possess four traits: self-direction, deep life experience, willingness to learn, and intrinsic motivation. Intrinsic willingness and motivation to learn are characteristics conducive to the use of the corequisite model. If adults are intrinsically motivated and more open to learning, then the newer corequisite model could help them learn more effectively. However, while using Knowles' model of andragogy is helpful as a theoretical framework, DTCC's population may not necessarily exactly reflect the audience Knowles had in mind. Therefore, it is necessary to strike a balance between theory and practice as

DTCC's population may not be as self-motivated as the original audience Knowles envisioned. At the same time, though, when I talked to the head of the LWM at APSU, he said the subsequent longitudinal studies conducted by APSU and CCBC indicate that adult learners are actually more successful when placed into a corequisite model than those students who place directly into college classes. The corequisite model appears to be more conducive to their needs and characteristics (Director of Academic Support Center, personal communication, November 30, 2016).

### **Implications for DTCC**

The rationale for selecting a corequisite model over other course redesign models is that it is an opportunity to increase the pass rates, retention rates, and ultimately graduation rates at DTCC. DTCC students need strong guidance in their developmental math courses and need other supports given the diverse population. However, more research from the perspectives of other institutions who use the examples of the corequisite model described above is needed. In addition, it is necessary to survey the student and faculty populations in DTCC's developmental math courses to determine if there is support for using such a model here. A new approach to developmental math education may be necessary because previous math course redesigns, such as the emporium approach, have not been effective in solving the problem of pass rates and retention rates.

If DTCC implemented this model, there would be many effects. First, the model could help tackle a college-wide issue, which is the number of students who must take developmental courses before they enter their major. The rate of success for

students in these courses is low. An instructional coordinator in the math department said that in the emporium model, which the math department at DTCC has adopted for all of its developmental math classes, the pass rate hovers at an average of 20 percent on the first time a student takes the course; given multiple attempts at the course, the pass rate rises to 60 percent (K. Schutte, personal communication, August 7, 2016). DTCC needs to improve its pass rates in developmental math course and its retention rates significantly to fulfill its mission statement of student success and preparing students for transfer to four-year institutions and/or career placement. However, what are the challenges associated with implementing the corequisite model at DTCC?

DTCC implemented an ALP model for its English courses in 2013 and 2014, according to the chair of the English department at the Wilmington campus. The model had success in that students in the ALP classes passed college-level ENG 121 (Composition) and ENG 122 (Technical Writing and Communication) at higher rates than students not in the ALP program (personal communication, October 6, 2016). Previously, students would take developmental reading and developmental English courses prior to taking ENG 101. Students who placed below the developmental reading and English class level had to take more basic classes, which increased the amount of time it took them to reach ENG 101. The ALP's goal was to decrease the amount of English classes students took. However, it was discontinued when the English curriculum was redesigned and the new courses were run beginning fall 2013. Despite the discontinuation, the chair did say that students in the ALP enjoyed the support and camaraderie associated with taking two classes in the same cohort.

Students were also more motivated to complete both classes and did so with higher pass rates than those not in the ALP program. Perhaps the same successful ingredients (instructor and course support, student comfort with their cohort, among others) could be useful if DTCC implemented an ALP model in the math department.

Another challenge presented to DTCC would be the sheer amount of time that would need to be spent redesigning the current developmental math curriculum to create a corequisite model. One of the ways to address this challenge is to gather a curriculum design team and ask them to create a corequisite model for developmental math education, and then to pilot the same model at each of the campuses. This solution could benefit DTCC because if the task force aligned the corequisite model college wide, the successes and/or failures at each campus could be analyzed. Once data is gathered from the pilot program, then it can be presented to the dean of instruction's office at each campus to determine if such an endeavor is worthwhile to pursue.

### **Conclusion**

DTCC has an extremely diverse student population with varied learning styles, and the current developmental math redesign is not working as effectively as it should. Some research and evaluations at other institutions point to the efficacy of the corequisite model as it relates to pass rates, grades, and retention. However, rigorous research and evaluations have not yet been conducted. Based on the results of success of the corequisite model as demonstrated at APSU through the linked-workshop model and at CCBC with its ALP, I think it is something worthwhile to pursue because of the

increased pass rates in both examples. In addition, there is local anecdotal information suggesting that the corequisite model could work at DTCC, as evidenced by the reported success of the limited implementation of English ALP.

Lastly, DTCC has created a “Blueprint for the Future” whose goals include more transparency with institutional data, improving that data via pass rates, retention rates, and graduation rates by up to 10 percent in the next few years. DTCC could potentially accomplish these goals if it attempts to implement the corequisite model. However, it is necessary to conduct more research to determine if this model would be the best fit for DTCC by comparing its context to other institutions that have adopted the corequisite model of developmental math education. Bringing such reform to DTCC would be impactful if well researched and carried out through evidence-based decision making. The way to know if a corequisite model will work at DTCC is to carefully evaluate the benefits of implementation with careful attention to institutional context and student learning outcomes. Implementing this course redesign at DTCC could save our students time and financial resources, and it would allow for a reallocation of DTCC’s academic resources if there is less of a need to focus on developmental math. If successful, it could also be scaled-up to other developmental course sequences. Given DTCC’s diverse student population and its previous track record of less than effective developmental math course redesigns, this model could work here. However, more research is needed to determine if it would be feasible to implement.

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**Appendix E**

**ARTIFACT 4: DTCC DEVELOPMENTAL MATH SURVEY ANALYSIS**

## **Executive Summary**

Developmental mathematics pass rates at DTCC have remained the same or decreased for a number of years despite two different course redesigns. Surveys were conducted internally to determine faculty and student perceptions of developmental mathematics at DTCC, along with their perceptions of other developmental math course structures.

**Question 1:** What is the faculty awareness of alternative approaches to developmental math instruction?

**Question 2:** What do faculty and students perceive as barriers for students trying to pass developmental math courses?

**Question 3:** Is there support among faculty and students for a different approach to developmental math instruction?

Results from research question 1 indicate that there is awareness on the part of faculty for some, but not all, alternatives to developmental math course structures. Results from research question 2 indicate that faculty and students perceive some common barriers for students in passing their math classes. At the same time, there are some differences among their responses. Lastly, results from research question 3 indicate that there is support for an alternative developmental math course structure at DTCC.

## **Purpose and Organization of Report**

Developmental mathematics course pass rates at Delaware Technical Community College (DTCC), a two-year college with urban, rural, and suburban

locations, have been hovering at 50 percent or below for the past several years. In the last six years, there have been two attempts to solve this problem through course redesign. The first redesign switched from a primarily face-to-face style developmental math instruction to an Emporium model. After a lack of significant improvements in pass rates, the math courses were redesigned again, this time returning to face-to-face course delivery. Data has been published for the Fall 2016 semester and suggests a slight, but not major improvement. Please see Table 1 below.

Table E.1: *Fall 2016 math pass rates, as percent*

Course type	MAT 005	MAT 010	MAT 020	MAT 140
Dover	89.11	60.93	30.07	36.36
Georgetown	74.18	54.10	66.06	55.56
Stanton	70.09	42.63	51.31	32.98
Wilmington	78.09	48.64	57.74	62.50
Average pass rate	77.87	51.58	51.30	46.85

To further understand the internal context of developmental education at DTCC, I conducted faculty and study surveys to assess their perceptions of developmental math along with the support for changing the course delivery method. First, the research questions and their importance will be described. Next, the sample, instruments, data collection, and analysis are discussed. Then, the results and a brief

discussion of each research question are presented. Finally, limitations and future use of this investigation are considered.

### **Research Questions**

For this analysis, I selected three research questions to investigate. Other relevant information was collected and compared for both faculty and students about the developmental math program at DTCC. The research questions are:

**Research question 1:** What is the faculty awareness of alternative approaches to developmental math instruction?

**Research question 2:** What do faculty and students perceive as barriers for students trying to pass developmental math courses?

**Research question 3:** Is there support among faculty and students for a different approach to developmental math instruction?

The first research question is important to answer because math faculty members have implemented two different math redesigns in the past six years. The first redesign was a departure from the traditional face-to-face, lecture-based mathematics instruction to the emporium model of instruction. The second redesign represents a return to lecture-based mathematics instruction from the emporium model of instruction in conjunction with a large curriculum overhaul. Knowing whether faculty have familiarity or experience with alternate corequisite approaches will be helpful when proposing new course designs.

The second research question is important because it is necessary to understand what barriers are of concern to both faculty and students. Also, it is important to see if

there are commonalities or differences to what faculty and students perceive as barriers to success.

The third research question is important to answer because it can help determine if a corequisite model of instruction is a good fit for DTCC. It is necessary to see if there is potential support among faculty and students for a different developmental math course structure.

### **Sample**

I contacted faculty and students to complete surveys. For the faculty survey, among the approximately 100 full-time and part-time mathematics instructors who teach MAT 005, MAT 010, MAT 020, and MAT 140, one instructor was randomly selected for each course from each of the four DTCC campuses for a total of 16 instructors. In addition, the four chairs of the math department were given the surveys as they also taught one or more of the developmental math classes at DTCC. This resulted in a sample of 20 faculty members, all of whom completed the survey.

Faculty respondents' demographic information is presented in Tables 2 and 3. Faculty course structures (some teach more than one type) appear in Table 4. Faculty demographics for this survey are as follows: 84.21 percent of respondents were white, 5.26 percent identified as Hispanic/Latino and Black/African-American respectively, and 5.26 percent identified as Asian/Pacific Islander. The gender breakdown was 61.11 percent female to 38.89 percent male. Faculty identified themselves as either full-time (57.89 percent) or part-time (42.11 percent). In terms of age, 26.31 percent

identified themselves as being 21-33 years old, 15.79 percent were 34-41 years old, and 57.89 percent were 45 years or older.

Table E.2: *Faculty information as percent*

Employment	Full-time	Part-time		
status	57.89	42.11		
Gender	M	F		
	38.89	61.11		
Age	21-33 yr.	34-41 yr.	45+yr.	
	26.31	15.79	57.89	
Primary Campus	Stanton	Wilmington	Dover	Georgetown
	25.00	25.00	25.00	25.00

Table E.3: *Faculty demographic information as percent*

White	84.21
Hispanic/Latino	5.26
Black/African American	5.26
Native American/American Indian	0.00
Asia/Pacific Islander	5.26
Other	0.00

Table E.4: *Faculty class structures, as percent*

Fully online	47.62
Face-to-face	85.71
Hybrid	53.38
Emporium	85.71

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For the student survey, entire class rosters of 20 randomly selected sections of MAT 005, MAT 010, MAT 020, and MAT 140 collegewide (five sections for each course) during the Fall 2016 semester were selected. Thirty-five percent (35%) of students responded, which is a rate comparable to that for standard course evaluations. Student respondents' information is presented in Tables 5, 6 (demographics), and 7 (course structure).

Student demographics for this survey are as follows: 38.46 percent of respondents were white, 20.51 percent identified as Hispanic/Latino, 21.79 percent identified as Black/African-American, and 5.26 percent identified as Asia/Pacific Islander, 10.26 percent identified as Native American/American Indian, 3.85 percent as Asia/Pacific Islander, and 5.13 percent as other. The gender breakdown skewed 55.13 percent female. For employment status, students identified themselves as full-time (23.08 percent), part-time (38.46 percent), unemployed (29.49 percent), or "other" (8.97 percent). For school attendance status, the breakdown was an even 50-50 for full-time and part-time. Lastly, the breakdown by campus was 19.23 percent for Stanton, 34.62 percent for Wilmington, 23.08 percent for Georgetown, and 23.08

percent for Dover. In their courses, 20.51 percent of students took MAT 005, 25.64 percent took MAT 010, 33.33 percent took MAT 020, and 20.51 percent took MAT 140.

Table E.5: *Student information*

Employment status	Full-time / Part-time / Not currently employed / Other 23.08% / 38.46% / 29.49% / 8.97%
Gender	M / F 44.87% / 55.13%
Primary campus	Stanton / Wilmington / Dover / Georgetown 19.23% / 34.62% / 23.08% / 23.08%
School status	Full-time / Part-time 50.00% / 50.00%
MAT Class	005 / 010 / 020 / 140 20.5% / 25.64% / 33.33% / 20.51%

Table E.6: Student demographics, as percent

White	38.46
Hispanic/Latino	20.51
Black/African American	21.79
Native American/American Indian	10.26
Asia/Pacific Islander	3.85
Other	5.13

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Table E.7: Students' class structure, as percent

Fully online	14.00
Face-to-face	53.85
Hybrid	7.69
Emporium	19.23

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Lastly, when looking at data for Table 8, even though 65.38 of students took their math class for the first time, 60.87 percent of students had failed the class before. While the mode failure rate was once, 45.83 percent of students had failed the class two or more times. This number is almost in line with the pass rates of MAT 010 and MAT 020 for the fall, so these results indicate that almost half of DTCC students in these classes are not passing.

Table E.8: *Previous student course data*

First time taking class	65.38%		
Failed class before	34.62%		
Number of times failed	1 (20.69%)	2 (24.14%)	2+ (55.17%)

### **Instruments**

Two instruments were used for this analysis. The first instrument was a student developmental mathematics survey, which I created and edited in conjunction with my ELP committee. The student survey contained a total of 33 questions, 26 of which pertained to developmental mathematics at DTCC and required a Likert scale or selected category response, two were open-ended questions about developmental math, and five were demographic questions. The faculty survey contained 34 questions, which I created and edited in conjunction with my ELP committee. The faculty survey contained 27 questions pertaining to developmental math instruction with Likert-scale or category response options, two open-ended items about developmental math, and five demographic questions. Both surveys were designed using Qualtrics and administered electronically during the 15<sup>th</sup> week of the semester to 223 students and 20 faculty.

