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Increase Enrollment of Underrepresented Students in Advanced Mathematics Classes: A School Improvement Plan

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Abstract

Providing minority students with the opportunity to engage in advanced mathematics courses affords them access to more engaging learning opportunities, increased motivational beliefs towards mathematics, and potentially higher future earnings dependent on the career they pursue. Examining the present enrollment statistics in math courses at the research site, the need to transform the enrollment in advanced math courses to represent the school population demographics is revealed. In response, a school improvement plan was developed using research-based initiatives. This plan includes teachers teaching a mixture of advanced and non-advanced math courses, teachers advising non-AP and non-IB students to enroll in advanced math courses, and school-wide formal meetings held annually about the IB and AP programs. Lastly, students will be provided with a trained teacher mentor to support them in not feeling isolated while taking these advanced math courses.

Keywords: Tracking, advanced courses, mathematics, IB, AP, underrepresented, minority

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Increase Enrollment of Underrepresented Students in Advanced Mathematics Classes

West High School in Salt Lake City, Utah, is an inner-city school serving a diverse student population residing in Salt Lake City's westside neighborhoods. It is also a magnet school, attracting students outside of Salt Lake City with its International Baccalaureate (IB) program. This combination yields a dynamic, diverse school community.

The mathematics program at West High School consists of three distinct course groupings, each representing a different difficulty level. The least challenging grouping contains the math lab classes. Students receive math instruction for 90 minutes every day in math lab courses, instead of 90 minutes every other day, as is the standard protocol with West High School's other math courses. Students enrolled in math lab classes have been identified by a previous math teacher or guardian as potentially benefiting from the additional time and support in these double-block classes. Currently, Hispanic students are enrolled in the math lab class at a rate disproportionate to their representation in West High School's student population.

The second mathematics course grouping consists of the regular on-grade level math courses. As is the case in math lab courses, Hispanic students are enrolled at a disproportionate rate in these regular math classes.

Finally, the most challenging mathematics course grouping consists of the Honors, advanced placement (AP), and IB math courses. Currently, the Honors, AP, and IB mathematics courses are primarily populated by Caucasian students. As a school with a majority-minority student body, this lack of diversity in advanced mathematics classes is not representative of the demographic of West High School; therefore, this is a desirable situation.

The student enrollment in all grouping levels offered by West High School's mathematics department should reflect the school population. To achieve a proportional balance of diversity

in the mathematics program, more minority students need to be encouraged to engage in advanced math classes. For that reason, the purpose of this school improvement plan will outline how to support the enrollment of marginalized students in advanced mathematics courses at West High School. The research question is: What initiatives can West High School take to enroll and retain minority students in advanced mathematics courses?

Existing research has shed light on the impacts of separating students according to ability level into courses that vary by difficulty; thus, ensuring the enrollment in mathematics courses be representative of the student body is vital for student success. Students will have access to more engaging learning opportunities to support students in developing higher-order thinking skills (Judson, 2017; Tyson, 2013). Additionally, research shows the difficulty level of the high school math classes students are engaged in impacts what type of occupation students will pursue and potentially their future earnings (Fletcher, 2012; Moller & Stearns, 2012). Research also shows students' mathematics self-concept is higher when placed in an advanced mathematics course (Chmielewski et al., 2013; Legette & Kurtz-Costes, 2020).

This research and more are thoroughly outlined in the literature review. The topics which can be found within the literature review are course placement, quality of instruction, motivational beliefs, and postsecondary outcomes. The research examined in this school improvement plan was obtained through Northwestern College’s Dewitt Library by searching relevant databases, using keywords such as tracking, underrepresented students, minority students, advanced math, self-concept, self-efficacy, postsecondary, and career choice. All sources extend from 2008 to current.

The literature review drives the need for the school improvement plan. The school improvement plan suggests actions West High School can take to enroll and retain minority

students in advanced mathematics courses. Some of these initiatives include having teachers teach a mixture of advanced and non-advanced math classes, holding formal family meetings regularly in English and Spanish to teach families about the IB and AP programs, and providing students with a trained mentor. The following school improvement plan is an application of the literature to increase the number of minority students in advanced mathematics courses to appropriately reflect the student demographics of West High School.

Literature Review

At West High School, most of the students enrolled in advanced mathematics courses identify as Caucasian. This enrollment is not representative of the school's student population, consisting of a Hispanic majority and the significant presence of students with other ethnic and racial backgrounds. With the goal of transforming the enrollment of students in advanced mathematics to more accurately reflect the composition of West High School, the literature surrounding the topic of student enrollment in mathematics courses will be examined, beginning with the processes used to determine student placement in mathematics courses. Quality of instruction will also be explored to consider any differences in the classroom experience of students enrolled in advanced mathematics courses compared to students enrolled in on-grade level courses. Additionally, the impact of students' motivational beliefs about mathematics will be analyzed based on the mathematical difficulty of the courses in which they are enrolled. Lastly, potential post-secondary career outcomes will be considered based on the types and difficulty levels of mathematics courses taken during high school.

Course Placement

The process used to determine student placement in mathematics courses of varying difficulty levels is an extensively researched theme. Both Glock et al. (2013) and Glock et al.

(2015) researched how minority students were placed in classes of varying levels of difficulty. Glock et al. (2013) also examined how teacher biases might impact the tracking placements of students with immigrant backgrounds. Tracking occurs when students are separated according to ability level into mathematics courses that vary in difficulty level.

