Self-Selection and Mathematics: Racial Equity and Appropriate Placement

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Abstract
This study explores the relationship between appropriate class placement and minority demographics, in relation to advanced mathematics classes. We study this relationship under the self-selection program model at an urban middle school in the Midwest. We define self-selection as a student's ability to choose his or her level of course regardless of test scores and other academic criteria. At this specific school, students have the choice of selecting their mathematics class level (double-advanced, advanced, or standard). While parental influences may play a role in students' course selections, we highlight that under this model the course for which a student registers for is up to the student. The purpose of the self-selection program model is to promote equal opportunities and access to advanced courses, especially for those students that may not have been tracked into higher-level classes earlier in their academic careers. Specifically, this model aims to increase the number of minority students that enroll in advanced classes, as we know that advanced classes are comprised mostly of White and Asian students. Through this study, we investigate how the self-selection program model affects the demographics of leveled classes. We also assess students' accuracy in choosing appropriate classes under this model. While we found no indication that self-selection increases minority enrollments in advanced classes, we did find that under this program model, fewer "misplaced" White and Asian students chose to pursue double-advanced classes. Therefore, there is evidence that self-selection contributes to appropriate choices per students and families, negating the need for school input.

Keywords: self-selection, racial equity, placement, advanced classes, tracking

Introduction

Today, students across the nation are facing unequal education opportunities. Whether students live in rural, suburban, or urban districts, equity may be sparse within the walls of their respective schools. While a variety of factors contribute to education inequity, research shows that race and socioeconomic status (SES) are amongst the highest contributors that limit the opportunities available for students (Brown Center Report, 2013). Furthermore, when we specifically look at mathematics classrooms, we see blatant inequities and racial disparities that our deep rooted and stem from our nation's history (Walker, 2007).

While various forms of inequity exist within schools, we will focus on the inequity that is associated with tracking in mathematics. Tracking refers to a wide variety of ability grouping models that have existed, and still do exist, in many American schools (Oakes, 2016). Both historically and currently, Black and Hispanic students represent the majority of students in lower-level tracks, while White and Asian students represent the majority of students in higher-level tracks (Hanushek & Wobmann, 2006; Walker, 2007). Students in lower-level tracks are taught less challenging material, have less experienced teachers, are less prepared for college entrance exams, and in turn have less success after high school compared to students in higher-level tracks (Newfield & Mcelyea, 1983). This means that because Black and Hispanic students are typically tracked into lower-level classes at an early age, they are educationally disadvantaged compared to their White and Asian peers. Therefore, it is clear that tracking continues to promote unequal education opportunities.

There have been several de-tracking movements throughout history to combat the inequities associated with tracking, yet schools continue to implement this practice. Currently, tracking is most prevalent within each subject, and in some districts, this begins as early as elementary school (Oakes, 2016). While completely de-tracking students has its own cons, some schools have implemented what is called self-selection. This model hopes to restructure traditional tracking and increase the number of opportunities available to all students, such that students can choose which level of classes they take (Corbett Burris, Heubert, & Levin, 2016).

In this study, we will focus on self-selection pertaining to mathematics classes at the middle school level. In short, self-selection is meant to focus on student-choice and allow students to self-select into higher-level courses without having to "make the cut". For example, a student that is currently taking standard-level sixth grade mathematics may choose to take advanced seventh grade mathematics the following year. While teachers and counselors may not endorse a student's course selection, a student's test scores and/or classroom performance can no longer prevent him or her from choosing to take a higher-level class. This is contrary to traditional tracking, and thus, self-selection is intended to help all students better prepare themselves for secondary and post-secondary education (Klopfenstein, 2004). Lastly, self-selection is also meant to eliminate the political aspect associated with advanced tracks. Since all students are given equal access to these higher-level classes, schools believe there is less room for parental influence and teacher discretion. Because certain parents typically interfere with traditional tracking, schools identify the self-selection program model as a means to even the playing field for all students (Corbett Burris et al., 2016).

