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Impact Comparison of Face-to-Face and Asynchronous Learning Environments on Student Performance

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**Impact Comparison of Face-to-Face and Asynchronous Learning Environments on
Student Performance**

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Capstone Project: An Action Research Project

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Abstract

The purpose of this action research project was to explore the impact of the Face-to-Face and Asynchronous learning environments on student performance. The recent Covid-19 pandemic of 2020 pushed primary and secondary schools nationwide to offer an online learning environment as an option in public education. Accordingly, grand debate arose about whether students' performance remained the same regardless of learning environment. A mixed-method study was used to determine significant difference in student performance, and analysis depicted learning environment outcomes by race as well. Data analysis revealed no significant difference in student performance between the Face-to-Face and Asynchronous learning environments overall. However, when examining data by student background, it was found that students of some predetermined race groups demonstrated higher performance in one learning environment over the other. The research findings from this study may prove beneficial in informing individual educators as they improve their own practices in diversifying curriculum to meet student needs. The outcomes may also provide information for stakeholders of urban and/or diverse school districts to consider as they make program decisions and determine solutions to current faults and necessities in academics.

Keywords: secondary, high school, face-to-face, asynchronous, culture, student performance, business education

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Impact Comparison of Face-to-Face and Asynchronous Learning Environments on Student Performance

The United States' education system continues to surge toward progress as it begins to feel the passing of the Covid-19 pandemic, an event that changed the world's understanding of typical school structure. Educational professionals all over the country have migrated into 21st Century ideals and expectations for K-12 education with a large emphasis on technology integration. Nationwide, many implore technology can provide more equitable educational experiences and success tools for adequate student preparation (Torchia, 2022). Still, some educational professionals are unsure if a technology-only approach to education can compare to the traditional educational methods.

Traditional education in the U.S., considered now to be face-to-face education, for some time has consisted of about 7-hour school days, 5 days a week, and for roughly 9 months of the year. Often broken down into trimesters, quarters, or semesters, these face-to-face environments have begun to evolve since the 1990s with more consistent access to technology and technology advancements. Long gone are the classrooms that do not have projected or SMART screens or even devices for individual students. In 2014, according to Dahlstrom et al. (2014), 99% of higher educational institutions, 85% of undergraduate institutions, and 78% of secondary schools were using a learning management system, or LMS. Today, nearly a decade later, it is extremely hard to find even an elementary school without an LMS used for both instruction and records in the United States. These advancements have begun to blur the line between face-to-face and blended learning.

Asynchronous learning environments gained traction throughout the pandemic and are likely here to stay even though most students have returned to the face-to-face classroom (Klein, 2022). School districts across the nation are working towards regular asynchronous options for families, and students, creating partial and/or full programs built around the idea of relieving schedule conflicts and/or content area restrictions. Nevertheless, there is a fine line where convenience and quality come together, and educational professionals are in the midst growing in understanding of how to mirror a face-to-face

learning environment in an asynchronous learning environment in order to not falter on curricular rigor, student performance, and student confidence.

Much like the advancement of technology and the progression of learning environments from traditional to asynchronous, America's cultural mix continues to develop as well. The Vespa et al (2018), in partnership with the U.S. Census Bureau, predicts by 2060, the nation's racial and ethnic mix will look quite different than it does now. Non-Hispanic whites will be 44.3%. Hispanics will rise to 27.5%. Blacks will be roughly 15%. Asians will be 9.1%. While rural schools have yet to experience cultural variance on a large scale, urban schools see cultural diffusion as a norm. The diversity of culture in education has beauty of its own, yet researchers continue to bring to light that cultural differences may impact student perspectives, student confidence, and student performance (Lin et al, 2010)

Purpose of the Research Project

This action research study will focus on student learning environments at the secondary, high school level. The purpose of this action research is to collect and analyze data of 2 separate sections of students enrolled in the same introductory Basic Computer Skills course. One section of students will be taking the course in-person traditionally using modern face-to-face methods, while the other section will be asynchronous through the new online academy. Both courses hold about 24 students; the mean score will be compared for each formative and summative assignment for each student, keeping quantitative data. A qualitative data collection approach will observe and gauge student confidence in learning and track educator reflections. The intention and primary focus are to evaluate if students perform better in one learning environment over the other with an enhanced consideration of student backgrounds.

Reflection

The recent pandemic pushed school districts all over the nation to step into a new realm in education in which students in upper secondary levels of education are provided with the continual option to take high school courses online. This has caused much debate with educators worldwide. For most, it's hard not to wonder:

- Is asynchronous learning a valid form of education for *any* student at the high school level? OR Can *any* student be successful at asynchronous learning?
- Is in-person learning superior to asynchronous learning for the average students' performance?
- Is asynchronous learning superior to in-person learning for the average students' performance?

Reasoning

Business educators in Bloomington, MN face providing courses in both asynchronous and face-to-face (F2F) learning environments. While the pandemic pushed most districts into asynchronous

learning, Bloomington's educators are not convinced high school students can have similar or greater success learning asynchronously than they can F2F. Nevertheless, most acknowledge the world is changing, and asynchronous and/or online learning in general are a permanent change to the school system's infrastructure.

Implementing a different grading system to better depict student understandings or evaluating the effects a bilingual educator in the classroom has on Hispanic, ELL students' confidence/performance were other considered action research topics. However, the chosen topic will lay a foundation for the high school business department's overall growth.

Scope

Resources for this study are derived from the DeWitt Library of Northwestern College. Relevance, publication type, and publication year are the criteria used to determine inclusion in the literature. Research that relates to the topics of student performance and confidence as well as research which examined cultural influence on educational perspectives was warranted. Ultimately, the majority of resources tie to face-to-face or blended learning environments, asynchronous learning environments, and student backgrounds. The research was used to provide not only perspective in what has already been studied but also to identify existing gaps.

Influence of Research

Research may influence the research educator's practice by using new, modern ways to interact with and engage students in both learning environments. It will likely not change the evaluative practice or data recording but could very well change how student assessments are utilized, distributed, and assigned to both sections of students. Research may also change the perspective and attitude of the educator on both forms of education through comparative examples of family/student experiences.

Review of the Literature

Modern asynchronous learning, brought on heavily by the Covid-19 pandemic, allows for student-centered education to occur online at the behest of varying student and teacher schedules. While offering an abundant amount of convenience, educational professionals often hold a negative connotation of asynchronous learning at the high school level. Research and educational practice continue to demonstrate that modern distractions and parental influence have led to a decline in socialization, motivation, and technology skills in students which are essential in education for cognitive growth (Hurst et al, 2013). Student performance is based in these skills, so approaches taken in both asynchronous and face-to-face (F2F) learning must foster them for students of all backgrounds.

Face-to-Face Learning

Recognized nationwide, students in secondary education are generally struggling with the transition back to high academic standards after the recent pandemic. Students had been released from the common pressures of traditional secondary education during the pandemic that typically encourage both social and academic growth and performance. Today, returning to rigor and a social scene is presenting struggles. Modern, secondary, pre-pandemic, F2F environments fostered an element of socialization between students themselves and between students and teachers (Selvaraj, 2021). In an early study by Beth Hurst and colleagues, feedback data was collected from their three groups of F2F students on a consistent basis that posed an association between socialization and cognitive growth (Hurst et al, 2013). “Analysis of data revealed three findings: (a) students learned from others, thus enhancing comprehension and retention by activating prior knowledge, making connections, and consolidating new ideas; (b) social interaction created a positive working environment; and (c) social interaction provided a means for ... students to view topics from multiple perspectives and enhance their critical thinking and problem-solving skills” (2013, p. 390).

Social Development

While educators today are making all efforts to reignite student socialization in the F2F classroom, students are reluctant to interact. According to Clark's study of the virtual community, many students are seeing F2F environments as inconvenient, unauthentic, and group-paced (2020, p. 77). Changes in both individual and family priorities since the pandemic have shifted students' perceptions and motivations (Nasution et al, 2021). Some American high school students and their families are motivated by independence via the ability to earn money or enjoy more time together. F2F learning can take away from this independence due to the structured daily schedule and environment.

Other studies on the current F2F classroom propose a different perception. The pandemic's abrupt online learning transition caused many students to realize their own need for F2F learning. In a study conducted in India, Selvaraj et al (2021) shared that students believed F2F courses "were better in terms of efficiency, interaction, and overall understanding" (p. 10). Nasution et al's (2021) study of Indonesian students enrolled in 3 different learning styles demonstrated 78% of their student group preferred F2F learning and portrayed that the organization of learning done by the school system and educators aided students in time-management, motivation, and engagement.

Environment of Support

During the pandemic, it was widely recognized across the world that students' capabilities in their asynchronous, or even synchronous, studies were largely affected by their study environment, which for many was their home (Nasution et al, 2021; Selvaraj et al, 2021; Fisher et al, 2021). Asynchronous study environments were found to be on an extreme scale of support, differing immensely from F2F classrooms that provide an equal opportunity of support to all students through both the environment and access to the educator. Selvaraj (2021) reported that "about 73.5 % of students say the online class [had] made some of the subjects more difficult than ...in a regular [F2F] class" due to a lack of real time supports.

