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Advanced Math Curriculum - ACT Prep and Pre-College Algebra

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ADVANCED MATH CURRICULUM – ACT PREP AND PRE-COLLEGE ALGEBRA

A Thesis

Submitted to the Graduate Faculty of the
Louisiana State University and
Agricultural and Mechanical College
in partial fulfillment of the
requirements for the degree of
Masters of Natural Science

in

The Interdepartmental Program in Natural Sciences

by

Lauren Louise Morris
B.S., Louisiana State University, 2011
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ABSTRACT

The purpose of this thesis was to create a non-traditional Advanced Mathematics course paired with Math XL[®] for School (MXL) for senior-level students with low ACT Math scores. The Advanced Math course was created with the purpose of helping students increase their ACT Math scores and preparing them for first-year college math, College Algebra. The course was taught at a private high school in Louisiana for the 2014-2015 school year and is attached to this thesis as an appendix. Upon completion of this course, the participating students achieved an average increase of 3.1 points in their ACT Math scores.

After a review of the ACT score data for the graduating class of 2014 in Louisiana, it is clear that a course of this design is a necessity for college readiness. This thesis discusses the aforementioned ACT data and the statistics on the number of students who enroll in and complete remedial college courses. Additionally, the thesis discusses the creation of the Advanced Math course and its resources, a description of the course, and a brief description of a few other ACT preparation programs.

The appendix of this thesis includes Binder #1, which contains the blank resources for notes, test reviews, and chapter tests that students use throughout the school year. This binder also contains a tentative calendar for the year and a description of each chapter and section. Binder #2 contains the teacher edition of Binder #1 and is not included in the appendix. Binder #3 and Binder #4 contain the MXL assignments for the ACT Prep fall semester and the Pre-College Algebra spring semester. Like Binder #2, these binders are not included in the appendix but are available upon request.

CHAPTER 1: INTRODUCTION

The purpose of this thesis is to create a non-traditional Advanced Mathematics course designed for a special target audience – senior-level students who have low ACT Math scores in the 15-20 range. These students have completed, but struggled, with Algebra 2 and are not prepared for Dual Enrollment College Algebra and Trigonometry. The goal of the course is to help the students raise their ACT Math scores and to also prepare them for first-year college math, College Algebra; it is not designed for students with a 24 ACT Math score looking to raise it to a 27. This course was developed for seniors at St. Joseph’s Academy, an all-girls private school in Baton Rouge, Louisiana, and was tested for one year.

The students placed in this course typically lack self-confidence and self-motivation to succeed in a subject they have generally struggled with throughout middle and high school. Not only is this course trying to help to improve the students’ ACT Math scores, but it also increases their confidence in their math skills that are needed to succeed in college-level mathematics. In addition, all of the reviewing is done inside in the classroom with lots of face-to-face teaching and a state-of-the-art web-based course support system. With the busy lives that high school students lead, making time to practice for the ACT in addition to homework, studying, extracurricular activities, and jobs is one of the tasks that one has to tackle in this course.

Despite the fact that many people claim that one cannot teach to the ACT, of the 25 students who retook the ACT after taking this course, results showed an average increase of 3.1 points in ACT Math scores, with some students increasing their math score by six to eight points. Although a sample size of 25 students is not enough to scientifically prove that the course is effective for *all* students, it has shown that it can make a difference with *some* students, whether it helps them increase their ACT Math scores or by boosting their confidence in their math

abilities. Please refer to Table 1 below to see the change in ACT Math scores for the 25 students who retook the ACT during the 2014-2015 school year.

Table 1: Change in Student ACT Math Scores

St. Joseph's Academy ACT Math Prep Class 2014-15							
Student	ACT Math Score Before August 2014	Sep- 14	Oct- 14	Dec- 14	Feb- 15	Apr- 15	Net Change
1	19	-	25	-	-		6
2	17, 19	-	-	21	-		2
3	17, 17	18	18	-	-		1
4	16	18	-	-	-		2
5	18	21	22	-	22		4
6	16	-	-	18	24		8
7	19, 21	17	-	-	-		-4
8	14	-	-	18	-		4
9	16	20	-	19	-		4
10	21, 20	-	21	-	-	22	1
11	16, 16	18	17	18	-		2
12	20, 23	23	-	-	-		0
13	20	-	26	-	-		6
14	17	-	-	22	-		5
15	17, 18	20	-	-	-	22	4
16	17	24	-	-	-		7
17	20, 18	-	-	25	-		5
18	16, 18	-	18	-	24		6
19	16	17	15	-	-		1
20	21, 23, 20	26	-	-	-		3
21	17	17	21	-	-		4
22	20	25	-	-	-		5
23	16	16	-	-	-		0
24	20, 21, 19	-	26	-	-		5
25	23	-	20	-	-		-3
Average Change							3.1

There were a total of 31 students in the course for the 2014-2015 school year. Six students' scores were not included in the data for multiple reasons. Three of those students, with ACT Math scores of 20, 22, and 23, had ACT Composite scores of 23, 28, and 29, respectively, prior to the 2014-2015 school year. These students did not retake the ACT again after taking this course; thus, they were intentionally left out of the data. Showing no improvement because these students chose not to retake the ACT should not count against the effectiveness of the course. The other three students not included in the data had not taken the ACT at all prior to the beginning of the course, so there was no baseline of where they stood before taking the ACT for the first time.

The course was separated into two semesters: an ACT prep fall semester first, followed by a Pre-College Algebra spring semester. Since the majority of senior students are taking, or retaking, the ACT in the first semester of their senior year, it is important that ACT prep is taught during the first semester. The students will be reviewing concepts needed to excel in Pre-College Algebra as well.

The ACT prep fall semester focuses on reviewing all material covered on the ACT: pre-algebra, elementary algebra, intermediate algebra, coordinate geometry, plane geometry, and trigonometry. The Pre-College Algebra spring semester is designed to be a bridge course to ease the transition into mathematics at the post-secondary level. It covers most of the topics of a typical college-level course: polynomial equations, functions and graphing, polynomial and rational functions, and logarithmic and exponential functions.

The course is paired with the Pearson product "MathXL[®] for School" (MXL), which is used for homework, quizzes, and test reviews. In addition to the MXL resources for homework and quizzes, I have created notes for every section, test reviews, and chapter tests. I also used

timed ACT practice worksheets taken from an ACT prep book, Amsco's *Preparing for the ACT Mathematics and Science Reasoning, Second Edition*, by Robert D. Postman, to review for quizzes and tests during the ACT prep semester. Binder #1 includes the blank resources for notes, test reviews, and chapter tests that students will use throughout the school year. This binder also contains a tentative calendar for the year and a description of each chapter and section. Binder #2 contains the teacher edition of Binder #1. It contains completed notes and solutions to reviews and tests. Binders #3 and #4 contain the MXL assignments for the ACT Prep fall semester and the Pre-College Algebra spring semester. The resources from Binder #1 can be found in the appendix and will be available digitally for future implementation. The other binders will be available upon request.