Likert scale responses, which both surveys used in the majority of the questions, are as follows: “Strongly agree” (5 points), “Agree” (4 points), “Neutral” (3 points), “Disagree” (2 points), and “Strongly Disagree” (1 point). The non-Likert scale responses pertained to the five demographic questions, the two open-ended questions,

and questions that asked students and faculty to use a given list of options to describe characteristics of their class. These surveys are shown in their entirety in at the end of this paper.

### **Data Collection Procedures**

For both surveys, data were collected through Qualtrics. The faculty/staff survey was administered via an e-mail link in Qualtrics. Faculty were contacted via email (with all names BCC'd) and asked to take the faculty survey. The same procedure was used with students. Email reminders were sent in two consecutive weeks after the initial email to follow-up about the survey administration to students and faculty. Each survey respondent was assigned a random alphanumeric sequence in Qualtrics to ensure anonymity of responses. In addition, confidentiality and anonymity were ensured in the introductory email sent to faculty and students.

### **Data Analysis Procedures**

Items from both the faculty and student surveys were separated into Likert scale questions, class characteristic questions, and open-ended questions. I calculated descriptive statistics (mean, mode, and standard deviation) via Qualtrics for the responses to Likert scale and class characteristic items. For the faculty survey, the two open-ended question results about barriers and suggestions for improvement on each survey were coded according to Creswell's data analysis spiral (2007). I sorted the data, read and annotated it. Then, I ordered the data into codes, interpreted it, and made graphic representations of it. Codes for faculty were divided into five different categories: time, motivation, lack of effort, lack of skills, and other.

For the student survey, the two open-ended question results about barriers and suggestions for improvement on each survey were coded according to Creswell's data analysis spiral (2007). I sorted the data, read and annotated it. Then, I ordered the data into codes, interpreted it, and made graphic representations of it. I began with several coded categories for what students perceived as barriers to their math success and upon a second and third read-through of the responses, I was able to come up with six coded categories of time, job and family obligations, money, nothing, lack of ability, and other.

## **Results and Discussion**

**Research Question 1:** What is the faculty awareness of alternative approaches to developmental math instruction?

**Results.** To determine the faculty awareness of corequisite approaches to developmental math instruction, faculty were asked a series of questions starting out with a question about being generally aware of alternative structures for developmental courses and then questions asking about specific models. It was noted that 73.69 percent of faculty said they were aware of alternative structures with the mode response being 4.00 ("agree") and the mean response being 2.75 with a standard deviation of 1.22. When comparing different course structures, faculty respondents have a wide range of experience teaching a broad spectrum of classes.

Table 9 presents specific information about which methods of developmental math instruction faculty had awareness. When asked about their knowledge of supplemental instruction, 83.33 percent of faculty respondents indicated they knew

what supplemental instruction was. The mode response was 5.00 (“strongly agree”), the mean response was 3.42, and the standard deviation was 0.75. The next question asked faculty whether they were familiar with the corequisite model. The numbers dipped to 36.85 percent of faculty indicating they knew what it was; the mode response was 1.00 (“strongly disagree”), the mean response was 2.80, and the standard deviation was 1.60. Next, faculty were asked if they were aware of the linked workshop model of course redesign. This response was even lower with only 15.79 percent of faculty indicating they had heard of it. The mode response was 1.00 (“strongly disagree”), the mean response was 1.60, and the standard deviation was 0.99. Lastly, faculty were asked about their awareness of structured learning assistance. This number was higher, with 26.32 percent of respondents acknowledging they were aware of it; the mode response, however, was 1.00, the mean response was 1.40, and the standard deviation was 1.36.

Table E.9: *Faculty knowledge of developmental math course structures*

	Percent	Mean	Mode	Std. dev.
Generally aware	73.69	2.75	4.00	1.22
Supplemental instruction	83.33	3.42	5.00	0.75
Corequisite model	36.85	2.80	1.00	1.60
Linked-workshop model	15.79	0.75	1.00	0.99
Struct. learning assistance	26.32	1.40	1.00	1.36

**Discussion.** For this research question, I found answers to the question of faculty awareness of alternative developmental math course structures. In general, 73.69 percent of faculty were aware of other developmental math course structures and the mode response was 4.00. I would expect that math faculty would be aware of developmental course structures different from their own since DTCC faculty attend numerous professional development seminars, conferences, and meetings on curriculum and instruction. In addition, faculty often research best practices.

It is also not a surprising result that 83.33 percent of faculty had an awareness of supplemental instruction, especially since supplemental instruction for BIO 120 (Anatomy and Physiology) and MAT 020 (Elementary Algebra) is now offered college-wide as support for students. However, what is more surprising is the decrease in faculty awareness that occurred with 36.85 percent of faculty being aware of the

corequisite model, 15.79 percent being aware of the linked-workshop model, and 26.32 percent being aware of structured learning assistance. Even more interesting is the mode response of 1.00 indicating that most faculty strongly disagreed when asked whether or not they were aware of each model's existence. Lack of awareness indicates that maybe DTCC should host professional development sessions to educate faculty on alternative course structures.

While it is difficult to say why they are not aware of these different ways to structure developmental math courses, the lack of awareness indicates perhaps they need to be made aware of these alternative developmental math structures given the current research and changing state-wide developmental course legislation that has been passed within the last 10 years.

**Research Question 2:** What do faculty and students perceive as barriers for students trying to pass developmental math courses?

**Faculty responses.** In response to the open-ended question about barriers, faculty suggested five different categories of concern: time, lack of effort, motivation, students lacking basic math skills, and "other." Of the 20 responses this question received, there were six comments that indicated students simply do not have the time outside of class to devote to their developmental math education at DTCC. Some comments discussed the reasons for this lack of time and said that many students have work or family responsibilities that prevent them from completing assignments and studying on time. Others cited the inability to manage the time that students do have. A couple of faculty members also commented on the lack of effort students put into

their math classes. “They don’t work on math outside of class time,” wrote one instructor.

Several faculty members also commented on lack of student motivation, saying that students lack the “internal drive and determination” to succeed in their math courses. Another major category of responses indicate that faculty think students lack the mathematics preparation from high school or grade school that is necessary for college-level math. Three different respondents specifically mentioned students lack basic math skills like knowing their multiplication tables, knowing fractions, and knowing any kind of study skills necessary to succeed in their developmental math courses. “These [concepts] are assumed to be known at this level,” indicated one faculty member. Responses falling into the category of other include students not having gas money or transportation, underestimating course difficulty, and students do not correct the test they failed. Faculty believe students are underprepared and are not motivated to do the work; such responses indicate that the current math course structure may not be working as well as intended and that alternative course structures should be investigated.

**Student responses.** Before discussing the pass rates, this semester, the average pass rate for MAT 010 is 51.58 percent after the redesign; the average pass rate for MAT 020 is 51.30 percent; the average pass rate for MAT 140 is 46.85 percent. It is clear from these numbers that, despite the redesign, pass rates in the developmental courses students take most (MAT 010 and MAT 020) are still just above 50 percent. In addition, MAT 010 and MAT 020 are supposed to prepare students for MAT 140, and

that average pass rate was 46.85 percent, which is lower than the pass rates for MAT 010 and 020.

However, approximately 77 percent of students felt they could keep pace with the course, and overall students found the math success center and the math lab tutors to be helpful. In addition, students felt overall that their instructors were helpful and 61.54 percent said they felt confident they would pass the course. The math textbook was ranked least helpful element to the course. Despite these positive views, students still identified several barriers to their success in developmental math at DTCC.

As the six coded categories of barriers identified from the student survey shows, they perceived major barriers to be time, job and family obligations, money, nothing, lack of ability, and other. Several students commented that time was a barrier to them passing their current math class. One student indicated that “my time is the most valuable thing,” while several students simply stated that time was a significant barrier in their eyes. In addition to time, several students cited job and family obligations as being a barrier to their success. Some responses to the question included simply “job,” “single parent with a job,” and “I work two jobs.” There were other similar comments. Thirdly, students perceive money as being a barrier to them by indicating simply responses such as “money” and “financial aid.” The fourth category also contained a few responses that said there were no barriers to students passing their math classes, with one student commenting “none, I have a good instructor,” and “I passed it,” in addition to other responses saying “nothing” or “NA.” For the lack of ability category, sample responses indicated that students perceive themselves as “not

good at math” or that their “brain” was a barrier to them passing. Other similar responses lamented a lack of ability. Lastly, the other category included responses indicating students simply said they “don’t know,” don’t care,” “teacher stinks,” “a lot” of barriers, and “more face-to-face” instruction.

**Discussion.** There were several common themes among the responses from faculty and students. The two barriers to passing math classes that both groups often reported were a lack of ability and a lack of time. These responses may be indicative of the diverse student population DTCC has (time) and also the underpreparedness of students when they take math classes at DTCC. It is not surprising that faculty and students acknowledge these issues. Furthermore, money and financial aid were also common responses from faculty and students. Again, these responses are not surprising given the number of students at DTCC who seek and use several forms of financial aid as well as the number of students who pay for their courses out-of-pocket.

In addition, there were several responses on both sides indicating that there were no perceived barriers to students passing their math classes. Lastly, the responses that fell into the “other” category for students against some of the faculty comments on student motivation are very interesting. Looking at some of the student comments, it is clear that there may be some disregard for the course and students may not take it seriously. That attitude is also reflected in some of the “other” category comments which were sarcastic, like the student who, when asked about barriers to math success, wrote “Jersey barriers.” There were other sarcastic responses so it is interesting to note

that the teachers may be correct in saying that (some) students do not have the right attitude towards their math classes.

**Research Question 3:** Is there support among faculty and students for a different approach to developmental math instruction?

**Faculty response.** The quantitative data results can be found in the tables listed below. Significant findings include the result that 40 percent of faculty either strongly agree (25 percent) or agree (15 percent) that student pass rates could be improved if there was a different approach to the developmental math curriculum at DTCC. Thirty (30) percent were neutral on the issue and 30 percent either strongly disagreed or disagreed with equal percentages for both.

An interesting comparison to make is between which course structure is viewed as helpful to faculty and to students, respectively. Faculty view face-to-face and emporium courses as being most helpful to students, with the hybrid and fully online courses coming in last place. Students, on the other hand, favor face-to-face courses with emporium in second place, followed by emporium and hybrid in last place. It's interesting to note that faculty view emporium courses as most helpful whereas students view them as least helpful. That could explain the discrepancy between the implementation of the emporium and improved developmental math pass rates. However, the faculty mode was 3.00 and the student mode was 2.00, which indicates that faculty are more ambivalent about the emporium than students are.

Qualitative data regarding the faculty responses to about suggestions for improvement fell under four codes created from this analysis. There were initially

seven codes, but using Creswell's data analysis spiral I trimmed them down to four. They were structure, activities, time/motivation, and other. First, several faculty members commented that there needs to be a more structured syllabus and class schedule from what currently exists. One faculty member said to make the course structure "like a high school class with intro. to lesson, hw online, quiz at the end on a few topics with no retakes, and a test at the end of the chapter." Students also might have more structure via required lab time with instructors and tutors. A couple of responses discussed course activities and said that students need "hands-on activities that replicate the math skills being taught." Several responses also indicate that time and motivation are factors in students' inability to complete their course. These responses were often together. In addition, some instructors felt that students needed to come to class on time and stay for the required class time, and that students needed to get more motivated.

There were also a number of other responses that did not fit in a particular category. Those responses were: having a more customized learning experience for students, instruction was ok as is, and students should not learn materials at their own pace (as in online and emporium courses) and they should therefore stay together. Lastly, one person enthusiastically asked that there be more emporium.

**Student responses.** Student responded in the open-ended question that they strongly agreed (46.15 percent) or agreed (28.21 percent) that they would prefer to be placed in a credit-level course rather than a developmental course in their first semester of college. More importantly, almost 47 percent of students strongly agreed

and almost 25 percent of students agreed that they would be willing to take a support class if they were placed into a credit bearing math class in their first semester. On the other hand, for the qualitative data from students' response to the open-ended question about suggestions for improvement, I initially came up with nine different categories. After going back over the responses, and using Creswell's data analysis spiral, I whittled down the categories to six final ones, which were differentiated class structure, more instructor and tutor help, pathways, nothing, improved instruction, and other.

For the differentiated class structure, students commented that they wanted "fewer computer activities," "less lecture," and "more time spent on problems." Clearly with this sample of responses students are interested in having a different course structure to their math class. For the more instructor and tutor help, student responses overwhelmingly indicated that they wanted not only more help from their instructors but also more assistance from the tutors in the math success center or the math lab. Students indicated they wanted "more help from instructor," "more time with instructor," "more tutoring," and "more individual interaction with the professor." From this sample of responses, I conclude that students need more individual assistance from both their instructors and from tutors as well. For the pathways category, students indicated that they wanted a different pathway or another way to be finished with their math courses. While one student wanted math courses to be tailored "to fit across as many majors as possible," two other students wanted to eliminate math altogether and wondered why they had to take it. Other similar

responses regarding pathways and an exit to their math courses shows that students are not satisfied with the developmental math sequence they must complete before starting their major.

