STUDENT SUCCESS IN A LARGE-SIZE HYBRID LEARNING COURSE – A STUDY OF STUDENT BACKGROUNDS, ONLINE VIDEO QUIZZES, AND PERSISTENCE

by

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ABSTRACT

ENOCH E. PARK. Student success in a large-size hybrid learning course – A study of student backgrounds, online video quizzes, and persistence. (Under the direction of DR. FLORENCE MARTIN)

The purpose of this study was to identify and examine the potential factors that could predict college students' success in a large-size undergraduate hybrid learning course, offered in a southeastern public university.

Based on a review of the existing literature, the researcher examined the relationship between the students' demographic and academic background variables and their final grades in a large-size hybrid learning course. Next, the students' online video quiz grades and completion records were analyzed to examine the relationship between students' participation and persistence in online learning activities and their final grades. Additionally, students' in-class quiz scores and completion records were analyzed, to examine the relationship between in-class activities and students' final grades in the sample course.

The findings indicated that students' academic and demographic background variables, such as gender, SAT scores, and high school GPA had statistically significant predictive values toward students' final grades. On the other hand, when the online video quiz score was included in the regression analyses as an independent variable, the quiz scores had statistically significant predictive values toward students' final grades.

Further, analyses on students' online video quiz scores and persistence by subgroups were conducted. The results indicated within-group differences and different patterns of participation in the online video quizzes and the in-class quizzes. The data indicated that

most of the sample students completed the online video quizzes persistently, and especially the students who were not highly successful in the course completed beyond the required number of quizzes.

The findings showed that the sample students completed as many low-stakes online learning activities, such as the online video quizzes, that were integrated to the course, and students who were persistent in the quiz managed to follow the pace of the course to be successfully complete the sample course.

Discussions of the findings and recommendations for hybrid learning programs and faculty are included.

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LIST OF ABBREVIATIONS

GPA	Grade Point Average
LMS	Learning Management System
CAO	Chief Academic Officer
SAT	Scholastic Aptitude Test

CHAPTER 1: INTRODUCTION

During the last decade, one of the most dramatic developments in higher education has been the growth of online learning. The number of students who took at least one online learning course has reached over 5.8 million in fall 2014, which is more than one in four students (28 %) among all post-secondary students (Allen & Seaman, 2016). With such a large number of students enrolling in online learning courses, educational researchers have been paying close attention to the effects of online learning courses on student learning, in order to answer whether online learning is equivalent to or more effective than traditional in-class courses. Previous studies compared the differences in student learning outcomes such as average grade, exam scores, student retention, and so forth by classes or sections that are taught face-to-face or online. Studies used various research designs and settings ranging from anecdotal reports of individual classes to large scale empirical studies. While the findings varied between reports of positive and negative effects, studies that found "no significant difference" between the delivery formats constituted a large part among them. In the effort to explain this trend of mixed findings, educational researchers have been paying close attention to identify and discuss potential factors that could affect the study outcomes, such as control of the research experiments, changes in teaching methods, students' background characteristics and preparedness, and course delivery options. Consequently, researchers called for more in-depth studies on the possible effects of online learning on students' achievements, with

closer attention to the factors that may have potential effects on student learning (Jenkins, 2011; Xu & Jaggars, 2011).

In order to control the potential factors that may hinder student learning in the online learning environment and affect their learning outcomes, one of the approaches that researchers have been examining is modifying the course delivery methods to better facilitate student learning, by combining the portions of face-to-face and online instruction into a form of mixed delivery. The mixed delivery method, is often referred to by various names, such as "blended or hybrid instruction", with a substantial proportion of course content delivered online (30%-79%), combined with a reduced number of in-class meetings (Allen & Seaman, 2016). "Blended learning" (Horn & Staker, 2011; Porter, Graham, Spring, & Welch, 2014) and "mixed mode" (Huang, Lin, & Huang, 2012) are also frequently used terms, and are often used interchangeably. As a result, no specific proportion of face-to-face and online components are prescribed or justified, yet (Legon & Garrett, 2018). Recently, another approach, "flipped learning" has been highlighted for the combination of both online delivery of course content and in-class learning activities, with an inversed order of instruction, in which students watch online lecture at home and work on the assignments in class (Davies, Dean, & Ball, 2013). This study used "hybrid learning" to describe a course that integrates both face-to-face and online instruction into an organic design and structure of the course, where the instructional planning overarches both the delivery modes through a course redesign process, instead of simply mixing course delivery and instructional components into a combined course.