In the study by Glock et al. (2013), 54 teachers were assigned to place students in one of three difficulty-level tracks based on student profiles which had been manipulated to highlight the ethnic backgrounds of each student explicitly. Each profile contained performance-related information, such as school grades, test scores, work, and learning habits, along with non-performance-related information, including ethnicity, socioeconomic status, and gender. According to the findings, students without immigrant backgrounds were most often recommended for the most challenging mathematics track. Moreover, the teachers often referred to both performance-related and non-performance-related information when considering the mathematics placement of students with immigrant backgrounds. This phenomenon indicates that the inclusion of non-performance-related information on student profiles can bias the placement process.

Similar findings were uncovered by Glock et al. (2015) in researching the accuracy of school placement recommendations for ethnic minority students. In this study, 64 teachers were required to assign students of varying abilities levels for the appropriate mathematics class based on difficulty: lowest, middle, or highest. The results of the research revealed teachers judged ethnic minority students less accurately than ethnic majority students. "Minority students whose academic profiles clearly indicated a recommendation to the highest track were more often referred to the middle track than majority students" (Glock et al., 2015, p. 180). In contrast, it was found that minority students with a student profile indicative of the lowest track were more

often recommended to the middle track than majority students with the same academic profile information. In other words, teacher placement accuracy is dependent on whether or not the student is a minority.

The research of Archbald and Keleher (2008) stands in contradiction to the two previously discussed studies. While Glock et al. (2015) suggest the consideration of non-performance data when placing students into mathematics courses often results in inaccurate course recommendations, the research of Archbald and Keleher (2008) recommends considering the whole picture of the student: student educational records (SER), student academic performance (SP), and course transcript (CT) data when making course recommendations for students. SER data includes students' ethnicity, gender, classification as nonnative English speakers, special education, and if the student is free lunch eligible. SP data includes attendance, test scores, grades, and suspensions. CT data includes course titles, course numbers, and teacher names. By synthesizing the literature, it would be wise for teachers to consider only SP data when making course recommendations for students but use all three data types to monitor and analyze how students of different ethnicities are being dispersed between courses of varying levels of difficulty.

Park and Datnow (2017) also studied the types of data that teachers use to group students. In this qualitative study, teachers from four racially and economically diverse schools were interviewed. What stood out about these teachers' grouping decisions was that these decisions were not based on a singular event. Teachers used curriculum-related tests, formative assessments, and teacher observations to inform student grouping decisions. Additionally, the teachers focused on a skill area or concept that needed targeted intervention rather than student's ability when grouping students. Park and Datnow (2017) also found that heterogeneous

grouping practices were commonly applied in mathematics to support students in developing critical thinking skills as students build upon their classmates' thinking.

Legette (2018) conducted research examining African American students' perceptions of themselves and of being African American based on whether they were in honors or non-honors classes. Interviews were conducted with 20 students where students in non-honors courses "expressed the belief that they had little academic ability, which is consistent with the notion that they perceive their placement as feedback of their ability as students" (Legette, 2018, p. 1318). These same students expressed concern that they had low academic ability and that their lack of ability could be related to their race. The underrepresentation of African American students in honors classes could cause classmates to make associations between academic ability and race. Students who participated in Legette's (2018) study believed changing classes would be nearly impossible, whereas the teachers interviewed for Park and Datnow's (2017) research are reevaluating students' grouping continuously.

The literature reveals teachers' course recommendations may not be accurate when non-performance data is presented with performance data. Using non-performance data may be beneficial after students are placed in classes to analyze if any inequities exist in the distribution of students in courses of varying levels of difficulty. Lastly, student placement should be reevaluated frequently to ensure students are enrolled in a class where they will experience success and make academic gains.

Quality of Instruction

Another theme revealed in the literature relates to the quality of instruction students receive in advanced courses compared to the quality of instruction in regular on-grade level courses. Advanced mathematics courses include honors, advanced placement (AP), and

international baccalaureate (IB) classes. Judson (2017) engaged in a study of 58 AP math teachers, comparing how teachers approached teaching AP courses compared to honors and regular on-grade level courses. Based on the AP course taught, each teacher was assigned a regular or honors course similar to their AP class topic. Additionally, the teachers responded to a 32-question survey based on the National Survey of Science and Mathematics Education. This research tool assessed the teachers' pedagogical beliefs, perceptions about control over curriculum, emphasis level placed on overarching goals, and frequency of specific math practices. Judson (2017) uncovered "the greatest proportion of significant differences was found in the goals math teachers had for their AP courses compared to the goals they had for their regular courses" (p. 243). Mathematics teachers indicated placing significantly greater emphasis on understanding mathematical ideas, emphasizing mathematical practices, understanding real-life application, increasing interest in math, and preparing for further study in mathematics in their AP math courses.

AP courses were also found to be more student-centered and engaging than regular on-grade level math courses. AP courses were "significantly more likely to engage the whole class in discussion, have students work in small groups, and prompt students to explain and justify their methods" (Judson, 2017, p. 244). All these practices promote the use of the critical thinking and reflection skills typical of higher-order thinking. Reyes and Domina (2017) affirm these findings, stating that teachers who teach "low and on-track courses typically use instructional styles that are more teacher directed than teachers who teach more rigorous above-track courses" (p. 24). Judson (2017), however, did find AP and honors math courses were alike regarding teaching practices.