Purpose of Our Study

The purpose of this research study is to determine the effectiveness of self-selection relevant to its promotion of equal opportunities and its effect on appropriate class placement for middle school students. We believe that tracking does create unequal education opportunities; however, we are skeptical that self-selection is the answer. We question if this program model is increasing the number of minority students in advanced classes, and we question whether middle school students are able to choose an appropriate mathematics class based on their mathematical abilities and needs. Additionally, we wonder if only certain students are taking advantage of this program model such that the student populations that self-selection is intended to best serve are not benefitting from its implementation.

To address our wonderings, we proposed the following research questions:

(1) How effective is the self-selection program model in increasing minority enrollments in advanced classes?
(2) How accurate are students in placing themselves in an appropriate mathematics class under this model?

Depending on our findings, we may recommend that more schools implement the self-selection program model. On the other hand, our findings may prompt us to recommend that schools move away from the self-selection model. For example, if our study shows that self-selection is effective in increasing the number of minority students enrolled in higher-level mathematics classes, then we will support self-selection and encourage more schools to adopt it. However, if our doubts about self-selection are confirmed, we will suggest that schools consider alternatives to combat the inequity associated with tracking.

Literature Review

As we stated in our introduction, education opportunities are unequal for students in the United States. These inequities can take many forms such as old facilities, limited extracurricular activities, inexperienced teachers, outdates textbooks, and so on. These inequities intersect with race and socioeconomic status, and for that reason we will utilize the theoretical framework of Critical Race Theory throughout our study. By showing that educational inequities are the product of historical segregation in schools, we hope to illustrate the importance of increasing access to rigorous learning opportunities for all students. In our study, we specifically focus on the history of tracking and demonstrate how other factors, such as parental influence and cultural characteristics, have allowed traditional tracking to continue over time and perpetuate segregated mathematics classrooms.

Tracking has remained a common practice in the United States' public education system, yet much criticism surrounds this topic. While tracking is intended to group students based on their ability levels so that teachers can effectively tailor instruction, researchers have observed a strong correlation between tracking and inequity

(Gamoran, 2009). Tracking is intended to decrease the amount of differentiation that would otherwise be needed; however, the majority of the research shows that the students who are tracked into high-achieving classes continue to widen their achievement advantages compared to students tracked into standard-level and remedial classes (Gamoran).

Additionally, research has shown that there is a strong correlation between a student's race and socioeconomic status and the track in which the student is placed (Oakes, 1992). While a student's socioeconomic status more directly effects his or her track placement, the student's race/ethnicity has an indirect effect on placement (Gamoran, 2009). Students of color, namely Black and Hispanic students, typically have lower test scores than White students; this means that students of color are typically placed in lower level tracks, especially when they begin high school (Hanushek & Wobmann, 2006). Theses students' lower test scores limit which classes they can take, and therefore may hinder their preparedness for post-secondary endeavors. This being said, several studies have concluded that students in high-achieving classes encounter more challenging tasks and curriculum compared to students in standard-level and remedial classes (Newfield & Mcelyea, 1983). This means that standard-level and remedial students are not being given the same opportunities, nor are they exposed to the same level of difficulty as their higher-tracked peers.

Furthermore, higher-level classes tend to be taught by more experienced and more highly educated teachers, whereas standard-level and remedial classes tend to be taught by new, less experienced teachers (Gamoran, 2009). This trend can either limit or enhance students' opportunities based solely upon what teacher some students have compared to others. Even more concerning is that low-income and/or majority minority schools generally have far fewer experienced and highly educated teachers compared to historically white schools (Oakes, 2016). This means that even students who are enrolled in higher-level courses at low-income and majority minority schools are still disadvantaged.