Flexibility, social engagement, and extension are positive components of a F2F environment that seldom are of quality or quantity in asynchronous learning. Clark (2020) concludes that in F2F learning courses content can be discussed in detail and can be modified; there is more networking (socializing) involved and peer support opportunities (p. 77). When sitting in a modern F2F classroom at the secondary level, both peer-to-peer interactions as well as classroom discussions are encouraged and planned; however, they often happen on the fly as well. Educators may make a radical change to their course plan for the day and redirect students to this social engagement to develop better or deeper understanding of the content. “92.1% of students believe direct student-teacher interaction is essential for proper learning” (Selvaraj, 2021, p. 4).

Nasution et al’s (2021) study confirms social engagement as necessary as 95% of students surveyed preferred F2F over online learning. The same flexibility and engagement cannot be had in asynchronous learning since students are completing coursework at different times and places of the day. Furthermore, educators are not *in the moment* with their students asynchronously. F2F environments allow students to receive immediate support in their learning with the constant presence of the educator in the classroom (Larson & Sung, 2009).

Student Performance

Ultimately, there is a wealth of research supporting the F2F environment’s academic influence. Fisher et al (2021) conclude flipped and blended learning (F2F learning environment options) positively “contribute to perceptions of student engagement, performance and satisfaction.” Adam & Nel (2009) advocate that students perceive the F2F environment as an important factor in their engagement and understanding due to the in-person component. Data analysis in these studies and many more depict support of these conclusions, with F2F student performance scores resulting above average.

Asynchronous Learning

Asynchronous Learning is far from a new concept. As early as the beginning of the 20th century, asynchronous learning began through organized mail, newspapers, and journals. Adults and children alike would learn at their own pace and virtuously, by their own free-will. Pushed by mandatory education requirements and increased need to educate the masses during World War II, asynchronous learning transformed throughout the subsequent years to include recorded audio and video and radio and television broadcasting. Due to the late 1990's technology boom, asynchronous learning at all educational levels began to convert from print to online – its recognized form today. (Glavin, 2018)

While growing in popularity with a convenience offered by online access, the turn of the 21st century still saw consistency in the traditional, F2F environment's enrollment. It wasn't until the Covid-19 pandemic of 2020 that asynchronous learning mainstreamed. The pandemic pushed nearly all secondary educators into asynchronous learning with very little time for preparation and merger. For years it has been a unique environment for every situation, student, and educator worldwide; nevertheless, it must, here-in, be recognized as equivalent to pre-pandemic standards and expectations. (Selvaraj et al, 2021)

Social Development

At secondary high school levels, educators fear students are taking advantage of not being physically present in the school building and are losing important social soft skills in doing so. Still, research demonstrates there *is* a social aspect to asynchronous learning when setup appropriately. In fact “the isolated nature of an asynchronous course places an increased level of importance on the integration of socialization and community building activities within the course” (Bickle et al, 2019). Students must feel like they are a part of the learning environment to truly be immersed in their studies., and research demonstrates this is already happening. Wegerif's (1998) students accounted that the asynchronous learning environment provided a more comfortable environment for discussions and discourse between

students (p. 41). One student denoted how the environment even took out biases and taught her how to engage more effectively in discussion than ever before (p. 41).

Nevertheless, while asynchronous online discussions are comparative and proving effective in undergraduate settings, student motivation to engage in asynchronous discussions at the secondary level varies by individual student backgrounds and foresights (Selhorst et al, 2017). Especially in districts where student grades are divided into required 20% formative and 80% summative categories respectively, necessity to complete formative discussions to achieve passing scores is virtually non-existent. Thus, students choose not to participate, and educators begin to see a gap in the learning.

Environment of Support

Educator support in the asynchronous environment at the secondary level is dependent upon the school district. Some secondary schools have moved toward online high schools, whose educators are available most of the learning day. Bickle et al's (2019) study of student perceptions concluded that 82% of students were satisfied with their online course, an overwhelming number of those students attesting their satisfaction stemmed from consistent access to their educator. Still, many other secondary districts have chosen to have F2F educators take on asynchronous courses concurrently with their F2F courses. When taking on a dual role, educators lack a regular presence for their online students. Thus, student questions or concerns are often responded to on the educator's time and not the student's time, which could be limited. Furthermore, the "in the moment" aspect of Q&A, a vital component of secondary education, is then not possible. (Adam & Nel, 2009; Bickle et al, 2019; Di Meo & Martí-Ballester, 2020; Nasution et al, 2021)

Flexibility *is* offered in the asynchronous environment for both students and educators. Both parties can decide when life allows for full engagement in the content or course, often more effectively balancing extracurricular activities and other employment. Likewise, technology may be offered through secondary school districts, but ultimately student/educator choice exists (Di Meo & Martí-Ballester,

2020). Still, flexibility has its limits where content is involved. There is seldom flexibility in making real-time curriculum shifts based on concurrent student performance (Adam & Nel, 2009). Educators have less control supporting student understandings through these normalized shifts than they would in the F2F environment. Asynchronous curriculum is planned in advance much like F2F curriculum, but changes are rare due to the nature of the environment. (Harwood, 2018; Bickle et al, 2019)

Student Performance

Ultimately, there is a wealth of research, just like in the F2F environment, that supports the asynchronous learning environment's academic influence. Harwood et al (2018) found asynchronous courses could be taught traditionally with 15 weeks or compacted with 7-8 weeks and provide equally positive results in student performance. Larson and Sung (2009) observed little to no significant difference was found in student performance between their F2F and asynchronous sections. While not the premise of their study, Adam and Nel (2009) found the same result; there was no significant difference between F2F and asynchronous environments when examining student performance and GPA. Moreover, "based upon student satisfaction, learning effectiveness and faculty satisfaction, ...online versions of the class compare[d] favorably to the face-to-face versions" (Larson and Sung, 2009, p. 40).

While an asynchronous learning environment can have little to no effect of student performance, it must be recognized that an overwhelming amount of research on the comparison has been done at the undergraduate and graduate levels, not the secondary level. Moreover, many factors create a larger gap between the lowest- and highest-level learners in most courses that may not present at the collegiate level. At the secondary level, there are more influences on the education environment including cultural makeup, parent/guardian involvement, student motivation, etc. Existing studies demonstrate 75% or more of secondary students favor F2F learning over asynchronous learning (Nasution, 2021; Selvaraj, 2021). Therefore, secondary studies could bare differing results.

Student Motivation

Secondary educators continue to hold out and push for the return of students' motivation regarding their education. The pandemic brought on a dramatic downturn in motivation in education at all stages, but K-12 educators see the brunt of it in their students. The gap in K-12 students' autonomy levels has increased immensely. Even before the pandemic, Gómez-Rey et al (2016) determined "55.8% of students with the lowest general self-efficacy values [have] ...the lowest possible autonomy values". Similar relationships were found between lowest possible autonomy values and the lowest motivation values (p. 233).

Influences

Immense amounts of research have been done in evaluation of student motivation. The social development of students at the secondary level by far has the largest influence. Wiesman (2012) detailed that "low self-esteem will affect motivation, school performance, and students' ability to focus on their studies and complete school tasks" (p. 104). Studies in socio-economic status and cultural backgrounds have demonstrated causation relationships between students' self-esteem and motivation as well (Adeoye & Wentling, 2007; Ditton et al, 2019; Gómez-Rey et al, 2016). So, it is no surprise students have low motivation when the CDC warns of a mental health crisis in youth. "In 2021, more than 4 in 10 (42%) students felt persistently sad or hopeless, and nearly one-third (29%) experienced poor mental health" (CDC, 2023). Low self-esteem continues to be a leading cause of this mental health crisis.

Social media also presents an overwhelming case for creating low motivation in secondary students. Adolescents are easily influenced by the world and "are most often influenced not by what their peers actually do and say, but how *they think* their peers will react to a potential action" (Wiesman, 2012, p. 104). A downfall to social media is the possibility of ridicule. Students who have a Social Media Addiction (SMA), may be fearful of negative peer reactions to social media comments or posts. They

become focused on their social media presence in hopes of peer praise and lose motivation to better themselves academically and financially. (Demircoglu & Kose, 2020; Malik & Elahi, 2020)

Technology

Since the pandemic, technology has become a standard in public schools in the United States. Government grants were issued during the pandemic for schools to purchase devices and hotspots for students to continue education. Today most schools have a device for every secondary student that travels with them from home to school and back. While this could be seen as progress in education, there are also unforeseen shortcomings where student abilities in technology and motivation collide.

Adeoye and Wentling (2007) demonstrated concern for knowledge of use inconsistencies in Learning Management Systems (LMS) and technology early on. The findings of their study revealed “there was a significant relationship between Uncertainty Avoidance and Learnability Time. This indicat[ed] respondents with higher levels of Uncertainty Avoidance were likely to have higher scores for Learnability Time ($r=.40$, $p=.05$). The higher score in Learnability Time is an indication that the respondents spent more time using the system (they are slow in completing tasks)” (Adeoye & Wentling, 2007). This sets a foundation for understanding student motivation regarding technology.

