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EFFECTIVENESS AND EFFICIENCY OF MATH 0045 AT EAST CAROLINA
UNIVERSITY

by

Kimberly Miller and Katalin Szucs, Ph.D.

A Senior Honors Project Presented to the

Honors College

East Carolina University

In Partial Fulfillment of the

Requirements for

Graduation with Honors

by

Kimberly Miller

Greenville, NC

May 2017

Approved by:

Katalin Szucs, Ph.D.

Department of Mathematics, Thomas Harriot College of Arts and Sciences

Abstract

At East Carolina University, students who do not place into a college-level mathematics course are required to enroll in a remedial course and master material before continuing with their mathematics studies. The purpose of this study is to examine the effectiveness and efficiency of the remedial mathematics program, with a particular focus on the MATH 0045 course offered in conjunction with Pitt Community College. Over the years, the delivery method for course content has changed. To examine the effectiveness of the remedial mathematics program, student success in college-level mathematics courses was compared to their success in remedial mathematics courses, and by an evaluation of drop-withdraw-fail (DWF) rates. The efficiency of the course was examined by the analysis of test scores on a question-by-question basis, and data on students who successfully completed one or more recovery units. The results of this study will help to determine the program's ability to remediate students and aim to improve the effectiveness of the program.

Introduction

The general education requirements at East Carolina University require students to complete at least three credit hours of college-level mathematics. Upon acceptance at East Carolina University, students are placed into mathematics courses based on their scores from Advanced Placement exams, SAT or ACT exams, or the mathematics placement exam. Students who are not placed into college-level mathematics by exam scores or transfer credits are enrolled in remedial mathematics to improve their mathematics skills in preparation for college-level mathematics courses.

Background

Since 1988, the remedial mathematics program at East Carolina University has been partnered with Pitt Community College. Since then, remedial mathematics, known as Intermediate Algebra, has been offered at East Carolina University to out-of-state students as MATH 0001 and to in-state students as MATH 0045, the PCC-partnered course. In 2012, the state of North Carolina mandated changes to developmental mathematics programs offered by community colleges. Significant changes included the installation of a modular system and mastery-based progression of course content. Course content is now divided into modules, or units, which must be sequentially passed to continue progressing in the developmental mathematics courses. These changes, in turn, altered the structure of the remedial mathematics course at East Carolina University offered in conjunction with Pitt Community College, and caused changes to the classroom setting and teaching methods of MATH 0045 at East Carolina University. It is important to analyze how this has affected the effectiveness¹ and efficiency² of

¹ “producing the intended or expected result” (“Effective,” 2017)

² “performing or functioning in the best possible manner with the least waste of time and effort” (“Efficient,” 2017)

the course, which will help determine if new methods need to be altered, or if old methods need to be re-implemented.

Remedial Mathematics at East Carolina University

It is important to note that remedial mathematics courses, MATH 0001 and MATH 0045, do not satisfy the general education requirements of East Carolina University. Therefore, remedial mathematics students are required to successfully pass an additional, college-level, mathematics course to satisfy these requirements.

Students enrolled in MATH 0045 typically enroll in MATH 1065, MATH 1066, or MATH 2127 after completion of the course. For the purposes of this study, MATH 0045 students who later enroll in MATH 1065 or MATH 1066 will be the focal population.

MATH 0045 Program Description

The MATH 0045 program offered in conjunction with Pitt Community College is currently held in a computer lab in the Austin building on East Carolina University's campus. It is offered, primarily, as a face-to-face course, with a few online sections offered some semesters. Course content is divided into three units, each of which must be mastered by the students before being able to test in the next unit.

During the first meeting of the class, the instructor explains the course syllabus to the students, which outlines the progression of course material and requirements for student success in the course. (The course syllabus for the Fall 2015 and Spring 2016 semesters can be found in Appendix A, and a sample course calendar can be found in Appendix B.) In each unit, students receive a grade for homework, quizzes, and tests. Students are provided the opportunity to test twice in each unit: Test A and Test B. Students who do not earn a grade of eighty percent or

better on Test A are required to take Test B; those who do earn a grade of eighty percent or better are given the option to re-test. Unit scores are then compiled using a weighted system. Students who do not pass a unit with a weighted average of seventy percent or better are required to complete a Recovery Unit. The Recovery Unit allows students to improve their unit scores by providing them with additional practice and an opportunity to re-test on the material covered in that unit. Students placed into the Recovery Unit are required to continue working on the material being covered in the current unit, but must successfully complete and pass the Recovery Unit, i.e. the previous unit, before being able to test in the current unit.

There is a strong support system in place for students at East Carolina University which provides free access to additional help. East Carolina University offers students additional support through the Pirate Academic Success Center and the Math CAVE in Joyner Library. MATH 0045 students, in particular, are provided additional assistance by Pitt Community College with access to tutoring assistance from embedded laboratory assistants available during class time, at specified extended times before test deadlines, and during specified “open lab” times which are determined each semester.

Methods

The first step for this study was to obtain approval from the Institutional Review Board (IRB). The Institutional Review Board at East Carolina University ensures the protection of the “rights and welfare of human subjects engaged in research at East Carolina University” (“University & medical center,” 2017). While the participants of this study were not directly affected by most of the process, the Institutional Review Board protects the rights of the students who participated in a brief survey conducted to obtain data on the demographics and opinions of the students enrolled in remedial mathematics and college algebra courses at East Carolina

University, and protects their identities in the collection of data with regard to other areas of the study. After approval from the Institutional Review Board was granted, the collection of data for the study could begin.

Effectiveness

The effectiveness of MATH 0045 was evaluated by analyzing student success, i.e. grades, in college-level mathematics courses compared to their success in remedial mathematics. This data was requested from the Institutional Planning, Assessment, and Research (IPAR) staff at East Carolina University. The data was compiled by the IPAR staff and presented in a Microsoft Excel document, recording students' grades in remedial mathematics with their corresponding grades in college-level mathematics.

After receiving the raw data from IPAR, it was categorized by remedial mathematics course, and then further by college-level mathematics course. In a separate Microsoft Excel document, the MATH 0001 and MATH 0045 students were separated further, and then were grouped by subsequent college-level mathematics course. This allowed for a comparison of achievement in college-level mathematics based on achievement in remedial mathematics.

Efficiency

The efficiency of MATH 0045 was evaluated by the analysis of each test from the three units on a question-by-question basis, and by analyzing the success rate of students who were placed into one or more recovery units.

Test question evaluation. The MATH 0045 course at East Carolina University uses Pearson's MyMathLab (MML) to distribute homework assignments, quizzes, tests, and supplemental material to students. Data is recorded and maintained in the MyMathLab online

system. Test results from the Spring 2016 semester were exported from the MyMathLab website in the form of Microsoft Excel documents. After exportation, results on a question-by-question basis for fifteen sections of MATH 0045 were compiled into a single Microsoft Excel document.

For the tests given in MATH 0045 through MyMathLab, questions are pooled from a sample pool of possible questions. As a result, multiple problems were used in the creation of each test for each student. The compiled Microsoft Excel document for each unit test, also separated by test version, A or B, presented the total number of students who correctly answered, received partial credit, incorrectly answered, or omitted each question. After raw numbers were recorded for each of these response options for each question, the numbers were converted to percentages of the total number of students who received each pooled question. Questions missed by at least sixty percent of students were noted as concepts not mastered by a majority of students.

In addition, as students are provided the opportunity to test twice in each unit, the results from Test A could be compared to the results of Test B. This allowed for the examination of improvement, stagnation in improvement, or non-improvement from Test A to Test B. These results help to further identify course content which is least mastered by students, allowing for consideration for improvements in content delivery.

Recovery Unit. As MATH 0045 is mastery-based, students who do not master course content in a given unit are required to complete a Recovery Unit. Recovery Unit scores are recorded on student attendance and grade sheets, and are collected at the end of each semester and kept on file by the course coordinator. In addition, as this course is offered in conjunction with Pitt Community College, each instructor for MATH 0045 must report students who did not receive a passing score for any unit. Data for the Recovery Unit was collected from the reports

sent to Pitt Community College and cross-checked with attendance and grade sheets, both of which were provided by the MATH 0045 course coordinator at East Carolina University.

Microsoft Excel was also used to record this data. Students who were placed into a Recovery Unit at any point during the semester were recorded, in addition to their passing status for each unit, the number of times they failed each unit before passing or ceasing progress, and their final East Carolina University letter grade and passing status.

This data will help to determine the efficiency of the Recovery Unit in recovering students who struggle with course content during the unit in which it is taught.

Student Perception of MATH 0045 Survey

A brief, eighteen question, survey was administered during the Fall 2016 semester to obtain demographics and student opinions regarding MATH 0045. Surveys were also distributed to students enrolled in MATH 0001, MATH 1065, and MATH 1066 during the same semester.

The surveys were created using Learning Catalytics, a Pearson program. The researcher was provided a brief training from a Pearson staff member regarding the creation and distribution of surveys using Learning Catalytics. After surveys were individually created for each course, a session³ could be created. Activated sessions automatically generated an access code which could be distributed to the population of students targeted by the survey.

After survey creation and activation, the course coordinators for each course were contacted and provided the course-specific code for the respective surveys. Course coordinators

³ A session, in the context of this study, means that the survey is activated, an identification number is created, and the survey becomes available to the intended audience, in this case, the students in MATH 0045 and other mathematics courses. After a session is activated, students can enter their session ID on the Learning Catalytics website using their Pearson login, and can complete the survey.

were asked for their assistance in survey distribution by contacting individual course instructors and requesting that the survey be distributed to their students.