In general, we summarize that the majority of research is in favor of de-tracking students; however, one recent study used a new approach to study tracking and found no evidence that tracking is detrimental to standard-level and remedial student outcomes (Figlio & Page, 2002). This study considered the possibility that school choice, whether parents and/or students decide what school is best for them, depends on the tracking programs that a school does or does not have. Per this study, high-ability students typically chose schools that did have tracking, while standard-level and remedial students typically chose schools that did not have tracking. With this consideration, further research was conducted such that unobservable factors correlated with tracking were controlled. With this approach, researchers concluded that de-tracking would not help close the achievement gap, and instead this study discussed the possibility that tracking programs may help lower-ability students reach adequate academic goals.

Parent involvement is another factor that has been linked to classroom segregation, and therefore has contributed to the perpetuation of tracking. Several researchers have shown that parent-involvement can lead to less diverse classrooms and potentially influence the amount of access students have to equal opportunities. When parents become overly involved in their children's schools, they often focus solely on the advancement of their own children without keeping other students in mind (McGrath & Kuriloff, 1999). Involved parents tend to be White and are typically from upper-middle class households; these parents typically have more pull at schools because, "They carry an implicit threat of flight from public schools", which administrators fear (McGrath & Kuriloff, 1999, p. 605).

Even if parents are not directly involved with their children's classrooms, they may be involved with committees such as the Parent Teacher Associate (PTA), Sports Booster programs, etc. Even with this more indirect involvement, researchers have shown that these parents still have more pull when it comes to their child's class placement compared to less involved parents (McGrath & Kuriloff, 1999). Again, the historically White aspect of parental involvement contributes to unequal opportunities.

Lastly, there is also a strong correlation between parents' level of education and the track placement of their children (Useem, 1992). Highly educated parents understand how the American public school system works, and thus they will heavily involve themselves in their students' course selections (Useem, 1992). Additional research has shown that highly educated people tend to be of higher socioeconomic status, and thus a higher proportion of advanced students come from more affluent households (Davis-Kean, 2005). This too perpetuates tracking, as more highly educated parents will not only push for schools to offer advanced courses, but they will also fight for their children to be enrolled in such classes.

Cultural Characteristics is the last factor we will discuss that has been studied in relation to classroom segregation and the inequities associated with tracking. More specifically, we bring up this factor to address why high-achieving minority students do not always stay in advanced tracks, even if they were originally placed there. One idea that is commonly referenced when discussing this factor states that high achieving minority students experience "the burden of acting white" (Tyson, William, Darity, & Castellino, 2005). While researchers have not found empirical evidence to support this, it is believed that a strong public belief in this assertion still exists today (Tyson et al.).

In terms of education, this theory suggests that high achievement is viewed as a White cultural norm, and thus high achieving minority students are viewed as "acting White" should they demonstrate academic achievement. Because of this, high-achieving minority students are thought to struggle with identity and acceptance of their high potential (Bergin, 2002). Similarly, Tyson et al. (2005) determined that high achievement is not always recognized in minority cultures because it is perceived as a successful White cultural norm (p. 584). The negativity associated with "acting white" prevents some minority students from taking higher-level classes even after they have been recognized as being gifted; this is because they feel too isolated from their minority peers (Ford, 1998). In turn, the stigma of "acting white" limits the number of other minority students that pursue higher-level classes. This contributes to the severe underrepresentation of minority students in advanced tracks, and in turn, this contributes to the classroom segregation that is so prevalent today.

To summarize, we recognize that tracking, parent involvement and cultural characteristics contribute to racial inequity and unequal opportunities for students.

Thus, we aim to further investigate the self-selection program model, as we hope to determine whether or not this implementation can help overcome the deep-rooted causes of segregation in the mathematics classroom. If self-selection does promote racial equity, then this research can support other schools in their decision to adopt the self-selection program model. On the other hand, if self-selection is determined to be ineffective, then it is our hope that schools will move away from this particular model and commit to finding other means for promoting equal opportunities.

Methods and Data Collection

In order to study the effectiveness of the self-selection program model, we identified an urban Minnesotan middle school that recently implemented self-selection. We requested historical and current registration records along with students' standardized state test scores from the district. This school was in their second year of its self-selection implementation, so they provided us with three years of data prior to the implementation and one year of data post-implementation. We had hoped to have a fifth year of data; however, the standardized exam scores that we would have needed were not published at the time of our initial research. The identified middle school is a 6-8 building and is the only middle school in the district. Additionally, this school is classified as a low-income school according to the Teacher Cancellation Low Income Directory. Demographics for the school are shown below.