In this thesis, I describe the necessity of a course of this nature, and why it is important, if not crucial, for college and career readiness. I explain the setup of the course, the student resources and teaching resources on MXL, the student selection process for the course, and the technology needed for implementation of the course. Additionally, I describe the policies used for homework, quizzes, and tests, and a description of the material covered in the course. Lastly, I provide a brief description of a few other ACT Mathematics prep courses that are available for students outside of school.

CHAPTER 2: NEEDS ASSESSMENT AND JUSTIFICATION

This Advanced Mathematics course was designed for seniors with the purpose of boosting low ACT Math scores and preparing for first-year college math, College Algebra. Such a course responds to a fundamental need in high schools across Louisiana and the nation. ACT scores determine admission to college, student financial assistance, placement in college-level courses, and school performance scores.

Minimum admission standards for first-time freshmen to a Louisiana university require that students obtain an ACT Composite score of 20. Figure 1 below shows the entire set of minimum admission standards for regular admission to any public, four-year university in Louisiana.

LOUISIANA BOARD OF REGENTS	
MINIMUM ADMISSION STANDARDS for FIRST-TIME FRESHMEN	
(1) <i>High School Curriculum</i>	Regents' Core: 19 units (from Core 4 Curriculum) Those courses in the English, Math, Science, Social Studies, Foreign Language, and Arts Categories as defined in the Core 4 Curriculum** listed in Louisiana Department of Education Bulletins 741 http://bese.louisiana.gov/documents-resources/policies-bulletins . <small>(Section 2318, p52 in Louisiana Handbook for School Administrators, Feb/2014; Section 2109, in LA Handbook for Nonpublic School Administrators)</small>
<u>AND</u>	
(2) <i>Overall HS GPA</i>	Minimum overall HS GPA — 2.0
<u>AND</u>	
(3) <i>Developmental Courses</i>	Developmental courses needed: Effective Fall 2012: 0 at Flagship and Statewide universities, ≤ 1 at Regional universities Effective Fall 2014: 0 at any university As demonstrated by the following minimum ACT sub scores: ACT English ≥ 18; ACT Math ≥ 19 <small>As per Board of Regents' Academic Affairs policy 2.18 http://regents.louisiana.gov/index.cfm?md=pagebuilder&tmp=home&pid=106.</small>
<u>AND ONE of the FOLLOWING</u>	
(4) <i>HS Core GPA</i>	GPA on the <i>Core</i> — 3.0 – Flagship GPA on the <i>Core</i> — 2.5 – Statewide GPA on the <i>Core</i> — 2.0 – Regional
-or-	<u>OR</u>
ACT	ACT Composite— 25 – Flagship ACT Composite— 23 – Statewide ACT Composite— 20 – Regional

* **Flagship:** LSU. **Statewide:** LA Tech, ULL, UNO. **Regional:** Grambling, LSU-A, LSU-S, McNeese, Nicholls, NSU, SLU, SU, SUNO, ULM.
 Two-Year institutions are open admission for freshmen students with: a diploma from a BESE-approved high school, or GED or its equivalent, or appropriate score on an Ability to Benefit test.
 ** Universities may admit 2012 high school graduates who have not met the Arts Category of the Core 4, but otherwise meet the minimum admission standards.

Figure 1: Minimum Admissions Standards (Louisiana Board of Regents, 2013)

However, according to the ACT Profile Report for Louisiana for the graduating class of 2014, the average ACT Composite score was 19.2. Table 2 below shows the five year trends for the average ACT scores for English, Mathematics, Reading, Science, and Composite for Louisiana and the nation.

Table 2: Average ACT Scores (ACT Profile Report: Louisiana, 2014)

Year	Number of Students Tested		English		Mathematics		Average ACT Scores Reading		Science		Composite	
	State	National	State	National	State	National	State	National	State	National	State	National
2010	35,601	1,568,835	20.1	20.5	19.6	21.0	20.2	21.3	20.2	20.9	20.1	21.0
2011	35,870	1,623,112	20.4	20.6	19.7	21.1	20.3	21.3	20.1	20.9	20.2	21.1
2012	36,736	1,666,017	20.4	20.5	19.9	21.1	20.4	21.3	20.1	20.9	20.3	21.1
2013	45,305	1,799,243	19.4	20.2	19.2	20.9	19.7	21.1	19.2	20.7	19.5	20.9
2014	49,178	1,845,787	18.9	20.3	18.9	20.9	19.5	21.3	19.1	20.8	19.2	21.0

The average Louisiana scores for each section of the ACT has been decreasing over the last three years, mostly due to the fact that Louisiana is now one of only 12 states that tested 100% of the graduates for the Class of 2014 using the ACT. Of those 12 states, Louisiana has the 3rd lowest average ACT Composite score and the 2nd lowest average ACT Math score. Table 3 below shows where Louisiana ranks in comparison to the other 11 states in terms of average ACT Composite and Math scores.

Table 3: Average ACT Composite and Math Scores (ACT National and State Scores, 2014)

State (100% ACT Participation)	Average ACT Composite	State (100% ACT Participation)	Average ACT Math
Utah	20.8	North Dakota	20.7
Illinois	20.7	Illinois	20.7
North Dakota	20.6	Montana	20.5
Colorado	20.6	Colorado	20.4
Montana	20.5	Utah	20.3
Wyoming	20.1	Wyoming	19.9
Michigan	20.1	Michigan	19.9
Kentucky	19.9	North Carolina	19.6
Tennessee	19.8	Kentucky	19.4
Louisiana	19.2	Tennessee	19.2
Mississippi	19.0	Louisiana	18.9
North Carolina	18.9	Mississippi	18.3

Furthermore, 56% of the Class of 2014 in Louisiana did not meet the minimum admission standard of a 20 ACT Composite score. Out of 49,178 total students in the graduating Class of 2014 in Louisiana, 27,460 students did not meet the ACT Composite requirement for admission to a four-year university. Table 4 shows the number of students (N) in Louisiana with each ACT Composite score and the cumulative percent (CP) of students at or below that ACT Composite score.