While a similar survey was distributed to the students in MATH 0001, MATH 1065, and MATH 1066, the responses from MATH 0045 students were primarily analyzed, and the responses from other courses were used as a comparative measure. The goal of the survey was to obtain demographic information representative of the student populations of remedial and college-level mathematics, and to obtain opinions of the course set-up and ability to prepare students for future courses, as well as students' general attitudes about the course.

Results

Effectiveness

For this study, the effectiveness of the MATH 0045 course was examined two ways – through the (1) analysis of grade comparisons of MATH 1065 or MATH 1066 versus remedial mathematics, and by (2) evaluating changes in drop-withdraw-fail (DWF) rates from pre- and post-redesign. A previous analysis that (3) compared the grades of students in MATH 1065 and MATH 1066 who placed directly into those courses versus students who did take remedial mathematics, MATH 0045 or MATH 0001, was used as a comparative measure for the methods used in this study.

This population for grade comparisons included students enrolled in remedial mathematics, both MATH 0001 and MATH 0045, during the Fall 2015 semester, who were then enrolled in college-level mathematics, specifically MATH 1065 and MATH 1066, during the Spring 2016 or Summer 2016 semesters. This population totaled 321 students, 260 of which were enrolled in MATH 0045, and 61 of which were enrolled in MATH 0001. Of the students

enrolled in MATH 0045 during the Fall 2015 semester, 187 were enrolled in MATH 1065 in a Spring 2016 or Summer 2016 semester, and 73 were enrolled in MATH 1066 during a subsequent semester.

Of the 187 students who took MATH 0045 and then MATH 1065, 182 students passed⁴ MATH 0045, and 110 of those students also passed MATH 1065 – approximately 60.44%. Of the 73 students who took MATH 0045 and then MATH 1066, 71 students passed MATH 0045, and 50 of those students also passed MATH 1066 – approximately 70.74% (refer to Appendix C, Table C3 for more information).

Sixty-one (61) students were enrolled in MATH 0001, and then enrolled in MATH 1065 or MATH 1066 in a subsequent semester. Thirty-one (31) of those students took MATH 1065. Of those students, 30 passed MATH 0001, 18 of whom also passed MATH 1065 – approximately 60% (refer to Appendix C, Table C4). Thirty (30) students took MATH 1066 after completing MATH 0001. Of those 30 students, 27 passed MATH 0001, 15 of whom also passed MATH 1066 – approximately 55.56% (refer to Appendix C, Table C5).

MATH 1065 or 1066 Grade	MATH 0045 Grade						
		A	B	C	D	F	W
A	15	5	1	0	0	0	
B	35	25	2	0	0	0	
C	12	45	20	0	1	0	
D	2	18	20	0	0	0	

⁴ Any grade of C- or better is considered a passing score

	F	5	15	29	1	2	2
	W	0	2	2	0	1	0

Table C1: (n = 260) MATH 0045 grades from Fall 2015 students with corresponding MATH 1065 or 1066 grades from Spring 2016 and Summer 2016 semesters. The green highlighted portion of the table represents the students who passed MATH 0045 and MATH 1065 or 1066. Similar charts for isolated comparisons between MATH 0045 and MATH 1065, MATH 0045 and MATH 1066, MATH 0001 and MATH 1065, and MATH 0001 and MATH 1066 can be found in Appendix C.

In addition, drop-withdraw-fail (DWF) rates from Fall 2008 through Spring 2016 were compared. Since Fall 2008, the average DWF rate for MATH 0045 is 38.75%. In 2013, after a one-year grace period, the state-mandated redesign was implemented at East Carolina University. Since the redesign, the DWF rate for Fall 2013 through Spring 2016 – the latest DWF rate available – is 26.835% (refer to Appendix D for more information).

Efficiency

Test question evaluation. Tests from the Spring 2016 semester were evaluated on a question-by-question basis. After calculating the percentage of students who answered each question correctly, partially, incorrectly, or by omission, questions missed by at least 60% of students were noted. The number of questions on each test given, number of questions missed by at least 60% of students, and percentage of questions missed by at least 60% of students broke down as follows:

Test Unit/Version	# of Possible Questions	# of Questions Missed by at least 60% of Students	% of Questions Missed at 60%+ out of Total Possible Questions
Unit 1 Test A	126	14	11.11%
Unit 1 Test B	129	11	8.53%
Unit 2 Test A	71	18	25.35%
Unit 2 Test B	71	11	15.49%
Unit 3 Test A	115	13	11.30%
Unit 3 Test B	113	10	8.85%
Average	104.17	12.83	12.32%

Table C1: Number of questions in test pools for each of the six tests given during the Spring 2016 semester, as well as the number of questions missed by at least 60% of students, and the respective percentages. Averages also displayed.

Recovery Unit. During the Spring 2016 semester, 403 students were enrolled in sixteen sections of MATH 0045. Of those 403 students, 161 students were placed into a Recovery Unit at some point during the semester. Therefore, approximately 40% of MATH 0045 students were sent through a Recovery Unit. Of the 161 students who were placed into a Recovery Unit during the Spring 2016 semester, approximately 51% passed the course, approximately 44.7% failed the course, and approximately 4.3% dropped the course.

Student Perception of MATH 0045 Survey

In the survey distributed to MATH 0045 students, students were asked questions which would help to establish a general demographic of the students enrolled in MATH 0045, and which would provide a general reflection of students' attitudes about the course.

Some important information to note about the demographics of this population of students is that 69% of them are freshmen, 20% have not had a mathematics course since their junior year of high school, and 53% have had at least a one-year gap since their previous mathematics course (Appendix F).

When asked about their time commitments, 93% of students indicated that they have a normal course load (12-18 credits), 40% are involved in at least one student organization, and 38% are employed part- or full-time (Appendix F).

Student attitudes of the course were evaluated by the following questions:

On a scale from one (1) to three (3), how difficult was this course for you? (261 responses)

- a. 1 – easy (11%)
- b. 2 – not too easy or too difficult (61%)
- c. 3 – difficult (28%)

On a scale from one (1) to three (3), how well do you think this course has prepared you for your next mathematics course? (261 responses)

- a. 1 – not well at all (8%)
- b. 2 – moderately well (56%)
- c. 3 – very well (36%)

Knowing what this course entails, would you have chosen to take this course had you not been placed into it? (261 responses)

- a. Yes, I would have chosen to take this course even if I had not been placed into it (40%)
- b. No, I would have chosen to bypass this course had I been given the option (60%)

This course is a face-to-face course with an online component, all assignments are completed online, and the material is self-paced. Do you find the setup of this course beneficial to your learning style(s)? (261 responses)

- a. Yes, I find this setup to be beneficial to my learning style(s) (66%)
- b. No, I do not find this setup beneficial (22%)
- c. Neutral/no opinion (12%)

The full survey, with responses, can be found in Appendix F.

Discussion

Effectiveness

The percentages of students who pass MATH 0045 and also pass their subsequent college-level mathematics course indicate that the MATH 0045 course can be considered fairly effective. On average, 65.48% of students who pass MATH 0045 will pass their subsequent college-level course, in this case, MATH 1065 or MATH 1066. Therefore, MATH 0045 is producing a significant number of students who pass remedial mathematics *and* their subsequent college algebra course. In addition, the drop-withdraw-fail (DWF) rates of MATH 0045 have, on average, decreased since Fall 2013. However, remedial-student success compared to non-remedial-student success in MATH 1065 and MATH 1066 has lowered since Fall 2013.

Dr. Katalin Szucs has previously analyzed data provided by the Institutional Planning, Assessment, and Research (IPAR) staff which compares the grades of students in MATH 1065 and MATH 1066 who placed directly into those courses, i.e. did not take remedial mathematics,

versus students who did take remedial mathematics, MATH 0045 or MATH 0001, prior to entry into MATH 1065 or MATH 1066. Prior to redesign, students in MATH 1065 and MATH 1066 who had previously been enrolled in MATH 0045 were outperforming students who had not taken a remedial mathematics course. The ABC rate of students with a remedial mathematics background was higher than those without, and the DWF rate was lower for those who had taken remedial mathematics.

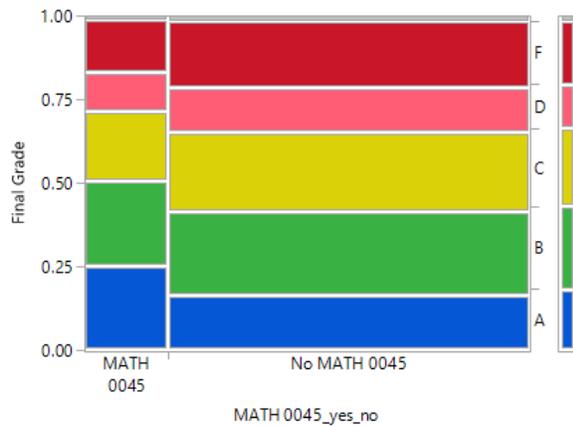


Figure 1: Contingency analysis of final grade by MATH 0045_yes_no for MATH 1065 students (pre-redesign).