Race	2012-2013	2013-2014	2014-2015	2015-2016	2016-2017
White	61.6%	61.2%	60.8%	58.3%	56.3%
Black	22.8%	22.7%	22.3%	23.9%	24.6%
Hispanic	9.5%	9.8%	9.9%	11.3%	12.5%
American Indian	0.7%	0.6%	1.1%	0.6%	1.0%
Asian/Pacific Islander	5.4%	5.8%	5.9%	5.9%	5.6%

Table 1: *Student Population Demographics by Academic Year*

Because our research pertains to a Minnesota state test, let us take a moment to share some background information on what is called the Minnesota Comprehensive Assessment (MCA). The MCA is a standardized exam given to all students each spring that measures students' performance relative to the Minnesota grade-level state standards. Note that Minnesota has its own state standards, as it does not adhere to the Common Core State Standards.

Based on a student's MCA score, he or she is categorized into one of the following sets: Does Not Meet Standards (D), Partially Meets Standards (P), Meets Standards (M), and Exceeds Standards (E). Scores for middle school students have three digits. The first digit indicates grade level, and the second two digits indicate the student's position within a category. The table below shows numerical scores that indicate each category.

Grade	D	P	M	E
6^{th} Grade	601-639	640-649	650-659	660-699
7^{th} Grade	701-739	740-749	750-759	760-799
8^{th} Grade	801-839	840-849	850-860	861-899

Table 2: *MCA Scoring Ranges for Grades 5-8*

The students included in our sample met the following criteria: (1) Had a seventh and/or eighth grade registration record, (2) Were enrolled in a mainstream mathematics course offered at the middle school, (3) Had a previous year's Minnesota Comprehensive Assessment (MCA) score.

For seventh grade students that met this criterion, we cross-referenced their seventh-grade mathematics courses with their sixth grade MCA scores. We did the same for eighth grade students such that we cross-referenced students' eighth grade mathematics courses with their seventh grade MCA scores. Unfortunately, we were not able to do this for our sixth-grade students because the middle school was not able to release students' fifth grade MCA scores, as those were considered to be property of the elementary schools. There are six elementary schools in the district, so at the time of our research, we chose not to seek approval from each elementary school. Also, we did not cross reference students' ninth grade mathematics courses with their eighth grade MCA scores, and thus eighth grade MCA scores were not of concern to us.

Students excluded from our sample were those that were new to the district such that the school could not provide us with a previous year's MCA score. Also, we did not include students that had opted out of the MCA exam because again, we did not have a previous year's score for such students. Finally, we did not include students that took special education self-contained mathematics classes, nor did we include certain gifted students that only took mathematics through the University of Minnesota's Talented Youth Mathematics Program (UMTYMP).

After the implementation of self-selection, students completed online registration for the following academic year. Registration took place in February and was held during a science class session. No parents were present at registration, and students were able to select their courses independently at this time. We do speculate that parent-involvement occurred prior to registration and impacted the selections students made. However, during the actual registration period, students were able to select all of their own courses including core and elective classes.

Language and literature and mathematics were the only subjects that offered leveled courses at this middle school. Students could choose between standard or advanced language and literature, and they could choose between standard, advanced, or double advanced mathematics. Note that students were highly recommended not to register for a double-advanced mathematics class unless they had started on that track in 6^{th} grade or had the support from their mathematics teacher and school administrators. In the end though, course selections were still up to each student.