Educators are interested in this idea of mixed delivery of instruction, in order to capture the benefits of both face-to-face and online instruction (He, Gajski, Fakas, & Warschauer, 2015; Wu, Tennyson, & Hsia, 2010), to help students learn better (Horn & Staker, 2011), and to increase access for more students (Legon & Garrett, 2018) as an alternative to the dichotomy of course delivery methods between traditional face-to-face instruction and fully online courses. The idea of mixed delivery can also be considered as a potential solution to save physical or fiscal resources such as space, instructional staff, and other campus resources (Porter et al., 2014).

The findings from the studies on hybrid learning approach report mixed outcomes: a good number of studies report an increase in student learning outcomes (Al-Qahtani and Higgins, 2013; Deschacht & Goeman, 2015), while other studies report a decrease in student learning (Drysdale et al., 2013; Xu & Jaggars, 2011), and some report an increase in attrition rate (Ashby, Sadera, & McNary, 2011) in hybrid learning courses. On the other hand, studies report no significant difference in student performance or persistence in the course, as a result of using the hybrid learning format (Bowen, Nygren, Lack, & Chingos, 2013). The findings of "no significant difference" between a hybrid learning course and other formats such as traditional face-to-face or fully online courses, could possibly imply that the influence of the hybrid learning format on student learning may not be significant enough, and students are learning just as much as in any format. However, one perspective that could be pointed out is that the comparisons are made mainly based on the class average of exam scores or final grades as the unit of measurement, instead of individual students' performance data, and often without controlling the complexity of other factors that may have mediating effects (Bowen,

2013; Willging & Johnson, 2009). For example, differences in final grades can be observed among the students who are enrolled in the same hybrid format course but with different levels of achievement in their prior learning. A number of studies report that students with different levels of previous academic achievement perform differently, based on the delivery format of the course. For example, Hachey, Wladis, & Conway (2015) found that students with low prior Grade Point Average (GPA) and students who were unsuccessful in their prior online courses are at high risk of academic failure in their subsequent online courses. Asarta and Schmidt (2017) found that students who attained low prior GPA performed better in traditional face-to-face class, but the students who are studying in the hybrid learning environment indicated a wider gap in their performance. High-achieving students, on the other hand, attained better performance in hybrid learning courses, compared to face-to-face courses. In another study, students who had a record of high, medium, or lower GPA showed different patterns and distributions of performance in hybrid learning courses (Lambert, Parker, & Park, 2015). This trend of different performance patterns by student groups was also noticed in a previous course redesign project conducted preceding the current research (van Wallendael, Siegfried, & Spaulding, 2011). In this context, the effect size of implementing the hybrid learning approach can be reduced, due to the within-group differences among the group of students with different levels of achievement in the course (Asarta & Schmidt, 2017). The reduced effect can then, lead the general findings toward the direction of "no significant effect". If such a trend is found to be common in studies of hybrid learning courses, researchers should examine the within-group differences among the sample students, in order to find the reasons why a certain group of students would be more

successful in the hybrid learning environment while others struggle more, and to guide the student to take the most helpful format of the course, either traditional or hybrid, in which they would work to their best potential.

Statement of the Problem

Some of the factors that may influence students' academic performance in a hybrid learning course include a) students' demographic backgrounds, b) students' academic backgrounds, c) student's participation in online learning activities integrated in the course, and d) students' persistence in completing assignments in hybrid learning courses. For an exploratory investigation of the possible factors that can predict students' success in a hybrid learning course, the current study reviewed the potential factors and examined their predictive values in contribution toward the students' final grades.

Students' Academic Backgrounds

When students take a hybrid learning course for the first time, they need to adjust their learning strategies for the new delivery format, and as a result, students learn and achieve differently in hybrid learning courses than in traditional face-to-face courses where they can use their existing strategies. Students with low prior GPA and students who were unsuccessful in their previous online courses tend to be less successful in subsequent online courses (Hachey, Wladis, & Conway, 2015). Also, Asarta and Schmidt (2017) found that there was a wider gap in students' individual achievement when students who had low pre-course GPA studied in a hybrid learning course, compared to a subsequent face-to-face course, where they performed better.