Today each district in each state across the nation sets its own plan for technology inclusive of device, applications, LMS, etc. Prior to technology students merely moved from district to district with the sole concerns of making new friends and tracking their course transcripts to meet graduation requirements as many districts aligned with foundational courses/plans of study. Now, technology has posed a new concern. Students and families who migrate to new cities, and schools may face a change in technology device, applications used/taught, and LMS. The learning curve required for learning new technologies can depend on the socio-economic background and culture of each student, presenting an unequal balance in the classroom. This lack of technology knowledge creating higher Learnability Time

could be misinterpreted as lack of motivation. (Adeoye & Wentling, 2007; Ditton et al, 2019; Gómez-Rey et al, 2016)

Student Performance

Secondary asynchronous and F2F learning environments collectively see student motivation as a hinderance to student performance. Especially in instances of formative activities and assignments, such as homework, only accounting for 20% of the grade, student motivation is low both online and in-person. However, research shows when students are engaged in courses through activities and formative assessments, student performance on summative exams and projects increases (Fisher et al, 2021; Larson & Sung, 2009). Secondary education must focus on pushing for student motivation in both asynchronous and in F2F environments through curriculum design and school district policy.

Student Backgrounds

America has a long history of immigration that has created the country renowned for its cultural diversity today. Early education institutions saw the era of assimilation in which America called for children of all cultures to adapt to a standard of education, leaving their culture differences at the threshold of their homes. Time and various revolutions created a newfound embrace of cultural differences, with acknowledgement of various learner types and formation of student supports in education. Still, today America's population differences across the nation give way to clashing cultural understandings, which propose issues in primary and secondary education. While informative, research does not yet represent culturally comparable demographics to the range of those found in *all* American classrooms.

College and Private Secondary Institutions

America's culture mix is more unique than any other place on earth. No other nation is home to such an eclectic group of cultures, yet in education, we still endure a great difference between students in college or even private secondary institutions versus public secondary institutions. Hanson (2023), of

Education Data Initiative, reports that across the United States' nearly 4000 colleges, 51.6% of college students are considered white. Of that percentage, 76.4% are enrolled in 4-year colleges. These figures are comparable to ethnically white countries such as the United Kingdom in which 54.6% of enrolled college students are considered white (HESA, 2023). Furthermore, 9% of enrolled college students are considered upper-class while 52% are middle-class and 39% are lower-class (Fry & Cilluffo, 2023). These ratios are arguably more diverse yet comparable to private secondary institutions. The US Department of Education (2023) shares that in 2019, 66% of private school students were considered white, 12% Hispanic, 9% black, 7% Asian, and 5% were of two or more races. The data on the socio-economic status of students enrolled in private secondary institutions is lacking; however, these institutions are renown in the US for being for upper-middle-class and upper-class students only unless a scholarship option is available.

Public Secondary Institutions

Public secondary institution demographics across the US are quite specific to region and population even within individual states. For example, in Minnesota's rural town of Slayton (pop: 2000), Murray Country Central (MCC) high school's student body has minimal diversity. 95.4% of students are considered white, 2.1% Hispanic, 1.2% American Indian/Alaska Native, .9% two or more races, and .3% black (U.S. News & World Report, 2022). U.S. News and World Report declares 29% of MCC's enrolled students are "economically disadvantaged" (2022).

The urban areas of Minnesota are radical opposites. Richfield High School, of Richfield, Minnesota, experiences diversity quite differently. 27.3% of students are considered white, 44.4% Hispanic, 15.7% black, 7.2% two or more races, 5% Asian, and .5% other (U.S. News & World Report, 2022). Still, opposition doesn't stop there. 54% of Richfield's student body are reported by U.S. News and World Report to be "economically disadvantaged" as well (2022). These contradicting diversity environments are replicated across the nation and demonstrate a disconnect in the relatability of secondary education research demographics.

A Gap in the Research on Learning Environments

Many studies have been conducted that examine student performance differences between the learning environment types; however, the leaders of the existing research have failed to capture a group of secondary high school students *and* students with highly diverse socioeconomic, racial, and ethnical backgrounds. Wegerif (1998), who's study of asynchronous environments is renown, based his findings on the behaviors and responses of 21 college students, 19 of whom were based in the United Kingdom (p. 35). Larson and Sung (2009) denoted 151 of the 174 college students divided between their 3 groups were white, while only 23 were non-white (p. 34). Hurst et al. (2013, p. 377) cruised past the topic of students' backgrounds completely by simply generalizing that "learners have different background knowledge, experience, and interests."

Socioeconomic Status. Primary and secondary education experiences are different for students who grow up in households with divergent socioeconomic status (SES). The relationship between SES and a student's performance can be seen as early as primary school. Ditton et al's (2019) study concluded that "cultural resources within the family substantially depend on SES (0.57) have a direct effect on a child's reading behavior (0.30)" due to their p values being radically greater than 0.05 (p. 1289). Other factors would also come into play in their study, but SES was the primary reason for performance differences. This scenario rings true in many urban populations throughout the nation. While students may all have the same in-school opportunities for learning, their at-home parental supports and resources differ from one student to the next. (Adeoye & Wentling, 2007; Gu et al, 2017; Marambe et al, 2012)

Cultural Capital. Although the aforementioned cultural diversity has an abundance of positive influences in education, it also can create cultural capital in student bodies. In fact, ridding America of any sort of assimilation in schools when an economy with a dominant conceptual ideology exists, has only set cultural capital to have a great deal of weight on student performance. Cultural capital is the social and cultural advantage some people have, and its scale relies on how close a person's culture is to the dominant culture's understandings. Students, who's own and families' understandings are rooted in

different ideologies and foundational understandings from those of the majority of their peers or educations, will see performance difficulties (Kumi-Yeboah et al, 2020). While educational research on cultures demonstrates the need for cultural inclusion for optimal learning for all, American secondary education has not advanced enough to get past existing cultural capital issues (Gu et al, 2017; Liu et al, 2010).

Implications for Continued Study. Unless the school district is in or near a high urban population in the United States, it is unlikely secondary researchers would capture a student population in which 77% of the students were from non-white backgrounds or from opposing ends of a socioeconomic scale. This scenario provides this action research with a unique foundation. The research data and outcomes will exclusively depict two high school student groups with no more than 6 students from a solely white, European background. Most student backgrounds will be unrelated in many ways including race, ethnicity, socioeconomic status, upbringing, obligations, and/or birth location (both in and outside of the U.S.). These factors will present in the data findings through commitment to learning, motivation, and academic performance.

Conclusion

As educational systems begin to make shifts in technology integration and learning environments, education professionals must begin to take a deeper look at who their students are as a whole person and group. The noted concern of some educators about the impact a learning environment can have on student confidence and performance is validated by the literature, especially when the gap is considered. There are prevalent mixed understandings and beliefs circulating on this topic that beseech further research. Furthermore, to remain relevant to America's clash of cultures, gaps in the research must be filled by the recognition of student backgrounds, allowing greater justification of each study's implications in education systems and classrooms worldwide.

Contextual Framework

Setting

This action research study takes place in a high school Business Education classroom and in a high school Business Education virtual environment. The location is a suburban city, south of the metropolitan Twin Cities in Minnesota. It is the 4th most populated city in Minnesota depicted by a racial demographic of 69% white, 10% black, 9% Hispanic, 6% Asian, and 6% other/mixed. The overall average income in the city is \$48,003/year.

The district includes 10 elementary schools, 3 middle schools, 2 high schools, and 1 online learning academy as well as early learning and other programs. The high school, which hosts the F2F classroom in this study, has a total population of 1808 students. The online learning academy is offered as an option to any student who attends either district high school; thus, student population is revolving.

Participants

This action research study hosts a relatively comparable roster when considering student backgrounds. The students of the F2F high school have an ethnic diversity percent (EDP) of 72%. 16% of the student body is considered English Learners, and 17% is part of the Special Education program. Similarly, the asynchronous high school has an EDP of 71%. 12% of their student body is considered an English Learner and 8% is part of the Special Education Program.

The asynchronous course has 23 enrolled students, 12 males and 11 females. There are 5 students in grade 9, 1 student in grade 10, 6 students in grade 11, and 11 students in grade 12. The F2F course has 24 enrolled students, 15 males and 9 females. There are 4 students in grade 9, 3 students in grade 10, 8 students in grade 11, and 9 students in grade 12. Student ethnicities in both courses portray 88% and 65% ethnic minorities respectively. Student backgrounds are immensely diverse without the ethnic bias. Many students are ethnically and racially mixed. Where students grew up (within the U.S. or in foreign countries) will affect their prior knowledge and common understandings in both course sections.

Research Plan

Research Questions

The purpose of this action research is to study student performance data between an asynchronous section and a face-to-face (F2F) section of the same course, entitled Basic Computer Skills. Findings will be used to answer the question, “What is the impact of an asynchronous learning environment versus a F2F learning environment on high school student performance?” From this research, educators in similar environments and learning levels will be able to make comparisons and decisions regarding learning environments most suitable to their students and learning situation.

Variables

The independent variables for this research include the assignments provided in both courses. Students in the asynchronous section will be given the same assignments as the formative section with the addition of course discussions. The assignments will simply vary in format due to the option to do assignments via paper in the F2F course. Submissions through Canvas (the district’s LMS) are also independent and allow for tracking of assignment completion and for data collection. Finally flipped materials such as supplements for teaching (i.e., video instructions) are independent as well, as they aren’t an exact replica of the instruction provided in the F2F course.

The dependent variables for this research include student performance data, such as summative scores and the final course grade. Student confidence responses are also considered dependent data. Formative completion will be used as a tool to gauge overall student performance as a direct correlation is generally seen between formative completion and summative scores.