Grade	Standard Level	Advanced	Double-Advanced
6	Math 6	Advanced Math 6	Advanced Math 7
7	Math 7	Advanced Math 7	Advanced Math 8
8	Math 8	Advanced Math 8	Geometry Honors

Table 3: *Mathematics Course Options by Grade*

As a reminder, our first research question asked how effective the self-selection program model is in increasing minority enrollments in advanced classes. To answer this question, we studied the demographics of each leveled class before and after the implementation of self-selection. This information was readily available per the data that the school provided. We were able to look at the change in minority demographics holistically and by individual races. Once we summarized this data, we were able to perform a proportions comparison test using Minitab software to identify if any changes in the demographics were significant.

Furthermore, our second research question asked how accurate students are in placing themselves in an appropriate mathematics class under the self-selection model. Answering this question was more involved, as we had to do more extensive work to make sense of the data that we were provided. To begin, we compared the mathematics classes that seventh and eighth grade students enrolled in with their previous year's MCA score. By doing this, we were able to see if students chose classes that were appropriate for them under this model. Based on the mathematics classes offered at this school, we expected students who scored in the D, P and M categories on the previous year's MCA to register for standard level mathematics the following year. We expected students who scored in the E category to register for either advanced or double-advanced mathematics depending on their category score position. More specifically, students who scored between 60 and 69 (inclusive) were expected to register for advanced mathematics, and students who scored at 70 or above were expected to register for double-advanced mathematics. We made this distinction for the Exceeds Category based on the MCA proficiency level guidelines.

As stated earlier, the Principal and administrators provided us with the middle school's registration records for the past five years and historical MCA data for individual students. Before giving us access to these records, all student names were removed, and instead each student was coded with a seven-digit id number. We had no knowledge of which student was coded with which id number, and thus the privacy of all middle school students was maintained.

The data consisted of five different races: White, Black, Hispanic, American Indian, and Asian/Pacific Islander. There were five different classes: Math 7, Advanced Math 7, Math 8, Advanced Math 8, and Geometry. The MCA Scores consisted of a three-digit number, where the first number corresponded to a student's grade level and the last two digits corresponded to a student's performance on the test.

Initially, there were approximately 3,200 registration record entries to sort through. In order to handle this batch of data, we created a Java application that would cross reference our input files and generate subset percentages pertinent to our research questions. Because our class registration and MCA score records were separate files, our application was able to match each student's respective information and then output whether or not the registration was appropriate or not.

Once we obtained a comprehensive data set from our application, we parsed out the records we deemed to be invalid. First, students that did not have previous MCA scores were removed from the comprehensive data set. This instance could occur for transient students or students that opted out of the previous year's MCA exam. Additionally, we did not include students that did not have a class record, even though they had an MCA score. This would include UMTYMP students and students that were enrolled in self-contained special education mathematics classes.

Once we had all summarized data and valid entries, we utilized Minitab to perform multiple proportion tests to see if any changes in enrollment, by class and by race, were statistically significant. We predominantly used alpha levels of 0.05; however on a final test we used an alpha level of 0.10.

Results

Per our research study, we identified the following major results: (1) The implementation of self-selection did not increase minority enrollments in advanced classes, (2) The implementation decreased the number of misplaced students in double-advanced mathematics, and (3) The implementation decreased misplaced White and Asian students in advanced and double-advanced mathematics classes.

First, we found no evidence that indicated minority enrollments increased after the implementation of self-selection. In fact, we observed decreases in advanced enrollments for Black, Hispanic, Asian, and American Indian students. We tested the percentage percent change in Black, Hispanic, and Asian student populations for significance using Minitab's two proportions test. We used an alpha level of 0.05 and constructed our two hypotheses as follows: H_O: $p_1 - p_2 = 0$ and H_A: $p_1 - p_2 > 0$. Our hypothesis tests produced p-values that indicated these decreases were not statistically significant. Also, note that because so few students identified as American Indian, we were not able to perform a test for this particular population.

Race	Before Self-Selection	After Self-Selection	P-Value
White	71%	71%	N/A
Overall Minority Enrollment	36%	32%	0.139
Black	31%	30%	0.402
Hispanic	37%	29%	0.158
Asian	53%	45%	0.226
Am. Ind.	50%	33%	N/A

Table 4: *Percent Changes: Student Enrollment in Advanced Classes by Race*

Next, we found that the implementation of self-selection did decrease the enrollments of misplaced students in double-advanced mathematics. We also tested whether or not the decrease of misplaced students in advanced mathematics was significant; however, it was not. Again, we used Minitab's two proportions test with the same requirements as above.

