International Journal of Education and Social Science; Vol. 9 No. 4; August 2022
ISSN 2410-5171 (Online), 2415-1246 (Print)
Published by Research Institute for Progression of Knowledge

A Quantitative Analysis of Emporium Developmental Mathematics Pass Rates for Student Demographics

Dr. David Wang
Chair, Dept of Math & Comp Sci
School of Liberal Arts
Mercy College
New York, USA

Abstract

Since the turn of the 21st century, the emporium model has become a popular choice for colleges and universities to reform developmental mathematics. The purpose of this study is to determine overall how successful Northeast Metro College (NMC)'s emporium developmental mathematics program is as compared to its traditional lecture-based program by comparing these two programs' student pass rates in developmental courses for each of the following demographic categories: gender (male and female), age (traditional college age of 18-24 years and non-traditional age of 25 years or older), credit load (full-time and part-time), race, and financial aid status (receiving Pell award or not). This research is a non-experimental, secondary data quantitative analysis study with nonrandom convenience samples. The findings indicate that generally emporium classes prepare students for passing developmental mathematics more successfully than traditional lecture-based classes do.

Keywords: Demographics, Developmental Mathematics, Emporium Model, Pass Rates

1. Introduction

In 1849, the University of Wisconsin launched the nation's first formal college preparatory program (Cafarella, 2014). The program provided remedial courses in reading, writing, and arithmetic for underprepared students (Brier, 1986). "By the 1940s, the college preparatory program had been largely replaced as a fixture in American higher education by junior colleges and college divisions within universities" (Boylan, 1988, p. 2). In the early 1970s the term "developmental education" was established and was increasingly and widely used as there was national focus on student preparation for college readiness (Arendale, 2002; Boylan & Bonham, 2007).

Globalization and domestic workforce competition demand future employees, our students, be equipped with competent writing, reading, and mathematics skills (World Economic Forum, 2016). Developmental education is designed to prepare student readiness for college in those competencies. However, the outcome of developmental education is dismal (Jaggars & Stacey, 2014) that the majority of developmental students are not able to fulfill their remediation requirements (Chen, 2016), and stakeholders are calling for national actions to reform developmental education.

Developmental education is increasingly the center of the national debate in higher education, especially developmental mathematics, which has much lower pass rate in comparison to developmental English's (Bonham & Boylan, 2011). Approximately half of developmental mathematics students fail to complete the courses, and this high failure rate is a barrier to college completion (Davis, 2014).

Enrollment in developmental mathematics not only costs students' money but also delays their graduation. With the pressure from all stakeholders, colleges are carrying out innovative ways to improve the pass rate in developmental mathematics.

Since the turn of the 21st century, the emporium model has become a popular choice for universities and colleges to reform developmental mathematics. The emporium model, named after its originator, Virginia Tech (Virginia Polytechnic Institute and State University) which called its initial course redesign (National Center for Academic Transformation, n.d.), intends to address the challenges facing the traditional lecture-based model. It is composed of several core components and much of the detailed implementations have been left to colleges. That means the redesigned emporium developmental mathematics programs can vary from one institution to another, and sometimes these programs can differ considerably.

2. The Emporium Model at NMC

Northeast Metro College (NMC), located in New York City metropolitan area, with an enrollment of approximately 8,000 full-time students and 6,000 part-time students at three campuses. Almost two-thirds of NMC first-year, first-time students take at least one remedial course. In Fall 2014, after experiencing some promising outcomes from several pilot programs aiming to improve developmental mathematics, NMC began to implement the emporium model for all existing developmental mathematics courses. Simultaneously NMC is running traditional lecture-based developmental mathematics courses. All gateway courses are traditional lecture-based. NMC focused on self-paced computer-based mastery method to implement the emporium model. How does self-paced computer-based mastery method work? After the Accuplacer test, remediation students have their free choice to enroll in the traditional course(s) or in the self-paced computer-based mastery course(s). The emporium classes meet twice a week with the same professor at a learning computer hub center which has 48 student stations and accommodates two class sections of 24 each with two professors and two student tutors. After class time, students can go to a large annex center with 24 student stations for dropping-ins and separate testing. The annex center opens six days a week and is staffed by at least two full-time supervisors. Students watch videos related to each homework assignment to begin with, complete notes related to each video, and achieve a level of mastery on each assignment. Students are able to work at their own pace and may retake tests to improve their score. Knowledge and concepts are organized into modules. Students watch video of a particular model first and then review video notes. During class time, professors and tutors stand by to answer on-demand individual request for assistances. Students then do warming-up exercises and homework and take the test whenever they feel ready. All student computer activities can be monitored by professors and tutors. So even if students do not ask questions and if the monitored computer activities indicate students are stuck in certain assignments, professors and tutors can proactively come to students to assist. Immediately students will receive feedback on tests and homework. Students only will be allowed to move to the next module if they successfully pass the test of the current module with a score at least 70% (mastery method). Students have the opportunity to progress more quickly (or slowly) with the help of courseware, MyMathLab, and they gain flexible scheduling accommodations. There are cost savings for students in this model. Students are able to complete more than one developmental mathematics course in one semester if motivated. Students are able to begin the next semester where they left off. Students can adjust schedule to suit life changes.

What are the differences between a "self-paced" class and a "traditional" class? The self-paced mastery program provides students with the opportunity to go through a course "at their own pace" instead of being controlled by the pace of the teacher in the traditional mathematics lecture time. In the self-paced computer labs staffed by professors and professional and peer tutors, students work on computer-based activities. Students spend the bulk of their course time doing mathematics problems rather than listening to a traditional mathematics lecture. Advantages of the self-paced program are: accommodates different learning styles; offers both videos and power points; offers on-demand individual assistance; provides immediate feedback on tests and homework; affords the opportunity to progress more quickly and complete two classes in one semester; and enables the students to become independent learners.
Students are placed into relevant remedial mathematics courses, as shown in Table 1, as per their Accuplacer test scores which are based on 120 points.

Table 1: Accuplacer Placement

Arithmetic Placement Scores	
0-29	DM1 - Basic Mathematics Linked Support and DM2 - Basic Mathematics must be taken together.
30-59	DM2 - Basic Mathematics
60–76	DM3 - Accelerated Basic Mathematics
Algebra Placement Scores	
0-75	DM4 - Algebra for Liberal Arts (planning to take MAT101, MAT102 and/or MAT103)
0-75	DM6 - Algebra (planning to take MAT104 and beyond, STEM, Nursing, or Business majors)

In order to enroll in a gateway mathematics course, students must demonstrate proficiency in basic mathematics and elementary algebra. Students may enroll in any of the following gateway mathematics courses: MAT101 - Contemporary Mathematics; MAT102 - Statistics I; MAT103 - Finite Mathematics; MAT104 - Intermediate Algebra. MAT101, MAT102, and MAT103 are general education courses. These courses may be used to satisfy the mathematics general education requirement. MAT104 is not a general education course and thus cannot be used to satisfy this degree requirement.