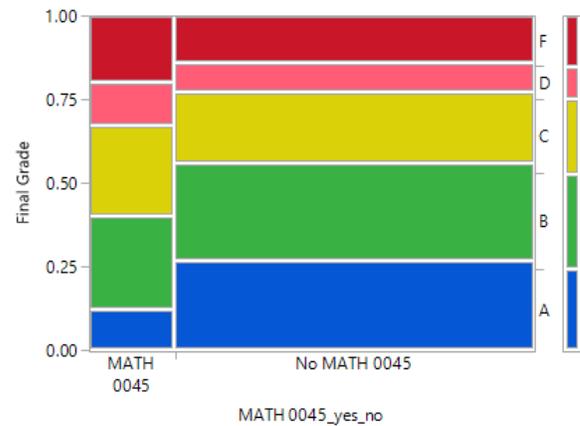


Figure 2: Contingency analysis of final grade by MATH 0045_yes_no for MATH 1065 students (post-redesign).

In Fall 2016, the same data was provided for the population of students from Fall 2014 through Spring 2016. During that time, students in MATH 1065 who had taken MATH 0045 were no longer outperforming students who had placed directly into MATH 1065. There were fewer As, Bs, and Cs among students who had taken MATH 0045, and they had a higher DWF rate. The corresponding results for students in MATH 1066, however, did not show as significant a change; the grade distribution was about equal for MATH 0045 students as non-MATH 0045 students.

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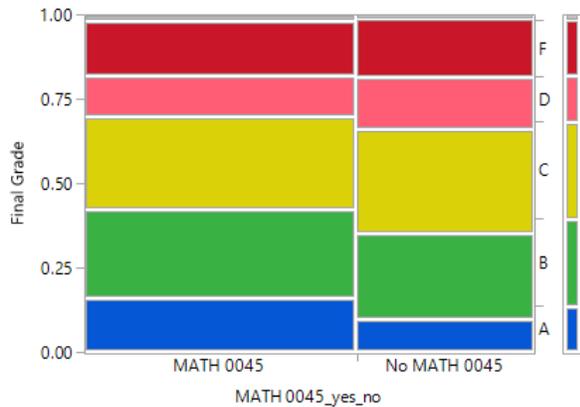


Figure 3: Contingency analysis of final grade by MATH 0045_yes_no for MATH 1066 students (pre-redesign).

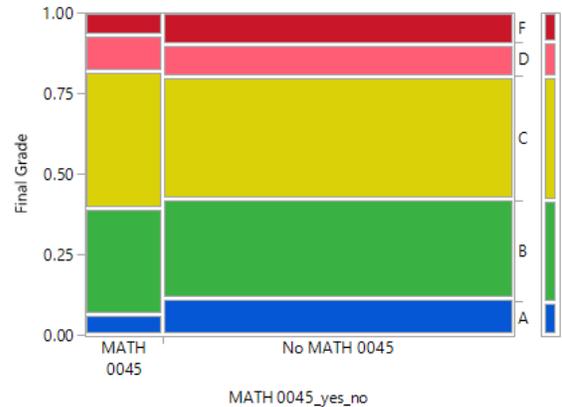


Figure 4: Contingency analysis of final grade by MATH 0045_yes_no for MATH 1066 students (post-redesign).

Looking at the results from this analysis, the redesign appears to have made the MATH 0045 course less effective.

Efficiency

Test question evaluation. The tests given in MATH 0045 can be considered an efficient means of testing student knowledge with minimal waste of time and effort. On average, 12.32% of an average 104 possible questions on the six given tests is missed by at least 60% of students, indicating that over 87% of questions are answered correctly by a majority of students. In addition, fewer questions were missed on Test B for all three units than were missed on Test A, indicating that students are improving their test scores either from studying on their own between test dates, from additional tutoring hours provided by MATH 0045 laboratory assistants, or other resources on campus. An improvement in test scores from Test A to Test B means that little to no additional time is required to cover material from previous units, allowing for a progression in course material.

As a result of the analysis of test questions, commonly missed concepts can now be emphasized during lectures in future semesters. Furthermore, the higher rate of questions missed

on Unit 2 Test A versus other tests during that semester can be attributed to a change in course content for that semester. During the Spring 2016 semester, the concepts taught in Unit 2 were shifted. Typically, Unit 2 consists of rational expressions and equations, and equations of lines. In the Spring of 2016, equations of lines and related material was removed from Unit 2, leaving only rational expressions and equations. Many remedial mathematics students struggle with fractions/rational expressions, so the removal of equations of lines from Unit 2 during that semester inherently created a more difficult test for students.

Recovery Unit. The Recovery Unit is producing its intended result for approximately half of the students who are placed into a Recovery Unit for one or more units during the semester. While it may not be the most efficient way of producing passing scores for those students, it is an effective tool. Of the 161 students placed into a Recovery Unit during the semester, 82 students, or 51%, passed the course with a grade of 70% or better. Without the Recovery Unit, those 82 students would have had a much less likely chance of passing the course resulting from the poor performance which placed them into a Recovery Unit. In this way, the Recovery Unit allows students, who may have otherwise failed the course, an additional opportunity to master the course content and prepare them for future mathematics courses. In addition, the students saved from failing the course help to decrease the drop-withdraw-fail (DWF) rate of the course. Therefore, the Recovery Unit is performing in the manner in which it was intended by helping to save approximately 20% of students from failing the course.

Student Perception of MATH 0045 Survey

The results of the survey distributed to MATH 0045 students provided interesting insight to student perceptions of the course.

It is important to note that the majority of students enrolled in MATH 0045 are freshmen, and are between the ages of 18-19. Freshmen are new to campus, are settling in and adjusting to college life, and, with that, comes the need to develop responsibility, study habits, and dedication to coursework. In addition, the vast majority of students are not overloaded with coursework and other responsibilities. Ninety-three percent of students are enrolled in a normal amount of credit hours, between 12-18, and an additional 5% are part-time (less than 12 hours), and only 38% are employed, with only 8% being employed full-time.

The results from the questions which focused on student perceptions of the course help to support the claim of the course's effectiveness and efficiency. Ninety-two percent of students indicated that they feel the course is "producing the... intended result" ("Effectiveness," 2017) by preparing them for their next mathematics course. In addition, 66% of students found the course setup beneficial to their learning. Despite these findings, though, one of the most interesting results from the survey regarding student perception of the course is that 60% of students would have chosen to bypass MATH 0045 had they been provided the option. Most students did not find this course too easy nor too difficult, most felt well-prepared for their next mathematics course, most found the course setup beneficial to their learning, yet, *most* also would have chosen to bypass this course.

Conclusion

The results of this study are not straightforward. Different methods for determining the effectiveness of the course have resulted in different outcomes. However, the methods used in this study have determined that the MATH 0045 course at East Carolina University can be considered effective and efficient. "Effective," for the purposes of this study, was defined as "producing the intended or expected result" ("Effective," 2017). The purpose of the remedial

mathematics program is to provide students with a solid mathematics foundation so that they can be successful in their future mathematics courses. Over 65% of students pass MATH 0045 and also pass MATH 1065 or MATH 1066, indicating that the program is producing the intended result. Furthermore, the graphs displayed in Appendix C portray expected results of the program: students who perform well in MATH 0045 will perform well in their subsequent mathematics course, whereas students who perform poorly in MATH 0045 will perform poorly in their subsequent mathematics course. The course can also be considered efficient: “perform[ing] or function[ing] in the best possible manner with the least waste of time and effort” (“Efficient,” 2017). Students are performing well on the tests given in MATH 0045, with just over 12% of questions being missed by at least 60% of students. In addition, students miss fewer questions on Test B than Test A, indicating that the required help is being sought between tests. As a result, the course instructors can proceed with new material without needing to revisit previously taught concepts, so little time is wasted in covering material which has already been taught.

Although the course can be considered effective and efficient as a result of the methods used in this study, there remains room for improvement. There are several other factors which contribute to the success of this course which were not analyzed in this study. It is the intention of this study that the results identify areas of further study and of possible improvement, so that the course may continue to improve its ability to effectively and efficiently remediate students, preparing them for their mathematics future.

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Appendix A

Course Description

This intermediate algebra course is a special dual-enrollment course. As such, please note the following:

	PCC	ECU
Course number	DMS003	MATH 0045
Credit Hours	3 semester hours	2 semester hours
Contact Hours	3.75 hours/week	3 hours/week

Students must fill out PCC registration cards and application forms at the first class meeting and later a census quiz.

This course will not satisfy the general education mathematics requirement, certification, or degree.

However, this course is used **in calculating a student's grade point average, and the total course load**. Grades are reported both to ECU and PCC.

Objectives

- 1) Review basic algebraic concepts
- 2) Acquaint the student with five types of equations, inequalities, polynomial, rational, radical expressions and equations, and word problems (DMA Modules 6, 7, 8)
- 3) To provide the student with a mathematical foundation that will prepare the student to succeed in their next level mathematics course.

Materials

Required

- MyMathLab access for Tobey/Slater: Intermediate Algebra, 7th.ed.

Recommended

- Book: While logging into the MML system provides an e-copy of Tobey/Slater: Intermediate Algebra, 7th. Ed. students often find purchasing a hard copy of the text beneficial to their studies.
- Calculator: **Simple** calculator use is *optional*. If you opt for a scientific calculator, we recommend **TI-30XIIS TI-30XS MultiView**. Use of programmable calculators, graphing calculators, or calculators embedded in other electronic devices (e.g. cell-phones) is expressly prohibited.

