

The Impact of School X's Hybrid Learning Program on its Advanced Placement Program

Ryan Mattimore¹ and Jennifer Pedersen[#]

¹ Bayport-Blue Point High School, Bayport, NY, USA

[#]Advisor

ABSTRACT

The purpose of this study was to determine how the hybrid learning program implemented by School X had an impact on the school's Advanced Placement (AP) program. Prior research shows how the COVID-19 pandemic had an impact on education and how AP has impacted school students; however, there was a lack of knowledge of how the COVID-19 pandemic impacted AP under the context of hybrid learning. Data was collected through survey research and a case study in which a mixed method was completed. Participants included 48 students enrolled in any of the following AP classes: Biology, European History, and World History as well as three teachers of the outlined AP classes at School X. Initial results showed that there were not significantly different AP scores in the hybrid year when compared to "normal" school years (2015-2019) and although students preferred in-person learning to hybrid learning, they did not feel as if it significantly hindered their performance in AP classes. Therefore, the conclusion can be made that although in-person learning is preferable to hybrid learning, it does not have a significant negative impact on AP classes; however, this is limited to students of AP classes and those who had a similar hybrid learning experience to School X. Future research should explore how the hybrid learning program impacted non-AP students as well as performing this study on larger populations to verify results.

Introduction

College Board's Advanced Placement program has been rapidly expanding over recent years, with more than thirty classes offered which are taken by millions of students each year worldwide (College Board, 2014). Their goal is to provide college-level material to students in high school to prepare them for their educational experiences beyond high school (College Board, 2014). The COVID-19 Pandemic caused School X, located on Long Island, to implement a hybrid learning program for the 2020-2021 school year. Students learned in a classroom 50% of the time and at home 50% of the time through a Google Meet because of social distancing restrictions from the government preventing all students from learning in-person at once. This study looked to examine how the hybrid learning program implemented by School X had an impact on its Advanced Placement program.

Literature Review

COVID-19 Pandemic

Existing research on the COVID-19 pandemic has concluded that the pandemic had an overall negative impact on education. For example, the traditional educational system of students learning fully in-person, five days per week is the most beneficial to students (Butnaru et al., 2021). Butnaru et al. (2021) further concluded that after switching to a fully online learning model as a result of the pandemic, limited social interactions negatively

impacted students' overall wellbeing. Similarly, students were found to be academically, emotionally, and socially behind while learning in an online environment as opposed to an in-person environment (Huber, 2021). Huber's (2021) study also concluded that the longer students were learning virtually as opposed to in-person, the negative effects worsened. Both Butnaru et al.'s (2021) and Huber's (2021) conclusions demonstrate how education has been maximized when material is taught in-person rather than virtually. Despite this, if problems with learning virtually are communicated effectively, they can be resolved, and virtual education can be just as successful as in-person learning (Farso et al., 2021). However, virtual education causes instability and new challenges not found in traditional education (Farsi et al., 2021). Existing research was based on how the COVID-19 pandemic impacted education, but there was an evident lack of research on how the pandemic impacted students in a hybrid learning environment.

The AP Program and Secondary Education

The AP program's impact on high school students has been studied extensively through a variety of methods by researchers since the program's formation in the 1950s (College Board, 2014). The AP program has been notoriously difficult for high school students to manage within their schedules and often causes students additional school-induced stress (Vanderbrook, 2006). Research has indicated that the main cause for this is that AP classes are often "feeder programs," in which one class is typically taken one after the other (Park et al., 2014). Students feel obligated to continue enrolling in AP classes because that is how they started off (Park et al., 2014). These studies, conducted by Vanderbrook (2006) and Park et al. (2014), exemplify how the AP program has been studied with high schoolers under the lenses of the social and emotional impact of these classes.