For the nothing category, several students indicated that “nothing” was wrong with their math experience. For the improved instruction category, a few responses asked for “better teachers.” For the “other” category, several students’ comments fell into areas that were not best included with the above six codes. For example, students cited ways to improve their math experience, such as “easier grading,” “financial aid,” and one said, “this class sucksss [sic].” The rest of the responses that fell into this category were not serious or commented on some of the options in the survey, such as the inability to skip certain questions or the lack of an “NA” option for some responses. However, some of those comments circle back to what the instructors said earlier about students not taking their math course seriously.

**Discussion.** The responses to these questions by faculty and students did not overlap as neatly as with the question about barriers, but there was some commonality. For example, some students and faculty both thought that nothing at all needed to be done with the math instruction. However, other responses from both faculty and students criticized the structure and curriculum of the developmental math courses. These responses are interesting to note, because these survey comments support the case that developmental math instruction should be changed to improve student pass rates and retention rates at DTCC. Moreover, the comments from students that fell into the “other” category are interesting to note. Many encompass “life” problems like

having no transportation, but others demonstrate that students were outright hostile toward their math class by either denigrating it or saying they wanted a different pathway out of math. That result is most interesting because there were responses indicating that people did not want to take math and that they wanted pathways away from it. I interpret those results to mean that there are several students (and could be many more who did not receive or respond to this survey) who are dissatisfied with the developmental math curriculum and expressed those sentiments.

In addition, the time/motivation responses from the faculty mean instruction at DTCC can be improved and that there is some support for a different approach to developmental mathematics here. This notion comes through in student responses as well. Responses to questions about alternative developmental math course structures show student support for a corequisite approach. Faculty also demonstrate varying levels of support for alternative math structures. Tables 10 and 11 also indicate that faculty and students view face-to-face course structure as most helpful; a face-to-face structure is an important aspect for the implementation of the corequisite model.

Table E.10: *Faculty views course structure as most helpful (“Strongly agree”)*

Course type	Percent	Mean*	Mode*	Std. dev.*
Fully online	9.09	3.55	3.00	1.23
Face-to-face	42.86	1.86	3.00	0.83
Hybrid	15.83	2.69	3.00	0.82
Emporium	16.67	3.11	3.00	1.20

\**Note.* Mean, mode, and standard deviation are in Likert scale units.

Table E.11: *Student views course structure as most helpful (“strongly agree”)*

Course type	Percent	Mean*	Mode*	Std.dev.*
Fully online	4.55	3.23	2.00	1.24
Face-to-face	28.57	2.21	4.00	1.03
Hybrid	12.50	3.25	3.25	1.25
Emporium	12.50	3.71	2.00	1.21

\**Note.* Mean, mode, and standard deviation are in Likert scale units.

Piggybacking on the above table, I found that students tend to view the Math Success Center, the math tutors, and their instructors as helpful in terms of the “strongly agree” Likert score. However, over a third of students do not feel confident passing the class. Thus, what can DTCC do to help their students gain more confidence so they can be successful in their math courses and be retained by the college in the long-term? Pass rates for the new redesign appear below and show slight improvement, but not much.

### **Limitations and the Future**

While this survey of faculty and students was by no means comprehensive or longitudinal, it creates a snapshot of the current developmental math courses at DTCC. Moreover, it gives an insight into how faculty perceive other developmental math course structures, what barriers faculty and students perceive to exist, and whether or not students and faculty support different developmental math structures or instructional modes.

**Limitations.** A few potential limitations stood out. The first is that the mean age response of faculty to the survey was on the higher end of the categories. Faculty who are older and have been at DTCC for a long time may be resistant to change. In addition, while the original intent was to give the survey to students earlier on in the semester, the survey was given later than hoped. This late timing could have impacted the survey results since students might have been more focused on their current class or situation rather than reflective of their past math coursework. Students at that point were almost done with classes, so there was the added stress of taking a survey, which could have affected the response rate. In addition, most likely attrition occurred in most or all of the sections surveyed because some students dropped the class before there was an opportunity to complete the survey. Since this survey was created only once and administered once to faculty and students, issues of validity and reliability could be present because the survey has not been given several times to different groups of people. Lastly, faculty results might have been improved, especially when making distinctions between full-time versus part-time respondents, if more math faculty had been surveyed.

**The Future.** This survey is an excellent starting point for determining if the corequisite model would be effective at DTCC. As evidenced by the results both quantitative and qualitative, I have reason to believe support exists for a different approach to developmental math education. Furthermore, this survey also brought to the forefront issues mentioned by both faculty and staff, which are issues of time and money. If students have a limited amount of time and money they can spend in school,

it would be important to minimize the amount of developmental math classes they must take. Minimizing the amount of developmental math classes for students could also benefit their work-life balance where both students and faculty mentioned how students have other jobs and family responsibilities that prevent them from devoting as much time as they should to their math courses. Lastly, this survey also showed with both faculty and student comments that the skill and ability level of students are not where they should be. Student are not prepared to pass their math classes. However, it would be interesting to survey faculty and students again next semester to see if anything has changed from the current survey results.

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## Student Survey of Developmental Mathematics at DTCC

Jack Bradley, the Language Lab Specialist at Delaware Technical Community College's Wilmington campus and a doctoral student at the University of Delaware, is asking you to fill out this survey about developmental math classes. Developmental math faculty at all of Delaware Tech's campuses are being asked to participate in the survey. The survey should take no more than 20 minutes to complete.

A summary report will be generated based on the information collected, and it may help guide professional development and developmental course redesign. The report will be shared with the math faculty at all campuses, the deans of instruction at all campuses, and Mr. Bradley's doctoral committee.

There are no risks to your participation. Participation is entirely voluntary, but your perspectives would be greatly appreciated.

Please rest assured that all responses are confidential. You will not be asked for any personally identifying information and none of your responses will be associated with you personally. There are no consequences if you choose not to participate.

If you have any questions concerning the survey, please contact Jack Bradley ([jbradl11@dtcc.edu](mailto:jbradl11@dtcc.edu)).

If you agree to participate in this survey, please click on the Qualtrics link and begin.

### DTCC Student Developmental Math Survey FINAL

Q1 What level of math are you currently taking?

- MAT 005 (1)
- MAT 010 (2)
- MAT 020 (3)
- MAT 140 (4)

Q2 How many students are in your class?

- Less than 5 (1)
- 6-10 (2)
- 11-15 (3)
- 16-20+ (4)
- 20+ (5)
- I don't know. (6)

Q3 How many days does your math class meet?

- 0 (1)
- 1 (2)
- 2 (3)
- 3+ (4)

Q4 How long does your instructor lecture the class?

- 0 to 0.5 hours (1)
- 0.5 to less than 1 hour (2)
- 1 to 2 hours (3)
- more than 2 hours (4)

Q5 How much time does the instructor work with you individually in class?

- 0 to 0.5 hours (1)
- 0.5 to less than 1 hour (2)
- 1 to 2 hours (3)
- more than 2 hours (4)

Q6 Have you ever taken a fully online math class before?

- Yes (1)
- No (2)

If No Is Selected, Then Skip to Have you ever taken a face-to-face ma

Q7 The fully online style of instruction is most helpful to me.

- 5 Strongly agree (1)
- 4 (2)
- 3 (3)
- 2 (4)
- 1 Strongly disagree (5)

Q8 Have you ever taken a face-to-face math course before?

- Yes (1)
- No (2)

If No Is Selected, Then Skip to Have you ever taken a hybrid math cla

Q9 The face-to-face style of instruction is most helpful to me.

- 5 Strongly agree (1)
- 4 (2)
- 3 (3)
- 2 (4)
- 1 Strongly disagree (5)

Q10 Have you ever taken a hybrid math class before?

- Yes (1)
- No (2)

If No Is Selected, Then Skip to Have you ever taken an emporium math

Q11 The hybrid style of instruction is most helpful to me.

- 5 Strongly agree (1)
- 4 (2)
- 3 (3)
- 2 (4)
- 1 Strongly disagree (5)

Q12 Have you ever taken an emporium math class before?

- Yes (1)
- No (2)

If No Is Selected, Then Skip to What is the structure of your current

Q13 The emporium style of instruction is most helpful to me.

- 5 Strongly agree (1)
- 4 (2)
- 3 (3)
- 2 (4)
- 1 Strongly disagree (5)

Q14 What is the structure of your current math class?

- Online (1)
- Face to face (2)
- Hybrid (3)
- Emporium (4)
- I don't know. (5)

Q15 I am able to keep pace with my math class.

- 5 Strongly agree (1)
- 4 (2)
- 3 (3)
- 2 (4)
- 1 Strongly disagree (5)

Q16 The tutors in the Math Success Center help me learn (The Math Success Center is where you go to complete the classwork if you are in an emporium class).

- 5 Strongly agree (1)
- 4 (2)
- 3 (3)
- 2 (4)
- 1 Strongly disagree (5)

Q17 The tutors in the math lab help me learn (The math lab is where you go to get help with your math homework.).

- 5 Strongly agree (1)
- 4 (2)
- 3 (3)
- 2 (4)
- 1 Strongly disagree (5)

Q18 The math textbook helps me learn.

- 5 Strongly agree (1)
- 4 (2)
- 3 (3)
- 2 (4)
- 1 Strongly disagree (5)

Q19 My math instructor is helpful when I have a question.

- 5 Strongly agree (1)
- 4 (2)
- 3 (3)
- 2 (4)
- 1 Strongly disagree (5)

Q20 My math instructor connects the coursework to real life situations.

- 5 Strongly agree (1)
- 4 (2)
- 3 (3)
- 2 (4)
- 1 Strongly disagree (5)

Q21 I am confident I will pass this class.

- 5 Strongly agree (1)
- 4 (2)
- 3 (3)
- 2 (4)
- 1 Strongly disagree (5)

Q22 This is my first time taking this class.

- Yes (1)
- No (2)

If Yes Is Selected, Then Skip to I would prefer to be placed in a cred

Q23 I have failed this class before.

- Yes (1)
- No (2)

If No Is Selected, Then Skip to I would prefer to be placed in a cred

Q24 If yes how many times have you failed this class?

- 1 time (1)
- 2 times (2)
- 2 or more times (3)

Q25 I would prefer to be placed in a credit-level math class rather than developmental in my first semester of college.

- 5 Strongly agree (1)
- 4 (2)
- 3 (3)
- 2 (4)
- 1 Strongly disagree (5)

Q26 If I were first placed in a college-level math requirement for my major, I would be willing to take a support class at the same time to help ensure my success.

- 5 Strongly agree (1)
- 4 (2)
- 3 (3)
- 2 (4)
- 1 Strongly disagree (5)

Q27 What could be done to improve your current math class experience at DTCC?

Q28 What are barriers to you passing your current math class at DTCC?

Q29 What is your employment status?

- Employed full-time (1)
- Employed part-time (2)
- Not currently employed (3)
- Other (4)

Q30 Do you attend school full-time or part-time?

- Full-time (1)
- Part-time (2)

Q31 What is your gender?

- Male (1)
- Female (2)

Q32 Please select your race/ethnicity.

- White (1)
- Hispanic/Latino (2)
- Black/African American (3)
- Native American/American Indian (4)
- Asian/Pacific Islander (5)
- Other (6)

Q33 What is your primary campus?

- Stanton (1)
- Wilmington (2)
- Dover (3)
- Georgetown (4)

## Faculty Survey of Developmental Mathematics at DTCC

Jack Bradley, the Language Lab Specialist at Delaware Technical Community College's Wilmington campus and a doctoral student at the University of Delaware, is asking you to fill out this survey about developmental math classes. Developmental math faculty at all of our campuses are being asked to participate in the survey. The survey should take no more than 20 minutes to complete.

A summary report will be generated based on the information collected, and it may help guide professional development and developmental course redesign. The report will be shared with the math faculty at all campuses, the deans of instruction at all campuses, and Mr. Bradley's doctoral committee.

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If you agree to participate in this survey, please click on the Qualtrics link and begin.

### DTCC Faculty Developmental Math Survey

Q1 What level of developmental math are you teaching in the current semester?

- MAT 005 (1)
- MAT 010 (2)
- MAT 020 (3)
- More than one of these (4)

Q2 How many students are in your class?

- 0-5 (1)
- 6-10 (2)
- 11-15 (3)
- 16-20 (4)
- 20+ (5)
- NA (6)

Q3 How many days per week does your class meet?

- 0 (1)
- 1 (2)
- 2 (3)
- 3+ (4)

Q4 How much time do you lecture the entire class?

- 0 to 0.5 hours (1)
- 0.5 to less than 1 hour (2)
- 1 to 2 hours (3)
- more than 2 hours (4)

Q5 How much time, on average, do you work one-on-one with a typical student in each class?

- 0 to 0.5 hours (1)
- 0.5 to less than 1 hour (2)
- 1 to 2 hours (3)
- more than 2 hours (4)

Q6 Have you taught a fully online math class before?

- Yes (1)
- No (2)

If No Is Selected, Then Skip to Have you ever taught a face-to-face m

Q7 The fully online style of instruction helps students learn the most.

- 5 Strongly agree (1)
- 4 (2)
- 3 (3)
- 2 (4)
- 1 Strongly disagree (5)

Q8 The fully online style of instruction is easy to implement.

- 5 Strongly agree (1)
- 4 (2)
- 3 (3)
- 2 (4)
- 1 Strongly disagree (5)

Q9 Have you ever taught a face-to-face math class before?

- Yes (1)
- No (2)

If No Is Selected, Then Skip to Have you ever taught a hybrid math cl

Q10 The face-to-face style of instruction helps students learn the most.