Timeline

This research will be completed over 2nd trimester during the 22-23 school year. During the 13 weeks, students will complete daily 10-minute typing assignments. These assignments will be done at the

beginning of the F2F course hour each day. There will be a midterm typing summative and a final typing summative for this portion of the course to demonstrate progress and improvement. Throughout the trimester students will complete 8 units of study. Each unit will include assignments relative to the unit. The summative for each unit will be in either test or project format. Summative completion/revision has a 2-week window in both environments according to the policy set by all the district's high schools.

Data will be collected throughout but reviewed after both midterm and end-of-trimester finals. A midterm and an end-of-course student confidence survey will be given covering all the learning objectives for the course. Data evaluation will begin after all summative and survey data has been collected.

Data Collection

A convergent parallel mixed-methods approach will be used for data collection to fully measure and evaluate student performance. Quantitative and qualitative data will be collected (and analyzed) separately. Microsoft Word and Infinite Campus will host qualitative data collection of the researcher and the students, while Microsoft Excel will host quantitative, student data collection.

Variables and Data

Independent

Assignments given to students will be collected and completion data will be recorded. The researcher will assign a '1' for complete and a '0' for incomplete for each assignment and student in both course sections. The researcher will also notate differences between asynchronous and F2F instruction via a journal and the district's LMS. Video instructions, announcements, and weekly guides will be included.

Dependent

Individual student scores for each formative assignment and summative test/project will be recorded. Final course grades will be transferred from the LMS after all grades are updated. Outcomes will be unique to each student and the learning environment.

Measurement Instruments

Homework assignments (formatives), summative and final exams, and student confidence surveys have been created by the researcher and the high school Business Education Department. Apart from their professional judgement on the validity of the measurement instruments and the correlation of state and national standards to each individually, there is not a specific, formal validity and reliability evaluation tool accessible for each. Still, the Bloomington School District tracks and keeps record of state and national standards and how each are being assessed through summative assessments in all courses via the ACCESS database and Google Drive.

Typing Club, a program used to facilitate the keyboarding portion of the course, is used to facilitate formative typing assignments and summative typing tests throughout the trimester. The program uses a professionally designed analytical code to assess and evaluate student progress and student abilities. Calculating both accuracy and REAL accuracy, educators can use the data to determine student abilities beyond speed (wpm). (TypingClub, 2022)

Data Collection Process

An Excel spreadsheet will host all quantitative data. Daily typing minutes will be logged via Typing Club and transferred as a weekly complete/incomplete score and as a formative score, based on percent of required minutes typed, to Excel for individual students. Typing test data and analysis will be done by Typing Club; results of each individual student will be transferred to Excel. Homework completion tracked by the LMS, Canvas, will be downloaded at the end of the term. Individual student data for each unit will be transferred to Excel for concrete scores and complete/incomplete conversions. Summative Test scores tracked by the LMS, Canvas, will be downloaded at the end of the term. Individual student data for each test will be transferred to Excel. Finally, student confidence survey responses will be tracked by a Google Form and transferred to the Excel spreadsheet.

A Word document, Canvas, and Infinite Campus (the district record keeping tool) will host all qualitative data. Teacher notations on Instruction differences for each unit will be kept in journal format in Word, organized by unit and lesson. Finally, individual student background information: gender, race, ethnicity, grade, age, etc. will be download from Infinite Campus, the student information platform, and kept for referencing.

Data Analysis

Analytical findings will need to answer the question, “What is the impact of an asynchronous learning environment versus a F2F learning environment on high school student performance and confidence?” This is the overall research question for the study to be conducted. Due to the nature of the question and the data to be collected (both quantitative and qualitative), the best approach to data analysis is direct quantitative analysis with qualitative analysis support. Hard numerical data collected and organized appropriately will allow for computational, comparative analysis. Student background information and educator journals, interviews, and surveys will identify trends and limitations and provide deeper understandings to support the quantitative data analysis. The overall data analysis design used will be the two-phase, mixed-methods design.

Data Collected

Qualitative Data

The educator will keep track of the differences between asynchronous, “flipped” materials and in-person materials in a journal and on the district’s LMS. Details consistently reported are video/in-person instructions, reminders/announcements, weekly plans, and necessary re-teachings. The information will be referred to for validity and reliability of the quantitative student performance data.

Quantitative Data

Assignment Completion (assigned ‘1’ for complete, ‘0’ for incomplete) for each individual formative assignment for each unit will be organized for each individual student in an Excel Spreadsheet. The 1s and 0s will be summated, and then the average completion will be

calculated by dividing the total completions by the total number of assignments. The average of the averages will be used to depict the entire course's average formative assignment completion for each unit. A p-value will be calculated and assigned for each unit.

Individual scores on summative tests will be tracked and calculated for each individual student. The summative tests will include the midterm and final content exams as well as the various typing tests. Scores for each exam will be placed in the Excel Spreadsheet, and a percent of total will be assigned to each score value. An average of all students will be calculated for each exam. Finally, the average performance on all exams will be calculated for each individual student and the course. A p-value will be calculated and assigned for the typing exams and content exams. Finally, Final Course Grades, which are inclusive of formative and summative assessments, will be reported on the Excel Spreadsheet.

Qualitative Data Analysis

In support of the quantitative data analysis, qualitative data analysis is done. The process of analyzing qualitative data requires organizing data into themes/clusters for pattern discovery. The predetermined categories for qualitative analysis are:

1. Instruction techniques
2. Diverse perspectives on the value of education
3. Student confidence in learning
4. Student motivation in learning

As data is collected over the course of the Trimester, it is organized divided into these categories. As analysis, ideas, points of view, or experiences, otherwise known as themes, are discovered, and connections are made within each category and/or between the categories. The themes are

then reported through a table or visual organizer in order to easily reference in the interpretation summary. (Efron and Ravid, 2020)

Quantitative Data Analysis

Quantitative Data Analysis begins with searching for correlation. In this case, a correlation between the assignment completion data, student confidence numerical data, and the summative test data for each unit. While looking for correlations between this numerical data, it is important to remember “correlation does not imply causation; the fact that two [or more] variables correlate does not mean that one *caused* the other” (Efron and Ravid, 2020).

Correlation of this data would be best depicted through the correlation coefficient, which measures relationships between variables, or a scatterplot, which provides a visual representation of the intersection of scores for each student. (Efron and Ravid, 2020)

To continue analysis of the quantitative variables, it is important to also measure differences for an overall look at student performance. Summative test scores and typing test scores respectively should be compared from unit to unit. To measure the differences in these scores, it would be necessary to either complete a t-test or an analysis of variance (ANOVA). Both tests compare means of data samples through renown strategies. Due to there being more than two units, ANOVA would likely provide the best analysis within each course. ANOVA would compare the means of summative test scores as well as student completion and student confidence data.

To compare the differences between the asynchronous and in-person courses overall performance and confidence data, a t-test could prove the best route. “The difference between the two means, as well as the groups’ standard deviations and size (number of people), all play a role in the computation of the t value” (Efron and Ravid, 2020). While still not proving

causation, this data analysis technique could be a demonstration effective reasoning. (Efron and Ravid, 2020)

Interpretation

Using the quantitative data analysis with the support of the qualitative data analysis an interpretation is conducted to draw out reason and conclusions. Interpretation will reference both quantitative and qualitative data reports, tables, diagrams, and other visuals. Interpretation can also be used to compare similar findings in other studies in order to demonstrate cohesion. The researcher's interpretation for this study can be found in the discussion.

Ethical Considerations

IRB

Without necessity of the collection of specific feedback from students about student confidence in their learning, the research educator did not have to submit the full application to conduct human subjects research to Northwestern's IRB. The US Code of Federal Regulation's exemption requirements under subsection 46.104 states, "The research involves normal education practices or diagnostic tests" (Protections of Human Subjects, 2018). Since the action research is within the parameters of this requirement as well as the other requirements, merely an exempt application was filed and approved.

Personal Bias

Background

Bias could appear through the educator's upbringing, understandings and experiences in educational settings as both a learner and an educator. The research educator, as a mother of high school-age students, could also present bias via the understandings of the parental side of typical student behavior present at home when taking asynchronous courses. The research educator is also taking courses asynchronously for a graduate program which again provides yet another lens to the learning (student) viewpoint of asynchronous learning.

Opposing Positions

There are only two strong sides of this focus. Educators stand with synchronous, F2F learning, or they stand with asynchronous learning. For the most part, educators do take one side over the other; however, the more educated they become on asynchronous learning or the more

they teach in this style, the more they may find advantages and disadvantages in both styles.

Forward-thinking, modern educators are finding ways to teach students the same content through either lens as asynchronous remains an option in most districts throughout our nation.

Slant Research

Accurate data collection and inquiry will be the main way in which bias is prevented in this study. Similarly, student confidence will be evaluated by both students and the research educator in order to demonstrate that the observations are founded on accurately perceived student emotion and performance. As the Business department and district continues to increase the department' number of asynchronous courses, the research educator seeks unbiased, ethical practices in order to ensure future decisions are made based on accurate conclusions found in this study. Literature has been thoroughly sought after and read to not create a larger bias but to be full prepared to combat predicted, aforementioned possibilities.

Findings

Data Analysis

For this action research project, the researcher used both quantitative and qualitative data to assess the impact comparison of face-to-face and asynchronous learning environments on student performance. Data was collected as intended throughout the 13-week trimester and was organized in an Excel spreadsheet and Word document. The mixed methods approach included analyzing quantitative formative assessment, formative completion, and summative assessment scores and cross-examining results with patterns found in qualitative educator notes, student background information and student confidence surveys. Findings are detailed in relation to the learning environment.