Students' Participation in Online Learning Activities

Previous studies indicate that students who access the online course content consistently (Baugher, Varanelli, & Weiboard, 2003), and those who access a higher number of course materials that are presented online (Crampton, Ragusa, & Cavanagh, 2012) performed better than those who only access the course site on the learning management system (LMS) infrequently and review only a limited number of course material. Also, students who are more actively engaged in online learning activities are found to be more successful in hybrid learning courses (Zacharis, 2015). While some basic quantitative measures of interaction, such as the total amount of time spent on the course site in the LMS (Kupczynski, Gibson, Ice, Richardson, & Challoo, 2011), or the number of clicks accessing the online content are found to be only weakly correlated to students' performances, it is notable that participation in the online quizzes for example, resulted in a significant effect on students' learning (Mcfadyen & Dawson, 2010; Zacharis, 2015). On the other hand, the amount of delays that students make in submitting assignments in online courses has a negative correlation on their learning outcomes (Cerezo, Sanchez-Santillan, & Paule-Ruiz, 2016). Additionally, the pattern of students' access to the online course site and course materials during the term indicate that students who accessed the course site and read course materials only at the beginning of the term (Hershkovitz and Nachmias, 2011), with delayed access and procrastination (Levy & Ramin, 2012), and decreasing access as the course goes on (Geri, Gafni, and Winer, 2014) are less successful in their achievement in the course or did not even complete the course. Therefore, students' academic background variables, students' record of participation in online learning activities (Zacharis, 2015) and completion

record of the required assignments (Asarta &Schmidt, 2017) can be used as predictive factors or progress indicators, to help faculty allocate timely support for student success in hybrid learning courses.

Frequently, hybrid learning courses use online videos as a main or supplemental course material. Online videos may include publishers' content, curated content from existing online sources, or instructor created videos such as the videos captured from in-class live lecture (Gorissen, van Bruggen, & Jochems, 2012), captured from instructor tablet annotations (Yoon and Sneddon, 2011), or pre-recorded by the instructor (Shah, Cox, and Zdanowicz, 2013). Depending on the course design, students may use the online videos in various ways as part of their learning process. For example, instead of one-way delivery of the online videos as a replacement of classroom lecture, recent studies report increased student achievement when they are engaged in learning activities, such as completing reflective thinking activities (Yilmiz & Keser, 2016), answering open questions at the end of each video lecture (Dupuis, Coutu, & Laneuville, 2013), or taking online quizzes integrated at the conclusion of the lecture videos (Tune, Sturek, & Basile, 2013).

Students' Self-efficacy in Hybrid Learning Course

In online or hybrid learning courses in which students need to put their own effort to learn in the new environment, students' self-efficacy (Bandura, 1994) can be affected by their experience in their prior online courses, toward their subsequent courses (Haverila, 2011). Factors such as students' perception of control on their learning (Hung, Chou, Chen, & Own, 2010), and ownership and autonomy on their learning would

increase self-efficacy (Bandura, 2006), whereas adverse feelings of the required tasks or compulsory course would decrease their self-efficacy (Geri, Gafni, & Winer, 2014).

Purpose of the Research

The purpose of this study was to examine the factors that can predict students' achievement in hybrid learning courses such as: a) students' demographic background variables, b) students' academic background variables, c) students' participation in online activities such as online video quizzes, and d) students' persistence in completing online and in-class learning activities in a hybrid learning course. For an exploratory investigation of the possible factors that can predict students' success in a hybrid course, the current study reviewed and examined the statistical significance of the potential factors and predictive values. In order to examine the potential factors and their relationships with student achievement, students' final grades were compared among different subgroups of students within the same class, based on their demographic and academic backgrounds. Online video quiz scores were also compared as an indicator of students' participation in online learning activities, and in-class quiz scores were analyzed for the relationship between students' persistence in in-class activities and their achievement.

The research questions that guided the study are:

1. To what extent are the students' demographic background variables such as gender and ethnicity, related to final course grades of students who are enrolled in a hybrid learning course in introductory psychology?
2. To what extent are the students' academic background variables such as first year at the university or continuing study, class standings, standard test scores for

admission, high school GPA, and pre-course college GPA, related to final course grades of students who are enrolled in a hybrid learning course in introductory psychology?

3. To what extent is the students' participation in the online video quizzes related to final course grades of students?
4. To what extent are the students' completion of online video quizzes and in-class quizzes related to final course grades of students and persistence in a hybrid learning course in introductory psychology?