- 5 Strongly agree (1)
- 4 (2)
- 3 (3)
- 2 (4)
- 1 Strongly disagree (5)

Q11 The face-to-face style is easy to implement.

- 5 Strongly agree (1)
- 4 (2)
- 3 (3)
- 2 (4)
- 1 Strongly disagree (5)

Q12 Have you ever taught a hybrid math class before?

- Yes (1)
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- 3 (3)
- 2 (4)
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Q15 Have you ever taught an emporium math class before?

- Yes (1)
- No (2)

If No Is Selected, Then Skip to What is the structure of your math cl

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- 5 Strongly agree (1)
- 4 (2)
- 3 (3)
- 2 (4)
- 1 Strongly disagree (5)

Q17 The emporium style of instruction is easy to implement.

- 5 Strongly agree (1)
- 4 (2)
- 3 (3)
- 2 (4)
- 1 Strongly disagree (5)

Q18 What is the structure of your math class? Check all that apply.

- Online (1)
- Face to face (2)
- Hybrid (3)
- Emporium (4)
- Strongly disagree (5)

Q19 This is my first time teaching a(n) \_\_\_\_\_ class. Check all that apply.

- Fully online (1)
- Face-to-face (2)
- Hybrid (3)
- Emporium (4)

Q20 Most students are able to keep pace my course(s).

- 5 Strongly agree (1)
- 4 (2)
- 3 (3)
- 2 (4)
- 1 Strongly disagree (5)

Q21 I am aware of different ways to structure developmental math courses.

- 5 Strongly agree (1)
- 4 (2)
- 3 (3)
- 2 (4)
- 1 Strongly disagree (5)

Q22 I know what supplemental instruction is.

- 5 Strongly agree (1)
- 4 (2)
- 3 (3)
- 2 (4)
- 1 Strongly disagree (5)

Q23 I know what the corequisite model is.

- 5 Strongly agree (1)
- 4 (2)
- 3 (3)
- 2 (4)
- 1 Strongly disagree (5)

Q24 I know what the linked-workshop model is.

- 5 Strongly agree (1)
- 4 (2)
- 3 (3)
- 2 (4)
- 1 Strongly disagree (5)

Q25 I know what structured-learning assistance is.

- 5 Strongly agree (1)
- 4 (2)
- 3 (3)
- 2 (4)
- 1 Strongly disagree (5)

Q26 I am confident my students will pass my class(es).

- 5 Strongly agree (1)
- 4 (2)
- 3 (3)
- 2 (4)
- 1 Strongly disagree (5)

Q27 Math pass rates could improve at DTCC with a different approach to developmental math instruction.

- 5 Strongly agree (1)
- 4 (2)
- 3 (3)
- 2 (4)
- 1 Strongly disagree (5)

Q28 What can be done to improve developmental math instruction at DTCC?

Q29 What are barriers to students passing developmental math classes at DTCC?

Q30 What is your employment status?

- Full-time (1)
- Part-time (2)

Q31 What is your gender?

- Male (1)
- Female (2)

Q32 What is your age?

- 21-26 (1)
- 27-33 (2)
- 34-41 (3)
- 41 years and older (4)

Q33 Please select your race/ethnicity.

- White (1)
- Hispanic/Latino (2)
- Black/African American (3)
- Native American/American Indian (4)
- Asian/Pacific Islander (5)
- Other (6)

Q34 What is your primary campus?

- Stanton (1)
- Wilmington (2)
- Terry (3)
- Owens (4)

**Appendix F**

**ARTIFACT 5: INSTITUTIONAL COURSE REDESIGN ANALYSIS**

## Executive Summary

Developmental math pass rates at Delaware Technical Community College (DTCC) have remained the same or decreased for a number of years in spite of two different course redesigns. An external interview process was conducted with two four-year universities and one community college to investigate the use of the corequisite model as an alternative developmental mathematics course structure. The external interviews and analysis were intended to answer the following three research questions:

**Question 1:** How did the institutions determine which courses to target in the redesign?

**Question 2:** What was the rationale for choosing the specific corequisite approach?

**Question 3:** What are their recommendations for other institutions doing corequisite redesign?

To answer the research questions, three individuals involved in recent changes to developmental math programs were contacted at two four-year universities and one community college. Eight interview questions were asked to each person. Interview questions covered university demographics, the redesign process, results of the corequisite model implementation process, and recommendations for institutions considering similar corequisite redesign in the future. Interviews were recorded, transcribed, and separate interview summaries were written up for each contact;

results from the summaries were then coded to determine common themes using Creswell's data analysis spiral (2007).

Results for Question 1 indicate that institutional research was conducted to determine which courses to target. Results for research Question 2 indicate that there were a variety of reasons for selecting the model currently in use at the different institutions. Results for research Question 3 indicate that there are several recommendations to completing a course redesign including time for implementation, demographics, finance, and other reasons unique to each institution.

### **Introduction**

Developmental mathematics pass rates at DTCC are lower than they should be. They are approximately 50 percent or below at each campus. I investigated this issue because two major course redesigns occurred in the last six to seven years. The first redesign switched from a primarily face-to-face style developmental math instruction to the emporium model. After a lack of significant improvements in pass rates, the math courses were redesigned once more, this time changing back to the lecture style of developmental math instruction, albeit with a larger curriculum overhaul. The data for the most recent semester (Fall 2016) developmental math courses showed a mix of improvement at one campus, no change at another, and decreases at two others. In response to DTCC's struggles with pass rates in developmental math courses, I researched several examples of an alternative model—the corequisite model—that has shown promise at other institutions. To gain further insight into the corequisite model, I conducted interviews with representatives of three different institutions that

had implemented examples of corequisite instruction. I hoped to understand the context in which these redesigns were done and to determine whether the model might be suitable for implementation at DTCC.

### **Research questions**

I focused on the redesign implementation process, the results, and the recommendations for other institutions of higher education that had implemented course redesign. The following questions were important to answer because they might offer guidance to DTCC as we continue to navigate the difficulty of low pass rates in developmental math courses and as a result lower retention rates.

**Question 1:** How did the institutions determine which courses to target in the redesign?

**Question 2:** What was the rationale for choosing the specific corequisite approach?

**Question 3:** What are their recommendations for other institutions doing corequisite redesign?

### **Evaluation Plan**

#### **Sample**

I chose three different schools that used a corequisite model to developmental mathematics. Each school used a different type of co-requisite implementation, which provided an opportunity to learn about a range of issues at these institutions. The sample included Ferris State University (FSU) in Michigan, which uses Structured Learning Assistance (SLA), Austin Peay State University (APSU), which uses the

linked-workshop model (LWM), and the Community College of Baltimore County (CCBC), which uses the Accelerated Learning Program (ALP).

### **Instrumentation**

The instrument used was a series of eight questions I created that were intended to address the three larger research questions. The questions can be found in Appendix A.

### **Data collection procedures**

Each potential interviewee was contacted by email and asked to participate. I ensured that all information would be confidential. The three interviewees were the director of Structured Learning Assistance (SLA) at FSU, a director of the linked-workshop model at APSU, and the creator-emeritus of the ALP program at CCBC. I recorded the interviews, took notes on them, and transcribed the recordings for later analysis.

### **Data analysis procedures**

I began my analysis by reading all transcripts from the three interviews to offer a general impression of the overall results. Then, I used Creswell's data analysis spiral (2007) in which "the researcher engages in the process of moving in analytic circles rather than using a fixed linear approach" (Cresswell, 2007). From the interview transcripts, I made summaries of each one. I then coded (by highlighting) parts of the summaries based on the three research questions—pink for question 1, blue for question 2, and green for question 3. I went over the interviews several times. After picking out coded information from the interviews that answered the three research

questions, I also went back to look for any common elements among all three interview summaries. If I found something that was common to all three interviews, I highlighted each place it was mentioned in yellow. I then read the transcripts again and was mindful of the codes I had already created. As I began to see recurring thematic elements from the interview summaries, I made note of them. The interview summaries can be found in Appendix B of this report.

## **Results**

### **Findings for research question 1**

How did the institutions determine which courses to target in the redesign? A common theme across institutions was that each conducted studies to determine courses with a high-risk for failure. In one case, the study was prompted by the state government (APSU in Tennessee), which specifically mandated a course redesign of all developmental education courses in the Tennessee state university system. In another case (CCBC), the motivations for changes were the result of not only high-failure courses but also several policy changes, including the elimination of tenure and a censure of the institution by the American Association of University Professors (AAUP). In all cases, courses were targeted based on a desire to increase pass rates in developmental courses along with overall retention rates. Moreover, each institution wanted to reach out to students who would not seek out academic assistance to remedy any problems before students were at risk for failing their particular course. APSU brought in an outside consultant, the National Center for Academic Transformation (NCAT) who worked with them to redesign all developmental education courses.

CCBC conducted longitudinal studies starting in 1993 to determine which courses to target, and before they began their redesign, they traveled the county and visited institutions with corequisite models. They eventually would “patch together” a redesign containing characteristics from several programs to create their own individual program, which would be known as ALP, or the accelerated learning program.

APSU had been given a mandate from the Tennessee Board of Regents to redesign all developmental courses as a result of not only low pass and retention rates but also to groom students to become a part of a workforce in Tennessee that would be responsive to labor market needs. The governor wanted more businesses to set-up shop in Tennessee and so created the “drive for 55,” which sought to equip approximately 55 percent of adults in Tennessee with a college degree or certificate by 2025.

FSU, on the other hand, also did internal research to determine high-failure rated courses to target. They found these courses in both developmental education and at the college level. FSU also used SLA, or structured learning assistance, to target several courses including math, English, and history where student pass rates were below 60 percent. In addition, FSU made SLA classes mandatory for students who had a C- average or below in any course. Furthermore, if students did not attend their required SLA sessions, they were not able to pass their college-level course. Lastly, CCBC conducted institutional research beginning with lower-level English classes and then began to scale up their ALP to other courses including math and history.

## **Findings for research question 2**

What was the rationale for choosing the specific corequisite approach?

For FSU, the rationale for choosing SLA was created through research of best practices, especially the idea that supplemental instruction in the form of tutoring, computer activities, and concepts of mastery learning have been shown to improve pass rates for students in both developmental courses and college-level courses. Their decision to implement SLA also took into account many factors, such as specific academic needs, potential benefits for students, and the amount of buy-in they could get from faculty and other subject matter experts who were brought in as consultants in the redesign.

APSU worked with the NCAT using their (at that time) five redesign models—emporium, buffet, fully online, supplemental, and the replacement model—but the pass rates after the first semester were below 50 percent, so the plan was scrapped. APSU liked the SLA model that FSU implemented and wanted to customize it for their students. They worked with the NCAT to create what they now call the “linked-workshop model (LWM),” which is corequisite.

Lastly, CCBC initially began to investigate English courses where there were low pass rates. CCBC began studying English courses in 1993 by surveying students, former students, and faculty to get ideas for how they could improve pass rates. They wanted to help students not only pass their developmental courses but also retain them. Based on this initial feedback, along with a confluence of internal leadership changes and new policies, CCBC appointed a committee headed by the person I

interviewed. They went to several institutions across the country to see what programs other institutions used to increase pass rates and retention rates in developmental courses.

CCBC borrowed elements they liked, especially from Arizona State University's stretch program, the University of South Carolina's corequisite model, and a corequisite model in the University of Texas college system. The conflation of models that they were able to "patch together" became known as the Accelerated Learning Program (ALP) for English and other courses; this program expanded to the math department a few years later and was known as the Accelerated Math Program (AMP). The program is dubbed "accelerated" because students can enroll in it and complete their developmental coursework more quickly than if APSU had used the traditional prerequisite model of developmental instruction. Another reason CCBC created this program was because in two of their studies, they found that 57 percent of students (only those who were retained from semester to semester) took four years to pass their developmental classes. CCBC, on the other hand, wanted to see more immediate success in developmental courses. The decision to continue the program was based on pass rates of 70 percent or higher in developmental and college-level courses that transcended major demographics, such as gender, race, military status, and employment status, among others.

### **Findings for research question 3**

What are their recommendations for other institutions doing corequisite redesign?

The person I spoke with at FSU had only one recommendation for schools looking to do developmental course redesign, and that was to do what is best in the context of the school. When I pressed her for more information, she said that was all she really could say because each school is different. The person who created the LWM at APSU had several recommendations for DTCC. First, he said that if a department charges a lab fee for the course, it should be higher rather than lower. He charged a lab fee of \$75 to his students but found the cost of running the course was slightly higher; when he tried to raise the price to \$100, the Board of Regents said denied his request so as to keep the price more affordable for students. Second, he recommended setting a logical baseline of SAT, ACT or Compass placement test scores because there are some students who may not be ready for college-level courses even if they are enhanced by the linked-workshop. Third, he said to be cognizant of academic resource restrictions such as classroom space. In their case, the program grew rapidly and more rooms and computers became necessary to run more sections of the course. He also said it was important to use concepts from a learning community model to create a cohort that would keep each other motivated. Lastly, he said that the redesign afforded his institution opportunities to work more closely with four-year universities by acting as feeders to them. It was also an opportunity to recruit instructors from their own college graduating classes to staff the LWM courses.

The CCBC interviewee also had several recommendations for institutions looking to redesign a developmental math program. First, they recommended borrowing favorable or preferred elements from other programs and adapting them to

the context at DTCC. The combination of features would allow far more customized programs based on the demographics of the institution. Next, they suggested trying to complete the redesign in under three years to scale it up and to align it with all campuses. They said it took CCBC 10 years to complete this process and they regret the 2700 students who failed and/or were not retained during the time CCBC was trying to scale up the ALP. If the redesign could have been done differently, then three years would have been a maximum amount of time to complete it. Next, they said that since some developmental courses are more sequential (such as math or English), it is necessary to synchronize the developmental courses as much as possible with the college-level courses. They also said the integration of ALP and non-ALP students is critical to the success of the program.