Reyes and Domina (2017) collected data about students' self-efficacy, utility, interest in

mathematics, and college expectations, using an assessment completed by 6,320 tenth-grade students. The data compiled was subsequently analyzed to discover trends in the information based on student tracking. They categorized students into three different tracks: lower track, on-track, and above-track. Low-track students were enrolled in Algebra, on-track students were enrolled in Geometry, and above-track students were enrolled in Algebra II. From their research, "low and on-track students report lower…interest in mathematics than students in the above track" (p. 24). This decreased interest in mathematics could be from receiving less engaging and challenging instruction in math.

Additionally, Tyson (2013) agrees that students in "lower-level classes…tend to receive lower-quality instruction and less engaging curriculum" (p. 176). Due to the lower quality instruction and less engaging curriculum, students tend to learn less than their peers in higher-level classes. This trend exasperates students' problem of moving from an on-grade level course to an advanced course; thus, students' course placements tend to be as rigid as the students who were part of Legette's (2018) research felt about their math course placements.

Motivational Beliefs

An additional theme evidenced by the literature related to how students' motivational beliefs impact their ultimate success in mathematics courses. Students' motivational beliefs refer to a student's desire to persistently work as they engage in a task or pursue a goal. Based on the significance of this theme, any effort to engage underrepresented populations in advanced mathematics courses will need to consider how students' motivational beliefs are impacted based on the mathematics course in which they are enrolled.

Chmielewski et al. (2013) describe three methods used by schools to separate students according to ability level into courses that vary in difficulty level. Moving forward, this will be

referred to as tracking. Between-school tracking occurs when students of varying abilities go to different schools; within-school tracking occurs when students are assigned to different tracks for all subjects. Course-by-course tracking occurs when students are tracked on a subject basis. According to Chmielewski et al. (2013), students' motivational belief of self-concept in mathematics is affected by tracking.

In this study, a total of 99,000 fifteen-year-old students from twenty countries took the 2003 PISA, which included a self-description questionnaire consisting of questions about mathematics self-concept, what math level students were in, the type of tracking in their school, and their math achievement (Chmielewski et al., 2013). The study results showed that the track with the highest ability students, enrolled in schools that take part in within- and between-school tracking, had lower mathematics self-concepts than students in the lowest ability track within these schools. In contrast, the highest ability students in schools with course-by-course tracking systems had high mathematics self-concepts, whereas the lowest ability students had low mathematics self-concepts. Chmielewski et al. (2013) believe this is because students in between- or within-school tracking schools are in constant contact with peers who are at the same ability level as themselves; therefore, within these homogenous grouping, students are comparing and contrasting their achievement with those of their similarly abled peers. This comparison leaves some high-ability students feeling they do not measure up to their peers and that their work is, therefore, substandard. On the other hand, in course-by-course tracking, students compare themselves to the students in the school as a whole: both low-level students and high-level students, leading high ability students to compare their mathematics performances against the work of others favorably.

Legette and Kurtz-Costes (2020) affirmed the findings in course-by-course tracking with

their research of 322 sixth graders. At the beginning of the school year, each student completed a four-item questionnaire regarding mathematics self-concept. Then at the end of the school year, the students completed the questionnaire again based on their perceptions of their math ability upon completing the course. Legettee and Kurtz-Costs (2020) found students placed in an honors mathematics class experienced an increase in math self-concept. "Students may perceive that placement in an honors track is an esteemed position indicative of higher math ability and in comparison placement in lower tracks indicates lower ability" (Legette & Kurtz-Costes, 2020, p. 9). These findings indicate that the act of being tracked itself leads to an impact on individual students' math self-concept.

In contrast, Reyes and Domina (2017) examined students' motivational beliefs through the lens of student self-efficacy beliefs, not from the mathematics self-concept perspective. While these two approaches are similar, self-concept is predictive of academic outcomes; whereas, self-efficacy is an indicator of a person's confidence in successfully performing a specific academic task (Chmielewski et al., 2013). Reyes and Domina (2017) collected data about students' self-efficacy, utility, interest in mathematics, and college expectations, using an assessment completed by 6,320 tenth-grade students. The data compiled was subsequently analyzed to discover trends in the information based on student tracking. They categorized students into three different tracks: lower track, on-track, and above-track. Low-track students were enrolled in Algebra, on-track students were enrolled in Geometry, and above-track students were enrolled in Algebra II. Students in the low track reported lower math self-efficacy than the on-track students, while the on-track math students reported lower math self-efficacy than the above track math students. These findings are similar to Chmielewski et al.'s (2013) findings for course-by-course tracking and Legette and Kurtz-Costes (2020) for sixth-grade students in

regular and honors mathematics classes.

In addition to self-efficacy, Reyes and Domina's (2017) research showed low- and on-track students report a decreased interest in mathematics than students in the higher track. Reyes and Domina suggest implementing more engaging and challenging instruction to counteract the effects of this finding, similar to high-track classes, to provide low-track and on-track students with an increased interest in mathematics. Wang (2013) also studied students' self-efficacy beliefs by collecting data from 5,650 twelfth-grade students using qualitative research methods. This research concluded that students' math self-efficacy could positively influence students' intent to pursue a degree in science, technology, engineering, or mathematics (Wang, 2013).