3. Methodology

The purpose of this study is to determine overall how successful NMC's emporium developmental mathematics program is as compared to its traditional lecture-based program by comparing these two programs' student pass rates in developmental courses. Therefore, this study would address the following research question and Hypothesis:

R1. For each of the following demographic categories, is there a difference in developmental mathematics pass rates for two groups: students in the emporium classes and those in the traditional lecture-based classes?

a. Gender.
b. Age: Traditional college age (18-24 years) and non-traditional age (25 years or older).
c. Credit load: Full-time (12 credits or above) and Part-time (less than 12 credits).
d. Race.
e. Financial Aid: Receiving Pell award or no Pell.

H1. For each demographic category in **R1**, there is a statistically significant difference in developmental mathematics pass rates for two groups: students in the emporium classes and those in the traditional lecture-based classes.

Type of research. Because of the availability of existing data and no requirement of experimental treatments, this research was a non-experimental, secondary data quantitative analysis study with nonrandom convenience samples. There is not a single best way to determine an academic program's success or failure. However, pass rate is deemed as one of the most effective and feasible assessment indicators. By examining the pass rates, this study applied several statistical analyses to validate the findings.

Population and Sample. The population were all NMC's developmental students (at least 18 years old at the time of enrollment). The sample was any student who took at least one developmental mathematics course in any of the fall or spring semesters of 2016–17 or 2017–18. Students could take different developmental mathematics courses as well as repeat them during the four semesters included in the study. Developmental mathematics courses included DM2 - Basic Mathematics, DM3 - Accelerated Basic Mathematics, DM4 - Algebra for Liberal Arts, DM5 - Algebra Topics, and DM6 – Algebra.

Data Collection. Final course grades of development mathematics (DM2, DM3, DM4, DM5, and DM6) in the fall and spring semesters of 2016 – 2017 and 2017 – 2018 were collected for NMC students (at least 18 years old at the time of enrollment) along with the demographic data (gender, age, credit load, race, and financial aid status). No student identifiers were in the data set. The enrollment data of developmental mathematics courses in the fall and spring semesters of 2016 – 2017 and 2017 – 2018 were shown in Table 2.

Table 2: Developmental Math Enrollment 2016 – 2018

	Emporium Program	Traditional Program
Fall 16	586	2056
Spring 17	547	1462
Fall 17	439	1523
Spring 18	343	1105
Total	1915	6146

Combining the four semesters, there were a total enrollment of 8061 in developmental mathematics. Approximately one out of four developmental mathematics students took emporium classes. Developmental math Student enrollment data by demographics were presented in Table 3.

Table 3: Enrollment and Demographics of Developmental Mathematics

Demographics	Fall 16	%	Spr 17	%	Fall 17	%	Spr 18	%
Male	1300	49%	959	48%	893	46%	679	47%
Female	1289	49%	1018	51%	1010	51%	745	51%
Other	53	2%	32	2%	59	3%	24	2%
18 - 24 yr old	2256	85%	1680	84%	1576	80%	1134	78%
25 or above	386	15%	329	16%	386	20%	314	22%
Part-time	1022	39%	982	49%	927	47%	771	53%
Full-time	1620	61%	1027	51%	1035	53%	677	47%
Caucasian	771	29%	513	26%	544	28%	434	30%
African-American	188	7%	144	7%	170	9%	128	9%
Hispanic	826	31%	614	31%	607	31%	460	32%
Other*	857	32%	738	37%	641	33%	426	29%
No Pell award	1311	50%	972	48%	918	47%	676	47%
Receiving Pell	1331	50%	1037	52%	1044	53%	772	53%

Note. * includes Asian, Hawaiian/Pacific Islander, American Indian, Two or More Races, and Unknown.

Over the four semesters, for developmental mathematics enrollment, 50% were female, and 48% were male; 82% were 18 – 24 years old; 54% were full-time; 28% were Caucasian, eight percent were African-American, 31% were Hispanics, and 33% were Other; 52% received Pell. African-American enrollment was less than 10% and would not be included in data analysis.

Data Analysis. IBM's SPSS Statistics was used to conduct all calculations and various data analysis. SPSS (Statistical Package for the Social Sciences) is a software package used for interactive and statistical analysis. Originally developed by SPSS Inc., it was acquired by IBM in 2009 and renamed as IBM SPSS Statistics (IBM, n.d.). Excel macros and functions were used to confirm the calculations and statistical analysis done by SPSS. The researcher calculated pass rates of developmental mathematics of various student groups studied for fall 2016, spring 2017, fall 2017, and spring 2018. Chi-square tests of goodness-of-fit were performed to further analyze whether there was a significant difference in pass rates between student groups.

Because of its easiness of construction and its reliability, the Chi-square test is frequently used to determine whether there is a significant difference between the expected values and the observed values in one or more variables among groups (Johnson & Christensen, 2014). Chi-square (x^2) with a (the level of significance) set at 0.05. If p (possibility of occurrence) < 0.05, the researcher would reject the null hypothesis that no significant difference is between or among groups and thus, would confirm the proposed hypothesis that significant difference is between or among groups. On the other hand, if p > 0.05, the researcher would accept the null hypothesis without enough evidence to support the proposed hypothesis. If p = 0.05, the researcher would neither confirm nor reject the proposed and null hypotheses.

Five demographic variables were integrated to steps of answering **R1.** The researcher calculated the developmental mathematics pass rate for each group in each semester: students in the emporium classes and those in the traditional lecture-based classes. A Chi-square test was used to further analyze if there was a significant difference between the pass rates of these two student groups in each semester. Lastly, the researcher compared numerically the two groups' pass rates. **H1** was then tested. If at least three of four semesters' ps < 0.05, the researcher would confirm **H1** and reject its null hypothesis. Otherwise, the researcher would reject **H1** and accept its null hypothesis.

4. Findings

R1a/H1a - gender

Table 4: Developmental Mathematics Pass Rates by Gender

Gender	Emporium			Traditional					
	Pass	Total	Pass Rate	Pass	Total	Pass Rate	E PassRate – T PassRate	x^2	*p*
Fall 16:									
Male	180	295	61%	538	1005	54%	7%	5.17	0.023*
Female	191	283	67%	657	1006	65%	2%	0.47	0.494
Spr 17:									
Male	170	280	61%	348	679	51%	10%	7.15	0.008*
Female	175	261	67%	460	757	61%	6%	3.27	0.071
Fall 17:									
Male	114	194	59%	337	699	48%	11%	6.76	0.009*
Female	146	233	63%	461	777	59%	4%	0.83	0.363
Spr 18:									
Male	85	171	50%	265	508	52%	-2%	0.31	0.578
Female	110	167	66%	347	578	60%	6%	1.86	0.173

Note. * indicates significant difference as $p < 0.05$.