Moreover, the resounding consensus among the three interviewees was to make the corequisite class have the same rigor as the college-level class. Another part of this recommendation was to make attendance mandatory and to threaten students with withdrawal or failure of the college-level class if they did not attend required sessions. While FSU and APSU corequisite classes were ungraded (unlike those at CCBC), the goal is to cause “students to be grateful for the opportunity we give them. They need to understand how lucky they are to be in this class” (Anonymous, personal communication, November 30, 2016).

Another theme was integration of developmental students with non-developmental students. In doing so, it is necessary to create a cohort or learning community to give students and faculty buy-in. In each case, the faculty threatened to

“revolt” based on the final program choice made, and in each case the institutions continued with their plan and persuaded faculty through the successes of the programs.

### **Summary of Results**

There were several common elements to these interviews. First, the impetus for the course redesign was based on internal institutional studies that determined courses that had high risks of failure. In two cases, APSU and CCBC, the change was mandated from the top of the organization: the government of Tennessee and by the dean of instruction, respectively. In addition, the demographics of each institution, although different, determine how to implement the redesign. Common recommendations for other institutions included thorough institutional analysis, a recommended timeline of three years to complete a redesign, an individual institution contextual-based approach, and higher lab fees to cover instructional costs.

Most importantly, the interviewees reported that the pass and retention rates increased and transcended several major demographics including race, gender, and military status. FSU increased pass rates of SLA sections to 11 percent higher than those of non-SLA sections. It also increased the average grade of students in SLA sections to 88 percent. At APSU, pass rates more than doubled, and at CCBC pass rates were steady at 69 percent for students who took the accelerated format. In all cases, the pass rates for students who had required support sections were higher than those students who took only their college-level course. Furthermore, these improvements also transcended several demographics. No matter what segment of the

student population was studied post-program implementation, there were increases in pass rates in developmental classes and also retention rates from semester to semester.

### **Limitations and Implications**

**Limitations.** One of the limitations for these interviews could be that I interviewed only three people at three different institutions. More interviews would have yielded more data. In addition, I chose to interview people at institutions that were consistent with the model I would like to implement at DTCC, so perhaps there is some bias associated with the interview choices and results. Another potential limitation is that the demographics of the two four-year universities included in the interview (APSU and FSU) are different from DTCC. Lastly, I created the interview questions, which means they were not tested for validity and reliability; however, the questions did cover what is necessary to know about each program.

**Implications.** The implications for DTCC in the future are several. First, these interview results and the successes described therein dovetail with the survey data from Artifact 4, which indicates there is not only awareness of other models of course redesign but also a desire to change the current developmental math curriculum. This research will serve an informational purpose for the Deans of Instruction at DTCC, who are ultimately responsible for curriculum. The research also informs my other artifacts and provides additional support for the direction I would like to see DTCC take, which is an implementation of a corequisite model of developmental math instruction. Moreover, the contexts in which these redesigns were implemented have

some similarities to DTCC's context: developmental course pass rates were too low, and the institution implemented course redesign through a corequisite model. DTCC is also looking to improve math pass rates, and given the success of these corequisite models at the three institutions in this study, a corequisite model could be feasible for DTCC.

In terms of demographics, while there were more students at APSU and FSU, and their demographics were slightly different from DTCC's, the improvement in pass rates that transcended nearly all demographics is of substantial note. A similar improvement was seen at CCBC, whose context matches more closely with DTCC's. Furthermore, I received consulting offers from two of the three interviewees to assist with DTCC's redesign. DTCC could use the expertise of these people who have gone through corequisite redesign and had great success with it across multiple demographics and cross-sections of student populations. Lastly, these interviews raised another question for me, one which I thought of after I completed the interviews. Given the successes in the cases above, why are more schools not doing this kind of redesign? Perhaps further research into this question will be helpful to DTCC as it, like many two and four-year institutions like it, continues to struggle with lower developmental math pass rates and lower retention rates.

## REFERENCES

Creswell, J. W. (2007). *Qualitative inquiry and research design: Choosing among five approaches* (2<sup>nd</sup> ed.). Thousand Oaks, CA: Sage.

## **Institutional Interview Questions**

Jack Bradley, the Language lab specialist at Delaware Technical Community College's Wilmington campus and a doctoral student at the University of Delaware, is asking you to participate in a confidential interview about your approach to developmental math education. The interview should take 30-45 minutes and would occur via telephone.

Summary and thematic reports will be generated based on the information collected that may help guide Delaware Technical Community College through the developmental mathematics redesign process. The report will be shared with Mr. Bradley's doctoral committee.

There are no risks to your participation. Participation is entirely voluntary, but your perspectives would be greatly appreciated.

Please rest assured that all responses are confidential. You will not be asked for any personally identifying information and none of your responses will be associated with you personally. Any responses taken from these surveys will only be reported in aggregate form. There are no consequences if you choose not to participate.

If you have any questions concerning the survey, please contact Jack Bradley ([jbradl11@dtcc.edu](mailto:jbradl11@dtcc.edu)).

If you agree to participate in this interview, please kindly reply to this email and I will set up a time that works with your schedule to speak via phone. Thank you in advance for your assistance.

First, I will introduce myself, describe the purpose of the project, and share DTCC information. Sharing information ideally will prompt comparisons with the other institutions that help to clarify context differences and similarities as well as elicit more information about implementation. The interview will begin and interviewees will be asked these questions:

1. Could you please describe the demographics of your institution?
2. How did you determine which courses to target in the redesign?
3. Why did you choose the approach you did?
4. Have you used a similar approach for other developmental courses? If so, which one(s)? If not, why not?
5. What is the process like? What was more difficult or easier than you thought?
6. How long did it take you from initial redesign to running the pilot? Did you see results right away, or did it take time?

7. What were the differences in pass rates after the first semester? Long-term?
8. What are your recommendations to other schools doing corequisite redesign?

## Individual Interview Summaries

### Case 1: Ferris State University

To understand Ferris State University's (FSU) model known as Structured Learning Assistance (SLA), I contacted its director. The director preferred to be sent the questions ahead of time so she could think of responses. They said that the population of FSU is approximately 13,000 students, roughly 78 percent of whom were Caucasian. It also skewed 52 percent female. When I corresponded with them, they offered to first share with me what SLA is and the SLA Program history at FSU. They were emphatic that SLA is not directed at developmental courses, but rather courses that have high rates of failure. Those courses are needed to progress through any given program. In addition, their developmental math courses happen to be supported by this program as well.

They said that the program was developed and piloted in 1993 and was a direct result of having too many historically high fail rates in several courses both developmentally and at the college level. It was not specifically a redesign, but rather a program designed to increase pass rates, retention rates, and to offer support to students who would not necessarily seek out tutoring. In terms of SLA's structure, it is a regularly scheduled workshop attached to a course.

For each course with an SLA component attached, there is a mandatory 2 ½ to 3 hours of directed study/practice in a weekly group setting. However, these sessions are mandatory only for students who have a grade below a C- in any of their classes. In practice, though SLA is open to anyone who wishes to attend. If students who need

the workshops miss more than four workshops with an unexcused absence, then they must withdraw from the college-level class or risk receiving an F.

These workshop sessions are very important to student success and are run by students who previously passed the class; these people assist students. SLA sessions are a place to ask question, a forum for reviewing concepts from the lecture, and a place to get extra practice in the targeted courses. Targeted practice takes the form of worksheets, games, activities, practice quizzes and tests, and other computer exercises that support students in their weaker areas. SLA also places less emphasis on remediation and more on collaborative learning. It also helps with faculty and staff's professional development.

They also wanted to make a few more important distinctions about SLA. SLA is not a study hall or a place to finish homework; it is not a replacement for attending class lectures. Lectures, like SLA workshops, are mandatory. SLA works within FSU's established course management system, which meant there was minimal difficulty with registration as a result of this new workshop where students had to enroll as a corequisite with their other courses.

The SLA Program grew out of a need to reach out to large numbers of students who would not self-refer for academic assistance. FSU discovered courses in which students would traditionally struggle across several programs. As part of an ongoing effort to help students be successful, we sought to provide a method of direct transference of study skills and learning methods to those content areas. Research

indicates that students should be taught study skills that will apply directly to a given content area. The SLA program was a result.

The concept for SLA was designed and developed at Ferris State University, and was piloted in 1993. It was established to help increase the number of students passing some historically high-risk-for-failure courses. In fact, there were several courses where 60 percent of students had a pass rate averaging below a C-, and FSU had lower retention rates over the years. The decision to implement SLA took into account many factors, such as specific academic needs, potential benefits for students, buy-in from faculty members, and subject-matter expertise. FSU had buy-in from its faculty and staff and has participation from more than 50 departments in six of its colleges. Since its implementation in 1993, the SLA program has served almost 28,000 students and pass rates are higher; in fact, grades average 88 percent for all students in SLA sections. The pass rate for students who took SLA was about 11 percent higher than students who did not take SLA from 1993-2015. SLA has made an impressive impact, she said, so I asked her about DTCC's situation. This person said that a school needs to decide what is best for it. Since this course was not a redesign, there were no real downsides or minuses to implementing it into FSU's current system.

## **Case 2: Austin Peay State University**

To understand the Linked Workshop Model (LWM), I interviewed the Director of the Academic Support Center at Austin Peay State University (APSU) in Clarksville, TN. I wanted to interview them because their university pioneered the

LWM, which was the sixth NCAT model of course redesign. Since I think the LWM would be a good fit for DTCC, I wanted to investigate more about his university's context, LWM implementation, and results.

I opened the interview by explaining who I was and giving them some background on DTCC's demographics and previous experience with math redesign at the developmental level. When I asked them about the University demographics, they said it followed the "40 percent rule," where any given percentage of students out of a total of 10,000 (veterans, minorities, students with disabilities, etc.) was about 40 percent. I then explained DTCC's past math redesign efforts, which sparked his interest. This led to discussion of why APSU initially redesigned its developmental math courses in 2007: it was mandated by the Tennessee Board of Regents. They are the governing body of the public college system in Tennessee. The impetus behind the redesign was not only to improve developmental course pass rates and college retention rates, but also it was to prepare a workforce to better suit the needs of various industrial sectors in Tennessee. The governor at the time, Mr. Hassel, also wanted to attract more businesses to the state and felt he could do so by offering a better educated workforce that had the skills necessary to work in these industries. The goal was part of the "Drive to 55," which sought to equip approximately 55 percent of the workforce with a college degree or certificate by 2025. I mentioned that this goal sounded similar to the mission statement of DTCC, which is to prepare students for the workforce in various Delaware industrial sectors.

To begin the redesign, APSU brought in the National Center for Academic Transformation. The first attempt at redesign of developmental math and English courses relied heavily on technology, but within a year pass rates had sunk below 50 percent, so the plan was scrapped. The NCAT then began to work more closely with APSU to create a sixth model that would revamp developmental education despite not being listed as one of the current five redesign as an addition to the NCAT's five others. However, the NCAT was so intrigued by the LWM concept that they worked with APSU to make it into a reality. The model was implemented in English and math courses. Rather than have students take developmental math courses to fix their math or English deficiency (as determined by the COMPASS placement test) prior to entering college-level courses, all developmental students were placed into the appropriate college-level math or English course associated with their major. They were placed side-by-side with students in college-level courses who did not have an English or math deficiency based on the COMPASS placement test. However, those students with a math or English deficiency via the placement exam were made to take an additional, ungraded course known as Structured Learning Assistance (SLA), which borrowed heavily from FSU's implementation but also had its differences.

In this SLA, developmental students attend their college-level lecture class (with non-developmental students) and then have an SLA session immediately afterwards. SLA sessions are taught by teaching assistants (TAs), whose job it is to make sure students master modules that would normally be taught in developmental courses. SLA is a form of mastery learning where if students can pass the modules,

they can work their way more quickly through the course materials. SLA sessions include individual and group activities, lecture review, individual work on MyLabsPlus, and test review, depending on what student needs were. The SLA sessions have to follow exactly the lessons of college-level course instructors and TAs; they must use the same terminology as the instructors. SLA TAs also meet with the instructor of the college-level course for one hour each week to plan lessons two weeks ahead of time. The interviewee said because the lessons are so well-coordinated, instructors have a better insight into their students and areas where each is struggling. That insight allows instructors to give students more targeted practice in weaker areas. Furthermore, SLA follows a schedule that is identical to the college-level course syllabus; however, SLA sessions have less lecture and are more interactive to practice concepts learned from the lecture.

With some rebranding assistance from the NCAT, this corequisite approach, going forward to be known as the linked-workshop model (LWM) was piloted in the summer of 2007 for developmental English and math classes; it immediately brought college-level English and math pass rates up to approximately 51.5 percent for each. However, there was resistance from summer students and from faculty, some of whom said they thought the model was doomed to fail and hoped it did. After the modest success in the summer, the model continued into the fall. Pass rates for college-level math courses rose to 70.4 percent and to 70.3 percent in college-level English classes. Longitudinal tracking of students in these classes found them to have higher pass rates in subsequent college-level English and math classes than students who did not enter

APSU with an English or math deficiency both prior to and after the implementation of the new LWM. Given the success of this model, the interviewee said that APSU then began to look at other gatekeeper courses where it could be effective. They began to try it in history and more advanced statistics courses. I was told that wherever they tried it, they found success among several cross-sections of the student population. More impressive is that retention rates also went up similarly across major demographics.