Research Design

The current study used quantitative analyses to identify the potential factors that can affect student learning. Student's background variables, online video quiz scores, and in-class quiz scores were analyzed for their predictive value on students' final grades and persistence in the sample course.

Setting

In order to examine the potential factors that affect student success in hybrid learning courses, an undergraduate hybrid learning course offered at a public university located in southeastern United States was used as a sample for this study. A total of 262 students were enrolled in the sample course which was titled *Introduction to Psychology (PSYC 1101).* The course was offered in a hybrid learning format, incorporating online instructional videos and online quizzes to help students check their understanding. The course was redesigned as a hybrid learning course in order to offer an enhanced learning experience to the large number of students who take the course to fulfill the general education requirements or as a required course for psychology major students. As a

result of the course redesign, the record indicated a significant improvement in student retention and final grade, compared to the face-to-face format. This study intended to identify and examine the predictive values of the potential factors that can predict students' success in the sample hybrid learning course.

Data Collection

The study analyzed a set of de-identified individual student data (N=262) from the sample course taught during Spring 2016. Student data included demographic background variables, such as gender and ethnicity, and students' academic background variables such as first year or continuing study at the university, class standing, standard test scores for admission, weighted high school GPA, and pre-course college GPA. Students' online video quiz scores and in-class quiz scores were also analyzed to find the potential relationship and predictive value to the final grades and persistence in the course.

Delimitations

Due to the design of the current study, there were some delimitations that may have influenced the findings of the study. As the scope of this study is limited to a single institution, department, instructor, and course, generalization to the wider range of population cannot be assumed. Also, as the sample data were provided as a convenient source, the backgrounds and characteristics of the sample students may pertain potential biases. Additionally, the researcher's familiarity with the research site (the University) may include potential biases in interpreting and understanding the study findings. As for the structure of the sample course used for the study, the weight of the online video quizzes and in-class quizzes grades calculated toward the final grade were relatively

small (21.6% and 7.8% respectively) and thus the size of variance toward the total final grade.

Summary

This study examined the relationship and predictive values of the potential factors that may be associated with students' learning in a hybrid learning course. From the initial review of the existing literature, a list of potential factors was identified and analyzed, using a set of student records from a large-size hybrid learning course. In particular, the relationship and predictive values of students' demographic and academic background variables with students' final grades were analyzed. Online video quiz scores, as an indicator of participation in online learning activities and in-class quiz scores, as an indicator of participation in in-class activity were analyzed for their predictive values toward the final grade, respectively.

Following the introduction, a review of current literature is presented in Chapter 2, regarding the effects of online course delivery formats on student learning and the discussion on the idea of combining both the online and face-to-face instruction in the hybrid learning platform. The discussion continues with the differences among groups of students with different academic backgrounds studying in hybrid learning courses. The review will address potential factors that have differentiating effects in relationship to the students' background, online video quiz scores, and in-class quiz scores in relationship with their final grades and completion of the course.

In Chapter 3, a description of the research methods used in this study is presented with the research questions and the hypothesis, developed based on the review of

literature. More details are provided regarding the research design, research settings, data collection, and analysis of the collected data.

In chapter 4, the results of data analyses are presented, in response to the research questions established for the study. Results of correlation analyses are presented to show the potential relationship between the variables and final grades. Consequently, students' online video quiz scores were analyzed for the relationship and predictive value toward students' final grades without including the online video quiz scores. Predictive values of other variables were calculated keeping the online video quiz scores separated from the final grades, to see if the variables imply different relationships toward the final grades. To compare the predictive values of the variables in calculation with or without including the online video quiz scores, multiple regression analyses based on standardized scores were conducted. Students' persistence in online video quiz and in-class quiz were examined in relationship with unsuccessful students who received a failing grade or who dropped the course.

In chapter 5, findings from the analyses are discussed in the context of existing studies and in the context of the sample course. Limitations and delimitations of the current study are presented, and future research topics are suggested. The findings and discussions are summarized in the conclusion of the study.