Leveled Class	Before Self-Selection	After Self-Selection	P-Value
Advanced	81%	79%	0.192
Double-Advanced	74%	60%	0.005

Table 5: *Percent Changes: Misplaced Student Enrollment in Advanced Classes*

Lastly, we found that certain student populations (by race) enrolled in more appropriate classes after self-selection was implemented. In part with self-selection's goal to increase minority enrollments in advanced classes, we would also argue that decreasing the enrollment of White and Asian students goes hand in hand. This being said, these results were particularly interesting. Again, we utilized Minitab's two proportion test; however, this time we set our alpha level to 0.10, as we were less concerned with a Type 1 error in this scenario.

Race	Before Self-Selection	After Self-Selection	P-Value
White	55%	50%	0.074
Black	28%	26%	0.363
Hispanic	28%	21%	0.113
Asian	46%	32%	0.099
Am. Ind.	50%	17%	N/A

Table 6: *Percent Changes: Misplaced Student Enrollment in Advanced Classes by Race*

Conclusion

To summarize what we did in this study, let us revisit its purpose. This study sought to determine whether or not self-selection was effective in combatting traditional tracking. To do this, we studied a specific middle school and analyzed the changes in enrollment patterns both before and after self-selection was implemented. We studied both the changes in overall student demographics, namely by race, and the changes in misplaced student enrollments before and after self-selection. Through our study, we found that minority enrollments in advanced classes did not increase post-self-selection. Even though all students can enroll in higher-level mathematics classes under the self-selection model, we do not feel that self-selection overcomes the factors we discussed in our literature review that contribute to low minority enrollments in advanced classes.

To note the limitations of our study, let us first acknowledge that our data set is relatively small. It is our hope to continue analyzing this middle school's registration records and test scores, as the school is still implementing self-selection today. Because we only had one year of post-self-selection data, we are curious to learn more about the changes in enrollment patterns that occur in the future. Additionally, we only identified students as misplaced or correctly-placed based on their previous year's MCA score. We understand that this is only one data point, and we also realize that there are other factors at play in regard to students' performance on that specific test. Thus, previous MCA's score may lack some validity in terms of what classes are most appropriate for students.

In the future, we would like to study more data from this middle school and potentially conduct a more in-depth longitudinal study about self-selection and the themes that emerge per its implementation. While conducting such a study, we would seek to obtain student's NWEA scores in addition to MCA scores to determine which mathematics classes are most appropriate. We would also like to collect two more years' worth of data post-self-selection so that we had more similar sample sizes between our two groups. Additionally, we would be interested in approaching this study through a mixed-methods approach, such that we would interview students and parents about the registration process and the factors that influenced their course selection. Lastly, we would like to obtain MCA data from each elementary school and include sixth grade students in our study as well.

We would like to offer the following recommendations for the identified middle school after completing our study: (1) Self-selection should be more advertised and promoted, especially to minority students and their parents. We learned that the advertisement of self-selection was lacking, and we wonder if more students would have been interested in pursuing advanced classes had they known about this option. (2) Some sort of summer "fly-up" program should be offered to students who want to move from a standard level to an advanced class the following year so that these students can be better prepared for more rigorous coursework. We also believe this may help entice students to pursue advanced coursework because they will not feel as if they are behind compared to other students who have already taken advanced classes. At this specific school, a high percentage of minority students attend summer school programs anyways, so we predict that more minority students may choose to pursue an advanced summer school option over a general one. In this case, these students could be pre-exposed to advanced coursework and become more familiar with the difference in expectations prior to starting the next school year. (3) Because this school has committed to continuing self-selection, we also suggest that more individual student counseling take place before registration. We feel it would be beneficial for teachers to consult with students before they register for classes, as we predict that only some students are having conversations about course selections at home. If teachers could reach more students and discuss students' options individually, then more students might be interested in pursuing classes that are most appropriate for them. Together, these recommendations could help increase minority enrollments in advanced classes while also decreasing the high numbers of misplaced students as well.