Grading

The course material is organized into three units, consisting of *Homework Assignments, Mastery Quizzes, Review Tests and Unit Tests*. Each Unit Grade is calculated via the following formula:

$$\text{Unit Grade} = 10\%(\text{MML Homework}) + 20\%(\text{Quizzes}) + 70\%(\text{Unit Test})$$

After the three units are completed, you will take the Final Exam. Your final grade will be the average of your three Unit Grades and your Final Exam Grade (E).

$$\text{Course grade} = \frac{U1+U2+U3+E}{4}$$

Note: A grade of C- is a pre-req. for Math1065, 1066 or 2127.

Letter Grade	Range	Letter Grade	Range	Letter Grade	Range
A	93 and above	B-	80-82	D+	67-69

A-	90-92	C+	77-79	D	63-66
B+	87-89	C	73-76	D-	60-62
B	83-86	C-	70-72	F	59 and below

PCC will award a **P** or **R** for the DMS 003 shell, based on your ECU numerical grade. An **R** will be awarded if you have less than 70% on any of the units.

Incompletes

Incompletes will only be issued if a student has a passing course average and extreme extenuating circumstances. Incompletes cannot be given to avoid a failing grade.

Attendance

This is a face-to-face class with web components. Regular and punctual class attendance is expected. Attendance is taken daily. Students are counted tardy if they are late or miss more than ten minutes of class time. Every two incidences of tardiness will count as one absence.

You are awarded 2 bonus points on each Unit Test for perfect attendance. Each absence deducts one point from your unit test grade. Therefore, **more than two absences per unit will negatively impact the unit test grade.**

Your number of absences **includes** absences due to illness, family emergencies, inclement weather, etc. Please immediately notify your instructor via campus e-mail, if you are an athlete or have extenuating circumstances.

Five or more consecutive absences may result an automatic F in the course. *However, in the event you finish the coursework before the end of the semester, you may stop coming to class altogether.*

Please use your absences wisely as attendance directly affects your grade!

Note: mere physical presence does not constitute attendance. Students engaged in non-class related activities, disruptive behavior, violation of cellphone rule, or missing a significant amount of class time may be asked to leave or counted absent at the instructor's discretion.

Lab Procedures

Class Structure

In class you have the opportunity to listen to a lecture, view Multimedia presentations, work with a tutor or peer, and actively engage in learning the concepts. Each class period has a corresponding MML homework assignment. Please refer to the Course Calendar, posted in MML, for specific deadlines. The Course Calendar sets the minimal pace, but you may work at a faster pace.

Working at an accelerated pace may allow you extra time on more challenging material or early testing options. Early testing is permitted if all corresponding unit assignments are completed with a satisfactory average. Students successfully (at least 70%) completing all three units may take the Final Exam and complete the entire course early.

Studying

We recommend you to spend at least two additional hours each day reading the appropriate sections, completing your online homework assignments, and utilizing the Multimedia Library. Bring your questions/problems to class or tutorials. Refer to Study Skills tab in MyMathLab.

Quizzes

There will be a combination of in-class and at home quizzes. There are no make-up quizzes, but a few of the lowest quiz grades will be dropped. Quizzes compose 20% of your Unit Grade.

Testing

After completing all the unit homework and quizzes, you will take the on-line unit Review A. The Review Test will prepare you for the in-class Unit Test A. You may take the Unit Test early, if all unit assignments are completed with scores of at least 80%. See the Course Calendar for testing deadlines.

If your Unit Test A score is lower than 80%, **you must complete Review Test B and take Unit Test B.** However, the higher score will be retained as your Unit Test score.

The Review Test will be used to award up to 5 bonus points on its matching Unit Test. Performance on Review Test A earns bonus points for Test A, while Review Test B earns bonus points for Test B. Bonus points are not interchangeable.

If your Unit Test A grade is higher than 80, you **may** take Unit Test B to improve your grade and the same policy applies as above.

Please remember the following:

1. A picture ID may be required to take a test.
2. You must put your name, class time, section# and date at the top of your lab provided scrap paper.
3. **When you take a test, you may have only a pencil, lab provided scrap paper and an authorized calculator on your desk.**
4. **Absolutely no phones!** If we see your phone during the test you will receive an automatic zero on that test and you will be asked to leave the room.
5. All relevant work should be shown on the lab provided scrap paper. It will be kept on file.
6. Tests must be taken during your class period (and only once a day).
7. You should allow **at least** 40 minutes to take a test.
8. Any grading errors must be reported by the next class period.

Recovery Unit:

Progression from unit to unit is based on mastery of the material (Mastery Based course). As such, students with a Unit Grade < 70% must complete additional assignments to recover their Unit Grade. Students will re-enroll in an additional MML section and must satisfactorily complete the additional unit **before** attempting the next Unit Test. This Recovery Unit will run concurrently with the next unit.

For example, a student failing Unit 1 must successfully complete Recovery Unit 1 before attempting the Unit 2 Test. While completing Recovery Unit 1, the student would also continue with Unit 2 material. The scores from the Unit and the Recovery Unit will be averaged to provide an overall Unit Grade. *Students requiring Recovery Units are at risk for failing the course.*

Final Exam:

You will take a Final Exam after all three units are completed. The Final Exam is comprehensive and given at the scheduled Exam time, except when you are finishing the course early. Early Final must be taken before Unit 3 Test A deadline. Testing rules 1-5 above apply for taking the Final Exam. Specific exam information is posted in MML. The exam schedule may also be found on the ECU University Calendar.

Tutoring

Students are encouraged to take advantage of the FREE peer tutoring services provided. Please see the side board in A-110 or MML for information.

Additional ECU and PCC PoliciesDisability Support

East Carolina University seeks to comply fully with the Americans with Disabilities Act (ADA). Students requesting accommodations based on a disability must be registered with the Department for Disability Support Services located in Slay 138 ((252) 737-1016 (Voice/TTY)).

Academic Integrity

Academic integrity is expected of every East Carolina University student. Academically violating the Honor Code includes the following:

- Cheating: The giving or receiving of any unauthorized aid or assistance or the giving or receiving of unfair advantage on any form of academic work.
- Plagiarism: Copying the language, structure, ideas, and/or thoughts of another and adopting those as one's original work.
- Falsification: A statement of untruth, either verbal or written, regarding any circumstances relating to academic work.
- Exportation: Removing of testing material or test questions by either physical or electronic methods.
- Attempting any act which if completed would constitute an academic integrity violation as defined above.

Consequences for violations are at the discretion of the instructor and lab coordinator. Possible consequences include 1. A zero on the assignment 2. A zero for the unit 3. An F for the course 4. Further referral to the University Committee on Academic Integrity. No student may drop the involved course or withdraw from school prior to resolving an academic integrity charge.

Disruption Statement

East Carolina University is committed to providing each student with a rich, distinctive educational experience. To this end, students who do not follow reasonable standards of behavior in the classroom, or other academic setting may be removed from the course by the instructor.

ECU Retention Requirements

GPA Hours at ECU Plus Transferred Credit Hours	Retention Requirement GPA
1-29 semester hours	1.8
30-59 semester hours	1.9
60-74 semester hours	2.0
75 or more semester hours	2.0

Substance Use

PCC prohibits the use, sales, or possession of alcoholic beverages or illegal substances, as defined by the North Carolina Controlled Substance Act, on college property or at college sponsored events. Any student violating this policy will be subject to disciplinary action up to and/or including expulsion from the College and possible criminal prosecution.

Caveat

The instructor reserves the right to amend this syllabus as necessary.

Appendix B

~ Unit 1 Spring 2016 ~						
Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
17	11 January	12 Welcome 0.0	13	14 1.1- 1.3; 1.5 & 1.6 H 0.0 Q 0.0	15	16
18	18  MLK Holiday	19 3.5+ H 1.1- 1.3; 1.5 & 1.6 Q 1.1- 1.3; 1.5, & 1.6	20	21 1.4 H 3.5+ Q 3.5+	22	23
24	25	26 5.1 & 5.2 H 1.4 Q 1.4	27	28 5.4 H 5.1 & 5.2 Q 5.1 & 5.2	29	30
31	1 February	2 5.5 H 5.4 Q 5.4	3	4 5.6 & 5.7 H 5.5 Q 5.5	5	6
7	8	9 Test 1A Deadline H 5.6; 5.7 Q 5.6; 5.7 Review Test 1A Due	10	11 Test 1B Deadline Review Test 1B		

~ Unit 2 Spring 2016 ~						
Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
		16 February 2.1, 2.2, & 2.3	17	18 5.8 H 2.1; 2.2 & 2.3 Q 2.1; 2.2 & 2.3	19	20
21	22 6.1 H 5.8 Q 5.8	23 6.1	24 6.2	25 6.2 H 6.1 Q 6.1	26	27
28	29 1 March 6.3 H 6.2 Q 6.2	30 6.3	31 6.4	1 6.4 H 6.3 Q 6.3	2	3
6	7	8	9	10	11	12
SPRING BREAK WEEK						
13	14 6.5 & 7.7 H 6.4 Q 6.4	15 6.5 & 7.7	16	17 Test 2A Deadline 6.5 & 7.7 Q 6.5 & 7.7 Review Test 2A	18	19
20	21	22 Test 2B Deadline Review Test 2B				

~ Unit 3 Spring 2016 ~						
Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
27	28	29	30	31	1 April	2
		7.1 & 7.2 H 2.6; 8.2 Q 2.6 & 8.2		7.3 H 7.1; 7.2 Q 7.1 & 7.2	25 State Holiday Happy Easter!	
3	4	5	6	7	8	9
		7.4 H 7.3 Q 7.3		7.5 & 7.6 H 7.4 Q 7.4		
10	11	12	13	14	15	16
		8.2 & 3.6 H 7.5 & 7.6 Q 7.5 & 7.6		Test 3A Deadline 8.2; 3.6 Q 8.2; 3.6 Review Test 3A		
17	18	19	20	21	22	23
		Test 3B Deadline Review Test 3B		Review for Final		
24	25	26	27	Final Exam dates and times depend on section Check the ECU Academic Calendar & MML For schedule		
		Friday Classes Meet	Reading Day 			

Appendix C

Graph C1. (n = 260) Visual comparison of MATH 1065 and MATH 1066 grades versus MATH 0045 grades.