Table 4: ACT Composite Score Distributions (ACT Profile Report: Louisiana, 2014)

COMPOSITE		
ACT Scale Score	N	CP
19	3,334	56
18	3,779	49
17	3,489	41
16	3,615	34
15	3,888	27
14	3,795	19
13	2,988	11
12	1,764	5
11	635	2
10	134	1
9	22	1
8	6	1
7	6	1
6	2	1
5	2	1
4	0	1
3	1	1
2	0	1
1	0	1
Total N:	27,460	

In order to get a 20 for an ACT Composite score, students' four test scores, English, Math, Reading, and Science, are averaged together and rounded to the nearest whole number.

Table 5 is a sample table showing the conversion of raw scores to scale scores for a 2014 ACT

Practice test. Based on this table, students would need to answer approximately 120 out of the 225 questions correct, or 53.3%, to achieve an ACT Composite score of 20. This conversion table varies slightly from test to test.

Table 5: ACT Scale Scores Obtained by Raw Scores (ACT, Inc., 2014)

Scale Score	Raw Scores				Scale Score
	Test 1 English	Test 2 Mathematics	Test 3 Reading	Test 4 Science	
36	75	59-60	40	40	36
35	73-74	57-58	39	39	35
34	71-72	55-56	38	38	34
33	70	54	—	37	33
32	69	53	37	—	32
31	68	52	36	36	31
30	67	50-51	35	35	30
29	66	49	34	34	29
28	64-65	47-48	33	33	28
27	62-63	45-46	32	31-32	27
26	60-61	43-44	31	30	26
25	58-59	41-42	30	28-29	25
24	56-57	38-40	29	26-27	24
23	53-55	36-37	27-28	24-25	23
22	51-52	34-35	26	23	22
21	48-50	33	25	21-22	21
20	45-47	31-32	23-24	19-20	20
19	42-44	29-30	22	17-18	19
18	40-41	27-28	20-21	16	18
17	38-39	24-26	19	14-15	17
16	35-37	19-23	18	13	16
15	33-34	15-18	16-17	12	15
14	30-32	12-14	14-15	11	14
13	29	10-11	13	10	13
12	27-28	8-9	11-12	9	12
11	25-26	6-7	9-10	8	11
10	23-24	5	8	7	10
9	20-22	4	7	6	9
8	17-19	—	6	5	8
7	14-16	3	5	4	7
6	11-13	—	4	3	6
5	9-10	2	3	—	5
4	6-8	—	—	2	4
3	5	1	2	1	3
2	3-4	—	1	—	2
1	0-2	0	0	0	1

ACT scores are so vital in Louisiana that they even affect School Performance Scores (SPS). The Louisiana Department of Education has issued School Performance Scores for public schools based on student achievement data. Each school is given a letter grade (A-F) to clearly communicate the quality of school performance to the public. As stated on the Louisiana Believes website, “School Performance Scores are based on student achievement, academic indicators and measures of career and college readiness, such as Carnegie credits earned through

9th grade, graduation rates, and earning Advanced Placement, International Baccalaureate, and Dual Enrollment.” ACT Composite scores make up 25% of the School Performance Score, and “[s]chools may earn points for the highest score earned by a student through the spring semester of their senior year” (Louisiana Believes). Any score below an 18 earns a 0 for that category, whereas 18 earns 100 points, and the remaining scores (19-36) are associated with bonus SPS points. Please refer to Table 6 to see the index points acquired for specific ACT Composite scores. The increase in index points per composite score is linear. Schools receive 2.8 bonus points for each ACT Composite score point above 18.

Table 6: Index Points for School Performance Scores by ACT Composite Score
(Louisiana Board of Elementary and Secondary Education, 2015)

ACT Composite	Index Pts
0-17	0
18	100
19	102.8
20	105.6
21	108.4
22	111.2
23	114
24	116.8
25	119.6
26	122.4
27	125.2
28	128
29	130.8
30	133.6
31	136.4
32	139.2
33	142
34	144.8
35	147.6
36	150.4

Even though private schools in Louisiana do not receive school letter grades from the Louisiana Department of Education based on School Performance Scores, ACT scores are still just as important. According to Sheri Gillio, Director of Admissions at St. Joseph’s Academy,

ACT scores are used for marketing to prospective families that are looking to come to SJA. Additionally, St. Joseph’s Academy uses ACT college readiness scores to evaluate the curriculum to ensure its students are ready for college-level work.

The ACT Composite score of 20 is not only required to get into a public four-year university, but it is also a minimum requirement to earn TOPS. TOPS, or the Taylor Opportunity Program for Students, is Louisiana’s merit-based student aid program that students can qualify for upon graduation. TOPS is a “comprehensive program of state scholarships and one of the most innovative and progressive student assistance programs in the nation” (Louisiana Office of Student Financial Assistance, 2014). A minimum ACT Composite score of 20 qualifies the student for the TOPS Opportunity Award, which includes full-time tuition plus certain fees for four years. The TOPS Performance Award requires a minimum ACT Composite score of 23 and pays full-time tuition and certain fees for four years, plus \$400 per year. The highest award, TOPS Honors, requires a minimum ACT Composite score of 27 and pays full-time tuition and certain fees for four years, plus \$800 per year. The number of Core units needed increased to 19 units for the graduating class of 2014.

Award	Core	Core GPA	ACT Composite	Award Specifics	Duration
Opportunity	17.5 Units	2.50	20	Full-Time Tuition & Certain fees	4 years, or 8 semesters
Performance	17.5 Units	3.00	23	Full-Time Tuition & Certain fees + \$400/year	4 years, or 8 semesters
Honors	17.5 Units	3.00	27	Full-Time Tuition & Certain fees + \$800/year	4 years, or 8 semesters

Source: LOSFA website- TOPS Informational Brochures and Flyers

Figure 2: TOPS Eligibility Criteria and Award Specifics (Louisiana Board of Regents, 2014)

Furthermore, according to the minimum admission standards for first-time freshmen for regular admission to any public, four-year university in Louisiana, students must obtain an ACT Math score of 19 (Louisiana Board of Regents, 2013). Once again, in the average this minimum requirement for the ACT Math score was not met for the class of 2014 in Louisiana. According to the ACT Profile Report for Louisiana for the graduating class of 2014, the average ACT Math score was 18.9. Furthermore, as shown in Table 8, 59% of the class of 2014 in Louisiana did not meet the minimum admission standard of a 19 ACT Math score. That is, out of 49,178 total students, 28,795 students did not meet the ACT Math requirement.