The previously mentioned studies in this section have focused on students' self-concept and self-efficacy at large. Kotok's (2017) research emphasizes how students' math self-efficacy varies based on student's ethnicity, with assessment data revealing that African American students have higher math self-efficacy than Asian students. African American students were also the only ethnicity that showed an increase in math self-efficacy was associated with a decrease in math achievement (Kotok, 2017). While this was surprising to read in the research, this could be due to African American students typically being placed in the lowest level of math courses where students may develop a false level of confidence. These courses may lack highly qualified teachers and rigorous learning opportunities that ultimately lead to student achievement. More research related to ethnicity and students' motivational beliefs would be valuable to the field.

Upon examination of the literature on the effects of students' motivational beliefs on mathematics achievement, it is clear that the level of mathematics course in which a student is enrolled based on ability impacts students' motivational beliefs about mathematics, as well as

their interest in pursuing a career in a field related to mathematics.

Post-Secondary Outcomes

A final unifying theme in the literature considers students' post-secondary outcomes. This topic has been researched in terms of students' ethnicity and their pursued career path. Existing research also investigates the relationship between the types of high school mathematics courses taken and the types of careers ultimately chosen by the corresponding students they pursue. Shim & Paik (2014) focused on the latter of these two relationships, specifically with students in South Korea. In this study, ninth-grade students were assigned to either the *Yika* track or *Munka* track, depending on aptitude measures and personal interests. The *Yika* track focused on math and science, while the *Munka* track focused on the liberal arts. Shim & Paik (2014) recorded the track assigned to each of the 1,036 students in the study. Four years later, they recorded each student's post-secondary outcome as enrolled in a four-year higher education institution, enrolled two-year higher education institution, or not enrolled at any kind of higher education institution. Shim & Paik (2014) found that students, regardless of track placement, had similar chances of attending either a two-year or four-year institution.
However, *Yika* students were more likely to enroll in a four-year institution, as opposed to two-year. Additionally, Shim and Paik (2014) conclude that "*Yika* students have substantial advantages in pursuing college majors that would lead to better vocational prospects than the *Munka* students" (p. 580). This finding could result from the advanced math courses *Yika* students take compared to *Munka* students.

Sadler et al. (2014) also researched the types of mathematics courses taken by high school students and each student's career interests. They collected data from 4,691 students at 34 different two- and four-year institutions about their career goals, high school course history, and

AP exam scores. They found a significant increase in students' interest in science, technology, engineering, and mathematics (STEM) careers between students having taken no Calculus in high school compared to one year. The same relationship was found for students who did or did not take Physics.

There was also a significant increase in students' interest in a STEM career between students who took one year of Chemistry compared to two years of Chemistry. In contrast, there was no significant increase in students' interest to pursue a STEM career for students who took another science course or an additional year of Biology. A noteworthy finding from their research is that even though advanced science and mathematics courses such as Calculus, Physics, and Chemistry taken in high school showed an increase in STEM interest, those courses being AP courses showed no increase in students' interest in pursuing a STEM career. It should be noted that most students who are striving to meet the minimum high school graduation requirements will not encounter a Calculus or Physics course during their high school education.

Fletcher (2012) also researched the types of classes students took in high school. Using a broader lens than Sadler et al. (2014), Fletcher (2012) categorized students by high school coursework background into four distinct tracks: College Preparatory, Career and Technical Education (CTE), Dual, and General. The College Preparatory track consisted of students who met the course requirements to enroll in a four-year higher education institution. The CTE track consisted of students who had earned three or more credits in technical education courses. Dual track students engaged in a combination of College Preparatory classes and CTE classes. Lastly, the General track consisted of students who took the minimum course requirements to graduate from high school.

Fletcher (2012) collected data on students' course track, as well as their occupational choice. The career choices of the 7,065 individuals who participated in the study were categorized into one of the fourteen occupational clusters: agriculture; architecture and construction; arts and communications; business management; education; health sciences; hospitality and tourism; human services; law and public safety; sales and marketing; military; science, technology, engineering, and mathematics (STEM); transportation; and office and administrative support. The most significant percentage (16.3%) of graduates in the College Preparatory track were employed in office and administrative positions. In contrast, the most significant percentage of CTE graduates (24.1%) were employed in architecture and construction occupations. Similarly, the Dual and General tracks had the most significant percentage of graduates (24.3%, and 20.3%, respectively) in the architecture and construction occupational group. Students "in the College Preparatory track were more likely to be employed in occupations with high prestige and professional, white-collar jobs" such as business management (Fletcher, 2012, p. 134). In contrast, General track students were more likely to be employed in lower prestige occupations such as architecture, construction, and transportation.

Moller & Stearns (2012) conducted more research regarding individual's ethnicity, high school coursework, and pursued career path, using the National Education Longitudinal Study to collect data on the participants' annual income and hourly wage. Participants' high school coursework was determined from their 1992 transcript. Moller & Stearns (2012) categorized students into three tracks based on their high school transcript: college preparatory track, which consisted of more rigorous courses, general track, which offered less-challenging courses, and vocational track, which offered technical, specialized classes in addition to general courses. Moller & Stearns (2012) found "11% of Caucasian males and females were educated on general

tracks, compared to nearly 20% of Hispanic males and females, and 16% of African American males" (p. 1040). Additionally, hourly wages were $1.50 lower per hour for individuals who studied on the general track than students who studied on the college preparatory track. Another valuable finding from Moller & Stearns' (2012) research was "68% of the students in the sample perceived that their parents were influential in determining which academic track they pursued" (p. 1046). This finding highlights the importance of educating families on the long-term implications of the types of courses students take in high school.