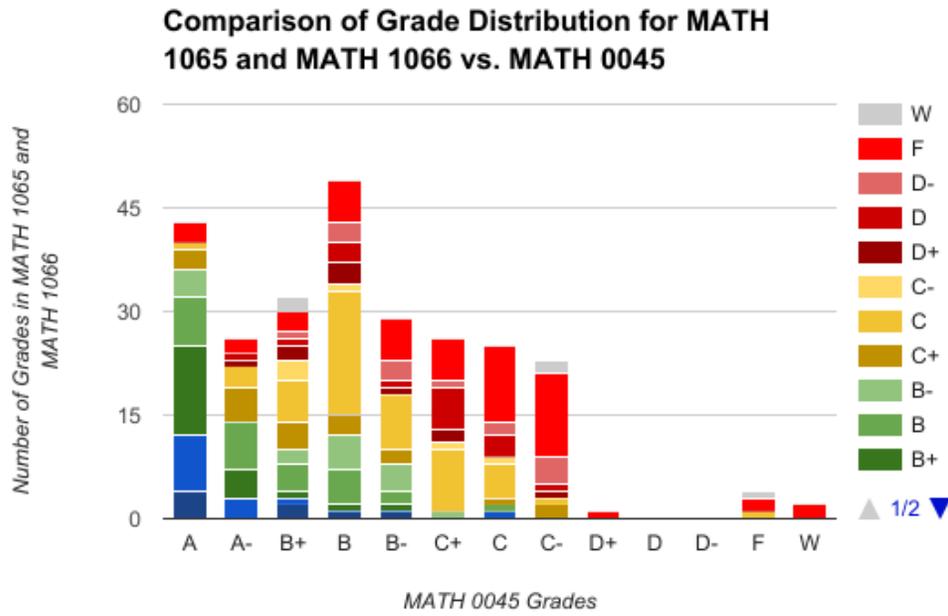


Table C3. (n = 73) Comparison of MATH 1066 grades to MATH 0045 grades. The green highlighted portion of the table represents the students who passed MATH 0045 *and* MATH 1066.

MATH 1066 Grade	MATH 0045 Grade						
	A	B	C	D	F	W	
A	3	3	0	0	0	0	
B	8	7	1	0	0	0	
C	1	17	10	0	1	0	
D	1	5	9	0	0	0	
F	0	3	3	0	0	0	
W	0	0	0	0	1	0	

Graph C3. (n = 73) Visual comparison of MATH 1066 grades to MATH 0045 grades.

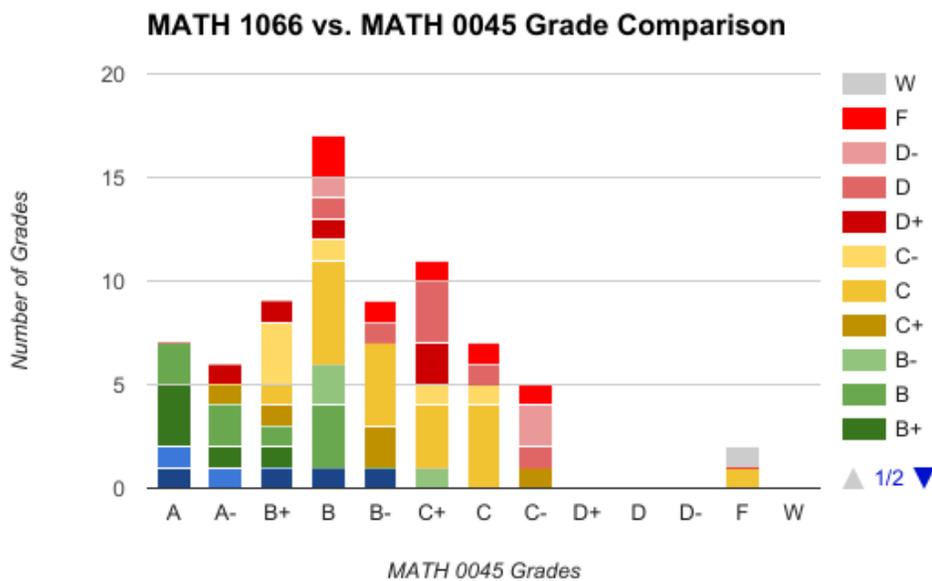
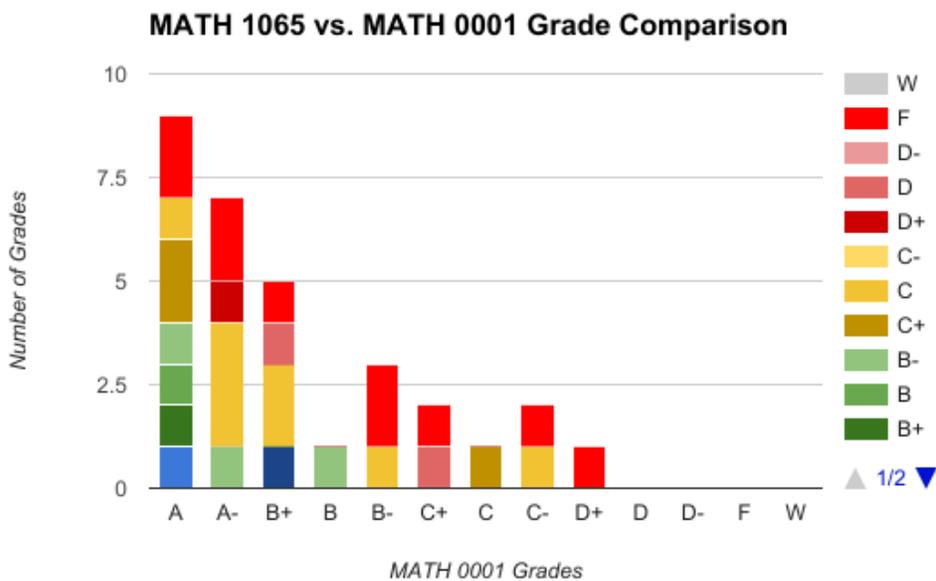


Table C4. (n = 31) Comparison of MATH 1065 grades to MATH 0001 grades. The green highlighted portion of the table represents the students who passed MATH 0001 *and* MATH 1065.

MATH 1065 Grade	MATH 0001 Grade						
	A	B	C	D	F	W	
A	1	1	0	0	0	0	
B	4	1	0	0	0	0	
C	6	3	2	0	0	0	
D	1	1	1	0	0	0	
F	4	3	2	1	0	0	
W	0	0	0	0	0	0	

Graph C4. (n = 31) Visual comparison of MATH 1065 grades to MATH 0001 grades.



Appendix D

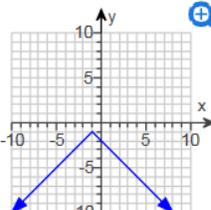
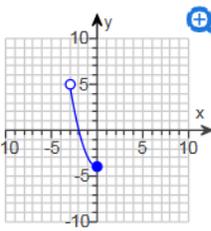
Table D1. Average passing and drop-withdraw-fail rates for MATH 0045, MATH 0001, MATH 1065, and MATH 1066, categorized by semester, year, and total.

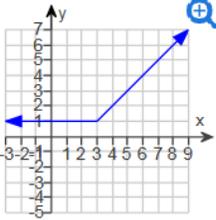
		Fall 2008 – Spring 2016		Fall 2008 – Spring 2013		Fall 2013 – Spring 2016	
		ABC	DWF	ABC	DWF	ABC	DWF
MATH 0001	Fall Avg.	72.375%	27.625%	68.8%	31.2%	78.33%	21.67%
	Spring Avg.	68%	32%	68.6%	31.4%	67%	33%
	Combined Avg.	70.1875%	29.8125%	68.7%	31.3%	72.665%	27.335%
MATH 0045	Fall Avg.	64%	36%	56.6%	43.4%	76.33%	23.67%
	Spring Avg.	58.5%	41.5%	51.6%	48.4%	70%	30%
	Combined Avg.	61.25%	38.75%	54.1%	45.9%	73.165%	26.835%
MATH 1065	Fall Avg.	57.625%	42.375%	54.8%	45.2%	62.33%	37.67%
	Spring Avg.	55.375%	44.625%	54.8%	45.2%	56.33%	43.67%
	Combined Avg.	56.5%	43.5%	54.8%	45.2%	59.33%	40.67%
MATH 1066	Fall Avg.	65.125%	34.875%	66%	34%	63.67%	36.33%
	Spring Avg.	61.25%	38.75%	62.8%	37.2%	58.67%	41.33%
	Combined Avg.	63.1875%	36.8125%	64.4%	35.6%	61.17%	38.83%

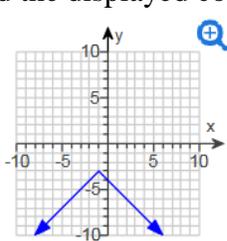
Appendix E

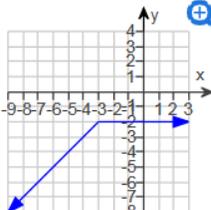
Table E2. Questions on each of the six tests offered during the Spring 2016 semester which were missed by at least 60% of students. “Example Problem[s]” were pulled from the textbook used during the Spring 2016 semester, and correspond to the concept number listed on the test for each question. Each “Example Problem” highlighted in red represents a problem missed by at least 60% of students on both Test A and Test B during that unit, representing concepts which may need more clarification during lecture.