Table 7: ACT Math Score Distributions (ACT Profile Report: Louisiana, 2014)

MATH		
ACT Scale Score	N	CP
18	3,331	59
17	5,455	52
16	8,933	41
15	6,758	23
14	2,686	9
13	1,110	3
12	369	1
11	97	1
10	29	1
9	11	1
8	4	1
7	2	1
6	5	1
5	0	1
4	4	1
3	0	1
2	0	1
1	1	1
Total N:	28,795	

According to the ACT Profile Report for St. Joseph’s Academy for the graduating class of 2014, 15% of the students did not meet the minimum ACT Math score of 19 needed to avoid remedial math and place into College Algebra. That is, 38 students out of 251 in the graduating class of 2014 did not meet the requirement. Additionally, 17 students, or 7%, of the graduating class of 2014 did not meet the minimum ACT Composite score of 20 to earn TOPS. Table 8 below shows the ACT Composite and Math Score Distributions, respectively, for the graduating class of 2014 at St. Joseph’s Academy.

Table 8: ACT Composite and Math Scores, SJA, 2014

COMPOSITE			MATH		
ACT Scale Score	N	CP	ACT Scale Score	N	CP
19	8	7	18	12	15
18	3	4	17	15	10
17	3	2	16	6	4
16	1	1	15	4	2
15	2	1	14	1	1
14	0	1	13	0	1
13	0	1	12	0	1
12	0	1	11	0	1
11	0	1	10	0	1
10	0	1	9	0	1
9	0	1	8	0	1
8	0	1	7	0	1
7	0	1	6	0	1
6	0	1	5	0	1
5	0	1	4	0	1
4	0	1	3	0	1
3	0	1	2	0	1
2	0	1	1	0	1
1	0	1			
Total N:	17		Total N:	38	

If the minimum ACT Math score is not achieved, the student is often required to take a developmental (remedial) math course. Figure 3 below shows the percentage of entering freshmen who enroll in remedial courses in their first year, and the number of remedial students who complete their gateway courses within two academic years. According to Complete College America, 70.9% of students enroll in remedial courses in their first year at a two-year university

and only 10.5% of those students complete their gateway courses. Additionally, 30.3% enroll in a remedial course at a four-year non-flagship university, and only 4.4% of those students complete their gateway courses.

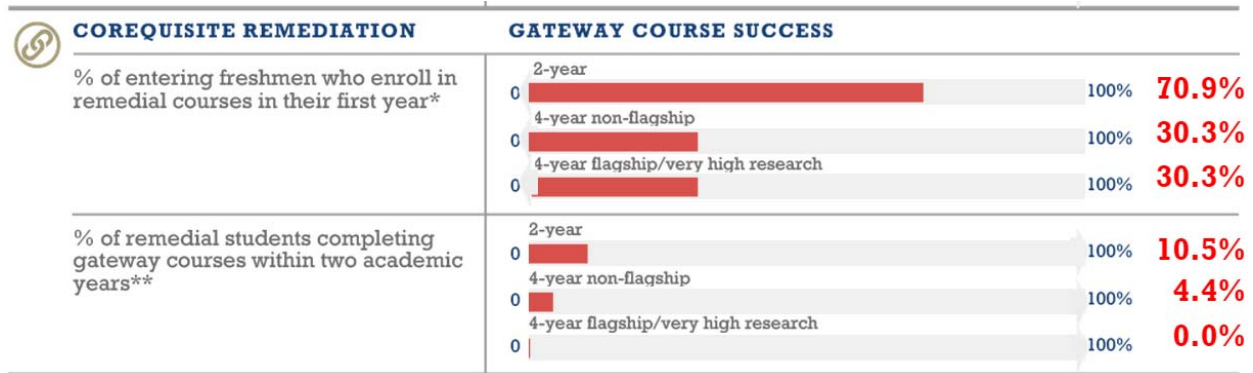


Figure 3: Gateway Course Success (Complete College America, 2013)

Furthermore, 70% of community college students referred to remedial math had not even attempted a college-level math class within two years (Complete College America, 2014). In Louisiana, the graduation rate for a two-year associate degree within 150% of the allotted time, or three years, is 7%. More specifically, the graduation rate within 150% of the allotted time is only 4% for students starting out with remedial math. In Figure 4 below, NP means that the state did not provide data for this metric, and DS means that there were fewer than ten students, so the data was suppressed.

Graduation Rate

FULL-TIME	1- TO 2-YEAR CERTIFICATE		2-YEAR ASSOCIATE		4-YEAR BACHELOR'S			
	ON TIME	IN 2 YEARS	ON TIME	IN 3 YEARS	NON-FLAGSHIP		FLAGSHIP/VERY HIGH RESEARCH	
					ON TIME	IN 6 YEARS	ON TIME	IN 6 YEARS
All Students	0%	4%	2%	7%	14%	39%	30%	65%
African American Students	DS	2%	2%	4%	8%	29%	21%	56%
Asian Students	NP	DS	DS	DS	13%	49%	31%	67%
Hispanic Students	NP	DS	DS	DS	13%	39%	25%	57%
White Students	DS	5%	3%	8%	18%	45%	31%	67%
Pell Grant Recipients (at any time)	DS	4%	2%	5%	NP	NP	NP	NP
Remedial Students (at any time)	NP	1%	1%	4%	4%	22%	NP	NP

Figure 4: Louisiana Graduation Rate (Complete College America, 2014)

These numbers show that remedial math is a bridge to nowhere for students. If these students can raise their ACT Math score to a 19 or above to avoid the (statistical) remedial math “death sentence,” their chances of succeeding in college increase drastically. In addition, raising their ACT Composite scores to at least a 20 will achieve the minimum admission standards for a four-year university, in turn, improving their chances to graduate within 150% of the time, or six years.

In addition to ACT score distributions, the ACT Profile Report also gives data on the percent of students ready for college-level coursework. The ACT determines college-level coursework readiness based on benchmark scores. According to the ACT Profile Report, “[a] benchmark score is the minimum score needed on an ACT subject-area test to indicate a 50% chance of obtaining a B or higher or about a 75% chance of obtaining a C or higher in the corresponding credit-bearing course.” The benchmark score for indicating success in College Algebra is a 22 ACT Math score. According to the ACT Profile Report for the graduating class of 2014 in Louisiana, only 27% of students met the mathematics benchmark score, in comparison to 43% nationally.