Face-to-Face Learning Environment Analysis

In the Face-to-Face (F2F) section of this course, formative data was analyzed both via the original score and the assessment completion for each student. (Note: if the student turned in the assignment, no matter the original score, they were given a “1” for completion.) Both the formative completion and the formative score means were found and used for correlation testing with the summative score mean. When comparing the overall *formative completion percentage mean* and overall *summative score mean*, the researcher found there was a statistically significant correlation ($r(23) = 0.85$, $p = 0.04$, $\alpha = 0.05$). Comparing the overall *formative score mean* and the overall *summative score mean* confirmed the statistically significant correlation between formative outcomes and summative outcomes ($r(23) = 0.84$, $p = .00006$, $\alpha = 0.05$). These correlations are visually apparent when examining individual overall outcomes of enrolled students in Figures 1 and 2.

Figure 1

Overall Formative Completion Percentage and Overall Summative Score Mean

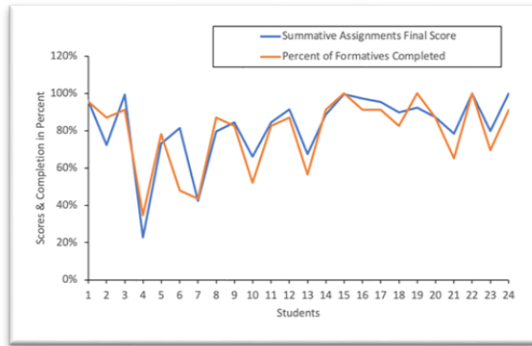
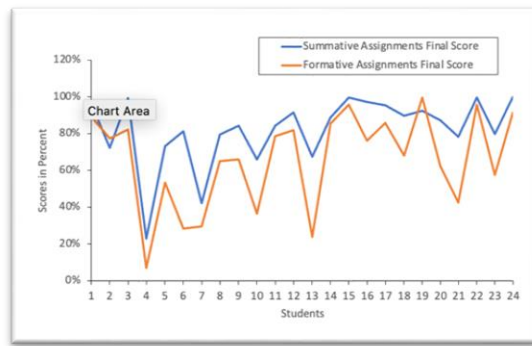


Figure 2

Overall Formative Score Mean and Overall Summative Score Mean



In most cases, the percentage of completed formative assignments and the averaged final score of those formative assignments correlate with the summative final score for individual students. Yet, it should be noted that when breaking down the course into the 2 parts: Typing and Computer Applications, the researcher found varying results in the comparison of means and standard deviations of formative completion percentages, formative scores, and summative scores within individual modules (Table 1 and Table 2).

Table 1

Mean & Standard Deviations for Variables of the Typing Portion of the F2F Course.

Variable	Typing Module 1		Typing Module 2		Mid-Term		Typing Module 3		Final	
	M	SD	M	SD	M	SD	M	SD	M	SD
Form. Comp.	91.67	24.08	92.71	21.47	85.42	23.73	85.65	22.1	80.83	22.25
Form. Score	78.89	30.87	70.69	29.39	63.03	29.68	59.34	27.67	56.01	27.18
Sum. Score	100	-	86.51	18.45	90.6	11.81	73.23	39.43	85.92	22.18

Table 2

Mean & Standard Deviations for Variables of the Computer Applications Portion of the F2F Course.

Variable	Module 1		Module 2		Module 3	
	M	SD	M	SD	M	SD
Form. Comp.	72.22	38.9	79.17	36.53	77.08	36.05
Form. Score	69.31	37.6	73.84	34.88	77.08	36.05
Sum. Score	72.08	43.75	71.53	40.87	71.53	33.51

As denoted by the sample comparison (Table 3), there is a drastic difference when determining correlation between formative and summative score means in both portions of the course. There is a prevalent, statistically significant correlation between *formative score mean* and the *summative score mean* in the sample from the typing portion, yet there is no statistically significant correlation between *formative score mean* and the *summative score mean* in the sample from the computer applications portion. A visualization of formative and summative score mean comparison in individual student data of the samples can be found in Figure 3 and Figure 4 respectively.

Table 3

Sample of Formative Score and Summative Score Outcomes in Typing and Computer Applications Portions of the F2F Course.

Variable	Mid-Term Typing	Module 2 Comp. App.
Pearson Correlation	r(23) = 0.43	r(23) = 0.43
Form. Score & Sum. Score Correlation	2.14E-05	0.39

*p < .05

Figure 3

Midterm Timed Test Summative Score and All Prior Typing Formative Scores Mean

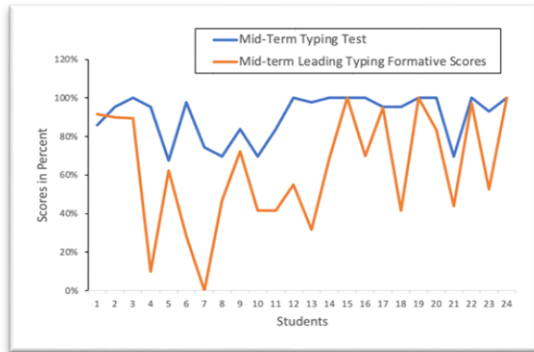
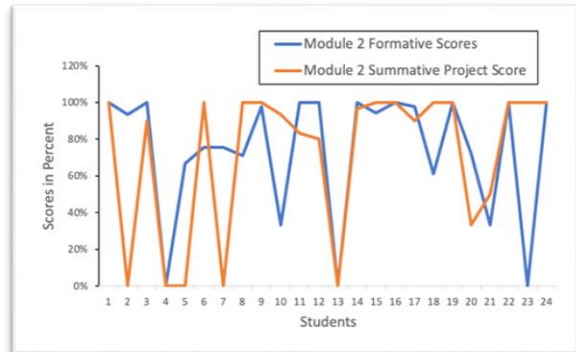


Figure 4

Module 2 Summative Score and Module 2 Formative Score Means



Asynchronous Learning Environment Analysis

In the Asynchronous section of this course, data was analyzed in the same manner as the F2F data. When comparing the overall *formative completion percentage mean* and overall *summative score mean*, the researcher found there was a statistically significant correlation ($r(22)= 0.53, p=0.004, \alpha=0.05$). Comparing the overall *formative score mean* and the overall *summative score mean* confirmed the statistically significant correlation between formative outcomes and summative outcomes ($r(22)= 0.57, p=.00006, \alpha=0.05$). These correlations are visually apparent when examining overall outcomes of enrolled students in Figures 5 and 6.

Figure 5

Overall Formative Completion Percentage Mean and Overall Summative Score Mean

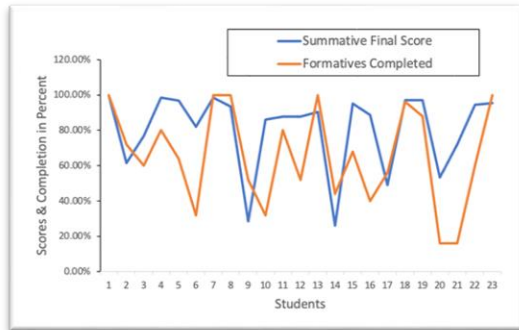
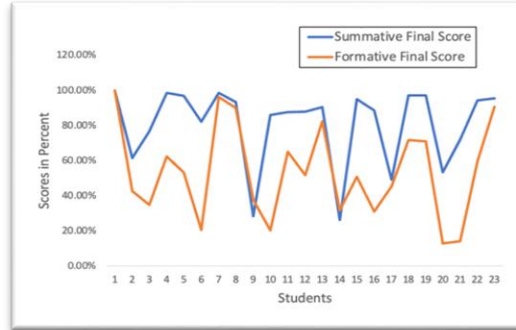


Figure 6

Overall Formative Score Mean and Overall Summative Score



In most cases, the percentage of completed formative assignments and the averaged final score of those formative assignments correlate with the summative final score for individual students. Comparable to the F2F data, it should be noted that when breaking down the course into the 2 parts: Typing and Computer Applications, the researcher found varying results in the comparison of means and standard deviations of formative completion percentages, formative scores, and summative scores within individual modules (Table 4 and Table 5).

Table 4

Mean & Standard Deviations for Variables of the Typing Portion of the Asynchronous Course.

Variable	Typing Module 1		Typing Module 2		Mid-Term		Typing Module 3		Final	
	M	SD	M	SD	M	SD	M	SD	M	SD
Form. Comp.	78.26	32.39	67.39	33.33	63.04	35.08	58.94	37.42	58.26	37.03
Form. Score	49.42	35.84	46.12	38.43	42.56	36.13	40.49	35.72	39.63	34.71
Sum. Score	99.28	3.4	94.62	20.39	96.26	36.13	81.04	32.03	82.09	28.37

Table 5

Mean & Standard Deviations for Variables of the Computer Applications Portions of the Asynchronous Course.

Variable	Module 1		Module 2		Module 3	
	M	SD	M	SD	M	SD
Form. Comp.	66.67	34.05	64.13	35.98	50.00	46.63
Form. Score	59.65	30.21	51.34	30.73	47.39	44.95
Sum. Score	60.87	39.22	56.59	37.06	65.51	40.69

As denoted by the sample comparison (Table 6), there is a drastic difference when determining correlation between formative and summative score means in both portions of the course. There is a prevalent statistically significant correlation between *formative score mean* and the *summative score mean* in the sample from the typing portion, yet there is no statistically significant correlation between *formative score mean* and the *summative score mean* in the sample from the computer applications portion. A visualization of formative and summative score mean comparison in individual student data of the samples can be found in Figure 7 and Figure 8 respectively.