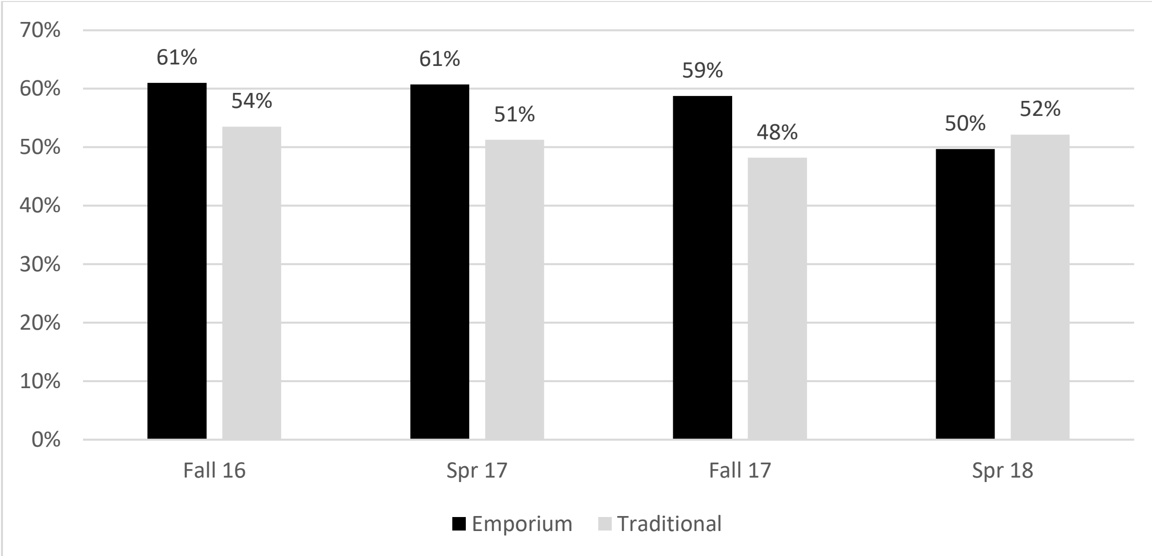

Figure 1: **Developmental mathematics pass rates for male students.**

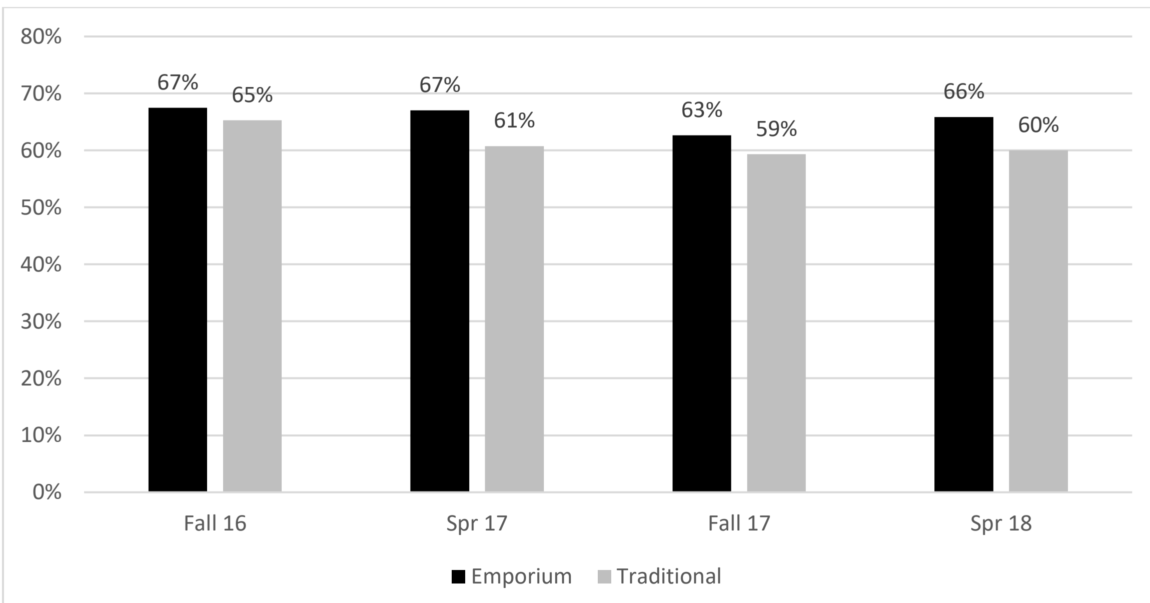

Figure 2: **Developmental mathematics pass rates for female students.**

For both male and female students, there is a difference in developmental mathematics pass rates for two groups: those in the emporium classes and those in the traditional lecture-based classes (see Table 4 and *Figures 1 - 2*). For each semester, the female emporium pass rate has been higher than its traditional pass rate. While for male students, except for Spring 2018, their emporium pass rate has been higher than their traditional pass rate.

For male students, with the exception for spring 2018, all *p*s < 0.05 assert that there was a significant difference in pass rates between emporium and traditional students and that the pass rates in the two groups were affirmatively contingent upon the type of developmental mathematic models students enrolled. With male emporium students significantly outperforming male traditional students in three of the four semesters, the researcher confirmed **H1a** and rejected its null hypothesis for male students. It was concluded that the developmental mathematics pass rate for male students in the emporium classes was higher (statistically significant) than that for male students in the traditional lecture-based classes.

For female students, all four Chi-square tests were not significant, indicating not enough evidence to support that there was a statistically significant difference in female students' performance in either the traditional or emporium model. Thus, the researcher rejected **H1a** and accepted its null hypothesis for female students. Though the pass rate for female emporium students was higher than that for female traditional students in each semester studied, the association between emporium classes and the higher pass rate was not considered to be statistically significant. Compared to their female counterparts, male students seemed to benefit more by taking emporium classes.

R1b/H1b – age

Table 5: Developmental Mathematics Pass Rates by Age

Age	Emporium			Traditional					
	Pass	Total	Pass Rate	Pass	Total	Pass Rate	E PassRate – T PassRate	x^2	*p*
Fall 16:									
18 - 24	322	505	64%	1029	1751	59%	5%	4.07	0.044*
25 or above	56	81	69%	194	305	64%	5%	0.86	0.354
Spr 17:									
18 - 24	305	484	63%	645	1196	54%	9%	11.58	0.001*
25 or above	45	63	71%	178	266	67%	4%	0.47	0.491
Fall 17:									
18 - 24	206	353	58%	643	1223	53%	5%	3.68	0.055
25 or above	62	86	72%	182	300	61%	11%	3.75	0.053
Spr 18:									
18 - 24	156	287	54%	436	847	51%	3%	0.71	0.399
25 or above	41	56	73%	186	258	72%	1%	0.03	0.865

Note. * indicates significant difference as $p < 0.05$.