The interviewee also attributes much of the success of the LWM to the strict attendance policy for the workshop sessions. Students are informed they must come to every class (unless there are extenuating circumstances) and do all of the required work. If a student has one unexcused absence, the TA contacts the head of SLA. If the student has two unexcused absences, the TA contacts the student and the instructor. If the student has three unexcused absences, they receive a letter from the Dean's office informing them that one more unexcused absence will result in an F in the college-level class and that they are forced to drop the corequisite course. The Director indicated that this constant communication is key and has led to high retention rates for students in the corequisite course. "We want students to come back begging and want students to be grateful for the opportunity we give them. They need to understand how lucky they are to be in *this* class," they said (Anonymous, personal communication, November 30, 2016).

Lastly, the interviewee had some recommendations for schools thinking of a similar developmental course redesign. They said that APSU charges a lab fee of \$75

for students who take SLA if they are placed in developmental math classes. They also said they wished in the beginning they had asked for a higher lab fee (for instructional resources, TA pay, etc.), and when they did last year, they were denied the request. Secondly, they said not to water down the corequisite to increase pass and retention rates. They also said that high performers and low performers (i.e., students with and without academic deficiencies) in the same class for the purposes of motivation and most importantly, they said there needs to be a way to assess the results of the students in the college-level class. They believe that there must be a baseline to compare against SAT/ACT and the COMPASS placement test score to distinguish between the performance of those who were college-ready and those who were not. Lastly, they said that it was a good opportunity to recruit SLA TA's not only from APSU but also from some of the larger feeder schools like University of Tennessee. It helps establish better relationships.

While the director spoke of the benefits of the LWM, they also said that some of the challenges he faced were getting technology and classroom space for these SLA classes and trying to set up the corequisite courses in Banner, which he says was particularly difficult. Overall, this interview yielded much information about APSU's implementation of the LWM. They also offered to be a resource for me in the future for whatever I need. This interview was very informative because it mentioned the pros/cons of the LWM and helped elucidate how this terminology came to be. It is also worth mentioning that the LWM is the original "corequisite model" and that today, "corequisite model" simply means any two courses taken concurrently. Since

APSU's implementation of the LWM, the governor has mandated that all institutions in Tennessee use it at the very least for developmental English and math classes. For them, overall it is a worthwhile endeavor to redesign developmental courses using the LWM.

### **Case 3: Community College of Baltimore County (CCBC)**

To get a better understanding of CCBC's pioneering Accelerated Learning Program (ALP), I contacted the program's original creator who is now a nationwide consultant for such programs across the country. I first asked about the demographics of CCBC. They are a "minority-majority" school with a population of 55 percent African-American. Other demographics leaned slightly female (52 percent to 48 percent male) and the average age was 27-28 years old. In terms of which courses to target in the redesign, the chair of the English department at the time began to study English department developmental pass rates and longitudinal student pass rates starting in 1993 because the data indicated that 57 percent of students took four years or more to pass ENG 101 (College Composition I) after passing the developmental prerequisite, ENG 052 (Basic Writing II). In addition, 16 percent of the students who passed ENG 052 did not even attempt to take ENG 101, and only 33 percent of students who passed ENG 101 then went on to pass ENG 102 (Composition and Literary Forms) within three years.

The interviewee and colleagues received funding to go across the country to investigate other developmental course pass rate solutions. Eventually, they "patched together" from several different programs, such as the Stretch program at Arizona

State University. The Stretch program is designed to assist the most at-risk-of-failure students in the English department by stretching their courses over two semesters to better prepare them in their developmental classes to pass college-level English. In addition, the interviewee also took some of the studio (small class) approach from the University of South Carolina. Initially, CCBC had five different ALP-like programs ready to go and was going to pilot each, but due to logistics they decided to go with the one they thought would be most effective, which is what they called ALP.

After a summer implementation, which saw modest success, the ALP was born. The interviewee says CCBC chose what would become the ALP because it was a conflation of the positive characteristics and features of other developmental course programs they had encountered as they were traveling the country. After seeing success in the summer semester of 1993 on a small scale, and despite the objections of faculty who threatened to revolt because of the new program, ALP for English was fully implemented after being scaled up in the fall of 2007. The reason it took so long to implement collegewide was because of numerous problems at CCBC, including leadership changes, firings, cancellation of tenure, censure from the AAUP, and turmoil at each of the four campuses. During this time, it took a full five years to align the curriculum across CCBC. However, once the program was implemented, the results indicated that 69 percent of students in ALP English passed both the corequisite course and ENG 101. That number has hovered between 74 to 81 percent of students who pass ENG 101 and ENG 052 since the full scale-up in 2007.

The math department, reading, and ESL departments all wanted a version of ALP for themselves. In particular, since the math courses are more sequential, they had to be more carefully aligned so that there would be synchronicity between the developmental-level course and the college-level math course. Alignment for all of these departments (except for ESL) eventually occurred after five years and pass rates increased substantially, especially in math. That increase was noted by the Community College Research Center, which commissioned a study on CCBC's ALP program. This honor was the "equivalent of the Pope coming to visit us" (personal communication, December 14, 2016). The year-long study by the Community College Research Center found that in all departments where some adaptation of the ALP was occurring, high pass rates were found in those departments. Retention also increased, and most importantly, the increases in passing and retention rates transcended all demographics. However, the interviewee said they still think even though minority students have closed the gap significantly between themselves and their Caucasian counterparts, there is still a gap that exists in some areas, which he is working to fix.

Other challenges included filling all of the sections once the entire ALP was scaled-up collegewide. In addition, there was little to no training available for instructors who taught the ALP courses. Therefore, CCBC created the "ALP Institute," a weeklong training session for instructors who would teach ALP courses. It was offered five times per year and was required for instructors who wanted to teach ALP courses; the interviewee said it trained them very well to offer the new program. Another challenge is that the Dean and the department chair (the interviewee) are now

retired from the college so there is some inertia. The interviewee said, though, that CCBC has to keep going and continue to innovate using the ALP program that is now what “made them famous.”

Lastly, we discussed recommendations for other institutions who are looking into course redesign. The biggest recommendation was that if possible, try to implement the redesign within three years, with three years being the outer limit for how long the redesign takes. They also said that if possible, the ALP or any variations should be scaled up more quickly to know the impact and what issues need to be addressed to make the program run more smoothly. While the success of the ALP was a nice way to end a career, if they had scaled it up sooner, then 2700 more students would have passed ENG 101. However, because of the delay, they did not.

**Appendix G**

**ARTIFACT 6: SYLLABUS AND CLASSROOM ACTIVITIES**

### Additional Class Information/Activities

Syllabus Link: [https://blackboard.dtcc.edu/bbcswebdav/pid-6902084-dt-content-rid-21400755\\_1/xid-21400755\\_1](https://blackboard.dtcc.edu/bbcswebdav/pid-6902084-dt-content-rid-21400755_1/xid-21400755_1) (See Artifact 7 to access course)

1) *Elementary Algebra* (2012) published by Saylor Academy. This book is a free, Creative Commons licensed book and can be found here:

[https://saylordotorg.github.io/text\\_elementary-algebra/](https://saylordotorg.github.io/text_elementary-algebra/)

2) Supplemental Material as needed; links can be found on Blackboard course for MAT 100.

### Goals

The goals of MAT 100 are as follows:

- ❖ To offer support for students in MAT 180
- ❖ To review lessons and concepts learned in MAT 180
- ❖ To preview lessons and concepts for future MAT 180 lessons
- ❖ To teach students study skills necessary for success in math
- ❖ To work with your teacher and classmates to help you succeed

### Homework Policy

Students will have time in class to complete MAT 100 and MAT 180 assignments. Students should work on and complete any assignments they did not finish in class to bring to the next meeting.

### Evaluation Criteria/Policy

The final grade in this course will be determined as follows:

Tests and Final	35%
Homework	35%
In-class activities	15%
Participation/Attendance	15%
<b>TOTAL</b>	<b>100%</b>

\*\*\*If you are passing MAT 180 with a C or higher going into the final, you do not need to take the final exam in this class.\*\*\*

**MAT 100: Support for College Algebra  
Course Assignments Fall 2020**

Dates: August 24-December 11

Instructor: John Bradley

<b>Week/Topic</b>	<b>Assignment Schedule</b>	<b>Points</b>
<b>1:</b> Arithmetic and Introductory Algebra Review	<p><u>In-class:</u> Introduction to the course; “I wish my teacher knew” online survey; four corners; definitions, explanations, and practice; Test-taking skills I</p> <p><b>Assignment 1:</b> a) View Blackboard Module 1.</p> <p>b) Complete <a href="#">Pre-test 1</a> (Arithmetic).</p>	<b>100</b>
<b>2:</b> Algebra Review, Continued; Right Triangle Trigonometry	<p><u>In-class:</u> Review of Algebra I topics; Introduction to Right Triangle Trigonometry; Time management; Test-taking skills II</p> <p><b>Assignment 2:</b> a) View Blackboard Module 2.</p> <p>b) Complete <a href="#">Pre-test 2</a> individually or in small groups (Algebra).</p>	<b>100</b>
<b>3:</b> Geometry Review; Right Triangle Trigonometry, Continued	<p><u>In-class:</u> Geometry review; continuation of special triangles; math problem-solving skills; Test-taking skills III</p> <p><b>Assignment 3:</b> a) View Blackboard Module 3.</p> <p>b) Small-group work in-class using <a href="#">SMART manipulatives</a>.</p> <p>c) Work on homework problems from MAT 180.</p>	<p><b>50</b></p> <p><b>50</b></p>

<p><b>4: Sine, Cosine, and Tangent; Trigonometry Application Problems</b></p>	<p><u>In-class:</u> Right-triangle applications wrap-up; application problems with SOHCAHTOA</p> <p><b>Assignment 4:</b> a) View Blackboard Module 4.</p> <p>b) Continue small-group work in-class using <a href="#">SMART manipulatives</a>.</p> <p>c) Work on homework problems from MAT 180.</p>	<p><b>50</b></p> <p><b>50</b></p>
<p><b>5: Graphing, Part I</b></p>	<p><u>In-class:</u> Vertical line test; domain; range; evaluating functions; function graphs and transformations</p> <p><b>Assignment 50:</b> a) View Blackboard Module 5.</p> <p>b) Use MyLabsPlus to practice graphing.</p> <p>c) Work on homework problems for MAT 180.</p>	<p><b>50</b></p> <p><b>50</b></p>
<p><b>6: Graphing, Part II</b></p>	<p><u>In-class:</u> Function operations; Function composition and applications; inverses; Test anxiety 101</p> <p><b>Assignment 6:</b> a) View Blackboard Module 6 and practice with MyLabsPlus.</p> <p>b) Work on homework for MAT 180.</p> <p>c) Complete take-home test 1 for weeks 1-6.</p>	<p><b>50</b></p> <p><b>100</b></p>
<p><b>7: Equations and Inequalities</b></p>	<p><u>In-class:</u> Absolute value; rational; exponential; polynomial</p> <p><b>Assignment 7:</b> a) “I wish my teacher knew.”</p> <p>b) View Blackboard Module 7.</p>	<p><b>50</b></p>

	b) Work on homework for MAT 180.	<b>50</b>
<b>8: Polynomial Graphs and Applications</b>	<p><u>In-class:</u> Piece-wise functions; polynomial graphs and end behaviors; finding polynomial zeroes; review polynomial operations</p> <p><b>Assignment 8:</b> a) View Blackboard Module 8.</p> <p>b) Complete interactive <a href="#">activity</a>.</p> <p>c) Work on MAT 180 homework.</p>	<p><b>50</b></p> <p><b>50</b></p>
<b>9: Review Week</b>	<p><u>In-class:</u> Review Unit 2</p> <p><b>Assignment 9:</b> a) Group practice in My Labs Plus</p> <p>b) Individual practice in MyLabsPlus</p> <p>c) Catch-up on MAT 180 homework</p>	<p><b>50</b></p> <p><b>50</b></p>
<b>10: Rational Functions, Part I</b>	<p><u>In-class:</u> Test 2 on Unit 2 (in class and in groups); Operations with Rational Functions; Vedic variations</p> <p><b>Assignment 100:</b> a) View Blackboard Module 9.</p> <p>b) MyLabsPlus Practice individually or in small groups</p> <p>c) Work on MAT 180 homework.</p>	<p><b>100</b></p> <p><b>50</b></p>
<b>11: Rational Functions, Part II</b>	<p><u>In-class:</u> Domain; Range; Zeroes; Asymptotes; graphing</p> <p><b>Assignment 11:</b></p> <p>a) View Blackboard Module 10.</p> <p>b) Small group <a href="#">application practice</a></p>	<p><b>50</b></p>

	c) Work on MAT 180 homework.	
<b>12: Radical Functions, Part I</b>	<p><u>In-class:</u> Radical expressions and complex numbers; complex numbers operations; radical operations</p> <p><b>Assignment 12:</b> a) View Blackboard Module 11</p> <p>b) Radicals <a href="#">“Who Wants to be a Millionaire?”</a> activity</p> <p>c) Work on MAT 180 homework</p>	<p><b>50</b></p> <p><b>50</b></p>
<b>13: Radical Functions, Part II</b>	<p><u>In-class:</u> Rationalize numerators and denominators; solve radical equations; graphing and domain/range of radical functions</p> <p><b>Assignment 13:</b> a) View Blackboard module 12</p> <p>b) <a href="#">Radical equation practice activity</a></p> <p>c) Radical <a href="#">Jeopardy!</a></p> <p>d) Work on MAT 180 homework</p>	<p><b>50</b></p> <p><b>50</b></p>
<b>14: Quadratics, Part I</b>	<p><u>In-class:</u> Test 3 on Unit 3 (in class and in groups); Solving quadratic equations; introduction to graphing quadratic functions</p> <p><b>Assignment 14:</b> a) <a href="#">Work on quadratic graphing</a></p> <p>b) View Blackboard module 13</p> <p>c) Practice problems</p> <p>d) Work on Homework for MAT 180</p>	<p><b>100</b></p> <p><b>50</b></p> <p><b>50</b></p>
<b>15: Quadratics, Part II</b>	Quadratic Graphing, continued; Domain and Range; Solving Quadratic Applications; Math strategies review I	

	a) <a href="#">Interactive Applications Activity</a> b) Finish homework for MAT 180	<b>50</b>
<b>16: Final Exam Review</b>	Exam review for MAT 180; math strategies review II	<b>100*</b>

\* If you have an A, B, or C in MAT 180, you do not have to take the final for this class.