Appendix 1: Historical Information

Number of Students Enrolled in Each Leveled Class for Each Academic Year (By Race)

	Course	White	Black	Hispanic	Asian	Am. Ind.	Total
2012-2013	Math 7	47	39	21	4	0	111
	Adv. Math 7	134	22	10	6	2	174
	Math 8	43	27	11	6	2	89
	Adv. Math 8	51	8	3	1	0	63
	Geometry	15	1	0	1	0	17
	Total	**290**	**97**	**45**	**18**	**4**	**454**
2013-2014	Math 7	49	31	15	9	1	105
	Adv. Math 7	64	6	5	6	1	82
	Math 8	41	30	17	3	0	91
	Adv. Math 8	137	20	16	6	0	179
	Geometry	50	6	2	3	0	61
	Total	**341**	**93**	**55**	**27**	**2**	**518**
2014-2015	Math 7	49	31	12	7	0	99
	Adv. Math 7	71	11	7	7	1	97
	Math 8	55	40	19	9	2	125
	Adv. Math 8	120	12	6	11	1	150
	Geometry	65	3	7	2	0	77
	Total	**360**	**97**	**51**	**36**	**4**	**548**
2015-2016	Math 7	50	38	22	10	3	123
	Adv. Math 7	81	20	7	6	0	114
	Math 8	54	40	12	7	1	114
	Adv. Math 8	123	11	6	8	2	150
	Geometry	45	2	1	0	0	48
	Total	**353**	**111**	**48**	**31**	**6**	**549**

Appendix 2: Hypothesis Testing Data

Question 1: Is the decrease in minority enrollment in advanced classes statistically significant?

- For all individual tests, use the following hypotheses with $\alpha = 0.05$:
  - H_o: $p_1 - p_2 = 0$
  - H_o: $p_1 - p_2 > 0$
- No decrease in minority enrollments were statistically significant.

I. Test and CI for Two Proportions: Overall Minority Enrollment

Descriptive Statistics

Sample	N	Event	Sample p
Sample 1	529	193	0.364839
Sample 2	196	63	0.321429

Test

Null hypothesis	H_0: $p_1 - p_2 = 0$
Alternative hypothesis	H_1: $p_1 - p_2 > 0$

Method	Z-Value	P-Value
Normal approximation	1.09	0.139
Fisher's exact		0.159

The pooled estimate of the proportion (0.353103) is used for the tests.

II. Test and CI for Two Proportions: Black Student Enrollment

Descriptive Statistics

Sample	N	Event	Sample p
Sample 1	287	89	0.310105
Sample 2	111	33	0.297297

Test

Null hypothesis	H_0: $p_1 - p_2 = 0$
Alternative hypothesis	H_1: $p_1 - p_2 > 0$

Method	Z-Value	P-Value
Normal approximation	0.25	0.402
Fisher's exact		0.452

The pooled estimate of the proportion (0.306533) is used for the tests.

III. Test and CI for Two Proportions: Hispanic Student Enrollment

Descriptive Statistics

Sample	N	Event	Sample p
Sample 1	151	56	0.370861
Sample 2	48	14	0.291667

Test

Null hypothesis	H_0: $p_1 - p_2 = 0$
Alternative hypothesis	H_1: $p_1 - p_2 > 0$

Method	Z-Value	P-Value
Normal approximation	1.00	0.158
Fisher's exact		0.205

The pooled estimate of the proportion (0.351759) is used for the tests.

IV. Test and CI for Two Proportions: Asian Student Enrollment

Descriptive Statistics

Sample	N	Event	Sample p
Sample 1	81	43	0.530864
Sample 2	31	14	0.451613

Test

Null hypothesis	H_0: p_1 - p_2 = 0	
Alternative hypothesis	H_1: p_1 - p_2 > 0	
Method	Z-Value	P-Value
Normal approximation	0.75	0.226
Fisher's exact		0.295

The pooled estimate of the proportion (0.508929) is used for the tests.