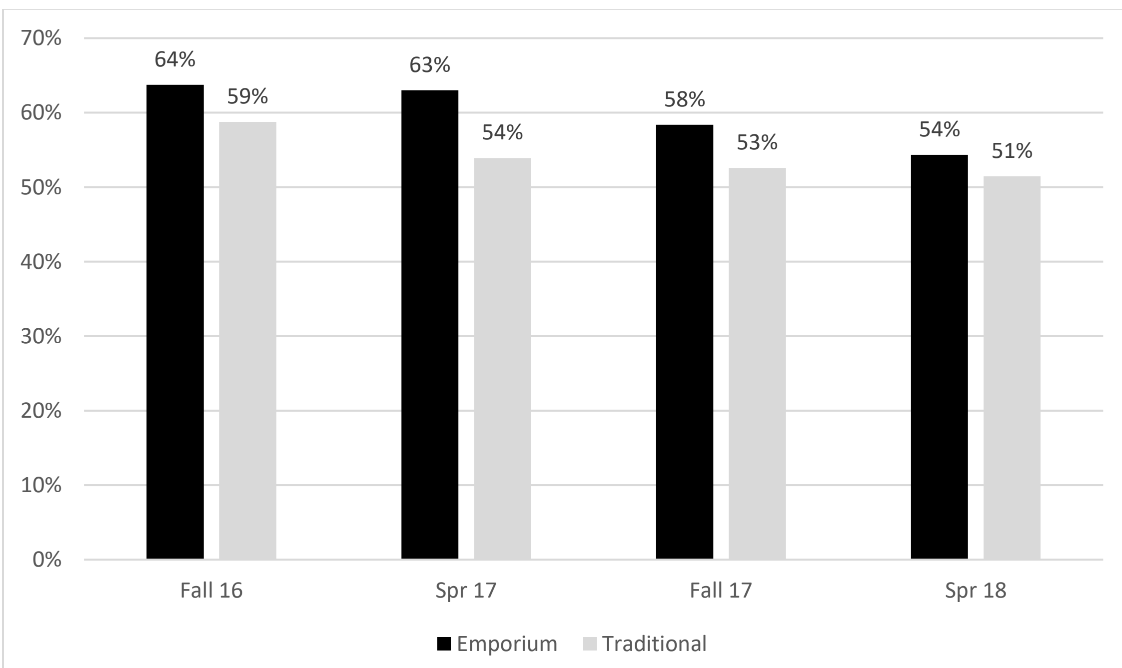

Figure 3: **Developmental mathematics pass rates for 18 – 24 years old students.**

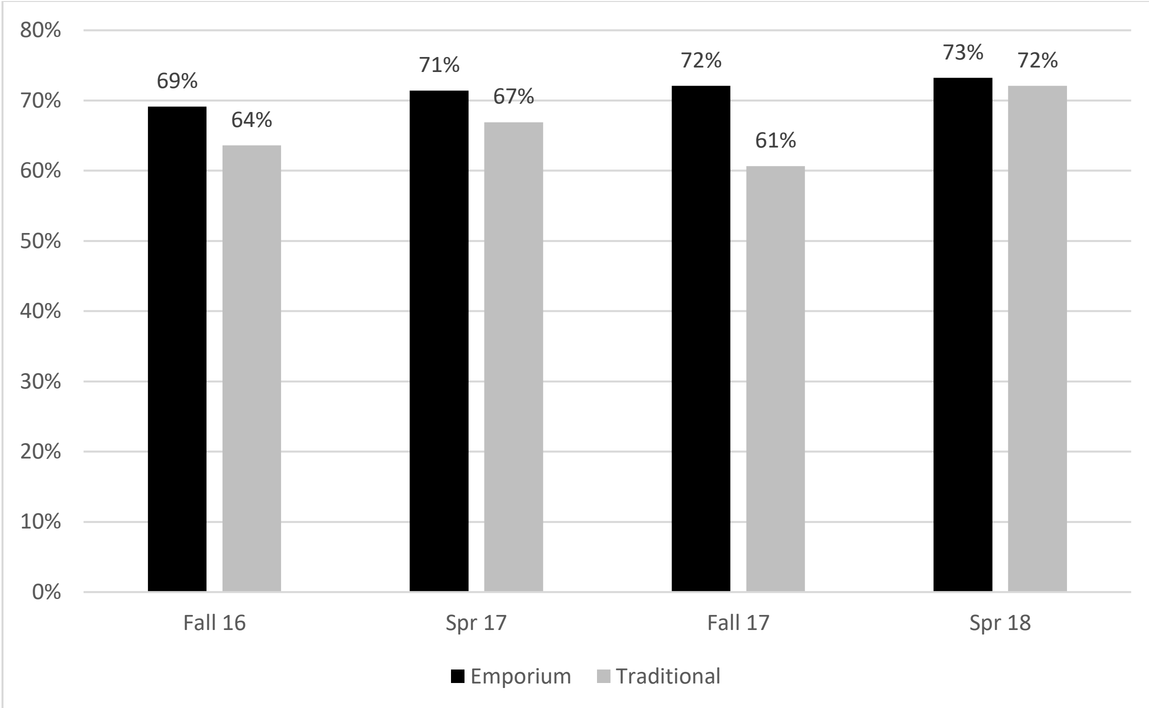

Figure 4: **Developmental mathematics pass rates for at least 25 years old students.**

For each age group, there is a difference in developmental mathematics pass rates for emporium and traditional students (see Table 5 and *Figures 3 – 4*). For every semester, each age group's emporium pass rate has exceeded its traditional pass rate.

For traditional college-age students, only two of four semesters' *p*s were less than 0.05. While for the minimum 25 years old group, none of four *p*s was less than 0.05. These Chi-square testing results indicate that for each age group, there was no significant difference in pass rates between emporium and traditional students and the pass rates for emporium and traditional students were not affirmatively contingent upon the type of developmental mathematic models they enrolled. Thus, the researcher rejected **H1b** and accepted its null hypothesis for all age groups. Though, for each age group, the pass rate for emporium students was higher than that for traditional students in each semester studied, the association between emporium classes and the higher pass rate was not considered to be statistically significant. However, compared to their older counterparts, 18 – 24 years old students seemed to benefit more by taking emporium classes.