Conclusion

While much of the research on the impacts of separating students by ability level into courses that vary in difficulty was comprehensive, it would add value to the body of literature to research the accuracy of students' course placement when only students' schoolwork, essays, and homework are considered for placement recommendations. In addition, research focused on adding students' school motivation to the criterion list used to place students in classes accurately would be of significance. Lastly, researching the impact of having a higher percentage of same-race peers in their advanced courses has on minority students would fill an important gap in the present literature.

As revealed in the literature, teachers' course recommendations may not be accurate when non-performance data is presented with performance data. Additionally, students frequently feel stuck with their current class placement with no opportunity to enroll in advanced courses that are more student-centered and engaging. Minority students need to be better represented in advanced mathematics courses as course placement can have long-term effects.

These effects include students' motivational beliefs about mathematics and the types of careers that students may pursue. For this reason, it should be a top priority to ensure minority students are encouraged and have the opportunity to enroll in advanced mathematics courses.

Need for Plan

West High School is a majority-minority student body. The student body consists of 41% of students identifying themselves as Hispanic, 35% Caucasian, 8% Asian, 5% Black/African American, 6% Pacific Islander, 4% Multi-Racial, and 1% American Indian/Alaska Native (Utah State Board of Education, 2020). However, when stepping foot into an Honors, AP, or IB mathematics course, the students present in the course are not representative of the student body. Advanced mathematics courses consist of predominantly Caucasian students, whereas on-grade level classes consist of predominantly Hispanic students.

School demographic data was collected with the appropriate permissions and access required to compile the data. The current demographics of Honors, AP, and IB math courses at West High School consist of students who are 24% Hispanic, 49% Caucasian, 13% Asian, 3% Black/African American, 3% Pacific Islander, 6% Multi-Racial, and 1% American Indian/Alaska Native. American Indian/Alaska Native students in advanced mathematics courses are the only group consistent with the school demographics. The most significant discrepancies are with Caucasian and Hispanic students. West High School has a student body consisting of 41% Hispanic students; however, Hispanic students only make up 24% of the students enrolled in advanced math courses.

Conversely, 35% of the students at West High are Caucasian, with Caucasian students making up 49% of the enrollment in advanced math classes. This is not representative of the student population. Asian students are also overrepresented in advanced math classes, but not to

the extent of Caucasian students. Appendix A provides a visualization of the differences between the student population and the students enrolled in advanced math classes.

Goals for Plan

This school improvement plan aims to increase the number of marginalized students in advanced mathematics courses to be representative of the student population at West High School by the end of the 2021-2022 school year. After implementing the initiatives outlined in this school improvement plan, the Hispanic student enrollment in Honors, AP, and IB math classes at West High will increase from 24% to 33%. Likewise, the enrollment of Black students in advanced math classes will increase from 3% to 4%, while the enrollment of Pacific Islanders in those classes will increase from 3% to 5%. These increases in the number of minority students in advanced math classes will bring the demographics of the students in Honors, AP, and IB math classes at West High School closer to the demographics of the student population. The math coach at West High School will compile the data of students enrolled in advanced math classes at the end of the 2021-2022 school year. This data will be compared to the demographic data for West High School provided by the Utah State Office of Education.

This goal is achievable as the goal is to increase the percentage of Hispanic students by 9%, increase the number of Black students by 1%, and increase the number of Pacific Islander students by 2%. These improvements will not make the advanced mathematics courses representative of the student body, but is a first step in altering the current demographics of Honors, AP, and IB classes at West High School. As the initiatives continue to be implemented in the following school years, advanced mathematics courses should become more reflective of the student body. This goal is also relevant as Salt Lake City School District's belief is excellence and equity: every student, every classroom, every day. More specifically, one of the

objectives in Salt Lake City School Board's Student Achievement Plan is to "increase the number of students that are career and college ready in mathematics as demonstrated by…increasing the number of students that are successful in…Advanced Placement (AP) and International Baccalaureate classes (IB)" (Salt Lake City School District, 2016).

Increasing the number of minority students enrolled in Honors, AP, and IB classes during the 2021-2022 school year is the first step in making these advanced mathematics courses more representative of the student body. As the plan is implemented for school years beyond the 2021-2022 school year, minority students will continue to be provided with the support necessary to enroll in advanced math classes.

Plan for Implementation

West High's school improvement plan includes long-term initiatives to increase the number of underrepresented students in advanced mathematics courses. This plan includes steps that will need to be done annually to continue supporting enrollment and retain students in advanced math classes.

The first step will involve restructuring teachers' teaching schedules for the following school year, 2021-2022. This process will reduce the number of teachers assigned to teach only Honors, AP, and IB courses. Currently, there are four teachers whose entire course schedules consist of only advanced mathematics classes. By allowing each teacher to offer various courses across the spectrum of difficulty, each teacher will be able to identify and prepare students for potential enrollment in advanced courses as juniors or seniors.

It will also facilitate faculty collaboration, as Flores & Gomez (2011) found in the example of an AP Calculus teacher who effectively collaborated with other teachers to develop Secondary Math 1, 2, and 3 curricula that helped students succeed in advanced mathematics

classes later in high school. It is necessary to anticipate pushback from the teachers who teach only advanced math classes. For this reason, the math coach at West High will need to speak to each teacher individually about the benefits for students, which have been outlined above in this paragraph. Additionally, the math coach may need to remind teachers of the agreed-upon norm within West High School's Math Department, centering instruction around students' needs and prioritizing student needs over teacher wants or ease.