Even though AP classes are potentially disruptive to the mental health and nonacademic parts of students' lives, they may provide certain academic benefits. When compared to students who did not enroll in an AP class or failed an AP class, students who passed an AP class had significantly higher ACT scores (Warne et al., 2015). This contradicts the idea that there are no other academic benefits to AP classes other than being in a more "advanced class" (Warne and Anderson, 2015). Warne et al.'s (2015) results support the conclusion that students who enroll in AP classes tend to be better test takers overall due to the complex nature of AP tests (Warne, 2017). There are also differences among AP students and students who do not take AP classes in how they approach their school work and the studying process (Warne, 2017). The AP program has been researched extensively on how the program impacts students' lives emotionally, socially, and academically. However, research had not been conducted on newly formed populations, such as students who took AP classes through a hybrid learning program.

The AP Program and Postsecondary Education

Despite the agreement of most scholars on the impact of AP programs on secondary education, scholars have not made similar conclusions when researching the AP program's impact on postsecondary education. Students who enrolled in AP classes but were unsuccessful in passing the exams were found to be more successful in college because they were more prepared to handle college-level coursework (College Board, 2021, July). Being that the College Board operates the AP program, it has an inherent bias when drawing conclusions. Based on an independent follow-up study of AP students in college, there was a weak correlation present between merely being enrolled in an AP class and being more prepared for college (Thompson and Rust, 2007). Therefore, Thompson and Rust's (2007) conclusions reject College Board's notion that AP students will perform better than non-AP students once in college. Additionally, questions were raised regarding giving preference to students who took many AP classes in high school during the college admissions process merely because AP classes are attributed with being more prepared for college (Klopfenstein and Thomas, 2009). Yet, a study examining success between AP science classes and their corresponding college classes found that there was a

partial correlation, where students who passed their high school AP classes were more successful than those who did not take an AP class, suggesting that AP students may be more prepared for college (Sadler and Tai, 2007). Similar to Warne et al.'s (2015) conclusion, merely being enrolled in an AP class has little impact on success; the student must have passed the AP class in order for the correlation to be present (Sadler and Tai, 2007). Extensive research has already been conducted on the AP program and postsecondary educational institutions, such as colleges and universities.

Gap of Research

Pre-existing research has examined the Advanced Placement program from a variety of facets: socially and emotionally (Vanderbrook, 2006), standardized testing (Warne et al., 2015), and its preparation abilities for college (Sadler and Tai, 2007). Furthermore, established research has concluded that the COVID-19 pandemic's impact on education, specifically due to learning virtually, has been negative for students (Butnaru et al., 2021). The Advanced Placement program has been studied under a variety of different populations and has been researched extensively. However, due to the novelty of the COVID-19 pandemic, there was an absence of research on how this pandemic has impacted AP students who learned through a hybrid learning model. This study was designed to address this gap of how learning through a hybrid learning model at School X has an impact on students' experiences in AP classes. The significance of this study is twofold: to offer School X an evaluation of its hybrid learning program should it ever need to be implemented again in the future, and, more applicable nationwide, to explore and possibly provide reasoning as to why discrepancies may exist between AP scores from the hybrid learning year (2020-2021) and past normal years of school (2015-2019). The question guiding the research for this study was: How did the hybrid learning program implemented by School X have an impact on its Advanced Placement program when compared to the last five normal years of 2015-2019?

Definitions and Assumptions

For the purposes of this study, success on an AP exam was defined as receiving a passing score of three or higher, and failure was defined as receiving a score of two or lower. Hybrid learning year was defined as the school year of 2020-2021 at School X. Normal year was defined as a school year where all students learned fully in-person, and was delimited to 2015-2019 for this study. My assumption for this study was that the hybrid learning program would have a negative impact on AP scores and classes because of the negativities associated with learning virtually (Butnaru et al., 2021).