R2c/H2c – credit load

Table 6: Developmental Mathematics Pass Rates by Credit Load

Credit Load	Emporium			Traditional					
	Pass	Total	Pass Rate	Pass	Total	Pass Rate	E PassRate – T PassRate	x^2	*p*
Fall 16:									
Part-time	116	216	54%	395	806	49%	5%	1.50	0.220
Full-time	262	370	71%	828	1250	66%	5%	2.71	0.100
Spr 17:									
Part-time	139	248	56%	355	734	48%	8%	4.38	0.036*
Full-time	211	299	71%	468	728	64%	7%	3.73	0.053
Fall 17:									
Part-time	109	195	56%	347	732	47%	9%	4.44	0.035*
Full-time	159	244	65%	478	791	60%	5%	1.77	0.184
Spr 18:									
Part-time	88	179	49%	278	592	47%	2%	0.27	0.605
Full-time	109	164	66%	344	513	67%	-1%	0.02	0.888

Note. * indicates significant difference as $p < 0.05$.

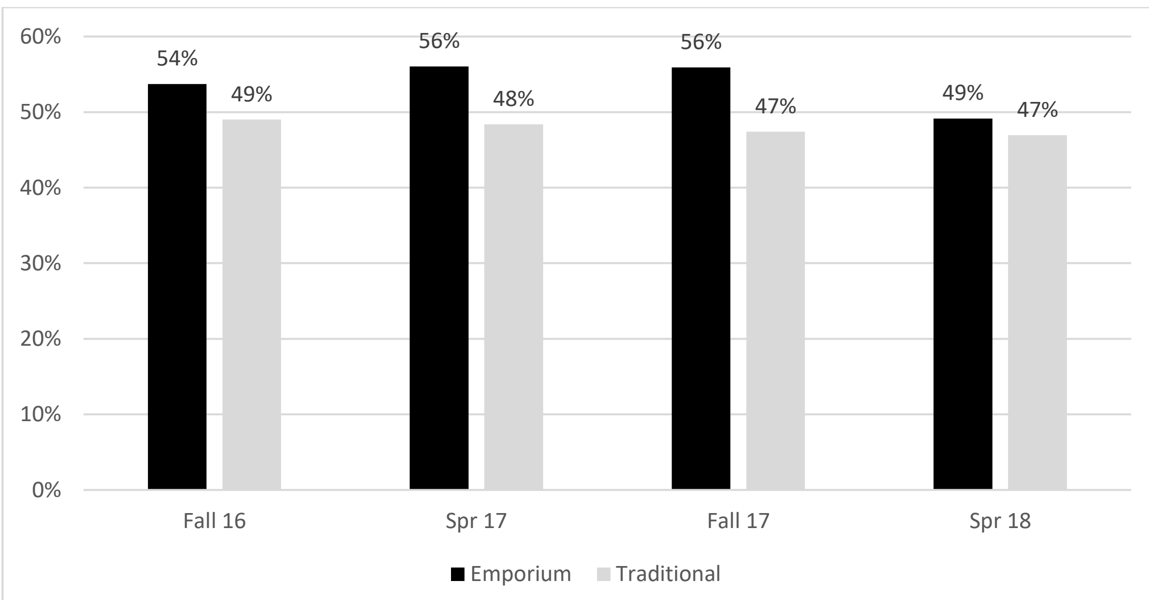

Figure 5: **Developmental mathematics pass rates for part-time students.**

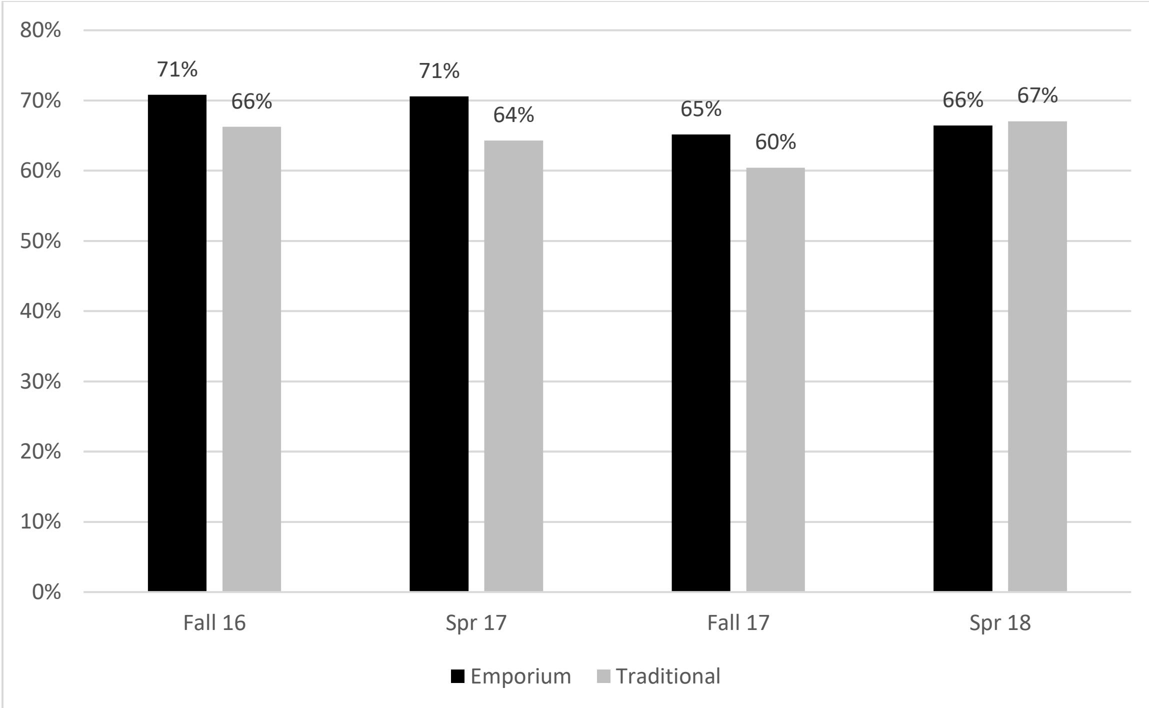

Figure 6: **Developmental mathematics pass rates for full-time students.**

For each credit load group, there is a difference in developmental mathematics pass rates for emporium students and traditional students (see Table 6 and *Figures 5-6*). For part-time students, the emporium pass rate has exceeded the traditional pass rate in all four semesters. For full-time students, the emporium pass rate has exceeded the traditional pass rate in three of the four semesters, with the exception for spring 2018.