The next integral piece of the school improvement plan will be the execution of formal meetings, in both English and Spanish, explaining the AP and IB programs to incoming ninth-graders and their families (Garriott et al., 2014). These meetings will be held at West High's feeder schools in the spring of the eighth-grade year before high school registration. To accomplish this task, the West High School AP and IB coordinator will be required to communicate with the counseling department at the feeder schools to arrange times to meet with students and families. As Moller & Stearns' (2012) shared, parents are influential in determining the academic classes students pursue.

Although ninth graders do not take AP classes and are not eligible for IB classes until their junior year, this early introduction to the requirements and benefits of advanced mathematics courses would enhance future AP and IB mathematics enrollment. These same formal meetings held in both English and Spanish would be held the first week of school in August and be available to all students and families regardless of grade level. As a result, the opportunity would be open for students of any grade level to enroll in an Honors math course, even those who may not have the previous school year. Parents would leave all informational meetings with a copy of Appendix B and learn that successful completion of Honors courses is a precursor to students being successful in AP and IB courses (Flores & Gomez, 2011).

For students at all high school mathematics learning levels, teachers would be encouraged to advise their non-AP and non-IB students to enroll in an advanced math class, as appropriate (Judson et al., 2019). Herein is one benefit to having teachers teach courses that are at varying levels of difficulty.

The last component of the school improvement plan involves initiating a mentorship program. The attributes necessary in a mentor would be love, commitment, and responsibility (Ecker-Lyster & Niileksela, 2017). Minority students engaged in advanced math courses must not feel isolated as there may be fewer students who look like them in their advanced classes (Tyson, 2013).

Mentors need to be "willing to commit their time and effort to demonstrate their support and love for the mentee" (Ecker-Lyster & Niileksela, 2017, p. 88). Mentors also need to maintain a consistent relationship with the student they are mentoring. For a successful mentorship program, motivated and committed teachers will need to be recruited as mentors. Once teachers have been recruited to mentor, they will need to receive training for the mentorship program. Appendix C outlines the table of contents for the mentoring guide, which will be used to train teacher mentors. Compensation for teachers outside of their paid time for mentor training and working with their mentees will need to be secured. In addition, financial resources for mentors to spend on their mentee to ensure they have the necessary school supplies to be successful in their classes and ensure the student is well nourished leading up to assessments. Time constraints and attendance commitments could potentially be a challenge on the part of the student.

By applying this school improvement plan, the makeup of Honors, AP, and IB classes at West High will increase from 24% Hispanic to 33%, which will be more representative of the

school's population. The initiatives consisting of having teachers teach classes of varying degrees of difficulty, teachers recommending their students for advanced math courses, holding formal meetings about the AP and IB programs beginning in eighth grade, and instituting a mentoring program will provide marginalized students with information and access to advanced math classes. Thus, the enrollment of underrepresented students in these courses will be increased.

Assessment

Multiple assessment components will be utilized to determine the success of this school improvement plan. One assessment component will compare the demographics of students enrolled in advanced math classes to the school population's current demographics. The West High School math coach will compile demographic data of students enrolled in advanced math classes at the end of the 2021-2022 school year. This data will be compared to the demographic data for West High School provided by the Utah State Office of Education. Analyzing these two data sets will determine if the percentages of minority groups have increased to the percentages outlined in the Goals for Plan section of the school improvement plan. Of particular interest will be evidence indicating the percent of Hispanic students has increased from 24% to 33%, Black students from 3% to 4%, and Pacific Islander students from 3% to 5%. If the percentage of students in these groups has increased to the levels outlined above, the school improvement plan will be deemed successful in this regard.

The second assessment component will be a five-question survey that will be emailed to parents in the May of their senior year. A copy of this survey can be found in Appendix D. The purpose of this survey is to assess if the annual formal meetings about the AP and IB programs have informed parents about the math course options students have at West High School. The data collected from these surveys will inform the math coach and the AP/IB coordinator about

the parental perception of the benefits derived from these meetings. The survey will also inform the math coach and administrators if families feel advanced math courses are accessible to their children. Questions Two through Four on the survey are scored using a 4-point Likert scale, with 1 point (indicating the parent strongly disagrees with the statement) through 4 points (indicating the parent strongly agrees). If the average score on these questions is a three or greater, it will be concluded that the annual formal meetings are a successful component of the school improvement plan.

Minority students enrolled in an advanced math class will also receive a six-question survey during the last week of the school year, assessing their beliefs about the subject of mathematics. This survey will be assigned to them through Salt Lake City School District's online learning management system, Canvas. The survey will only be assigned to students enrolled in an Honors, AP, or IB math course. The items in the survey will be scored using a 4-point Likert scale, with 1 point (indicating the parent strongly disagrees with the statement) through 4 points (indicating the parent strongly agrees). A copy of the survey can be found in Appendix E. If the average score on these questions is a three or greater, it will be concluded that students' beliefs about mathematics are positive when enrolled in an advanced mathematics course. This conclusion would indicate the school improvement plan is successful.

Lastly, teacher interviews will be conducted to determine the value of having teachers' courses vary across the spectrum of difficulty instead of some teachers only teaching advanced math courses. Interview questions can be found in Appendix F. Teachers' responses will be compiled and evaluated in terms of the benefits to students and the math department. All assessment data will be reported to the principal and the district math supervisor to consider the value of implementing this school improvement plan at all the high schools in the district.