Methods

Study Design

The goal of my study was to explore the impact the implementation of a hybrid learning program had on School X's Advanced Placement program. It followed a non-experimental design, which was consistent with the educational discipline of the study (Foutz, 2020). This study had a mixed method, where the quantitative aspect of the study was completed as survey research, and the qualitative aspect was completed as a case study. A mixed method was necessary in order to fully accomplish the goal of examining the impact of the hybrid learning program on School X's Advanced Placement Program. The quantitative portion of the study addressed the AP scores of School X and made comparisons to statistics provided by College Board from 2015-2019 and 2021

in order to determine whether or not a significant statistical difference was present between AP scores from the hybrid learning year and normal school years. The qualitative portion of the study addressed how students and teachers felt the hybrid learning program had an impact on their educational experience and allowed me to gain more insight into their experiences which could not be gleaned from mere quantitative data. My research question would not be fully answered without knowledge on AP scores as well as the unquantifiable experience of the hybrid learning school year which could only be learned through a case study, making a mixed method properly aligned to answer my research question.

Method

Conducting survey research to obtain standardized testing scores from students was inspired by Sadler and Tai's 2007 study where the researchers distributed a questionnaire to college students in order to have them self-report their scores on Advanced Placement exams. I modeled my survey research after Sadler and Tai's 2007 study to have participants self-report their AP scores on a questionnaire. The results of the questionnaire were analyzed using Welch's t-test to determine whether or not a significant statistical difference was present between AP scores from the hybrid learning school year and previous normal school years. Welch's t-test was chosen as the best method for statistical analysis because in my study, the sets compared had two different sizes, and Welch's t-test accounted for that difference in its calculation (Leedy and Omrod, 2015).

Using a case study allowed me to gather data about how participants felt the hybrid learning program impacted their ability to be successful within School X's AP program. A case study was inspired by Schmidt's 2015 study, where interviews were conducted to learn information about experiences in high school classes. I modeled my case study on AP classes on Schmidt's (2015) study. Participants were asked a variety of questions designed to obtain a complete understanding of how the hybrid learning program had an impact on their AP classes including: "Overall, do you think the hybrid learning program was more or less beneficial to you as an AP student?" and "Did you feel adequately prepared to take the AP exam(s) you took at the end of the hybrid learning year?" Questions were modified for AP teachers so that their responses reflected their perspective by asking questions such as "Were there any additional difficulties in teaching you AP class during the hybrid school year?" A thematic analysis was conducted on the interviews from the case study interview after responses were coded.

Participants

The participants of the quantitative aspect of the study consisted of eleventh graders enrolled at School X. A questionnaire was distributed to all juniors of the 2021-2022 school year in English classes because this study examined AP Biology, AP European History, and AP World History which are only available to tenth graders at School X, and all students must take English. Therefore, the eleventh graders would have had the opportunity to enroll in the designated AP courses during the hybrid learning year. These three AP classes were chosen to ensure that all participants would still be in high school and able to participate. All other AP classes at School X could have had students which had graduated, limiting my sample size. The questionnaire was only distributed to students at School X because of variations of style in hybrid learning programs at nearby schools. It would be inappropriate to compare students' AP scores who learned under different environments.

Participants for the qualitative aspect were obtained through the questionnaire. The final two questions on the questionnaire asked participants if they would be willing to be interviewed, and if they were, to provide a method of contact. Upon the submission of all questionnaire results, participants who wished to be interviewed were contacted to confirm their participation in the case study. Additional participants of the case study consisted of teachers of the selected AP classes at School X. Those teachers were asked directly at School X if they would be willing to participate.

Research Instruments

To complete the quantitative survey research, a questionnaire asked participants to indicate which AP classes, of the ones in the scope of this study, they had taken during the hybrid year, as well as the score they had received on it (1-5). The questionnaire was reviewed by an IRB to ensure there were no ethical concerns with the questions asked. To complete interviews, the platform Zoom allowed for all interviews to be conducted virtually; however, some interviews were conducted over FaceTime or in-person as well. The transcriptions were automatically produced by the software Otter.ai so that a thematic analysis could be conducted.