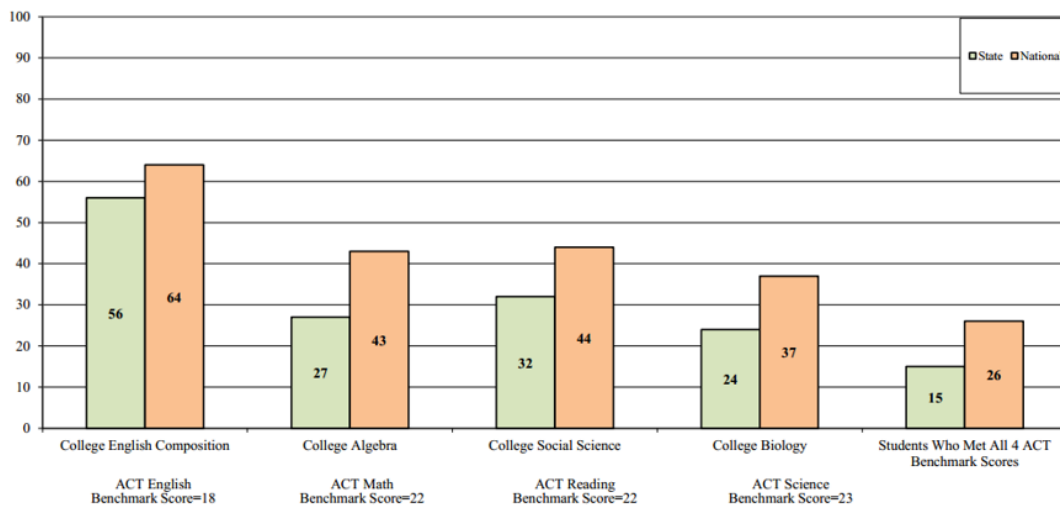


Figure 5: Percent of Students Ready for College-Level Coursework (ACT Profile Report: Louisiana, 2014)

Every high school, whether public or private, shares one common goal: to prepare students for post-secondary education. Every high school also has seniors who do not yet have the minimum ACT score needed to get into college. Thus, secondary schools need to offer a fourth-year math course to help bridge the gap from Algebra 2 to Advanced Math for those students that consistently struggle with math and need an extra boost in confidence to be able to succeed in first-year college math. Having been exposed to a majority of the material already, these students have a fighting chance to succeed in college as well.

CHAPTER 3: GETTING STARTED – SETUP OF THE COURSE

3.1 Math XL[®] for School

This Advanced Math course was paired with a Pearson product called MathXL[®] for School (MXL), which is an online homework, assessment, and tutorial program. The program is tied to over 300 Pearson mathematics textbooks so teachers can easily create, edit, and assign homework, quizzes, and tests.



Figure 6: Pearson, 2015

Teachers can choose a textbook-based course, most of which come with pre-built assignments, a universal course, which can be used with any or no textbook, or a preloaded course, which comes with ready-made homework and tests. The teacher can also create a personalized learning plan based on a student's individual test performance that highlights the student's strengths and weaknesses. MXL is a useful tool for students for many reasons: it provides immediate feedback, guided solutions, example problems, and regenerates exercise to give students unlimited opportunity for practice and mastery.

MXL is extremely teacher-friendly. For the technologically-challenged teachers, the website offers plenty of resources on everything they need to know about MXL. There are step-by-step instructions on how to get started and how to enroll students. There are also videos on how to create tests and quizzes, personalize homework, assign questions from other books, assign "show work" questions, change due dates, change question settings, use prerequisites, set late submission penalties, use the lockdown browser, use the study plan manager, and use an adaptive study plan. It also has an overview of the gradebook and how to use assignment weighting.

When choosing a textbook course, the teacher must select one textbook to use as the primary textbook. When making an assignment, at least one question must be chosen from the primary textbook in order to select questions from any other textbook, and a maximum of 20 questions can be included on a single assignment from textbooks that are not the primary textbook. This Advanced Math course is based on *Lial: College Algebra, 11e*, which was mainly used for the Pre-College Algebra spring semester. For the ACT Prep fall semester, the majority of assignment questions were taken from the *Pearson Test Prep* textbook. This textbook is one of the alternate textbooks the teacher can use, which covers content anywhere from whole numbers and fractions to conic sections and trigonometry. For this course, I pulled questions from other textbooks that offered additional problems to supplement my assignments, as well.

For each assignment in MXL, for each assignment the teacher can choose which learning aids are available for the students to use when completing the assignment. The “Help Me Solve This” learning aid requires the student to answer the given question using guided steps. When finished with the problem using “Help Me Solve This,” MXL regenerates the problem for the student to try again. The MXL “View An Example” learning aid shows step-by-step instructions on how to solve an example with different numbers. The “Video” learning aid will open a clip of an instructor solving an example problem with explanation. The “Textbook” learning aid will bring the student to the correct page in the textbook where the material begins. The “Ask My Instructor” learning aid will allow the student to send a question to the teacher via email. The “Instructor Tip” learning aid is the hint that appears after answering a question incorrectly. For my course, I made all of the learning aids available to the students for homework assignments and test reviews. Students are diverse learners and may not all prefer using the same learning aids as other students.

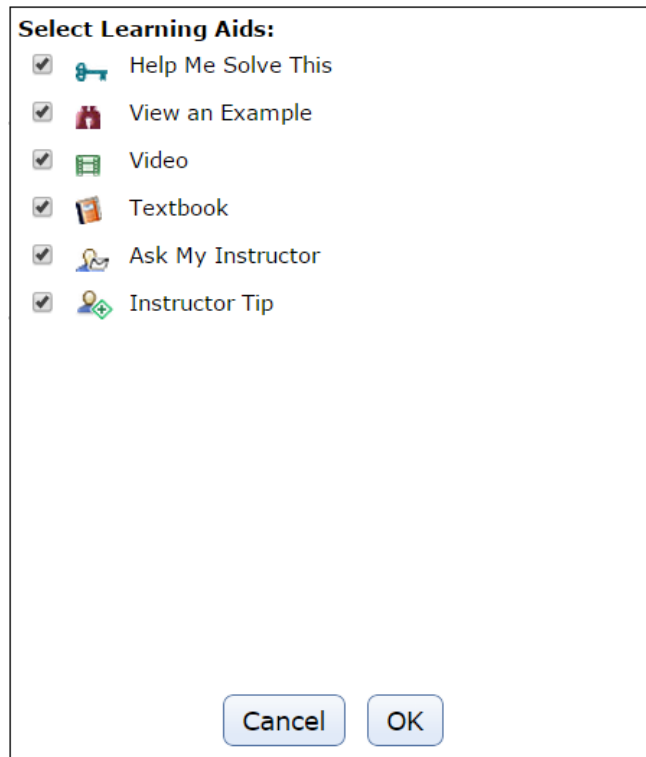


Figure 7: Student Learning Aids, 2015

Another option teachers have available when creating assignments is to create your own question. You can make it a multiple choice question, true or false, short answer, or essay answer. You can insert equations, graphs, charts, or other figures into the custom question, as well. Teachers can choose to enter instructor tips that appear when a problem is answered incorrectly. The main downfall is that there are no student resources such as “Help Me Solve This” or “View An Example” for these problems. The problems can also not be regenerated for additional practice.