For part-time students, only two of the four semesters' *p*s were less than 0.05. While for full-time students, none of the four *p*s was less than 0.05. These Chi-square testing results indicate that for either part-timers or full-timers, there was no significant difference in pass rates between emporium and traditional students and the pass rates for emporium and traditional students were not affirmatively contingent upon the type of developmental mathematic models they enrolled. Thus, the researcher rejected **H2c** and accepted its null hypothesis. Though, for each credit load group, the pass rate for emporium students was higher than that for traditional students in most semesters studied, the association between emporium classes and the higher pass rate was not considered to be statistically significant. However, compared to their full-time counterparts, part-time students seemed to benefit more by taking emporium classes

R2d/H2d – race

Table 7: Developmental Mathematics Pass Rates by Race

Race	Emporium			Traditional					
	Pass	Total	Pass Rate	Pass	Total	Pass Rate	E PassRate – T PassRate	x^2	*p*
Fall 16:									
Caucasian	113	166	68%	390	605	64%	4%	0.75	0.387
Hispanic	131	192	68%	367	634	58%	10%	6.58	0.010*
Other	116	183	63%	395	674	59%	4%	1.37	0.242
Spr 17:									
Caucasian	90	140	64%	231	373	62%	2%	0.24	0.623
Hispanic	113	166	68%	233	448	52%	16%	12.71	<0.001*
Other	125	197	63%	317	541	59%	4%	1.42	0.234
Fall 17:									
Caucasian	73	114	64%	254	430	59%	5%	0.93	0.336
Hispanic	74	130	57%	260	477	55%	2%	0.24	0.624
Other	94	141	67%	268	500	54%	13%	7.64	0.006*
Spr 18:									
Caucasian	49	92	53%	200	342	58%	-5%	0.81	0.369
Hispanic	66	116	57%	183	344	53%	4%	0.48	0.489
Other	66	105	63%	188	321	59%	4%	0.60	0.437

Note. * indicates significant difference as $p<0.05$.