Procedure

To distribute the questionnaire to all eleventh graders at School X, the link was emailed to all eleventh grade English teachers at School X. Email addresses were found on School X's website. The English teachers were asked to post the questionnaire link to their respective Google Classroom's Stream so all students would have access to it. After all questionnaire results came in, Welch's t-test was completed, and those who responded that they would like to be interviewed were sent a message via the method of contact they provided (email address of a phone number). If the participant responded affirmatively, they were given an informed consent form, informing them of the nature of the study and everything that they would need to know prior to the interview. An informed consent form was not necessary for the quantitative aspect of my study because my questionnaire asked participants about a school-related topic in a school setting. Participants were then asked to choose a time that fit their schedule and whether the participant preferred to be interviewed virtually or in-person. Before the commencement of an interview, participants were again informed of the information on the consent form and given a chance to ask any questions beforehand. Then, the transcriber was turned on and all interview questions were asked to participants. The same process was followed for all teacher interviews. All teacher interviews were conducted in-person. After all interviews were completed, a thematic analysis was performed on the transcriptions.

Results

Quantitative

The goal of the quantitative portion of this study was to obtain data regarding the scores of students at School X on AP exams during the hybrid learning school year. Of approximately the 160 members of the junior class, I received 120 responses to the questionnaire. Out of those 120 responses, 49 indicated that they were enrolled in at least one of the classes studied (AP Biology, AP European History, AP World History). Table 1 shows the number of students who indicated they were enrolled in each AP class studied.

Table 1. Number of Participants Enrolled in Each AP Class from School X

AP Biology	AP European History	AP World History
36	13	21

Note. Table 1 does not reflect all students enrolled, but merely those who chose to take the questionnaire. Certain students could have been enrolled in more than one of the classes studied.

Each student who indicated that they were enrolled in one of the designated AP classes was asked to report the score they received on the AP exam so that the scores from School X could first be compared to the nationwide AP results from each class and then to the nationwide AP results from the last five normal school years (2015-2019). The number of scores reported by each AP student from AP Biology, AP European History, and AP World History are shown in Table 2, Table 3, and Table 4, respectively.

Table 2. Number of Participants Reporting Each AP Biology Score

AP Score	Number of Students Receiving That Score
5	6
4	11
3	15
2	3
1	0

Note. There was one student who indicated they took AP Biology, but chose not to submit their score.

Table 3. Number of Participants Reporting Each AP European History Score

AP Score	Number of Students Receiving That Score
5	1
4	3
3	5
2	3
1	0

Note. There was one student who indicated they took AP European History, but chose not to submit their score.

Table 4. Number of Participants Reporting Each AP World History Score

AP Score	Number of Students Receiving That Score
5	1
4	5

3	9
2	4
1	1

In order to make sense of the data collected, Welch’s t-test was conducted on the various data sets. To avoid calculation errors, Statology’s Welch’s t-test Calculator was used. Means, population sizes, and standard deviations were all taken into consideration for the calculation. First, the data from School X was compared to the data from College Board’s AP Score Report (2021, May) for the 2020-2021 school year to determine whether or not there was a significant difference between scores from School X and nationwide scores under the null hypothesis that there was no significant difference between scores nationwide and from School X during the hybrid learning year. A t-value larger than a critical value indicated a statistically significant difference. If there was a significant difference present and the null hypothesis was rejected, data from School X could not be compared to previous normal years nationwide because of statistical variability of scores from School X to nationwide, which was not examined in this study. Table 5 shows the results of this first phase of analysis.