Conclusion

At West High School, the enrollment of students in advanced math classes is not currently representative of the student population demographics. In response, this school improvement plan has been developed to increase the number of minority students enrolled in advanced math courses. The initiatives presented to enroll and retain students in these advanced math courses include having teachers teach a mixture of advanced and non-advanced math classes, advise non-AP and non-IB students to enroll in advanced math classes, and hold formal meetings in both English and Spanish annually about the IB and AP programs. Additionally, students in advanced math courses will be provided with a trained teacher mentor to support students in not feeling isolated while taking these courses.

By implementing this school improvement plan, minority students will have access to more engaging learning opportunities to develop higher-order thinking skills (Judson, 2017; Tyson 2013). Their motivational beliefs towards mathematics will be impacted, and their future earning potential broadened based on the types of occupation they can pursue (Fletcher, 2012; Moller & Stearns, 2012). This school improvement plan can impact students beyond their time as students at West High School.

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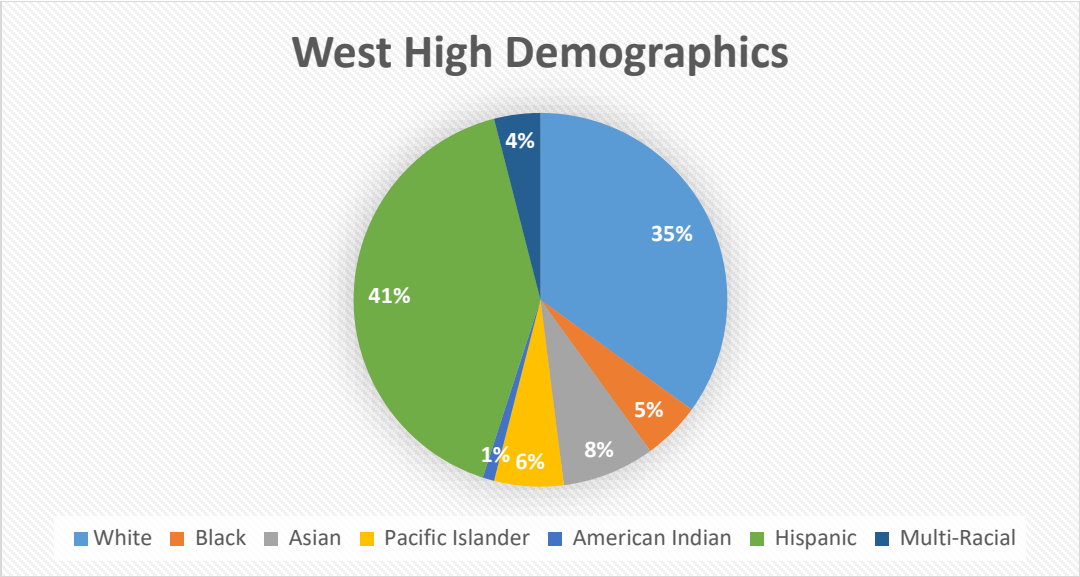
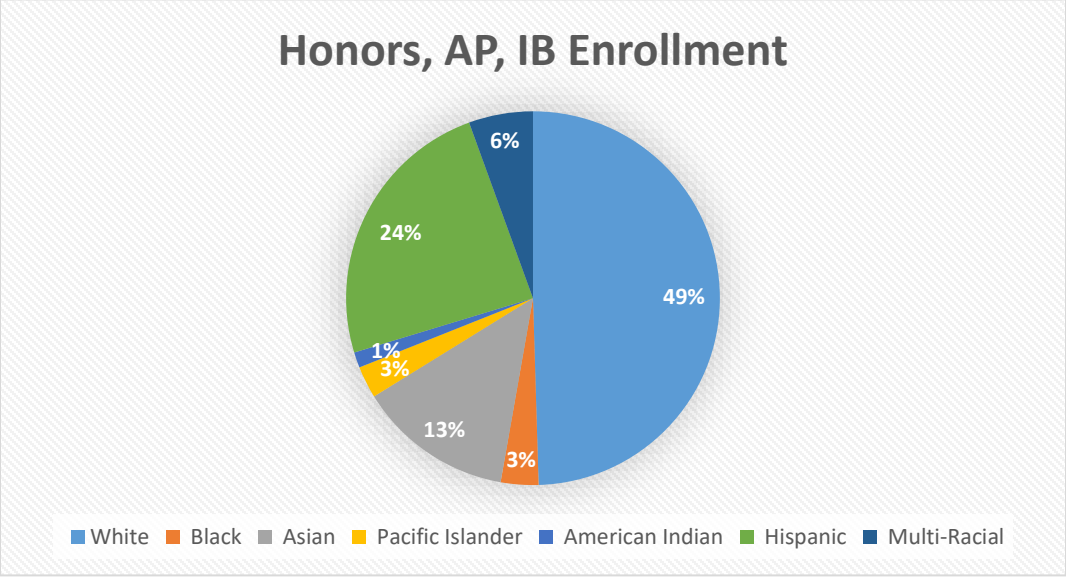
Appendix A


West High Demographics
35%
5%
8%
6%
1%
41%
4%
White
Black
Asian
Pacific Islander
American Indian
Hispanic
Multi-Racial


Honors, AP, IB Enrollment
49%
3%
13%
3%
1%
24%
6%
White
Black
Asian
Pacific Islander
American Indian
Hispanic
Multi-Racial

Appendix B

AP & IB Programs at West High School

IB Career Program & IB Diploma Program

The IB program is a rigorous two-year curriculum which students enroll in to begin their junior year. The IB program prepares students for college and supports them in developing skills that include asking challenging questions, learning how to learn, developing a strong sense of their own identity and culture, and develop the ability to communicate with and understand people who are different from themselves. IB students follow the course progression prior to and during their junior year (see diagram to the right) to successfully prepare for their IB math course. Students complete the program to potentially earn college credit dependent on exam scores.