Unit 1 Test A		
Concept	Example Problem	% Missed
Identify the subsets of the real numbers to which a given number belongs.	1.1.15 Indicate the set(s) to which the number belongs: 0.79 Answer: rational numbers, and real numbers	65.42% Incorrect
	1.1.19 List the negative integers: {-25, -28/7, -18/5, - π , -0.763, -0.333..., 0, 1/10, 2/7, $\pi/4$, $\sqrt{3}$, 9, 52.8, 283/5} Answer: -25, -28/7	69.57% Partial Credit, 0% Incorrect
Use the quotient rule of exponents.	1.4.31 Divide. Simplify your answers. $\frac{2x^3}{x^8}$ Answer: $\frac{2}{x^5}$	64.52% Incorrect
	1.4.51 Simplify. Express your answers with positive exponents only. $\frac{2^{-3}a^2}{2^{-4}a^{-2}}$ Answer: $2a^4$	69.81% Incorrect
Use the power rule of exponents.	1.4.53 Simplify. Express your answers with positive exponents only. $\left(\frac{1}{3}y\right)^{-3}$ Answer:	73.77% Incorrect, 6.56% Omitted

	$\frac{27}{y^3}$	
	<p>1.4.55 Simplify. Express your answers with positive exponents only.</p> $\left(\frac{y^{-3}}{x}\right)^{-2}$ <p>Answer: x^2y^6</p>	67.92% Incorrect
Remove grouping symbols in their proper order to simplify algebraic expressions.	<p>1.5.53 Remove grouping symbols if necessary and simplify.</p> $3y[y - (x - 5)]$ <p>Answer: $3y^2 - 3xy + 15y$</p>	64.71% Incorrect
Cumulative Review + (3.5) 3.5 rev_1	<p>Use the graph to determine the following.</p> <ol style="list-style-type: none"> the function's domain the function's range the function values, $f(-2)$ and $f(3)$ <p>Assume that the graph of the function continues its trend beyond the displayed coordinate grid.</p>  <p>Answer:</p> <ol style="list-style-type: none"> $(-\infty, \infty)$ $(-\infty, -1)$ $f(-2) = -2, f(3) = -5$ 	72% Partial Credit, 4% Incorrect
Cumulative Review + (3.5) 3.5 rev_2	<p>Use the graph to determine the following.</p> <ol style="list-style-type: none"> the function's domain the function's range the function value indicated below. $f(-1)$  <p>Answer:</p> <ol style="list-style-type: none"> $(-3, 0]$ $[-4, 5)$ $f(-1) = -3$ 	51.43% Partial Credit, 28.57% Incorrect

Cumulative Review + (3.5) 3.5 rev_3	Use the graph to determine <ol style="list-style-type: none"> the function's domain the function's range the function values indicated below. $f(1)$ $f(4)$  <p>Answer:</p> <ol style="list-style-type: none"> $(-\infty, \infty)$ $[1, \infty)$ $f(1) = 1, f(4) = 2$ 	78.79% Partial Credit, 9.09% Incorrect
Add and subtract polynomials.	5.1.17 Add or subtract the following polynomials as indicated. $(5a^3 - 2a^2 - 6a + 8) + (5a + 6) - (-a^2 - a + 2)$ Answer: $5a^3 - a^2 + 12$	59.09% Incorrect, 3.25% Omitted
Quick Quiz 5.1.2	Multiply. $(5x - 2y^2)^2$ Answer: $25x^2 - 20xy^2 + 4y^4$	62.5% Incorrect
Factor polynomials.	5.7.33 Factor if possible. Be sure to factor completely. $81a^4 - 1$ Answer: $(9a^2 + 1)(3a + 1)(3a - 1)$	67.12% Incorrect, 2.63% Omitted
Factor the sum or difference of two cubes.	5.6.43 Use the sum and difference of cubes formulas to factor. Be sure to factor out any common factors. $64x^3 + 125$ Answer: $(4x + 5)(16x^2 - 20x + 25)$	53.26% Incorrect, 11.96% Omitted
Unit 1 Test B		
Concept	Example Problem	% Missed
Rewrite expressions with negative exponents as expressions with positive exponents.	1.4.5 Simplify. Rewrite all expressions with positive exponents only. $(-7)^{-2}$ Answer: $1/49$	68.75% Incorrect, 2.08% Omitted
Use the quotient rule of exponents.	1.4.51 Simplify. Express your answers with positive exponents only.	75% Incorrect

	$\frac{2^{-3}a^2}{2^{-4}a^{-2}}$ <p>Answer: $2a^4$</p>	
Use the product rule of exponents.	<p>1.4.53 Simplify. Express your answers with positive exponents only.</p> $\left(\frac{1}{3}y\right)^{-3}$ <p>Answer:</p> $\frac{27}{y^3}$	82.35% Incorrect
	<p>1.4.55 Simplify. Express your answers with positive exponents only.</p> $\left(\frac{y^{-3}}{x}\right)^{-2}$ <p>Answer: x^2y^6</p>	64.62% Incorrect, 4.62% Omitted
Remove grouping symbols in their proper order to simplify algebraic expressions.	<p>1.5.53 Remove grouping symbols if necessary and simplify. $3y[y - (x - 5)]$ Answer: $3y^2 - 3xy + 15y$</p>	60.98% Incorrect
Cumulative Review + (3.5) 3.5 rev_1	<p>Use the graph to determine the following.</p> <ol style="list-style-type: none"> the function's domain the function's range the function values, $f(-2)$ and $f(1)$ <p>Assume that the graph of the function continues its trend beyond the displayed coordinate grid.</p>  <p>Answer:</p> <ol style="list-style-type: none"> $(-\infty, \infty)$ $(-\infty, -3]$ $f(-2) = -4, f(1) = -5$ 	55.81% Partial Credit, 11.63% Incorrect
Cumulative Review + (3.5) 3.5 rev_3	<p>Use the graph to determine</p> <ol style="list-style-type: none"> the function's domain the function's range the function values indicated below. $f(-5)$ $f(-2)$ 	54.84% Partial Credit, 12.90% Incorrect,

	 <p>Answer:</p> <p>a. $(-\infty, \infty)$ b. $(-\infty, -2]$ c. $f(-5) = -4, f(-2) = -2$</p>	3.23% Omitted
Give the domain and range of a relation, and determine if it is a function.	3.5.7 What are the domain and range of each relation? Is the relation a function? $F = \{(85, -12), (16, 4), (-102, 4), (62, 48)\}$ Answer: $D = \{85, 16, -102, 62\}, R = \{-12, 4, 48\}$, a function	56.25% Partial Credit, 6.25% Incorrect
Factor the sum or difference of two cubes.	5.6.37 Use the sum and difference of cubes formulas to factor. Be sure to factor out any common factors. $64x^3 - 1$ Answer: $(4x - 1)(16x^2 + 4x + 1)$	60.66% Incorrect, 3.28% Omitted
	5.6.43 Use the sum and difference of cubes formulas to factor. Be sure to factor out any common factors. $64x^3 + 125$ Answer: $(4x + 5)(16x^2 - 20x + 25)$	59.68% Incorrect, 9.68% Omitted
Identify the subsets of the real numbers to which a given number belongs.	1.1.19 List the negative integers: $\{-25, -28/7, -18/5, -\pi, -0.763, -0.333\dots, 0, 1/10, 2/7, \pi/4, \sqrt{3}, 9, 52.8, 283/5\}$ Answer: $-25, -28/7$	63.44% Partial Credit

Unit 2 Test A		
Concept	Example Problem	% Missed
Solve literal equations for the desired unknown.	2.2.5 Solve for x. $y = \frac{2}{3}x - 4$ Answer: $\frac{3y + 12}{2} = x$	66.67% Incorrect, 2.47% Omitted
Simplify a rational function expression or function.	6.1.7 Simplify completely.	69.23% Incorrect,

	<p>Answer:</p> $\frac{3x^3 - 24x^2}{6x - 48}$ $\frac{x^2}{2}$	7.69% Omitted
	<p>6.1.9 Simplify completely.</p> <p>Answer:</p> $\frac{9x^2}{12x^2 - 15x}$ $\frac{3x}{4x - 5}$	60.29% Incorrect, 7.35% Omitted
	<p>6.1.13 Simplify completely.</p> <p>Answer:</p> $\frac{2x + 10}{2x^2 - 50}$ $\frac{1}{x - 5}$	67.74% Incorrect, 3.23% Omitted
Simplify the product of two or more rational expressions.	<p>6.1.29 Multiply.</p> $\frac{y^2 - y - 12}{2y^2 + y - 1} * \frac{2y^2 + 7y - 4}{2y^2 - 32}$ <p>Answer:</p> $\frac{y + 3}{2(y + 1)}$	50.93% Incorrect, 28.70% Omitted
Simplify the quotient of two or more rational expression.	<p>6.1.33 Divide.</p> $\frac{2mn - m}{15m^3} \div \frac{2n - 1}{3m^2}$ <p>Answer: 1/5</p>	53.54% Incorrect, 14.14% Omitted
	<p>6.1.35 Divide.</p> $\frac{b^2 - 6b + 9}{5b^2 - 16b + 3} \div \frac{6b - 3}{15b - 3}$ <p>Answer:</p> $\frac{b - 3}{2b - 1}$	39.42% Incorrect, 32.69% Omitted
Quick Quiz 6.1.3	<p>Simplify.</p> $\frac{x^2 + x - 6}{x - 5} \div \frac{x^2 + 8x + 15}{15 - 3x}$ <p>Answer:</p> $\frac{3(x - 2)}{x + 5}$	70.48% Incorrect, 12.38% Omitted