Table 5. Results of Analysis Comparing School X and 2020-2021 Nationwide Scores

	T-Value Calculated	Critical Value	Statistically Significant Difference?
AP Biology	4.961182821	2.136	Yes
AP European History	1.280887	1.725	No
AP World History	1.085136	1.796	No

In the case of AP European and World History, there was no significant statistical difference between School X’s data set and the nationwide totals from the hybrid year, so results from School X could be compared to nationwide data sets from normal school years. Since AP Biology had a significant difference between the scores from School X and the nationwide scores, AP Biology scores from School X were not comparable to the nationwide scores from the normal school years. Table 6 shows the results of the second phase of analysis comparing AP European and World History scores at School X during the hybrid year to nationwide data from normal years.

Table 6. Results of Analysis from School X Hybrid Learning Year and 2015-2019 Nationwide Scores

	T-Value Calculated	Critical Value	Statistically Significant Difference?
AP European History	1.310475	1.796	No
AP World History	1.147819	1.725	No

This second analysis was most important to answering my research question because it allowed me to make comparisons between results of the hybrid year from School X with results from normal years in the past, all based on statistical significance. When compared, both classes yielded no significant difference between scores of the hybrid and normal years.

Qualitative

The goal of the qualitative portion of this study was to obtain a more in depth understanding of how the hybrid learning program implemented by School X impacted the experience of students and teachers of the AP program at the school. Of the 49 participants from the questionnaire, 14 agreed to be interviewed. Additionally, each teacher of the designated AP classes agreed to be interviewed, bringing the total number of interviewees to 17. Interview transcripts for both students and teachers can be found in (APPENDIX). A thematic analysis was conducted to analyze the transcripts of the interviews. Transcripts were coded using an open coding system, and a total of five themes were derived. In order for themes to be developed, they had to be addressed by multiple participants. Table 7 explains the most common themes found in this study.

Table 7. Explanation of Themes Derived from Thematic Analysis

Theme	Explanation
Barrier between the classroom and home	A variety of participants expressed that it was hard to focus and stay motivated when not in a school setting. Furthermore, many participants found that it was harder for examples, models, and diagrams to be shown to virtual students, specifically in the sciences.
Struggles of technology	Almost all participants highlighted that issues caused by technology such as Wi-Fi connection problems, not being able to hear teachers, or malfunctioning of software such as Google Meets negatively impacted their experiences in their classes. Many participants also noted how it was harder to participate in class discussions and ask questions because of not being in person.
Lack of impact on AP exams	Despite not preferring the hybrid learning model, every student participant felt prepared for their AP exams, and most thought they would receive the same AP score they would have in a normal year.
Desire for in-person learning	When given the choice between fully in-person, hybrid, or fully virtual, every single participant expressed a desire to teach and be taught their AP classes in a fully in-person environment.
Responsibility and independence	Most student and all teacher participants described how they believed the hybrid learning program fostered a new independence since AP students were required to take more ownership of their learning experience.

Note. There were certain codes not incorporated into a theme because they did not recur often enough among participants.

Themes

The barrier between school and home was seen in a variety of conducted interviews. According to Participant I, “It’s hard to focus at home. You have your phone next to you all day, and you don’t want to listen.” Participant I’s quote exemplified a struggle many students faced: distractions. Furthermore, according to Participant 2, “I think it’s hard for science because of the lab aspect of it because students are in class for part of the week, and sometimes lab activities take multiple days. There’s definitely no way to do the same lab experience if you’re remote.” Being an AP Biology teacher, Participant 2 demonstrated how certain experiences are not possible to do remotely. According to Participant D, “There were some cases where students had trouble hearing or like