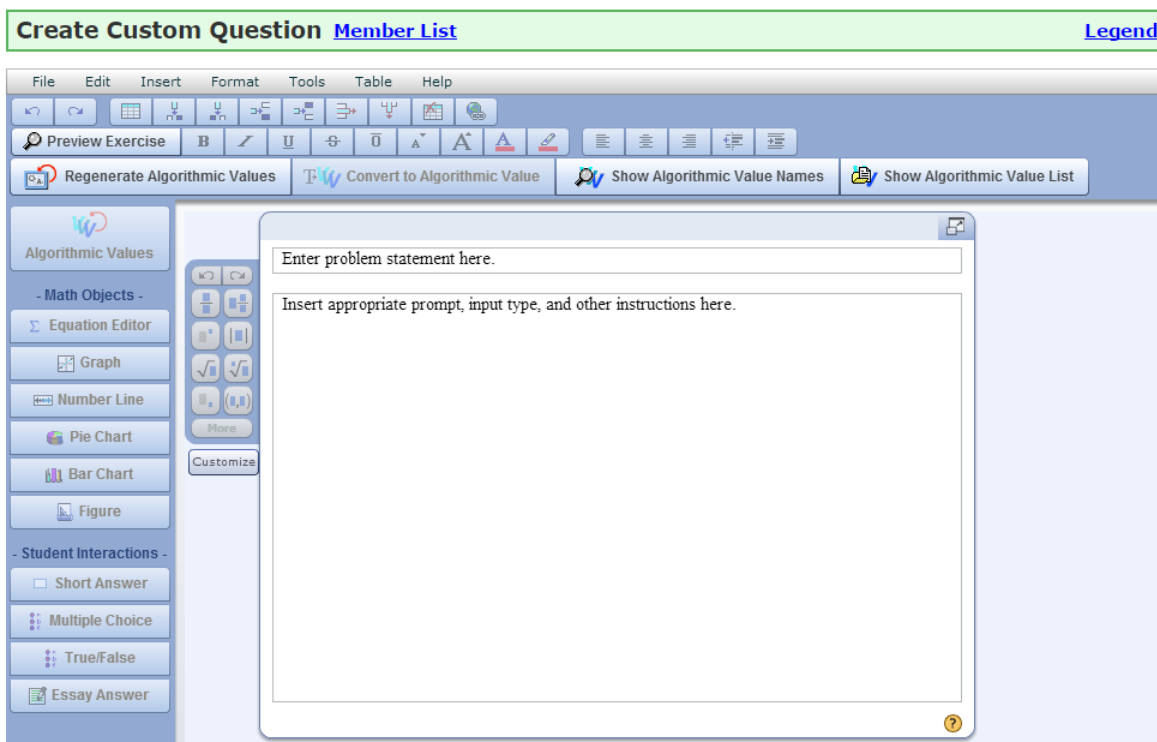


Figure 8: Create a Custom Question, 2015

For students with accommodations, the teacher can edit the settings for a specific student to allow extra time on a quiz, or print the assignments for a student with paper-only accommodations.

3.2 Planning the Course

I planned my class by grouping lessons together, assigning a homework for each lesson and a quiz for each group. Each lesson had notes in outline form that were posted on the class Moodle page for students to download or print prior to class. I projected notes on the interactive white board and students followed along as we discussed and solved example problems. Giving the notes in outline form allows the class to move along much quicker, so more content can be covered in a class period.

Students were required to submit their homework by the night before the quiz. One of the features of MXL is that the teacher can make each preceding homework a prerequisite for

starting the next. I would suggest requiring that all homework be done to at least 85% accuracy before allowing students to take the quiz. I chose 85% because that is the lowest B at St. Joseph's Academy and I feel that students who achieve a B are proficient in the content. I gave a one-point penalty per day for late homework but allowed students to finish the homework if necessary. I will be changing this to a 10% deduction per day for the upcoming year, putting more responsibility on my students to stay on top of their work.

For homework problems, students are allowed three chances to get each problem correct. When a question is answered incorrectly on the first two attempts, it gives a hint on how to solve the problem. The figure below shows an example of an "Instructor Tip" a student may receive when incorrectly solving rational equations.

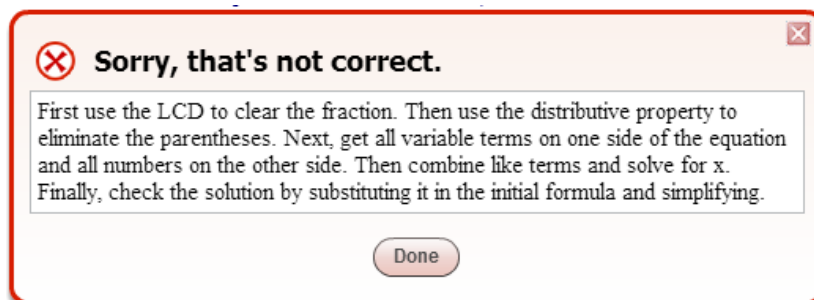


Figure 9: Instructor Tip, 2015

On the third incorrect submission, it reveals the correct answer and allows the student to regenerate the question(s). The teacher can choose to allow unlimited attempts at each problem, or limit the number of chances a student has to answer the question correctly.

During the ACT fall semester, I chose to use the practice questions from the Amsco ACT prep book as a supplement to the homework assignments on MXL. Students need additional practice to what is offered in a traditional ACT prep book. Homework assignments where students can regenerate problems for more practice are helpful alongside timed practices from an ACT prep book. When choosing an ACT prep book to use in the classroom, it is suggested that

teachers use Amsco's *Preparing for the ACT Mathematics and Science Reasoning, Second Edition*, by Robert D. Postman.

For quizzes, I gave students three attempts to take the quiz to achieve the score they wanted. This allowed room to improve especially because students make simple arithmetic mistakes on the first try. I dedicated one day in class for students to take the first attempt, and any subsequent attempt would be done on the students' own time (unsupervised), due five days from the original quiz date. The policy I use for quizzes is similar to the policy LSU uses for Math 1021 and 1022. Recently, MXL began offering a new feature that requires students to show work with the problem if the option was assigned by the teacher. If the students are using a tablet where they can write on the screen and show work with each question, especially on quizzes, this allows a teacher to grade using partial credit without having the students turn in scratch paper.

To use the "Show Your Work" feature on MXL, the teacher must first choose the questions for the assignment first. From there, teachers can preview each question and check the box that says "student to show work" for only the questions one wishes. Another way to assign a student to show work is when viewing the list of questions in the assignment, one can choose "View Question Details" and select for the student to show work for all problems or specific problems there, as well. This feature can be used for any assignment, whether homework, quiz, or test. I did not use the "Show Your Work" feature during the course because it was not made available until the spring semester. In the future, I plan to implement this feature on quizzes.