Table 6

Sample of Formative Score and Summative Score Outcomes in Typing and Computer Applications Portions of the Asynchronous Course.

Variable	Mid-Term Typing	Module 2 Comp. App.
Pearson Correlation	r(22) = 0.29	r(22) = 0.67
Form. Score & Sum. Score Correlation	1.5E-07	0.19

*p < .05

Figure 7

Midterm Timed Test Summative Score and All Prior Typing Formative Scores Mean

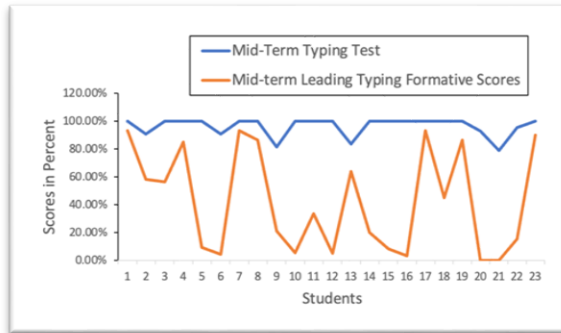
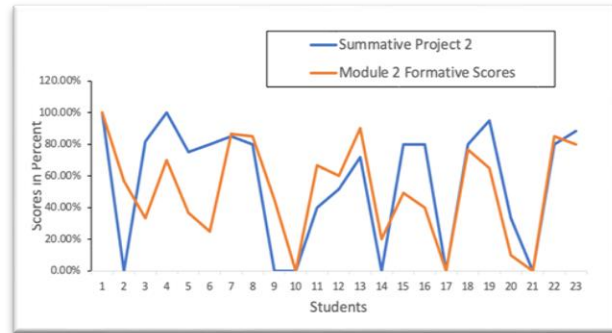


Figure 8

Module 2 Summative Score and Module 2 Formative Score Means



F2F and Asynchronous Comparison

Analysis of data across the learning environments demonstrated similar patterns in the statistically significant correlations between the overall *formative completion percentage mean* and overall *summative score mean* as well as between the overall *formative score mean* and the overall *summative score mean*. One-sample p-value calculations of overall *formative completion percentage mean*, overall *formative score mean*, and overall *summative score mean* respectively were compared, and it was found that while each were statistically significant and likely to reoccur ($\alpha=0.05$, $p < .05$) the F2F environment had a higher statistically significance in all 3 areas (Table 7). When correlating formative outcomes and summative outcomes through p-value analysis in both learning environments formative scores and summative scores (Correlation B, Table 7) demonstrated a higher statistically significant correlation than formative completion and summative scores (Correlation A, Table 7).

Table 7

Overall Analysis of F2F and Asynchronous Learning Environments.

Overall	Formative Completion	Formative Score	Summative Score	Final Score	Correlation A ^a	Correlation B ^b
F2F	5.3E-12	1.7E-16	4.3E-17	2.8E-16	0.04	5.65E-06
Asynchronous	1.0E-09	5.0E-11	1.0E-14	1.8E-14	0.004	5.54E-06

^aCorrelation A: Correlation of Formative Completion/ Summative Score Means

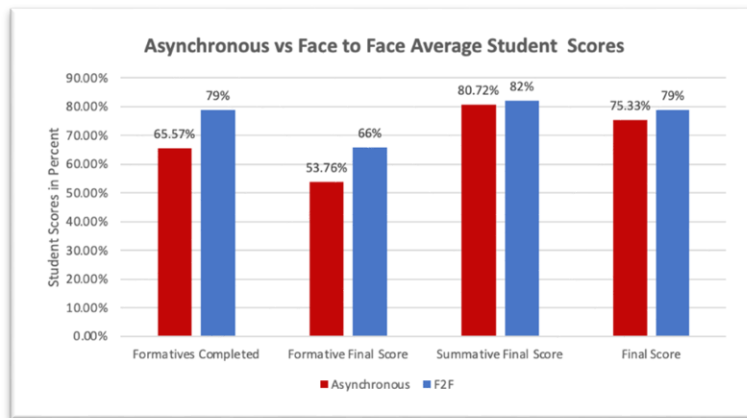
^bCorrelation B: Correlation of Formative Score/ Summative Score Means

*p < .05

Comparisons of means between the learning environments demonstrated the F2F learning environment produced significantly higher formative completions and significantly high formative scores. However, summative score means and final score means demonstrated comparable outcomes with a summative score mean difference of 1.28% and a final score mean difference of 3.64% leaning slightly toward the F2F learning environment. Results of this analysis can be found in Figure 9.

Figure 9

Asynchronous and F2F Student Score Means



Student Background Analysis

Data was further analyzed by student background, specifically by race, to determine if a student's cultural background depicted learning differences in either environment. The average percentage of formative work students in different race categories completed was radically different in both learning environments (Table 8). Students who proclaimed to be of white, Asian, black/African, and Hispanic/Latino origin proved to complete more formative work on average in the F2F than the asynchronous environment whereas students of two or more races completed more formative work on average in the asynchronous environment (Table 8, Figure 10). Two or more races origin performed detrimentally low on the completion percentage of formative work in the F2F environment (demonstrated by both mean and standard deviation), and Hispanic/Latino origin performed detrimentally low on average in the asynchronous environment (demonstrated primarily by mean).

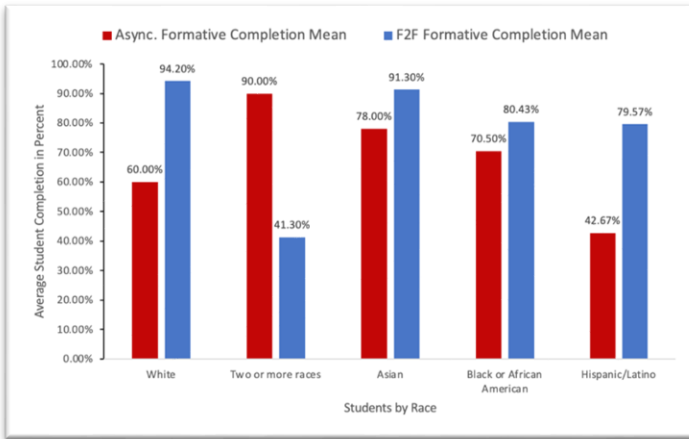
Table 8

Means and Standard Deviations in F2F and Asynchronous Environments by Race.

Race	F2F Avg. Formative Completion		Async. Avg. Formative Completion	
	Mean	SD	Mean	SD
White	94.2	5.02	60	21.59
Two or more races	41.3	9.22	90	14.14
Asian	91.3	-	78	31.11
Black or African American	80.43	20.92	70.5	32.91
Hispanic/Latino	79.57	12.64	42.67	23.44

Figure 10

Average Student Formative Completion by Race in the Learning Environments



The average score on formative assignments continues to demonstrate a similar perspective (Table 9). Students who proclaimed to be of white, Asian, black/African, and Hispanic/Latino origin proved to have higher performance on formative work on average in the F2F than the asynchronous environment whereas students of two or more races proved to have higher performance on formative work on average in the asynchronous environment (Table 9, Figure 11). Again, two or more races origin performed detrimentally low in the F2F environment (demonstrated by both mean and standard deviation), and Hispanic/Latino origin performed detrimentally low on average in the asynchronous environment (demonstrated by both mean and standard deviation). Furthermore, researcher analysis demonstrated students of white origin also performed detrimentally low on formative work in the asynchronous environment in this course (demonstrated primarily by mean).

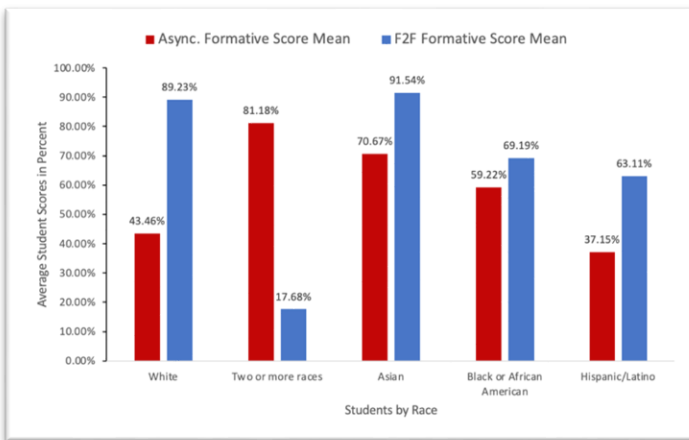
Table 9

Means and Standard Deviations in F2F and Asynchronous Environments by Race.

Race	F2F Avg. Formative Score		Async. Avg. Formative Score	
	Mean	SD	Mean	SD
White	89.23	9.25	43.46	19.07
Two or more races	17.68	15.17	81.18	26.62
Asian	91.54	-	70.67	35.95
Black or African American	69.19	24.45	59.22	29.23
Hispanic/Latino	63.11	20.39	37.15	22.63

Figure 11

Average Student Formative Scores by Race in the Learning Environments



Of further interest, the research noted correlation between average formatives completed and average formative scores. Student groups who completed (or submitted) more of the formative assignments on average in both learning environments were likely to get higher formative scores on average (Table 10).