Quick Quiz 6.2.1	Add or subtract and simplify your answers. $\frac{5}{x} - \frac{4}{x+3}$ Answer: $\frac{x+15}{x(x+3)}$	67.12% Incorrect, 10.96% Omitted
Quick Quiz 6.2.3	Add or subtract and simplify your answers. $\frac{6x}{3x-7} + 5$ Answer: $\frac{7(3x-5)}{3x-7}$	61.82% Incorrect, 12.73% Omitted
Simplify complex rational expressions.	6.3.3 Simplify the complex fractions by any method. $\frac{\frac{2x}{x+5}}{\frac{x^2}{x-1}}$ Answer: $\frac{2(x-1)}{x(x+5)}$	53.33% Incorrect, 26.67% Omitted
	6.3.5 Simplify the complex fractions by any method. $\frac{1 - \frac{4}{3y}}{\frac{2}{y} + 1}$ Answer: $\frac{3y-4}{3(y+2)}$	58.33% Incorrect, 27.78% Omitted
Quick Quiz 6.3.1	Simplify. $\frac{\frac{1}{4x} + \frac{1}{2x}}{\frac{1}{3y} + \frac{5}{6y}}$ Answer: $\frac{9y}{14x}$	48.15% Incorrect, 29.63% Omitted
Solve rational equations.	6.4.11 Solve the equations and check your solutions. If there is no solution, say so. $\frac{1}{3x} - \frac{2}{x} = \frac{-5}{x+4}$ Answer: $x = 2$	65.08% Incorrect, 15.87% Omitted
	6.4.23 Solve the equations and check your solutions. If there is no solution, say so.	79.59% Incorrect,

	$\frac{8}{3x+2} - \frac{7x+4}{3x^2+5x+2} = \frac{2}{x+1}$ Answer: $x = 0$	14.29% Omitted
Quick Quiz 6.4.1	Solve. $2 + \frac{x}{x+3} = \frac{3x}{x-3}$ Answer: $x = -3/2$	70.11% Incorrect, 14.94% Omitted
Quick Quiz 6.4.2	Solve. $\frac{1}{x+2} - \frac{1}{3} = \frac{-2}{3x+6}$ Answer: $x = 3$	70% Incorrect, 13.64% Omitted
Quick Quiz 6.4.3	Solve. $\frac{1}{3x-2} + \frac{2x}{x+1} = 2$ Answer: $x = 1$	62.16% Incorrect, 17.12% Omitted
Unit 2 Test B		
Concept	Example Problem	% Missed
Simplify a rational function expression or function.	6.1.9 Simplify completely. $\frac{9x^2}{12x^2 - 15x}$ Answer: $\frac{3x}{4x - 5}$	55.93% Incorrect, 5.08% Omitted
Simplify the product of two or more rational expression.	6.1.29 Multiply. $\frac{y^2 - y - 12}{2y^2 + y - 1} * \frac{2y^2 + 7y - 4}{2y^2 - 32}$ Answer: $\frac{y + 3}{2(y + 1)}$	52.48% Incorrect, 16.83% Omitted
Quick Quiz 6.1.3	Simplify. $\frac{x^2 + x - 6}{x - 5} \div \frac{x^2 + 8x + 15}{15 - 3x}$ Answer: $-\frac{3(x - 2)}{x + 5}$	1.92% Partial Credit, 67.31% Incorrect, 8.65% Omitted
Simplify complex rational expressions.	6.3.3 Simplify the complex fractions by any method. $\frac{\frac{2x}{x+5}}{\frac{x^2}{x-1}}$ Answer:	56.72% Incorrect, 11.94% Omitted

	$\frac{2(x-1)}{x(x+5)}$	
	<p>6.3.5 Simplify the complex fractions by any method.</p> $\frac{1 - \frac{4}{3y}}{\frac{2}{y} + 1}$ <p>Answer:</p> $\frac{3y-4}{3(y+2)}$	71.91% Incorrect, 14.61% Omitted
Quick Quiz 6.3.1	<p>Simplify.</p> $\frac{\frac{1}{4x} + \frac{1}{2x}}{\frac{1}{3y} + \frac{5}{6y}}$ <p>Answer:</p> $\frac{9y}{14x}$	50.70% Incorrect, 16.90% Omitted
Solve rational equations.	<p>6.4.11 Solve the equations and check your solutions. If there is no solution, say so.</p> $\frac{1}{3x} - \frac{2}{x} = \frac{-5}{x+4}$ <p>Answer: $x = 2$</p>	62.26% Incorrect, 13.21% Omitted
	<p>6.4.23 Solve the equations and check your solutions. If there is no solution, say so.</p> $\frac{8}{3x+2} - \frac{7x+4}{3x^2+5x+2} = \frac{2}{x+1}$ <p>Answer: $x = 0$</p>	1.14% Partial Credit, 75% Incorrect, 15.91% Omitted
Quick Quiz 6.4.1	<p>Solve.</p> $2 + \frac{x}{x+3} = \frac{3x}{x-3}$ <p>Answer: $x = -3/2$</p>	72.90% Incorrect, 9.35% Omitted
Quick Quiz 6.4.2	<p>Solve.</p> $\frac{1}{x+2} - \frac{1}{3} = \frac{-2}{3x+6}$ <p>Answer: $x = 3$</p>	67.44% Incorrect, 11.63% Omitted
Quick Quiz 6.4.3	<p>Solve.</p> $\frac{1}{3x-2} + \frac{2x}{x+1} = 2$ <p>Answer: $x = 1$</p>	63.92% Incorrect, 12.37% Omitted

Concept	Example Problem	% Missed
Solve a factorable quadratic inequality in one variable.	8.6.3 Solve and graph. $x^2 + x - 12 < 0$ Answer: $-4 < x < 3$ (Graph not shown.)	24.14% Partial Credit, 37.93% Incorrect, 1.72% Omitted
Quick Quiz 8.6.1	Solve. $x^2 - 7x + 6 > 0$ Answer: $x < 1$ or $x > 6$	64.06% Incorrect
Simplify expressions with rational exponents.	7.1.45 Simplify and express your answers with positive exponents. Evaluate or simplify the numerical expressions. $6^2 * 6^{-\frac{2}{3}}$ Answer: $6^{\frac{4}{3}}$	57.38% Incorrect, 8.20% Omitted
	7.2.73 Evaluate or simplify. Assume that all variables represent positive real numbers. $(64x^4)^{-\frac{1}{2}}$ Answer: $\frac{1}{8x^2}$	68.18% Incorrect, 9.09% Omitted
Quick Quiz 7.1.3	Simplify. $(25x^4)^{\frac{3}{2}}$ Answer: $125x^{\frac{3}{2}}$	60.87% Incorrect, 4.35% Omitted
Change expression with rational exponents to radical expressions.	7.2.59 Change to radical form. $7^{-\frac{2}{3}}$ Answer: $\frac{1}{\sqrt[3]{49}}$	87.23% Incorrect, 2.13% Omitted
	7.2.61 Change to radical form. $(a + 5b)^{\frac{3}{4}}$ Answer: $\sqrt[4]{(a + 5b)^3}$ or $\sqrt[4]{(a + 5b)^3}$	56.10% Incorrect, 14.63% Omitted
Simplify a radical by using the product rule.	7.3.21 Simplify. Assume that all variables are nonnegative real numbers.	69.70% Incorrect

	<p>Answer: $\sqrt[3]{27a^5b^9}$</p> <p>$3ab^3\sqrt[3]{a^2}$</p>	
	<p>7.3.23 Simplify. Assume that all variables are nonnegative real numbers.</p> <p>Answer: $\sqrt[3]{40x^{12}y^{13}}$</p> <p>$2x^4y^4\sqrt[3]{5y}$</p>	74.29% Incorrect, 4.29% Omitted
Quick Quiz 7.4.2	<p>Rationalize the denominator.</p> <p>Answer: $\frac{9}{\sqrt{3x}}$</p> <p>$\frac{3\sqrt{3x}}{x}$</p>	64.29% Incorrect, 2.86% Omitted
Solve a radical equation that requires squaring each side once.	<p>7.5.9 Solve each radical equation. Check your solution(s).</p> <p>$2x = \sqrt{11x + 3}$</p> <p>Answer: $x = 3$</p>	61.11% Incorrect, 5.56% Omitted
	<p>7.5.15 Solve each radical equation. Check your solution(s).</p> <p>$y = \sqrt{y + 3} - 3$</p> <p>Answer: $y = -2$, or $y = -3$</p>	56.25% Incorrect, 6.25% Omitted
	<p>7.5.19 Solve each radical equation. Check your solution(s).</p> <p>$\sqrt{3x^2 - x} = x$</p> <p>Answer: $x = 0$, or $x = 1/2$</p>	56.52% Incorrect, 4.35% Omitted
Unit 3 Test B		
Concept	Example Problem	% Missed
Quick Quiz 7.1.3	<p>Simplify.</p> <p>Answer: $(25x^4)^{\frac{1}{2}}$</p> <p>$125x^{\frac{3}{8}}$</p>	63.16% Incorrect, 7.89% Omitted
Simplify expressions with rational exponents.	<p>7.2.73 Evaluate or simplify. Assume that all variables represent positive real numbers.</p> <p>Answer: $(64x^4)^{-\frac{1}{2}}$</p>	64.44% Incorrect, 4.44% Omitted