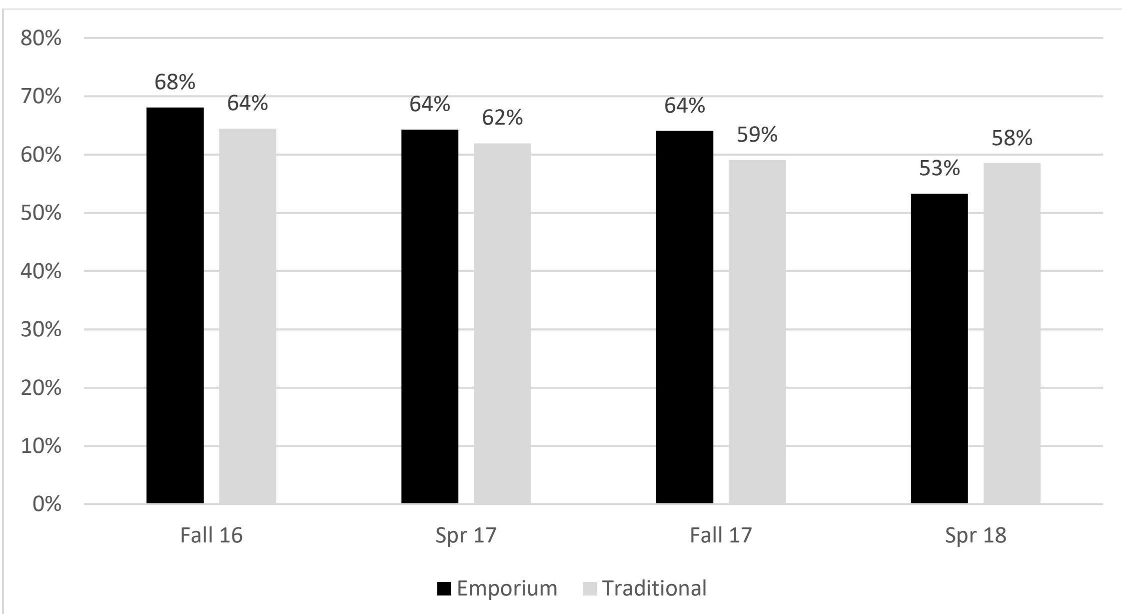

Figure 7: **Developmental mathematics pass rates for Caucasian students.**

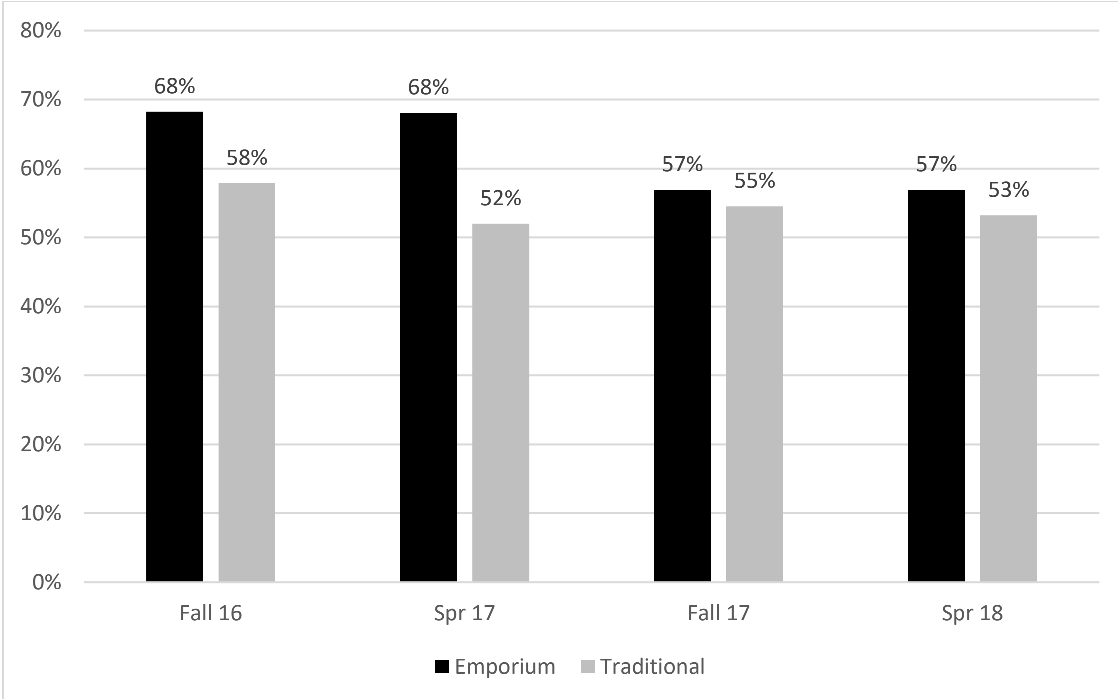

Figure 8: **Developmental mathematics pass rates for Hispanic students.**

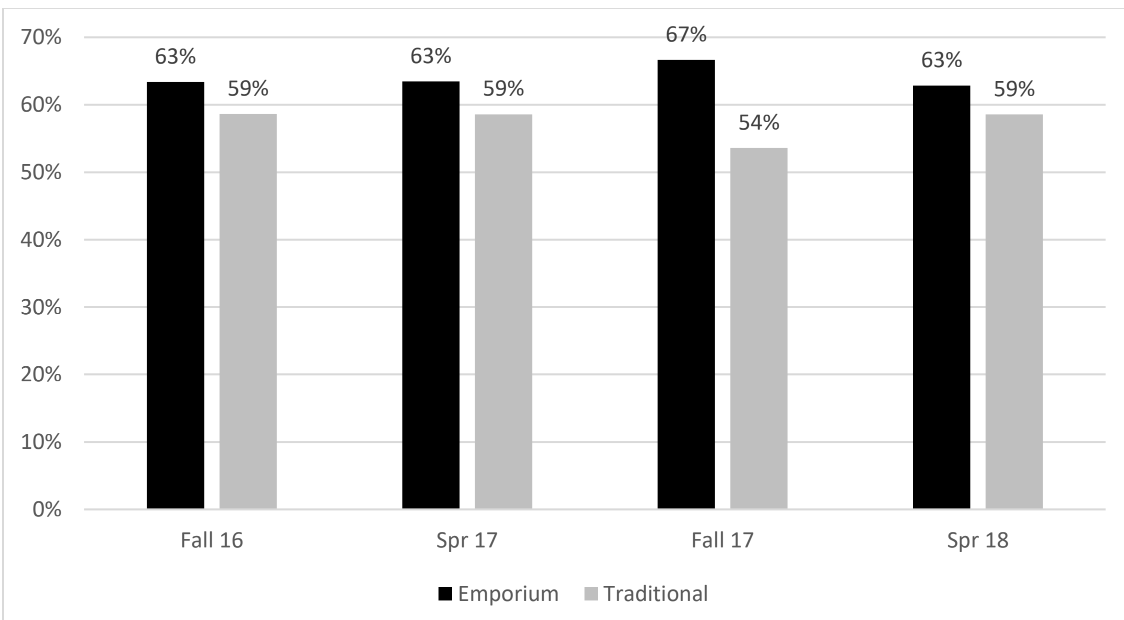

Figure 9: **Developmental mathematics pass rates for Other students.**

For each race, there is a difference in developmental mathematics pass rates for emporium students and traditional students (see Table 7 and *Figures 7-9*). For both Hispanic and Other students, the emporium pass rate has exceeded the traditional pass rate in all four semesters. For Caucasian students, the emporium pass rate has exceeded the traditional pass rate in three of the four semesters, with the exception for spring 2018.

For Hispanic students, two of the four semesters' *p*s were less than 0.05. For Other students, only one of the four semesters' *p*s was less than 0.05. While for Caucasian students, none of the four *p*s was less than 0.05. These Chi-square testing results indicate that for each racial group studied, there was no significant difference in pass rates between emporium and traditional students and the pass rates for emporium and traditional students were not affirmatively contingent upon the type of developmental mathematic models they enrolled.

Thus, the researcher rejected **H2d** and accepted its null hypothesis. Though, for each race, the pass rate for emporium students was higher than that for traditional students in most semesters studied, the association between emporium classes and the higher pass rate was not considered to be statistically significant. However, compared to other racial counterparts, Hispanic students seemed to benefit more by taking emporium classes.

R2e/H2e – financial aid

Table 8: Developmental Mathematics Pass Rates by Financial Aid Status

Financial Aid	Emporium			Traditional					
	Pass	Total	Pass Rate	Pass	Total	Pass Rate	E PassRate – T PassRate	x^2	*p*
Fall 16:									
No Pell award	193	279	69%	647	1032	63%	6%	4.01	0.045*
Receiving Pell	185	307	60%	576	1024	56%	4%	1.55	0.213
Spr 17:									
No Pell award	176	268	66%	421	704	60%	6%	2.82	0.093
Receiving Pell	174	279	62%	402	758	53%	9%	7.19	0.007*
Fall 17:									
No Pell award	138	215	64%	386	703	55%	9%	5.79	0.016*
Receiving Pell	130	224	58%	439	820	54%	4%	1.44	0.231
Spr 18:									
No Pell award	85	152	56%	318	524	61%	-5%	1.11	0.292
Receiving Pell	112	191	59%	304	581	52%	7%	2.31	0.129

Note. * indicates significant difference as $p<0.05$.

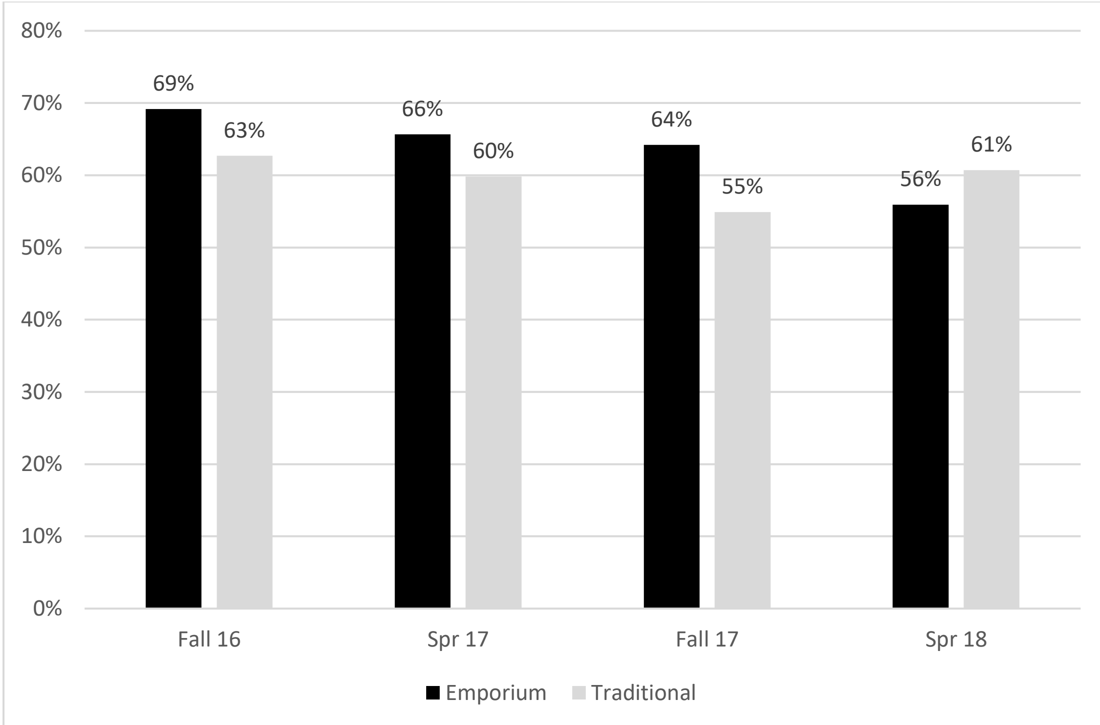

Figure 10: **Developmental mathematics pass rates for students not qualified for Pell.**