Table 10

Means and Standard Deviations in F2F and Asynchronous Environments by Race.

Race	F2F Avg. Formative Completion		F2F Avg. Formative Score		Async. Avg. Formative Completion		Async. Avg. Formative Score	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
White	94.2	5.02	89.23	9.25	60	21.59	43.46	19.07
Two or more races	41.3	9.22	17.68	15.17	90	14.14	81.18	26.62
Asian	91.3	-	91.54	-	78	31.11	70.67	35.95
Black or African American	80.43	20.92	69.19	24.45	70.5	32.91	59.22	29.23
Hispanic/Latino	79.57	12.64	63.11	20.39	42.67	23.44	37.15	22.63

In analysis of summative score data, the researcher found students of white, Asian and Hispanic/Latino background performed higher on summative assignments in the F2F environment whereas students with black/African American and two or more races backgrounds performed higher on summative assignments on average in the asynchronous environment (Table 11, Figure 12). Standard deviations of students with black/African American and two or more races backgrounds were high in the F2F environment, and standard deviations of students with white, Asian, and Hispanic/Latino backgrounds were high in the asynchronous environment. This analysis is important to note for a clear depiction of the differences within the student race group.

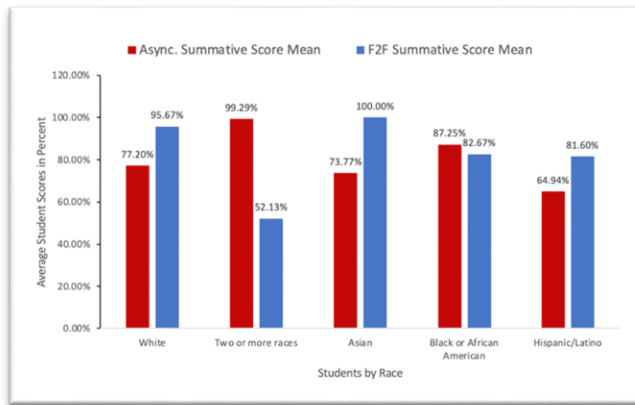
Table 11

Means and Standard Deviations in F2F and Asynchronous Environments by Race.

Race	F2F Avg. Summative Score		Async. Avg. Summative Score	
	Mean	SD	Mean	SD
White	95.67	3.44	77.2	23.55
Two or more races	52.13	41.36	99.29	1
Asian	91.3	-	73.77	34.94
Black or African American	80.43	20.92	87.25	14.41
Hispanic/Latino	79.57	12.64	64.94	33.45

Figure 12

Average Student Summative Scores by Race in the Learning Environments



The overall student performance in both learning environments is best depicted in the overall outcome of the course – *Final Score Mean*. When broken down by student background (race), students of white, Asian, and Hispanic/Latino background were more successful in the Face-to-Face environment whereas students of two or more races or black/African American background were more successful in the asynchronous environment of this course (Table 12, Figure 13). Again, the research found it was important to note the standard deviations of the corresponding means as in many races there was a large standard deviation denoting a large range of final score differences (Table 12).

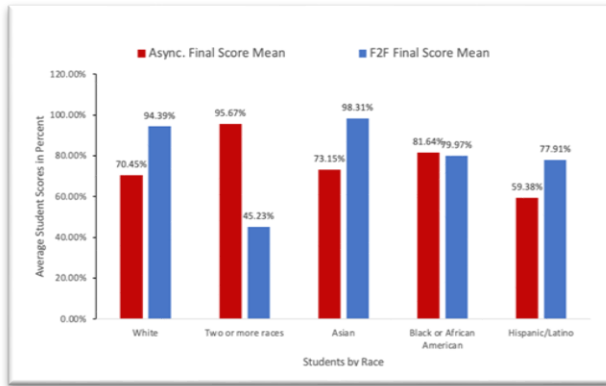
Table 12

Means and Standard Deviations in F2F and Asynchronous Environments by Race.

Race	F2F Avg. Final Score		Async. Avg. Final Score	
	Mean	SD	Mean	SD
White	94.39	1.31	70.45	20.59
Two or more races	45.23	36.12	95.67	6.12
Asian	98.31	-	73.15	35.14
Black or African American	79.97	20.12	81.64	16.5
Hispanic/Latino	77.91	11.37	59.38	28.51

Figure 13

Average Student Final Course Scores by Race in the Learning Environments



Discussion

Summary of Major Findings

This study has aligned with the literature of which has shown there is relatively no impact of the learning environment on overall student performance. Qualitative analysis detailed student confidence additionally remained the same in both courses with only a 1% mean difference between the learning environments in overall student confidence level at midterm and at the end of the course. Still, students in asynchronous courses had slightly higher marks in “teacher demonstration allowed for a deeper understanding,” which researcher notes depicted could be due to abilities to rewatch recorded lecture and step-by-step videos in the asynchronous course – not offered in the F2F course.

Overall, the data in both learning environments demonstrated significantly positive correlation between formative completion/formative scores and summative scores. This informs students who complete more formatives and score higher on their formative work are likely to have higher summative scores in both learning environments. However, when breaking down the course into the typing portion and computer application portion, the research found different results. In both learning environments, the researcher observed the positive correlation between formative and summative outcomes within the typing portion, yet the computer application surprisingly was in contrast. Qualitative analysis in the asynchronous course depicted that students were less likely to complete and submit computer application, formative assessments, and the researcher denoted this was likely due to student unfamiliarity of asynchronous requirements (many students took this as their first asynchronous course), lack of student motivation (students leave campus during their asynchronous hour; do not have personal contact

with educator), and/or lack of student support during the course hour in their schedule (0 hour facilitators are not required to be knowledgeable in the content).

It is important to note a few revelations brought to light for the case of student background influence and the case of correlation between formative and summative outcomes and overall performance in the learning environments. While there was only a 3.64% difference in the final scores between the two learning environments, student performance by culture told a different story. Students of proclaimed white, Hispanic/Latino, or Asian background performed roughly 20% better on average in the F2F environment than the asynchronous environment. Students of proclaimed two or more races background performed around 50% better in the asynchronous environment, and students of proclaimed black/African American background performed about the same in both environments. This could provide reason to accept the literature that points out student background as a leading factor in student performance differences. Furthermore, vast range in the standard deviation of mean final scores could imply more elements within each student's cultural background, such as socio-economic status and student motivation, as other factors in student performance.

Limitations of the Study

There are several potential limitations to this study. Trimester 2 runs through the winter months in Minnesota. It is quite likely results of the study could be affected by inclement weather and holiday travel. Snow Days, days of school cancelled due to weather, reduce the number of F2F days but don't take away days for asynchronous learning. Winter break, which will run from December 21 through January 3, is a time in which families take vacations with their students. Due to travel arrangements students are pulled from school prior to or after winter

break. The absences caused by those vacations can take away from student involvement in both learning environments.

Winter break also tends to cause a distraction for many students in either learning environment simply due to the excitement of having time away from curricular study. Due to this and SAD, students are generally less motivated during this time. SAD (Seasonal Affective Disorder), recognized by Mayo Clinic as a leading cause of Winter Depression, is prevalent in students who are unable to be outside in the winter months (MFMER, 2021).

Students, overall, pose a few different limitations. Student schedules in asynchronous courses do not always align. For some students an asynchronous course period is provided within their school day, but for others the course is an extra-course to their regular 6-period school day. Having an extra course happens when students are trying to graduate early or even on time and can insinuate students are overloaded on their coursework.

Student bodies between both high schools in Bloomington are well-known to be just “built different.” Educators are working tirelessly to close the differences gap, but students in both school high schools, who come together for online learning under the academy, have a range of academic differences in behaviors, motivations, and overall understandings. This can affect the comparison of both learning environments as the F2F environment are only students of one of the high schools. Furthermore, the study is simply not evaluating the exact same group in two different learning environments. Groups of students could be incomparable as not one student learns the same as the next or has the same experience/history in education.

The educator brings their abilities/inabilities to the differing environments daily. Due to lack of experience in asynchronous education and lack of understanding of the student body,

they could lack curriculum, planning, and student supports. In the F2F environment, the educator is still grasping who the student body is – their needs, requirements, and overall understandings.

Finally, students who are in asynchronous learning complete formative assignments and summative tests without educator observation. A variety of factors including using various resources to find answers to summative test questions are inevitable and unavoidable. This could dismiss any correlation between the data of each learning environment entirely.

Further Study

The future of primary and secondary education is likely to continue featuring an online component in all learning environments. Increased need for practical use and knowledge of technology will be required, making internet use a standard resource. School districts will continue to structure and restructure what online education in particular looks like at each level in order to meet the needs of their students in accordance with societal demands. Some districts may choose a hybrid option allowing for both asynchronous/synchronous learning and F2F learning while others may solely choose between synchronous and asynchronous online options.

This study has demonstrated student performance is likely to remain the same in both the asynchronous and F2F learning environments. However, this experience has portrayed many differences when a student's background is recognized. The researcher recommends further research in cultural backgrounds as a determining factor in learning environment success. Other background areas such as socio-economic, demographic, generational lineage of immigration, etc. are recommended areas of exploration.