Preview and Add to Homework [Member List](#) # Items in your Homework: 0
Preview Item: 3 of 6 | Item #: 1.6.19

Section 1.6 | Objective: Solve rational equations that lead to quadratic equations.
Availability: Homework, Tests and Quizzes, Study Plan
Origin: Publisher

Solve the equation.

$$\frac{4}{x^2} - \frac{55}{x} = 14$$

Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

A. The solution set is $\left\{\frac{1}{14}, -4\right\}$.
(Simplify your answer. Type an integer or a fraction. Use a comma to separate answers as needed.)

B. The solution is the empty set.

Question is complete. ?

All parts showing [Similar Exercise](#) [Close](#)

Show completed problem
 Work problem as student
 Student to show work
Question points: [Scoring options](#)

[Show Answer](#)
[Reload](#)
[Copy and Edit](#)
[◀ Previous](#)
[Add](#)
[Next ▶](#)

Figure 10: Preview an Assignment Question, 2015

To help students prepare for quizzes, I created practice quizzes on MXL similar to the actual quiz. I made the settings so that “Help Me Solve This” and “View An Example” learning aids were available in review mode only, so the students could get assistance on the problems they struggled with. Some students liked to use this optional assignment to review problems that were missed on the actual quiz.

To prepare students for tests, I made a MXL test review as an optional homework assignment with learning aids available. For a few chapters in the ACT Prep fall semester and all of the Pre-College Algebra spring semester, I also offered a paper review for extra practice since the tests were given on paper.

If the overall class performance on the test was below a 75% average, I offered a test retake. An average of 75% was chosen because that is the lowest C at St. Joseph's Academy. Students were required to get parental consent in order to retake the test. Retakes were mostly offered in the Pre-College Algebra spring semester; however, I did offer a test retake for Chapter 2 in the ACT Prep fall semester because it included factoring.

When making daily plans, it is important to allow time for "lab days," where students can spend time working independently and asking questions with the teacher there to assist. It seems to be the students are more motivated on these work days, whereas, if they struggle working at home, they are likely to get frustrated and quit. Students will need more lab time for more difficult concepts. The more lab days the teacher can allow, the better. Please refer to the calendars in the teacher resources found in Binder #1 to see when I allow time for lab days throughout the year.

Throughout the entire school year, I started each class with an ACT practice question as a warm-up or bell-ringer. This was done almost daily, except on quiz or test days. I required the students to write the question and answer choices, gave them a set amount of time to solve, and then we went over the solution. At the end of each week, the students would turn in the warm-up worksheet for a small homework grade. Saving these worksheets also created a packet of example problems for these students to review in the future, as well.

3.3 Cost per Student

MXL charges \$15 per student for a one-year access code. A portion of the math department budget at St. Joseph's Academy is used to cover this cost for my students. Since unused codes do not expire, it is good practice to order a few extra codes to have them ready when needed.

3.4 Selecting Students

St. Joseph's Academy used a soft guideline of an ACT score of 19 or below and a recommendation from the students' Algebra 2 teacher in order for students to be admitted into this Advanced Math course. There were some exceptions made for students with higher ACT scores, but I found that these students were not as motivated as the students who were trying to improve their scores.

Next year we are requiring stricter guidelines for students to take this course. The students are placed into this course if they have an ACT Math score of 19 or below and below a C average upon completion of Algebra 2. Any student who has a C average is placed on a student-by-student basis by teacher recommendation. The teacher recommendation is based on the student's ACT Math score and work ethic in the classroom.

If students have no plans for post-secondary education, they will have no motivation to focus on ACT performance. The type of students that should be chosen for this class are seniors who struggle with math and who need to start with reviewing the basics, but the students who also want to succeed.

3.5 Grading Policy

Each participating student's high school grade for this course was based on her performance in my class alone, based on completing homework and performing well on class quizzes and tests. Homework and quizzes were each worth 30% of the quarter grade, and tests were worth 40% of the quarter grade. Because of the heavy emphasis on homework and quizzes, this grade relies on a student's work ethic; lazy students who do not care about their grades will not succeed in this class. Any increase or decrease in the ACT Math score had no effect on the students' high school grade. Students' personal goals for post-secondary education are a

contributing factor to their level of motivation for ACT performance. I attempted to motivate my students by offering words of encouragement often and telling the students how proud I was of them when they worked hard and reached the goals I set for them. I also offered additional assignments for students who wanted to boost their grades.

When exporting grades from MXL, the teacher can choose “Quick Export” under “Export Data” in the Gradebook section of MXL, which will give an immediate report of the student’s grade out of 100%. Another option is “Advanced Export,” which gives additional options of exporting data than “Quick Export” does. For example, the teacher can select to export scores as points instead of percent, or can include the time spent on the assignment.

Name	Correct	Total	Time Spent
Student 1	16	16	0:33:59
Student 2	16	16	2:30:38
Student 3	16	16	1:09:19
Student 4	16	16	0:30:17
Student 5	16	16	0:58:40
Student 6	16	16	0:35:44

Figure 11: Advanced Export Example, 2015

3.6 Technology

Computer and internet accessibility is vital for the implementation of this course. My students have personal tablets to use throughout high school, which is ideal, but not necessary. However, access to computer labs or class sets of computers or iPads will be needed. The students will need to use the computers for lab days and quiz days. I think it is also important to allow time outside of class for students to work independently, especially if internet capability is limited at home.

As far as calculator usage, if a student has a graphing calculator, this would be good to use for the ACT prep fall semester, since it is allowed on the ACT. A graphing calculator is not

necessary, though. It is vital that students familiarize themselves with the calculators they plan to use on the ACT. For the Pre-College Algebra spring semester, I would recommend a scientific calculator such as the TI-30X, since that is the requirement in college. With as much graphing that is done in Pre-College Algebra, students should understand how to graph without the use of the graphing calculator.

CHAPTER 4: COURSE DESIGN AND DESCRIPTION

The first semester of this Advanced Math course is dedicated to ACT preparation. It is divided into chapters by the six broad topics covered on the ACT: pre-algebra, elementary algebra, intermediate algebra, coordinate geometry, plane geometry, and trigonometry. Since the majority of senior students are taking, or retaking, the ACT in the first semester of their senior year, it is important that ACT prep is taught during the first semester. The students will be reviewing concepts needed to excel in Pre-College Algebra, as well.