IB Diploma Program

6 IB Courses in each of the following content areas: English, World Language, Social Studies, Science, Math Fine Arts

Theory of Knowledge Course, Creativity, Activity, & Service (CAS) project, Extended Essay (4000 word college level paper on topic of student's interest)

IB Career-Related Program

Completion of Career Technical Education pathway, 2 IB Courses related to pathway, Personal and Professional Skills course, Service Learning project, Reflective Project (written, visual, or oral presentation of an ethical dilemma in the student's career field), Language Development (50 hours of world language study)

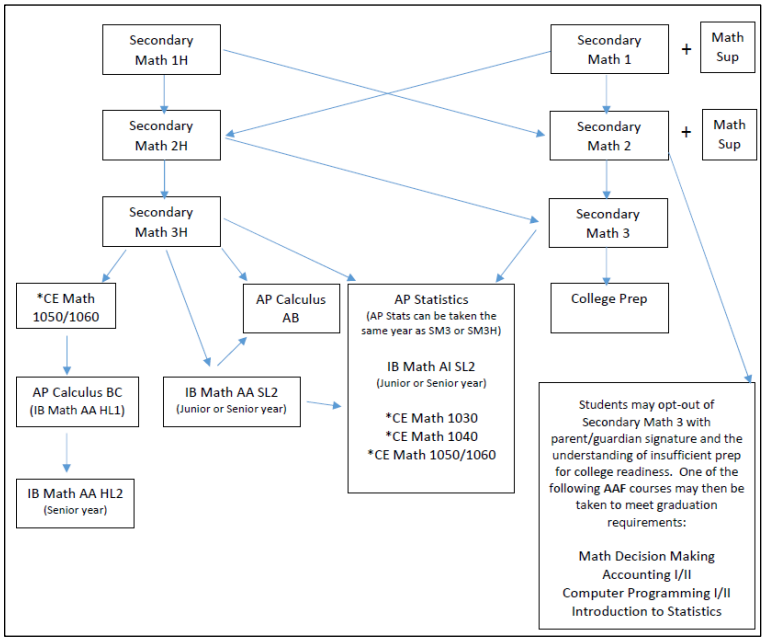
Apply Sophomore Year

https://west.slcschools.org/academics/international-baccalaureate/

or email Kelly.Boren@slcschools.org

AP Program

Students are eligible for AP courses as early as freshman year with having successfully taken the previous courses in the progression (see diagram below). Students take the course and then take an exam at the end of the school year to potentially earn college credit dependent on their score.



Benefits

AP and IB courses improve writing skills, critical thinking skills, and study habits, which will benefit students beyond high school. AP and IB exams reduce the number of semesters in college, in result saving student's money on tuition. AP and IB increases students' belief they are capable of being in successful in college as students engage in college-level work during high school.

Successful completion of Honors courses is a precursor to students being successful in AP and IB courses.

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Appendix C

Mentoring Guide

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Appendix D

This survey is to measure your experience as a parent of a student at West High School.

1. I attended a formal meeting about the AP and IB programs when my students was in _____ grade. **Select all** that apply.

a. 8th b. 9th c. 10th d. 11th e. 12th f. I did not attend

2. I have an understanding of the AP and IB programs at West High School.

1	2	3	4
Strongly disagree	Disagree	Agree	Strongly agree

3. I have an understanding of the benefits associated with enrolling in an advanced math class (Honors, AP, or IB).

1	2	3	4
Strongly disagree	Disagree	Agree	Strongly agree

4. If my child was interested in enrolling in an advanced math course (Honors, AP, or IB), they were able to.

1	2	3	4
Strongly disagree	Disagree	Agree	Strongly agree

5. My child took **at least** one Honors, AP, or IB math course during their time at West High School.

a. No b. Yes

Appendix E

This survey is to measure your current beliefs about your relationship with mathematics.

1. I am good at mathematics.

1	2	3	4
Strongly disagree	Disagree	Agree	Strongly agree

2. Math is one of my best subjects.

1	2	3	4
Strongly disagree	Disagree	Agree	Strongly agree

3. I am good at learning something new in math.

1	2	3	4
Strongly disagree	Disagree	Agree	Strongly agree

4. I can understand the math in a difficult math class.

1	2	3	4
Strongly disagree	Disagree	Agree	Strongly agree

5. I can do an excellent job on math assignments.

1	2	3	4
Strongly disagree	Disagree	Agree	Strongly agree

6. I can master new math skills.

1	2	3	4
Strongly disagree	Disagree	Agree	Strongly agree

Questions adapted from Chmielewski et al. (2013), Legette & Kurtz-Costes (2020), Reyes & Domina (2017), and Wang (2013).

Appendix F

Teacher interview questions

1. What changes have you seen within the department regarding collaboration now that no teachers teach only advanced math classes?

2. Have you recommended more students for an advanced math class this year than in previous years?

3. How do you feel about your students' ability to be successful in an advance math class?