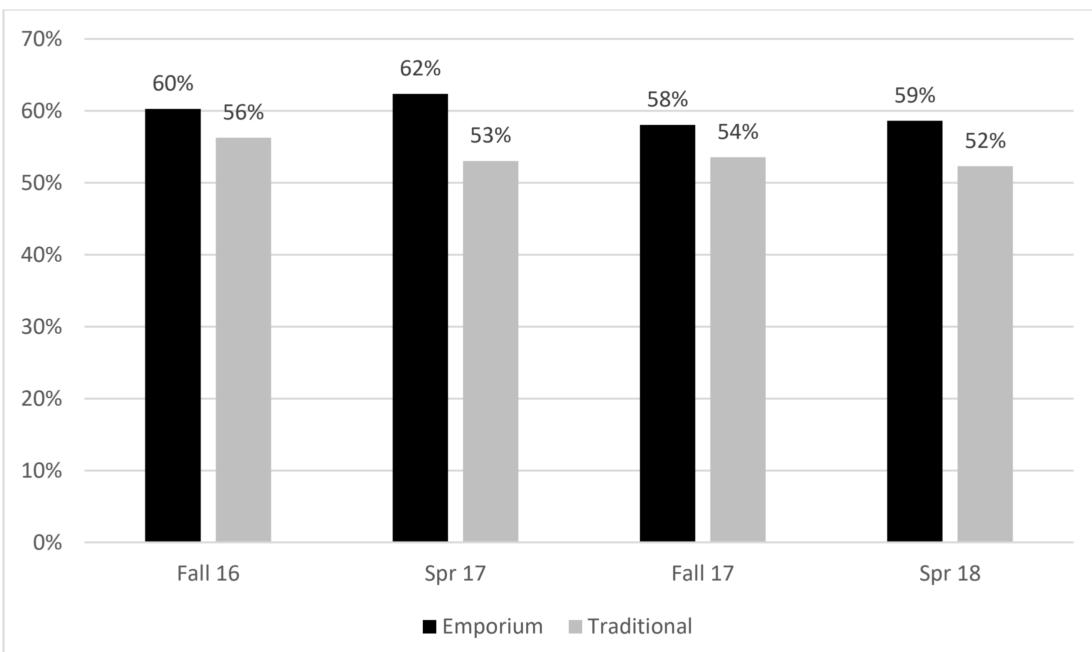

Figure 11: **Developmental mathematics pass rates for Pell recipients.**

For students whether receiving Pell or not, there is a difference in developmental mathematics pass rates for emporium and traditional students (see Table 8 and *Figures 10-11*). For Pell recipients, the emporium pass rate has exceeded the traditional pass rate in all four semesters. For students not receiving Pell, the emporium pass rate has exceeded the traditional pass rate in three of the four semesters, with the exception for spring 2018.

For Pell recipients, two of the four semesters' *p*s were less than 0.05. While for students receiving no Pell, only one of the four semesters' *p*s was less than 0.05. These Chi-square testing results indicate that for students whether receiving Pell or not, there was no significant difference in pass rates between emporium and traditional students and the pass rates for emporium and traditional students were not affirmatively contingent upon the type of developmental mathematic models they enrolled. Thus, the researcher rejected **H2e** and accepted its null hypothesis. Though, for these two cohorts with different financial aid status, the pass rate for emporium students was higher than that for traditional students in most semesters studied, the association between emporium classes and the higher pass rate was not considered to be statistically significant. However, compared to their no-Pell awarded counterparts, Pell recipients seemed to benefit more by taking emporium classes.

5. Discussions and Conclusion

Limitations of the Study. While comparing pass rates for the two student groups (emporium and traditional), the study assumes that the prior mathematics levels of emporium students and those in the traditional students were not significantly different. There is no guarantee for this assumption. As in any non-experimental studies, the researcher would not be able to control, manipulate or change part of the experiment (Johnson & Christensen, 2014). Instead, the researcher would rely on existing student records to draw the conclusion. Thus, the data obtained from NMC are assumed to be in the good state and have been verified. To enroll in emporium developmental mathematics courses, students had to agree with the self-paced computer-based setting. Students might not be used to this type of learning environment. The time period studied was limited to two academic years because the emporium program was only launched a few years ago. Instructors and students might have biases (positive and/or negative) about the emporium classes. The researcher also acknowledges that the findings of the study may not be conclusive for colleges of different characteristics for their developmental mathematics populations.

Recommendations. To serve developmental students more efficiently and to conduct more conclusive studies, the researcher recommends that Admissions collect each student's race category (categories) inclusively rather than exclusively: students can check as many race categories as they prefer. Admissions should remove "Unknown" from the list. By doing so, the college would have more detailed developmental student demographic information to better track their completion data. The college needs to find out the legal requirements and ramifications for students to disclose their race data. It is also important for the college to find out the reasons why number of students in this "Unknown" race category has increased over the past few years.

Future Research. The current study was a quantitative research and it is crucial to get student, staff and faculty points of views regarding the emporium model. A mixed-method research would produce more insightful and comprehensive findings. The researcher would replicate the study incorporating interviews and surveys to get qualitative data from developmental mathematics students, staff and faculty. The study can be also improved by collecting and analyzing emporium gateway student data after NMC offers emporium gateway classes.

Conclusion. This study has outlined the profile of students who are likely to be benefitted most for passing developmental mathematics by taking emporium classes. They are male, between 18 and 24 years old, part-time, Hispanic, and not qualified for Pell. Overall, NMC has implemented a very successful emporium developmental mathematics program. Emporium classes prepared students for passing developmental mathematics more effectively than traditional lecture-based classes. For all demographic subgroups studied, the developmental mathematics pass rates for students in the emporium classes were higher than those for students in the traditional lecture-based classes in at least three of the four semesters. Especially for male students, the association between emporium classes and higher pass rate was considered to be statistically significant. This study's findings indicate that female, older, and white students more likely perform better than male, traditional college age (18 – 24), and minority students in developmental mathematics, respectively, and that across all five demographic subgroups

The need to study the emporium model in developmental mathematics is urgent as more students arrive at colleges academically underprepared in mathematics (Jaggars & Stacey, 2014). The emporium model is rather a new and innovative instruction method applying technologies. "One size fits all" approach does not work. After initial implementations, each college should collect and analyze its own data to determine if appropriate steps are being executed and if necessary, additional operations are to be implemented.

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