Future research could also explore long-term effects of asynchronous learning on high school, secondary students as this study was relatively short in nature (13-weeks) and was only inclusive of one academic, elective course. Sustaining research into the impact of learning environments on student performance in different areas of academia could also be beneficial to understand student behavior between core and elective courses. Cultural background's involvement could continue to be monitored throughout these studies as well.

Conclusion

Districts all over the nation and world are facing a demand for asynchronous education in at the secondary level. Educator confidence in asynchronous education is necessary to appropriately fuel the motivation to create rigorous programs that equally push for high student performance and student confidence in learning. Especially in urban communities, in which student backgrounds and understandings collide in the classroom, there must be more well-rounded study done of both the asynchronous and face-to-face learning environments to create foundational understandings that are inclusive of student diversity. This action research study only initiates a lessening of the literature gap.

References

- Adam, S. & Nel, D. (2009). Blended and online learning: student perceptions and performance. *Interactive Technology and Smart Education*, 6(3), 140–155.
<https://doi.org/10.1108/17415650911005366>
- Adeoye, B., & Wentling, R. M. (2007). The relationship between national culture and the usability of an e-learning system. *International Journal on E-Learning*, 6(1). Retrieved February 19, 2023, from <http://www.tandfonline.com/doi/abs/10.1080/1367886042000338245>.
- Bickle, M. C., Rucker, R. D., & Burnsed, K. A. (2019). Online learning: examination of attributes that promote student satisfaction. *Online Journal of Distance Learning Administration*, 22(1).
- Centers for Disease Control and Prevention (CDC). (2023). *YRBSS Data Summary & Trends*. Centers for Disease Control and Prevention. Retrieved March 19, 2023, from https://www.cdc.gov/healthyyouth/data/yrbs/yrbs_data_summary_and_trends.htm
- Clark, H. E. (2020). Perspectives in HRD—online learning: a system of knowledge transfer while building a strong virtual community. *New Horizons in Adult Education and Human Resource Development*, 32(3), 76–81. <https://doi.org/10.1002/nha3.20289>
- Dahlstrom, E., & Bichsel, J. (2014). ECAR Study of Undergraduate Students and Information Technology, 2014. *Educause*.
- Demircoglu, Z. I., & Kose, A. G. (2020). Mediating effects of self-esteem in the relationship between attachment styles and social media addiction among university students. *Dusunen Adam*, 33(1), 8–18. <https://doi.org/10.14744/DAJPNS.2019.00056>
- Di Meo, F., & Martí-Ballester, C.-P. (2020). Effects of the perceptions of online quizzes and electronic devices on student performance. *Australasian Journal of Educational Technology*, 36(1), 111–125.

- Ditton, H., Bayer, M., & Wohlkinger, F. (2019). Structural and motivational mechanisms of academic achievement: a mediation model of social-background effects on academic achievement. *The British Journal of Sociology*, 70(4), 1276–1296.
- Efron, S. E., & Ravid, R. (2020). Action research in education: A practical guide. *The Guilford Press*.
- Fisher, R., Perényi, A., & Birdthistle, N. (2021). The positive relationship between flipped and blended learning and student engagement, performance and satisfaction. *Active Learning in Higher Education*, 22(2), 97-113.
- Fry, R., & Cilluffo, A. (2019). *A Rising Share of Undergraduates Are From Poor Families, Especially at Less Selective Colleges*. Pew Research Center's Social & Demographic Trends Project. Retrieved March 22, 2023, from https://www.pewresearch.org/social-trends/2019/05/22/a-rising-share-of-undergraduates-are-from-poor-families-especially-at-less-selective-colleges/psd_05-22-19_higher-ed-05/
- Glavin, C. (2018). *History of asynchronous learning*. History of Asynchronous Learning | K12 Academics. Retrieved March 18, 2023, from <https://www.k12academics.com/pedagogy/asynchronous-learning/history>
- Gómez-Rey, P., Barbera, E., & Fernández-Navarro, F. (2016). The Impact of Cultural Dimensions on Online Learning. *Journal of Educational Technology & Society*, 19(4), 225–238.
- Gu, X., Wang, H., & Mason, J. (2017). Are they thinking differently: a cross-cultural study on the relationship of thinking styles and emerging roles in computer-supported collaborative learning. *Journal of Educational Technology & Society*, 20(1), 13–24.
- Hanson, M. (2023). *College Enrollment & Student Demographic Statistics*. Education Data Initiative. Retrieved March 22, 2023, from <https://educationdata.org/college-enrollment-statistics#:~:text=66.6%25%20of%20college%20students%20are,olds%20are%20enrolled%20in%20school.>

- Harwood, K. J., McDonald, P. L., Butler, J. T., Drago, D., & Schlumpf, K. S. (2018). Comparing student outcomes in traditional vs intensive, online graduate programs in health professional education. *BMC Medical Education, 18*(1), 240–240. <https://doi.org/10.1186/s12909-018-1343-7>
- Higher Education Statistics Agency (HESA). (2023). *Who's Studying in HE?* Higher Education Statistics Agency. Retrieved March 22, 2023, from <https://www.hesa.ac.uk/data-and-analysis/students/whos-in-he>
- Hurst, B., Wallace, R., & Nixon, S. B. (2013). The Impact of Social Interaction on Student Learning. *Reading Horizons: A Journal of Literacy and Language Arts, 52*(4), 375-398. Retrieved from https://scholarworks.wmich.edu/reading_horizons/vol52/iss4/5
- Klein, A. (2022). *Is remote learning here to stay? yes, but it needs to get better.* Education Week. Retrieved December 18, 2022, from <https://www.edweek.org/technology/is-remote-learning-here-to-stay-yes-but-it-needs-to-get-better/2022/01>
- Kumi-Yeboah, A., Dogbey, J., Yuan, G., & Smith, P. (2020). Cultural diversity in online education: an exploration of instructors' perceptions and challenges. *Teachers College Record, 122*(7).
- Larson, D. K., & Sung, C. H. (2009). Comparing student performance: Online versus blended versus face-to-face. *Journal of Asynchronous Learning Networks, 13*(1), 31-42.
- Liu, X., Liu, S., Lee, S.-hee, & Magjuka, R. J. (2010). Cultural differences in online learning: international student perceptions. *Journal of Educational Technology & Society, 13*(3), 177–88.
- Malik, M. J., & Elahi, M. Z. (2020). Student use of social media, academic performance, and creativity: the mediating role of intrinsic motivation. *Interactive Technology and Smart Education, 17*(4), 403–415. <https://doi.org/10.1108/ITSE-01-2020-0005>
- Marambe, K. N., Vermunt, J. D., & Boshuizen, H. P. A. (2012). A cross-cultural comparison of student learning patterns in higher education. *Higher Education: The International Journal of Higher Education and Educational Planning, 64*(3), 299–316.

- Mayo Foundation for Medical Education and Research (MFMER). (2021). *Seasonal affective disorder (SAD)*. Mayo Clinic. Retrieved December 11, 2022, from <https://www.mayoclinic.org/diseases-conditions/seasonal-affective-disorder/symptoms-causes/syc-20364651>
- Nasution, A. K. P., Surbakti, A. H., Zakaria, R., Wahyuningsih, S. K., & Daulay, L. A. (2021). Face to Face Learning vs Blended Learning vs Online Learning (Student Perception of Learning). *Journal of Physics: Conference Series*, 1783(1), 012112. <https://doi.org/10.1088/1742-6596/1783/1/012112>
- Protection of Human Subjects, 45 CFR Part 46 § 46.104 (2018).
- Selhorst, A. L., Bao, M., Williams, L., & Klein, E. (2017). The effect of online discussion board frequency on student performance in adult learners. *Online Journal of Distance Learning Administration*, 20(4).
- Selvaraj, A., Radhin, V., Nithin, K. A., Benson, N., & Mathew, A. J. (2021). Effect of pandemic based online education on teaching and learning system. *International Journal of Educational Development*, 85, 102444.
- Torchia, R. (2022). *Benefits of technology in the classroom for K-12 schools*. EdTech. Retrieved December 18, 2022, from <https://edtechmagazine.com/k12/article/2022/09/benefits-integrating-technology-todays-k-12-classrooms-perfcon>
- US Department of Education (USDoE). (2022). *Fast Facts: Public and private school comparison*. National Center for Education Statistics (NCES). Retrieved March 22, 2023, from <https://nces.ed.gov/fastfacts/display.asp?id=55>
- U.S. News & World Report. (2022). *Murray County Central Secondary*. US News and World Report. Retrieved March 22, 2023, from <https://www.usnews.com/education/best-high->

schools/minnesota/districts/murray-county-central-school-dist/murray-county-central-secondary-10509

U.S. News & World Report. (2022). *Richfield Senior High School*. US News and World Report.

Retrieved March 22, 2023, from <https://www.usnews.com/education/best-high-schools/minnesota/districts/richfield-public-school-district/richfield-senior-high-school-11031>

Vespa, J., Medina, L., & Armstrong, D. M. (2018). *Demographic turning points for the United States: Population ...* Census.gov. Retrieved March 19, 2023, from

<https://www.census.gov/content/dam/Census/library/publications/2020/demo/p25-1144.pdf>

Wegerif, R. (1998). The social dimension of asynchronous learning networks. *Journal of Asynchronous Learning Networks*, 2(1), 34-49.

Wiesman, J. (2012). Student motivation and the alignment of teacher beliefs. *The Clearing House*, 85(3), 102-108.