\*\*Activities and discussion of objectives 7-9 will be integrated and discussed throughout the course.

Total: **1600 points (no final)**

**1700 points (final)**

### **Evaluation Criteria/Policy**

The final grade in this course will be determined as follows:

Tests and Final	35%
Homework	35%
In-class activities	15%
Participation/Attendance	15%
<b>TOTAL</b>	<b>100%</b>

**Appendix H**

**ARTIFACT 7: MAT 100 BLACKBOARD SUPPORT COURSE**

This artifact is a support course for MAT 180 in Blackboard that uses the corequisite model. It is an example of how the hypothetical math support course would look and be laid out. The link can be found here:

[https://blackboard.dtcc.edu/webapps/login/?action=default\\_login](https://blackboard.dtcc.edu/webapps/login/?action=default_login)

Committee passwords and access:

Laura Eisenman

[eisenman@udel.edu](mailto:eisenman@udel.edu)

URL - [https://blackboard.dtcc.edu/webapps/login/?action=default\\_login](https://blackboard.dtcc.edu/webapps/login/?action=default_login)

User ID - eisenman

PassWord - DTCC1@3#

Chrystalla Mouza

[cmouza@udel.edu](mailto:cmouza@udel.edu)

URL - [https://blackboard.dtcc.edu/webapps/login/?action=default\\_login](https://blackboard.dtcc.edu/webapps/login/?action=default_login)

User ID - cmouza

PassWord - DTCC2@3#

Josh Wilson

[joshwils@udel.edu](mailto:joshwils@udel.edu)

URL - [https://blackboard.dtcc.edu/webapps/login/?action=default\\_login](https://blackboard.dtcc.edu/webapps/login/?action=default_login)

User ID - joshwils

PassWord - DTCC3@3#

(Mary Doody is already on the course as she works at DTCC.)

The videos and resources selected for the Blackboard course were from the Creative Commons website and were selected because the explanation of the topic is clear for students; the videos portray the concepts students will need to learn in MAT 180. Based on what is known about mathematics learning, these videos were selected because they offer students a chance to understand concepts and algorithms needed for problem-solving. Furthermore, these videos portray the best practice of reinforcing

“procedural learning and fluency” (Strengthening student, 2016) by serving as a “balanced supplement, especially with students who struggle with self-regulation and efficacy” (NCTM, 2015) as many DTCC students seem to do.


The selection of these videos and supplementary resources resulted from several studies that indicate the purposeful use of technology can improve both the learning and teaching of algorithmic problem-solving and higher levels of thinking (Pauley & Moore, 2016). The videos also offer students ready access to materials that will both allow them to understand the material being taught and see examples of math in everyday life. These videos and supplementary materials in the Blackboard course will also serve as a baseline for inquiry-based study. In addition, these materials will further enable students to focus on the problem-solving competencies they are expected to acquire in their math courses through better visual depictions of the math in action. The videos and other resources were selected deliberately for students to gain a balanced understanding of problem-solving steps that can be applied not just to a given problem they are working on, but also enable them to apply the techniques to other variations of a concept rather than seeing the concepts that are taught as stand-alone. Students will be able to relate them more readily to their math course and other aspects of their lives. They could help foster inquiry-based learning which they student can use not just in math but also in other courses and in the workplace, which is where DTCC prepares students one day to be.

## REFERENCES

- NCTM. (2015). *Strategic use of technology in teaching and learning mathematics*. Retrieved from <http://www.nctm.org/Standards-and-Positions/Position-Statements/Strategic-Use-of-Technology-in-Teaching-and-Learning-Mathematics/>.
- Pauley, G. & Moore, P. (2016). *Strengthening student educational outcomes*. (2016). Retrieved from <http://www.k12.wa.us/SSEO/pubdocs/MathMenu.pdf>

Screenshots of the site can be found here:

The results from this Course for the **DelTech Course Evaluation** survey have been made available for your analysis. [View Results](#)



## Welcome to MAT 100!

[Build Content](#) [Assessments](#) [Tools](#) [Partner Content](#) [Discover Content](#)

### Welcome!

My name is Jack Bradley and I will be your instructor for MAT 100! I hope you are all as excited to be in this class as I am. This is a journey we will take together and regardless of your math background, *know* that you can succeed!

We will have a number of activities and assessments for this course, and the main goal is to help you pass MAT 180, College Algebra. I know for some of you, this is the first math course you have taken in a while. For others, this course is the next step along the way to attaining a degree from Delaware Tech.

Whatever your background, we are all in this together. Please don't be afraid to ask questions as we go along about concepts or lessons you may not understand right away. Learning math is a gradual process and what you learn is built on previous knowledge.

## Learning Materials

Build Content 

Assessments 

Tools 

Partner Content 



### Week 1

8/24 to 8/31

Each week begins on Monday at 8:30 a.m. and ends at 11:59 p.m. Sunday night.

Objectives

- Discuss pre-course survey results
- Take arithmetic pre-test
- Discuss arithmetic pre-test results
- View Blackboard module 1
- Finish assignments for week 1



### Week 2

8/31 to 9/7

Objectives

- Complete algebra pre-test
- Review pre-test results
- Review algebra I topics
- View Blackboard Module 2
- Begin studying right triangle trigonometry







### Week 3



9/7 to 9/14

Objectives

- Continue right triangle trigonometry
- Review geometry as necessary
- Complete math problem-solving skills workshop
- SMART manipulatives work
- View Blackboard module 3





## Shared Problem Solver



[Build Content](#)  [Assessments](#)  [Tools](#)  [Partner Content](#)  [Discover Content](#)

 **Shared Problem Solver** 

In this space, please post homework problems that stump you. We will go over them in class. However, if you know how to solve it, please post your solution and show all of your work. This is a great resource to share what you've learned and to create a study guide, too.

## My Labs Plus

[Build Content](#)  [Assessments](#)  [Tools](#)  [Partner Content](#)  [Discover Content](#)


 **My Labs Plus Introduction** 

If this is your **first time** using MyLabsPlus, please use the following information for your user name and password:

user name: Delaware Tech username





password: mathstudent


If you have used MyLabsPlus before, please use your previous log-in information.

 **My Labs Plus link**

You will use this link when we complete My Labs Plus problems in and out of class.



## College Algebra Resources

[Build Content](#)  [Assessments](#)  [Tools](#)  [Partner Content](#)  [Discover Content](#)


 **Free Resource Page**

This page lists some great links to resources that can help you reinforce and practice what you've learned in class.

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 **Video Lectures and Practice** 

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 **College Algebra Practice Worksheets**

**Appendix I**

**ARTIFACT 8: ADVISEMENT SHEET**

## Corequisite Course Advisement and FAQ

1) What is a corequisite?

A corequisite is a course you must take at the same time as another course.

2) What is a corequisite math model?

A corequisite math model is a way for students who score lower on the math placement test to take math for their major with their classmates. Even though they did not score high enough to be exempt, they can still take a corequisite four-credit math class to help them successfully pass college-level math.

3) How do I know if I have to take the corequisite math class?

If you scored 120 or below on the College Placement Arithmetic test, you will need to take the corequisite class. You will still enroll in the college-level math course for your major, but you will also take **MAT 100: Support for College Algebra** at the same time. Please refer to the diagram below to see the new pathway for students who place into Pre-tech (developmental) math courses.

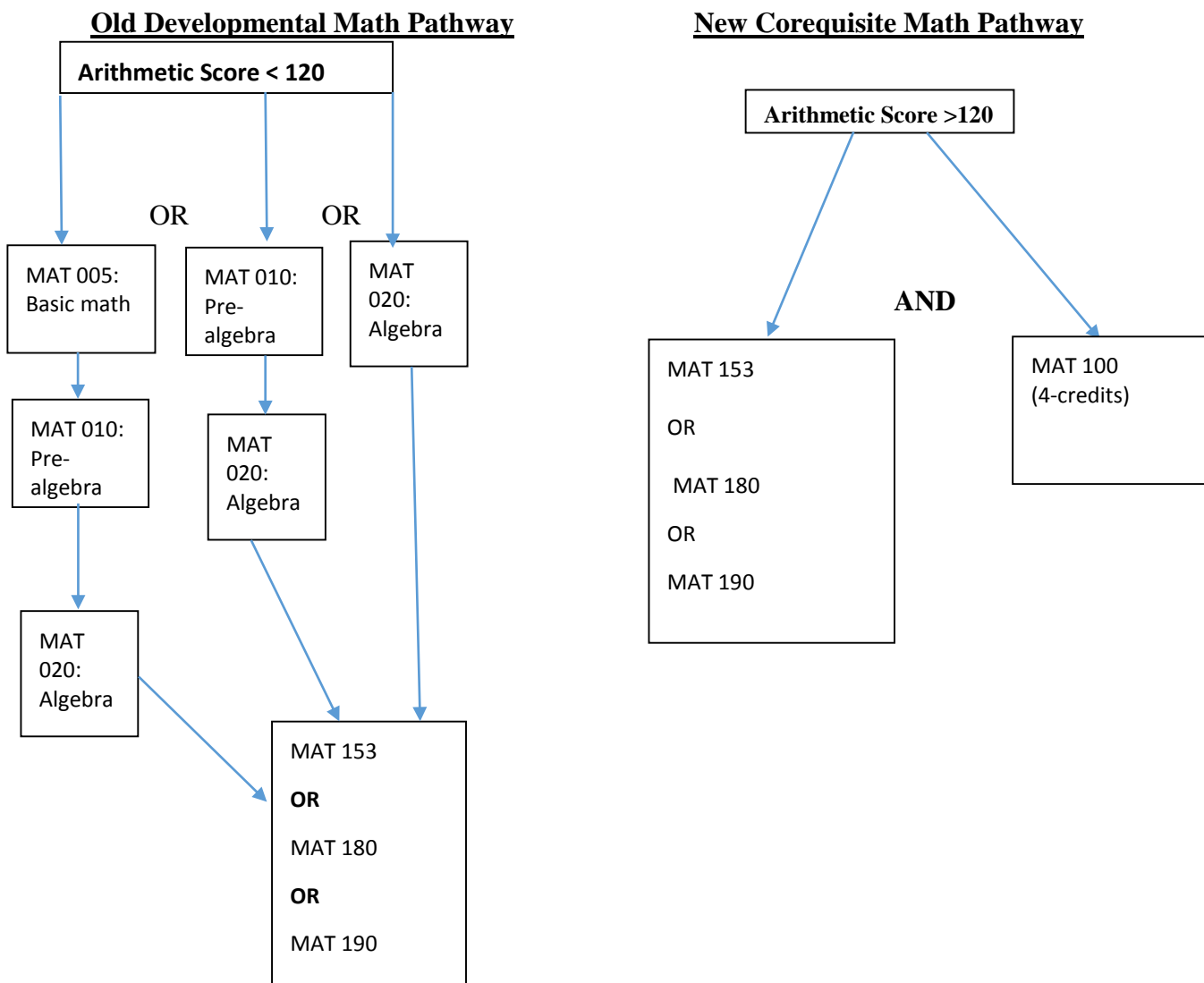


Figure 1. New versus old pathways

4) What's the point of having to take two math classes?

This program will help you start classes for your major more quickly. Please see the diagram above for a comparison of the old and new programs.

5) What is **MAT 100: Support for College Algebra**?

MAT 100: Support for College Algebra is a course that meets for four hours each week on days when you don't have your college-level math class.

For example, if your college-level math class meets on Mondays and Wednesdays from 1-2:50, your MAT 100 class will meet Tuesdays and Thursdays at that same time, 1-2:50. It will help you keep pace and succeed in your college-level math class, either MAT 180 or 153, depending on your pathway.

6) Who teaches MAT 100?

MAT 100 is taught by the same instructor as your college-level math course. There are also tutors available during class time who can help you, too.

7) What exactly do we do in MAT 100?

In MAT 100, you will work individually, in small groups, and as a class to tackle any problems or questions from your college-level math class. Instructors and tutors will review, give small group and individual assignments, and will work with you to address any problems you are having with your college-level math class.

You will also learn test-taking strategies and ways you can reduce math stress and anxiety. It's also a great place to do homework, work with your classmates, and

prepare to take tests for your college-level math class. It's kind of like a learning community.

8) Are there any tests in the class?