The detailed descriptions of each chapter and section, along with blank teacher resources for notes, study guides, and tests are all found in Binder #1 (see appendix). The descriptions of the chapters also include the importance of the concepts to the ACT and College Algebra, a list of the assignments, and the pacing for the chapter. The completed resources for everything from Binder #1 are found in Binder #2. The MXL assignments for the ACT Prep fall semester are found in Binder #3. Binders #2 and #3 are available upon request.

Below is a list of the chapters and sections covered in the ACT Prep semester.

Chapter 1: Pre-Algebra

1.1 – Numbers

1.2 – Fractions

1.3 – Order of Operations

1.4 – Percent

1.5 – Ratio and Proportion

1.6 – Statistics and Data

1.7 – Probability and Elementary Counting Principle

1.8 – Linear Expressions and Equations

Chapter 2: Elementary Algebra

2.1 – Evaluating Formulas and Expressions

2.2 – Exponents and Radicals

2.3 – Polynomials

2.4 – Factoring Polynomials and Quadratic Equations

Chapter 3: Intermediate Algebra

3.1 – Inequalities and Absolute Value Equations

3.2 – Systems of Linear Equations

3.3 – Quadratic Equations and Inequalities

3.4 – Complex Numbers

3.5 – Patterns, Sequences, and Modeling

3.6 – Matrices

Chapter 4: Coordinate Geometry

4.1 – Graphing Equations on the Coordinate Plane

4.2 – Distance and Midpoint Formulas

4.3 – Graphing Linear Inequalities

4.4 – Conic Sections

Chapter 5: Plane Geometry

5.1 – Basic Elements of Plane Geometry, Angles, and Quadrilaterals

5.2 – Properties of Triangles and Pythagorean Theorem

5.3 – Similar and Congruent Triangles

5.4 – Circles and Transformations

5.5 – Geometric Formulas

Chapter 6: Trigonometry

6.1 – Right Triangle Trigonometry

6.2 – Unit Circle Trigonometry

6.3 – Law of Sines and Law of Cosines

The second semester of the Advanced Math course covers Pre-College Algebra topics. It is divided into chapters based on the main topics covered in College Algebra: types of equations, functions and graphing, polynomial and rational functions, and exponential and logarithmic functions. Those concepts in College Algebra that were covered in the ACT prep fall semester were left out when planning the College Algebra semester. Such concepts included factoring, solving absolute value equations and inequalities, solving quadratic equations and inequalities, distance and midpoint formulas, and equations of circles.

The detailed descriptions of each chapter and section, along with blank teacher resources for notes, study guides, and tests are all found in Binder #1. The descriptions of the chapters also include how the material compares to LSU College Algebra, a list of the assignments, and the pacing for the chapter. The completed resources for everything from Binder #1 are found in Binder #2. The MXL assignments for the Pre-College Algebra spring semester are found in Binder #4. Binders #2 and #4 are available upon request.

Below is a list of the chapters and sections covered in the Pre-College Algebra semester.

Chapter 7: Types of Equations

7.1 – Linear Equations

7.2 – Higher-Order Polynomials and Radical Equations

7.3 – Rational Exponents and Disguised Quadratics

Chapter 8: Functions and Graphing

8.1 – Functions

8.2 – Graphs of Basic Functions and Piecewise Functions

8.3 – Graphing Techniques

8.4 – Function Operations and Compositions

Chapter 9: Polynomial and Rational Functions

9.1 – Quadratic Functions and Models

9.2 – Synthetic Division

9.3 – Zeros of Polynomial Functions

9.4 – Graphs of Polynomial Functions

9.5 – Graphs of Rational Functions

Chapter 10: Exponential and Logarithmic Equations

10.1 – Inverse Functions

10.2 – Exponential Functions

10.3 – Logarithmic Functions

10.4 – Evaluating Logarithms and Change-of-Base Theorem

10.5 – Exponential and Logarithmic Equations

10.6 – Applications of Exponential Functions

CHAPTER 5: OTHER ACT PREP PROGRAMS

MasteryPrep is an ACT[®] Mastery program used in an institutional setting focusing particularly on students scoring below an 18 on the ACT. The program offers an all-inclusive ACT prep curriculum, online test prep, warm-up exercises, practice testing and analysis for students throughout the year, one-day student workshops for test-taking strategies, and an application for students. The program also offers professional development for teachers, a teacher's manual with detailed lesson plans, a video library of essential ACT skills, and teacher training. MasteryPrep promises an average three-point increase in student scores on the ACT (MasteryPrep, 2015). According to the 2015-2016 Draft Catalog for Supplemental Course Academy from the Louisiana Believes website, the price for the face-to-face program is \$1,250 per student for the school year, or \$625 per semester (Louisiana Department of Education, 2015).

MasteryPrep also offers an online full course, MasteryWorks, for students to complete at home with full-length practice tests, over 80 hours of instruction, nearly 200 lessons, over 2,000 ACT practice questions, and test-taking strategies. The price for this course is \$297. It also advertises a money-back guarantee if the overall score does not increase for any reason (MasteryWorks, 2015).

Kaplan is a well-known test prep company for the SAT[®], ACT[®], and PSAT[®] that offers full prep courses and tutoring. These courses range in price from \$249 to \$3,499. The different prep options Kaplan offers include live instruction with expert teachers, proven test-taking strategies, proctored, full-length practice tests, timed practice and review, and detailed Smart Reports[®] that track progress to a higher score. Kaplan also advertises personalized learning using an adaptive approach, where each student is given a custom-learning plan based on his/her performance on a diagnostic exam. The different programs offered by Kaplan, which range in

price, are one-on-one tutoring, a classroom course, a live, online classroom course, or an online course. Kaplan advertises a three-point increase on the ACT[®] or your money back (Kaplan, 2015).

Princeton Review is another well-known test prep company for college and graduate exams that advertises in-person and online full prep courses and private tutoring. These courses range in price from \$699 to \$1,599, or a self-paced version for \$299. Their prep strategies include personalized learning, test-taking strategies, live instruction, proctored practice tests, and extensive practice and drills with the instructor or at home. The program options include classroom courses of different sizes with varying amounts of live instruction, private tutoring, and an online, self-paced course. Princeton Review also guarantees a three-point increase on the ACT[®] or your money back (Princeton Review, 2015).

PowerScore is an ACT prep company offering in-person and online full-length prep courses, weekend courses, and tutoring. These courses range in price from \$350 to \$595. Tutoring ranges in price from \$595 to \$4400. Their prep strategies include live instruction, proctored practice exams, the Email Assistance Program, and the Online ACT Student Center. PowerScore advertises three, four, and five point scores increases, depending on which program, or you can retake the course for free (PowerScore, 2015).

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