	$\frac{1}{8x^2}$	
Change expressions with rational exponents to radical expressions.	<p>7.2.59 Change to radical form.</p> $7^{-\frac{2}{3}}$ <p>Answer:</p> $\frac{1}{\sqrt[3]{49}}$	88.10% Incorrect
Simplify a radical by using the product rule.	<p>7.3.21 Simplify. Assume that all variables are nonnegative real numbers.</p> $\sqrt[3]{27a^5b^9}$ <p>Answer:</p> $3ab^3\sqrt[3]{a^2}$	64.29% Incorrect, 1.79% Omitted
	<p>7.3.23 Simplify. Assume that all variables are nonnegative real numbers.</p> $\sqrt[3]{40x^{12}y^{13}}$ <p>Answer:</p> $2x^4y^4\sqrt[3]{5y}$	58.54% Incorrect, 7.32% Omitted
Quick Quiz 7.4.2	<p>Rationalize the denominator.</p> $\frac{9}{\sqrt{3x}}$ <p>Answer:</p> $\frac{3\sqrt{3x}}{x}$	70% Incorrect, 4% Omitted
Solve a radical equation that requires squaring each side once.	<p>7.5.9 Solve each radical equation. Check your solution(s).</p> $2x = \sqrt{11x + 3}$ <p>Answer: $x = 3$</p>	70.45% Incorrect, 2.27% Omitted
	<p>7.5.19 Solve each radical equation. Check your solution(s).</p> $\sqrt{3x^2 - x} = x$ <p>Answer: $x = 0$, or $x = 1/2$</p>	59.38% Incorrect, 3.13% Omitted
Solve a quadratic equation by using the quadratic formula.	<p>8.2.17 Simplify each equation. Then solve by the quadratic formula. Simplify your answers and use i notation for nonreal complex numbers.</p> $2x(x + 3) - 3 = 4x - 2$ <p>Answer:</p>	60% Incorrect

	$x = \frac{-1 \pm \sqrt{3}}{2}$	
	<p>8.2.31 Simplify each equation. Then solve by the quadratic formula. Simplify your answers and use i notation for nonreal complex numbers. $3x^2 - 8x + 7 = 0$ Answer:</p> $x = \frac{4 \pm i\sqrt{5}}{3}$	61.29% Incorrect, 6.45% Omitted

Appendix F

Survey questions and responses from MATH 0045 students during the Fall 2016 semester.

Important findings are highlighted. To conserve space, only a few free-responses from the final question are listed.

MATH 0045 Survey Questions and Responses

1. Please select your section from the options below: (261 responses)
 - a. MWF 8:00-8:50am, Sun (2%)
 - b. MWF 9:00-9:50am, Sun (3%)
 - c. MWF 10:00-10:50am, Ferrell (8%)
 - d. MWF 11:00-11:50am, Szucs (8%)
 - e. MWF 12:00-12:50pm, Debellis (6%)
 - f. MWF 1:00-1:50pm, Szucs (7%)
 - g. MW 2:00-3:15pm, Howard (5%)
 - h. MW 3:30-4:45pm, Howard (8%)
 - i. MW 5:00-6:15pm, Howard (5%)
 - j. TR 8:00-9:15am, Barreiro-Talbert (5%)
 - k. TR 9:30-10:45am, Szucs (8%)
 - l. TR 11:00-12:15pm, Szucs (7%)
 - m. TR 12:30-1:45pm, Barreiro-Talbert (5%)
 - n. TR 2:00-3:15pm, Howard (5%)
 - o. TR 3:30-4:45pm, Howard (5%)
 - p. TR 5:00-6:15pm, Sharp (6%)
 - q. DE Online Section 601, Howard (4%)
 - r. DE Online Section 602, Howard (3%)
2. Please indicate your sex: (261 responses)
 - a. Female (64%)
 - b. Male (36%)
 - c. Identify as other than listed (0%)
3. Please select your age: (261 responses)
 - a. 18 (52%)
 - b. 19 (25%)
 - c. 20 (10%)
 - d. 21 (4%)
 - e. Over 21 (10%)
4. Please select your year in school: (261 responses)
 - a. Freshman/First Year (69%)
 - b. Sophomore/Second Year (17%)
 - c. Junior/Third Year (11%)

- d. Senior/Fourth Year (2%)
 - e. Fifth Year or More (0%)
5. When was the least time you took a mathematics course prior to this one? (261 responses)
 - a. 9th Grade (0%)
 - b. 10th Grade (2%)
 - c. 11th Grade (20%)
 - d. 12th Grade (59%)
 - e. Community College (12%)
 - f. University Setting (6%)
6. How long has it been since your last completed mathematics course? (261 responses)
 - a. Minimal gap – a summer separates your current course from your previous course or your last completed mathematics course was during your last semester in school (24%)
 - b. One semester (24%)
 - c. Two semesters/one year (25%)
 - d. Three semesters (10%)
 - e. Four semesters/two years (11%)
 - f. Five semesters (2%)
 - g. Six semesters/three years (1%)
 - h. Seven semesters (0%)
 - i. Eight semesters/four years (1%)
 - j. More than four years (3%)
7. How many credit hours are you enrolled in this semester?
 - a. Less than 12 credit hours (part-time) (5%)
 - b. 12-15 credit hours (69%)
 - c. 16-18 credit hours (24%)
 - d. More than 18 credit hours (2%)
8. Are you involved in any student organizations?
 - a. Yes (40%)
 - b. No (60%)
9. If you are involved in student organizations, how many hours per week do you spend involved with activities related to your organization(s)? If you are not involved in any organizations, please enter a “0.” Enter a number below: (261 responses)
10. Are you employed? (261 responses)
 - a. Yes, I am employed full-time (8%)
 - b. Yes, I am employed part-time (30%)
 - c. No, I am not employed (62%)
11. How were you placed into MATH 0045? (261 responses)
 - a. ALEKS (9%)
 - b. ACCUPLACER (41%)
 - c. ACT score (13%)
 - d. SAT score (12%)

- e. Other (25%)
12. On a scale from one (1) to three (3), how difficult was this course for you? (261 responses)
- a. 1 – easy (11%)
 - b. 2 – not too easy or too difficult (61%)
 - c. 3 – difficult (28%)
13. On a scale from one (1) to three (3), how well do you think this course has prepared you for your next mathematics course? (261 responses)
- a. 1 – not well at all (8%)
 - b. 2 – moderately well (56%)
 - c. 3 – very well (36%)
14. Knowing what this course entails, would you have chosen to take this course had you not been placed into it? (261 responses)
- a. Yes, I would have chosen to take this course even if I had not been placed into it (40%)
 - b. No, I would have chosen to bypass this course had I been given the option (60%)
15. This course is a face-to-face course with an online component, all assignments are completed online, and the material is self-paced. Do you find the setup of this course beneficial to your learning style(s)? (261 responses)
- a. Yes, I find this setup to be beneficial to my learning style(s) (66%)
 - b. No, I do not find this setup beneficial (22%)
 - c. Neutral/no opinion (12%)
16. Please select the tools used in the classroom which you find useful (select all that apply): (253 responses)
- a. Face-to-face lecture conducted by professor (73%)
 - b. Professor's office hours (17%)
 - c. Computer lab setting (40%)
 - d. Teaching assistants (62%)
 - e. Extra tutoring hours during test time (night hours offered as test deadlines approach) (44%)
 - f. Self-paced option (59%)
 - g. None of the above (4%)
17. What tools do you use to study for this course? Please select all that apply: (251 responses)
- a. MyMathLab tutorials (64%)
 - b. "Help" buttons on MyMathLab assignments (75%)
 - c. Unit by unit material in MyMathLab (43%)
 - d. Multimedia library in MyMathLab (7%)
 - e. Course textbook (10%)
 - f. Flash cards (6%)
 - g. Private tutor (13%)
 - h. Extra tutoring hours during test time (night hours offered as test deadlines approach) (20%)

- i. Other (9%)
18. Please describe your overall opinion of the course below: (258 responses)
- “I was very impressed with how Dr. Szucs taught math. I have never learned so much in one semester and for once, I feel like I have potential to be good in this subject. I liked each challenge that the assignments brought me and I felt like I was definitely exercising my brain instead of straining it or stressing out. I thoroughly enjoyed this course. :)”
 - “I took this course as an option as my ACT scores allowed me to go up the next level but I felt that I needed some help in math before I went into college level math. This course met all my expectations and has made me better prepared for the next math.”
 - “I liked this course as a basis for math because it helped me understand things I previously didn't. I feel like I wouldn't have done very well in MAT 1065 had I went ahead and taken it before this class if I was given the option. I don't really like the online portion of this class, but I like the pace of it and how you can work ahead if you are ahead and know what you are doing. I think there should be more in lecture parts of this course, and less online portions. I think homework should be completed outside of class, however I like that we are offered help on it in class. Maybe one class a week to complete homework, and the other two lectures.”