the teacher muted themselves accidentally, and it was just very inconvenient.” Participant D’s quote highlighted how technological difficulties were an added problem to not being in the classroom. In addition, according to Participant A, “Over the Chromebook, it’s hard to ask questions because you feel like you’re breaking the silence, and you feel like you’re talking when no one else is talking.” Participant A’s response indicated a reasoning as to why some students were reluctant to participate while at home. According to Participant E, “Yes, [I did feel prepared] because my teacher gave us lots of preparation and review-like stuff.” Participant E showed one example of how students throughout School X still felt prepared and ready for their exams. This was the most important data from the qualitative section because it best helped me answer my question of how the hybrid learning program impacted School X’s AP program. According to Participant K, “I like social interaction with others. In-person learning is just a better experience.” Participant K’s response was an example of a final statement regarding preference to in-person learning over hybrid learning which was quite similar among participants. A preference for in-person learning also became important in allowing me to answer my research question. Finally, according to Participant I, “Resilience to overcome will be a long-term factor to help.” This was an example of how a teacher saw students becoming more independent, a positive of the hybrid learning program.

Discussion

My initial research question was: how did the hybrid learning program implemented by School X have an impact on its Advanced Placement program when compared to the last five normal years of 2015-2019? My hypothesis was that the hybrid learning program would have a negative impact on AP scores and classes because of the negativities associated with learning virtually (Butnaru et al. 2021).

Quantitative Analysis

When examining the results from both sets of analysis addressed earlier (Tables 5 and 6), AP Biology scores at School X were significantly higher during the hybrid year when compared to nationwide results, so it could not be compared to normal school years. However, since AP European and World History could be compared, analysis demonstrated no significant statistical difference between scores at School X during the hybrid year and normal years. Therefore, there is an absence of proof for the conclusion that the hybrid learning program negatively impacted AP scores when compared to the last five normal school years, challenging my hypothesis that scores would be negatively impacted due to the challenges to virtual learning. This discovery is contradictory to the results of Huber’s 2021 study which concluded that learning was negatively impacted by learning virtually as opposed to in person because my quantitative analysis suggests that there was no significant negative impact on academic performance due to learning in the hybrid learning year. However, my research question would not be fully answered with the conclusion from my quantitative data.

Qualitative Analysis

After performing a thematic analysis on the transcripts of the interviews of the cause study, five main themes emerged (Table 7). However, two themes, a lack of impact on AP exams and a desire for in-person learning, were the most important to answering my research question due to their focus on the hybrid learning program’s impact on AP classes. Table 8 displays notable numbers of participants relating to these themes.

Table 8. Number of Students Indicating Responses Relating to a Lack of Impact on AP Exams and a Desire for In-Person Learning

Number of participants who indicated that they hybrid learning program was less beneficial to their AP experience.	15
Number of participants who indicated that they felt prepared for their AP exam(s) at the conclusion of the hybrid learning school year.	14
Number of participants who indicated they would prefer to be taught their AP classes fully in-person	17

Note. There were 17 total interview participants. Of that 17, 15 indicated the hybrid learning program was less beneficial. However, the second prompt was only asked of student participants, and there were only 14 student participants. The third prompt was asked of both student and teacher participants, meaning every participant expressed a desire for in-person learning.

The results of the thematic analysis showed evidence for the conclusion that the hybrid learning program had a somewhat negative impact on the overall educational experience for both students and teachers in School X. However, it is important to note that the goal of this study was not to study the overall experience, but to study the hybrid learning program under the context of School X’s Advanced Placement program. While all students preferred in-person learning to hybrid learning, all students indicated that they felt prepared for their AP exams at the conclusion of the hybrid year. Therefore, the thematic analysis suggests that the hybrid learning program did not significantly negatively impact students’ AP learning experiences since all student participants indicated that they felt prepared to take their exams at the culmination of the hybrid year.