Question 2: Is the decrease in misplaced students in advanced classes statistically significant?

- For all individual tests, use the following hypotheses with $\alpha = 0.05$:
  - H_o: $p_1 - p_2 = 0$
  - H_o: $p_1 - p_2 > 0$
- The p-values indicated that the decrease in advanced classes was not significant; however, the decrease in double-advanced classes was significant.

I. Test and CI for Two Proportions: Advanced Classes

Descriptive Statistics

Sample	N	Event	Sample p
Sample 1	587	477	0.812606
Sample 2	214	168	0.785047

Test

Null hypothesis	H_0: p_1 - p_2 = 0	
Alternative hypothesis	H_1: p_1 - p_2 > 0	
Method	Z-Value	P-Value
Normal approximation	0.87	0.192
Fisher's exact		0.219

The pooled estimate of the proportion (0.805243) is used for the tests.

II. Test and CI for Two Proportions: Double-Advanced Classes

Descriptive Statistics

Sample	N	Event	Sample p
Sample 1	313	231	0.738019
Sample 2	98	59	0.602041

Test

Null hypothesis	H_0: p_1 - p_2 = 0	
Alternative hypothesis	H_1: p_1 - p_2 > 0	
Method	Z-Value	P-Value
Normal approximation	2.58	0.005
Fisher's exact		0.008

The pooled estimate of the proportion (0.705596) is used for the tests.

Question 3: Is the decrease in misplaced students (by race) statistically significant?

- For all individual tests, use the following hypotheses with $\alpha = 0.10$:
  - H_o: $p_1 - p_2 = 0$
  - H_o: $p_1 - p_2 < 0$
- The p-values indicated that the decrease in misplaced students was significant for White and Asian students.

I. Test and CI for Two Proportions: White Students

Descriptive Statistics

Sample	N	Event	Sample p

Sample 1	991	544	0.548940
Sample 2	353	178	0.504249

Test

Null hypothesis	$H_0: p_1 - p_2 = 0$
Alternative hypothesis	$H_1: p_1 - p_2 > 0$

Method	Z-Value	P-Value
Normal approximation	1.45	0.074
Fisher's exact		0.083

The pooled estimate of the proportion (0.537202) is used for the tests.

II. Test and CI for Two Proportions: Black Students

Descriptive Statistics

Sample	N	Event	Sample p
Sample 1	287	80	0.278746
Sample 2	111	29	0.261261

Test

Null hypothesis	$H_0: p_1 - p_2 = 0$
Alternative hypothesis	$H_1: p_1 - p_2 > 0$

Method	Z-Value	P-Value
Normal approximation	0.35	0.363
Fisher's exact		0.414

The pooled estimate of the proportion (0.273869) is used for the tests.

III. Test and CI for Two Proportions: Hispanic Students

Descriptive Statistics

Sample	N	Event	Sample p
Sample 1	151	45	0.298013
Sample 2	48	10	0.208333

Test

Null hypothesis	$H_0: p_1 - p_2 = 0$
Alternative hypothesis	$H_1: p_1 - p_2 > 0$

Method	Z-Value	P-Value
Normal approximation	1.21	0.113
Fisher's exact		0.152

The pooled estimate of the proportion (0.276382) is used for the tests.

IV. Test and CI for Two Proportions: Asian Students

Descriptive Statistics

Sample	N	Event	Sample p
Sample 1	81	37	0.456790
Sample 2	31	10	0.322581

Test

Null hypothesis	$H_0: p_1 - p_2 = 0$
Alternative hypothesis	$H_1: p_1 - p_2 > 0$

Method	Z-Value	P-Value
Normal approximation	1.29	0.099
Fisher's exact		0.141

The pooled estimate of the proportion (0.419643) is used for the tests.

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