Yes. You will take four tests and a final exam\* for this class, in addition to completing assignments for it. You are assigned a final grade based on DTCC's letter grade system.

\*If you have an A average in your college-level math class heading into your final exam there, you are exempt from the final exam in this class (MAT 100).

9) Do I have to take the corequisite math class?

Only if you place below 120 on the Arithmetic placement exam.

10) Can I see the syllabus and list of activities for MAT 100?

Sure! Please go to

[https://blackboard.dtcc.edu/webapps/blackboard/content/listContentEditable.jsp?content\\_id=\\_69\\_02058\\_1&course\\_id=\\_91327\\_1](https://blackboard.dtcc.edu/webapps/blackboard/content/listContentEditable.jsp?content_id=_69_02058_1&course_id=_91327_1) to start your course.

The course begins with a brief orientation video (transcript also available below the video link if you learn better by reading). You can follow along with the video to see the different parts of your MAT 100 support course.

11) What's in it for me?

This is a chance for you to eliminate your math requirement in potentially one semester. You can start taking classes for your major right away instead of waiting a semester before you complete your general prerequisite requirements. Most importantly, this new course sequence will hopefully save time, money, and help you get your degree faster!

**Questions?**

Contact John Bradley, Academic Support Assistant

**Phone:** 302-830-5254

**Email:** john.bradley@dtcc.edu

**Appendix J**

**ARTIFACT 9: STRATEGIC PLAN**

## **Strategic Plan: Corequisite Remediation at DTCC**

Developmental mathematics has always been an area where DTCC students struggle. In 2012, the Vice President for Academic Affairs charged the math departments at each campus with creating an innovative developmental math course sequence. This course sequence would theoretically help students be successful in developmental math, would increase developmental math course pass rates, and would decrease the gap between when students apply to DTCC and when they finish their math classes. In other words, it would theoretically help them earn their degree or certificate more quickly (personal communication, S. Smith, April 11, 2014). While many changes occurred in the math department and the developmental math course sequence since then, what follows is a strategic plan for a new sequence of math classes. This strategic plan calls for the elimination of developmental math courses; any student who places into developmental math courses according to the ACCUPLACER exam (score less than 120) will be placed in college-level math. (Math review courses will still be available for students who truly need developmental math courses, but these courses will be offered through the Workforce Development department of DTCC.)

In addition to being placed alongside their non-remediated peers, students with lower scores on the test will take a corequisite course called MAT 100: College Algebra Support that will offer them just-in-time, targeted remediation. It also gives them the ability to pass the college-level class at the same time as their non-remediated peers. The elimination of developmental math courses will save the

students time and academic resources. The following plan outlines steps that have been taken to research current math practices at DTCC and other institutions. It then suggests steps to implement, pilot, analyze and expand a corequisite model of mathematics at Delaware Tech. To solicit feedback on this strategic plan, I consulted the Dean of Instruction at the Stanton and Wilmington campuses along with two math instructors. Details of those communications follow below.

### **DTCC Corequisite Model Implementation Plan**

#### **First steps**

- 1) *Cull and analyze data from past emporium model use in all developmental math courses collegewide.*** This step was finished in July 2016 and the results indicated that the pass rate for emporium math classes hovered around 51 percent at each campus of DTCC in Fall 2016.
- 2) *Conduct surveys and/or interviews with math faculty, students, tutors, and supplemental coordinators to determine pros and cons of past, present and corequisite math redesign at DTCC.*** This step was conducted from December 2016 to January 2017 and the results indicated that there would be support for an alternative developmental math structure.
- 3) *Contact and write report on up to four institutions who use corequisite model or variation; report results.*** As part of this step, I contacted the Structured Learning Assistance Supervisor at Ferris State University, the Director of the Academic Support Center at Austin Peay State University, and the ALP founder-emeritus at Baltimore County Community College. Each university operates as a different example of the

corequisite model. Ferris State University employs the Structured Learning Assistance model, whereby students must attend labs with TAs and tutors outside of class to maintain and improve their grade average in their college-level math class. Austin Peay State University uses the linked workshop model branch of corequisite remediation, whereby students who place into developmental mathematics via the entrance exam are still put into college-level math courses for their major; however, they must take a corequisite course that offers extra practice, just-in-time instruction, and group work to help the student succeed in their college-level math class. Lastly, the Community College of Baltimore uses an Accelerated Learning Program (ALP) where students concurrently take a shorter math corequisite course along with their college-level course.

The results of the interviews indicated that the corequisite model has been effective at three different institutions: two four-year ones and a community college near DTCC. In all cases, successes transcend multiple demographics.

**4) *Create syllabus, measurable objectives, and classroom activities for corequisite model.*** This step was completed in October 2016. I researched syllabi from these institutions to create one for a theoretical corequisite model at DTCC. While the objectives in the support course, MAT 100 (“College Algebra Support”), are the same as those in MAT 180, the activities are designed to show what such a course would look like at DTCC. This course as designed as a four-credit class that meets four hours per week. Two of those hours are mandatory teaching sessions in the math lab, and the

other two hours involve staying in the math lab to complete required assignments for this course.

This course complements objectives in MAT 180 and is a variation on current developmental math instruction at DTCC, which currently uses a prerequisite model. It is designed to support students who placed in a developmental math course via the placement exam. Despite developmental math placement, students can take the support course along with the college-level math class. Objectives are standard collegewide and this syllabus and course are designed to be implemented collegewide. The next step would be to present the idea to the math department chairs and deans of instruction to for collegewide feedback. If they support it, the changes could potentially be sent to the curriculum committee.

*5) Design sample course for MAT 180 using an implementation of the corequisite model, such as Structured Learning Assistance (SLA) or the linked-workshop model (completed in November 2016); demonstrate these modules to math departments and deans of instruction at each campus (yet to be completed).*

To help visualize corequisite model implementation, I created a sample Blackboard support course (MAT 100) that complements lessons in MAT 180. This course contains videos from several creative commons sources and also contains class activities, supplementary practice problems, and resources for learning to master the objectives of MAT 180.

*6) Create a policy advisement sheet for corequisite math model to be distributed to academic counselors, math instructors, and department chairs. I designed an FAQ*

and advisement sheet in January 2017 that explains in plain terms what the corequisite model is, who qualifies, and what it means for their major. I have also included a flow chart of the old math placement process and the new math placement process to help students understand the difference and how it affects them if a corequisite model is implemented.

7) In this step, I received feedback in February 2017 about this strategic plan from Wilmington and Georgetown campus math chairs, two math instructors, and the Dean of Instruction at the Stanton and Wilmington campuses. The Dean of Instruction indicated that the math department is again looking at the low pass rate results from this past semester of the new math redesign. However, she also said that one of the biggest barriers to implementing this corequisite redesign would be obtaining buy-in from the math chairs to do a redesign. The reason buy-in would be difficult is because the math department recently underwent a redesign, used a consultant for the redesign before that (where they implemented the emporium model), and did not unanimously support the corequisite model based on the survey data I explained to her. The Dean of Instruction said that this proposal seems like a viable option for the math department to address the low pass rates in developmental classes; however, she indicated that I would need to present the data to them (K. Friel, personal communication, February 9, 2017). Other feedback I received from a math instructor asked whether it would be unfair to non-remediated students that they would not be able to attend the MAT 100 course sessions. This feedback was noted and will be incorporated into discussions

and a presentation with the math department regarding the corequisite model. It is a valid point (B. Thompson, personal communication, February 8, 2017).

### **Next steps**

These next steps are similar to what was in my proposal; however, they have been modified slightly based on feedback I received.

**8)** *Resurvey faculty and students in the fall 2017 semester to see if their perceptions of barriers, knowledge of redesign models, feelings on new math redesign, and willingness to take a math support class have changed.*

**9)** *Analyze survey results and share with a focus group of students and faculty, both separately and later together, to promote the corequisite model and try to gain buy-in from each constituency.* This task includes hosting information sessions and meeting with the math department chairs and faculty, and focus groups of students.

**10)** If buy-in seems likely, it will be necessary to present this strategic plan to the Deans of Instruction at each campus to investigate buy-in at that level as well.

If buy-in seems likely and approval to proceed is obtained from Deans of Instruction, I can proceed to step 11 below.

**11)** *Administer NCAT Course Readiness Criteria to all math departments.* Analyze and share results with math departments. I plan to take on an active role in the reboot of the developmental math program. I will administer, collect, and analyze the results of the NCAT Course Readiness Criteria. This assessment will be administered to the math departments college-wide. Results will be shared (see Step 9) to determine how to proceed with eliminating developmental math courses and building courses around

both the corequisite syllabus already created and the new math pathway options students have going forward.

**12)** While I did not obtain approval yet, the Dean of Instruction seemed to suggest that if the math departments college-wide approve the idea after my presentation to them, I could conceivably convene a task force at each campus to determine the best approach to redesign using the corequisite model. The task force would be comprised of the math chair, three math faculty, and faculty members from the Business and Computer Information Systems departments. However, at a math instructor's suggestion, a notice will be made to the entire college so that anyone interested in working on this project could.

The task force would meet quarterly at their individual campuses and as a collegewide task force at the Dover campus. At the initial meeting, they will analyze results of the NCAT survey, write recommendations for redesign, and determine as a group how best to proceed using a version of the corequisite model. In addition, they will dole out assignments for a completed redesign and will meet regularly (on campus and collegewide) to work on their individual assignments at the discretion of the committee chair, who will be the Assistant Director of the Center for Creative Instruction and Technology (CCIT) who reports to its Director. CCIT is responsible for all instructional design collegewide. The campus and collegewide committees will continue to work on the redesign as part of their regular job responsibilities.

**13)** One year later, this group will create a college-wide syllabus for a corequisite course that will be linked initially to parallel sections of MAT 180. The syllabus will

contain Core Course Performance Objectives, Measurable Performance Objectives, and adhere to the college grading system. Once the syllabus is created, it will be sent to the collegewide curriculum committee for consideration. After responding to and addressing the questions and/or concerns of the curriculum committee, the syllabus will be sent to the Assistant Dean of Instruction at each campus to gain approval. Once the Assistant Deans of Instruction who will submit it the Deans of Instruction collegewide. If approved, the syllabus will be sent through the proper channels to the Vice President for Academic Affairs in order to gain approval for collegewide implementation.

**14)** As a result, in fall 2020-51 (the fall 2019 semester) four corequisite sections will be piloted at each campus in parallel to both prerequisite developmental math courses and in parallel to MAT 180 (College Algebra).

**15)** During each semester, the campus committees will track, analyze and write a report to be shared with the collegewide committee based on data and recommendations from pilot program.

**16)** The task force will then share, discuss, and analyze the results to determine whether the results of the pilot are worth full implementation of the corequisite model.

**17)** If this redesign process has been successful, standardized, and aligned collegewide, the corequisite model will be implemented parallel to all MAT 180 courses. However, the Dean of Instruction and I agreed in our conversation that MAT 180 was just an example of a course where the corequisite model could be

implemented. We also discussed piloting it for MAT 153 (College Algebra and Statistics or MAT 190 (Precalculus).

**18)** The task force would then meet again after one year (having met as campus task forces at least three times during that year) to determine if the program is worth implementing collegewide. A decision can then be made to create other math pathways and/or implement changes in other subject areas.

**19)** If it is, then the same steps starting with #8 will be followed for all other math pathways until the corequisite model is effectively implemented for all math courses at DTCC. For the purpose of this ELP, MAT 180 was selected as the parent college-level course; however, this process could begin with MAT 153 or other college-level math courses as needed.

**Appendix K**  
**IRB APPROVAL**



RESEARCH OFFICE

210 Halliburton Hall  
University of Delaware  
Newark, Delaware 19716-1551  
Ph: 302/831-2136  
Fax: 302/831-2828

DATE: October 18, 2016

TO: John Bradley, Ed. D.  
FROM: University of Delaware IRB

STUDY TITLE: [974811-1] Developmental Math Protocol, Interviews, and Surveys

SUBMISSION TYPE: New Project

ACTION: DETERMINATION OF EXEMPT STATUS  
DECISION DATE: October 18, 2016

REVIEW CATEGORY: Exemption category # (2)

Thank you for your submission of New Project materials for this research study. The University of Delaware IRB has determined this project is EXEMPT FROM IRB REVIEW according to federal regulations.

We will put a copy of this correspondence on file in our office. Please remember to notify us if you make any substantial changes to the project.

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.

cc:

**APPROVAL PAGE**

*Delaware Technical Community College supports thoughtful, valid research designed to benefit the College and its students. However, the College is in no way obligated to approve research requests. Approval will be determined by 1) the study's potential benefit to the College and 2) the human and financial resources available for the level of support requested. Therefore, the decision of the Associate Vice President for Academic Affairs is final and non-appealable. In no instance shall research approval be granted to an individual who is not an employee of Delaware Tech.*

*It is the employee's responsibility to move the application through the signature process. Once you obtain the signatures of your Director/Dean and Campus Director, please allow two weeks for the application to be reviewed by Academic Affairs. Once approved, the employee will be notified via email and a signed PDF of the application will be attached. Hard copies of approved applications will be filed and stored in Academic Affairs, Office of the President.*



11/7/16

**DEAN/DIRECTOR**

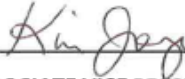
**DATE**



11/18/16

**VICE PRESIDENT/CAMPUS DIRECTOR**

**DATE**



12/1/16

**ASSOCIATE VICE PRESIDENT FOR ACADEMIC AFFAIRS**

**DATE**

Updated September 26, 2013