New Understanding

Quantitatively, scores from AP Biology were significantly higher at School X, making them incomparable, but scores from AP European and World History demonstrated no significant statistical difference between School X during the hybrid years and nationwide normal years. Qualitatively, participants expressed that although in-person learning was preferable, they still felt prepared to take their AP exams at the culmination of the hybrid year. Therefore, when the analyses of the quantitative and qualitative aspects of the study are put in combination, it can be reasonable concluded that the hybrid learning program did not have a significant negative impact on AP scores and classes, directly challenging my hypothesis. This demonstrates a new understanding since there was a gap of research on the impact of the AP program under the context of the hybrid learning program. It is important to note, however, that although my new understanding suggests no significant negative impact on School X’s AP program due to the hybrid learning program, it does not suggest a positive impact. Therefore, in-person learning is still the best option for AP class instruction. The findings of this study are consistent with the conclusions drawn by Farsi’s 2021 study, where it was concluded that virtual learning can be just as successful as in-person learning because the results of this study demonstrated no significant negative impact of the hybrid learning program on education. Furthermore, the findings of my study are consistent with Butnaru et al.’s conclusion that in-person learning is the best method for effective education because the results of my study suggest that students and teachers alike would prefer to be in school in-person, five days a week. Additionally, my study adds to the body of knowledge surrounding the Advanced Placement program since the results and conclusions of my study have helped fulfill the gap of research on AP exams under the context of the COVID-19 pandemic. Although my study’s conclusions bear similarities to other studies, it addresses a gap in the knowledge and provides a new understanding on how AP classes are impacted by a hybrid learning program being implemented.

Conclusion

Upon completion of my study, I came to the new understanding that the hybrid learning program implemented by School X did not have a significant impact on its Advanced Placement program when compared to normal school years. However, my study also revealed that in-person learning is preferable to hybrid learning for Advanced Placement students.

Implications

My new understanding has a variety of implications to education and the response to the COVID-19 pandemic. One being that virtual learning associated with the hybrid learning program may not be as harmful to a learning experience as other studies have concluded. This is important to educational administrators who need to make decisions regarding the functioning of their schools. My new understanding suggests that virtual learning through a hybrid learning program is a viable option to continue academic success in dire circumstances. Another implication would be that hybrid learning programs, which follow a similar structure to that of School X, could be used for a school year without drastically negative consequences on the AP exam scores of Advanced Placement students. Therefore, the hybrid learning program implemented by School X could be used effectively for AP students should it need to be implemented. Finally, School X could implement the hybrid learning model in the future should it need to, and other schools can consider adopting a hybrid learning model similar to that adopted by School X while still maintaining the success of their AP programs. As a result of my new understanding, the hybrid learning program implemented by School X is a viable option for education should it need to be implemented in the future.

Future Research

Although the results of this study satisfied its intended gap, many more questions were uncovered that could be the topics of future research on the topic of Advanced Placement and the hybrid learning program. Some include studying how the hybrid learning program impacted non-AP students and comparing them to the results of this study, exploring why some classes seemed to perform significantly better during the hybrid learning school year, and using the methods outlined by the study on a larger scale. If this study was applied to a more nationwide population, the results of this study could be applied to a broader population than the results of this study.

Limitations

As with any research, there are inherent limitations to the new understanding and conclusions of my study. The biggest limitation to my new understanding is the small sample size of students who were enrolled in AP classes at School X. There is a greater chance for variance in my data with a smaller sample size. It is a result of this small sample size that my results cannot necessarily be applied to every student who took an Ap class during the hybrid learning year, limiting my new understanding to those who learned under a hybrid learning program identical or vastly similar to School X's. However, using this population was still the best choice for my study because of the differences among various school districts in their implementation of a hybrid learning program. If students from other districts were included, they could have had different experiences with hybrid learning, making it so that students from different districts could not be compared. Small sample size is a limitation of performing a case study as well, since not many participants are included. However, a case study was still appropriate for my study because I wanted an in-depth understanding which can best be provided with a case

study. Another limitation was the lack of available scores from School X from normal years. This was a limitation to my new understanding because I was not able to directly compare AP exam scores at School X from hybrid and normal school year; I have to use College Board data sets and perform a two-step statistical analysis. A lack of available data from these students limited my new understanding by also preventing me from applying my results to all students who took AP classes during the hybrid year, only those who learned under a hybrid program identical or vastly similar to School X's.

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