CHAPTER TWO: LITERATURE REVIEW

In the United States, online education has become a significant part of higher education in the last two decades. With the development of new technologies and access to the internet, online education has proliferated. In Fall 2014, over 5.8 million students, which is 28% of total post-secondary students, were enrolled in at least one online course. Among them 2.85 million students were fully online, taking all of their courses online, and the other 2.97 million students were taking some of their courses online (Allen & Seaman, 2016). Also, during the period between 2012 and 2014, for example, the number of students who enroll in at least one online course continued to grow, while the overall total enrollment of students in post-secondary education has decreased. This could mean that not only the number of students who take online courses increases, but fewer students take only face-to-face courses (Allen & Seaman, 2016).

Toward this growing acceptance of online learning, 71.4% of chief academic officers (CAO) surveyed in 2015 consider online education as the same or more effective as face-to-face courses; among them, 41.7% of CAOs at large online programs (more than 10,000 student enrollments) consider online learning as "superior" or "somewhat superior" to face-to-face courses (Allen & Seaman, 2016). On the other hand, CAOs report that a relatively small number of faculty consider online education legitimate and valid, as only 29.1% of CAOs report that their faculty demonstrates positive approval and acceptance for online education. The discussion on the effectiveness of online education

has intrigued educational researchers since the early development of online education, to determine whether online learning is equivalent to or more effective than traditional face-to-face courses, thus justifying the new platform.

Earlier studies often examined whether online learning is equal or better in terms of student learning. Comparison studies were frequently conducted between online and face-to-face classes or class sections, comparing students' average grades, final course grades, retention, or other measures of student learning. The research settings were varied among studies, such as the sample size, single or multiple instructors, different course structures, and control of the experiments (Bowen, 2013). Consequently, the findings were as varied as the research settings and the result was that a good number of studies found "no significant difference" in student learning between the online and face-to-face format. A longer range meta-analysis also found that students who are in online courses outperformed the student in face-to-face courses (Shachar & Nuemann, 2010). On the other hand, many studies report a higher rate of attrition in online learning for various reasons: different characteristics of students, reasons to choose the platform (online or face-to-face), or self-discipline to study independently. Consequently, 44.6% of CAOs across the country expressed concern in retaining students in online courses, more than those who are enrolled in face-to-face courses (Allen & Seaman, 2015). The questions about why more students in online courses would drop out than those who are in face-to-face courses and what factors would affect student learning in online courses would offer an important insight to support students for their success (Jenkins, 2011; Xu & Jaggars, 2011).

In addition to comparing online and face-to-face courses, another approach that researchers have been investigating is combining the portions of in-class and online instruction in a form of hybrid learning or mixed delivery. Instead of comparing the dichotomy of course delivery platforms between online and face-to-face, the mixed delivery method used in hybrid learning courses, could allow students to take the benefits from both approaches (He et al., 2015; Means, Toyama, Merphy, & Bakia, 2013; Owston, York, & Murtha, 2013; Wu, Tennyson, & Hsia, 2010), thus encouraging and facilitating student learning. Also, by controlling the potential factors that may have negative effects on student learning in online courses, students may learn better, instead of struggling to overcome the difficulties. As students take and progress in hybrid learning courses, they would also develop their own perceptions regarding the online content and online activities, which could affect their motivation to persist, progress, or, in some cases, to drop the course.

This review of literature surveys the existing research on the effect of the hybrid learning format, effects of student academic background, students' use of online content, participation in online activities, and persistence in hybrid learning courses. In this context, exploratory study intends to identify and examine the potential factors that can predict students' success in hybrid learning courses.

Hybrid Learning Course

The concept of hybrid learning refers to the integrated use of face-to-face and online instruction, structured on the foundation of instructional design for organic structure and plan of the course. The instructional design overarches both delivery modes, often through a course redesign process, instead of simply mixing course delivery modes

and instructional components. A typical hybrid learning course would include a substantial proportion (30%-79%) of course content delivered online, combined with a reduced number of in-class meetings (Allen & Seaman, 2016), and specific instructional plans for both face-to-face and the online portion of the course. As a result, a course with this mixed mode (Huang et al., 2012) would include online delivery of content, online activities, and in-class activities, at varying proportion and weight, and sometimes in specific order of presentation, such as flipped or inverse order.

As the main intention of the hybrid learning approach is to capture the benefits of both face-to-face and online instruction (He et al., 2015; Wu et al., 2010) in order to help students learn better (Horn & Staker, 2011), the expectation for the approach in facilitating student learning is high, and a growing number of institutions are implementing hybrid learning initiatives in place. Consequently, a recent survey reports that 42.3% of CAOs believe that hybrid learning can offer a better or the same learning experience than fully online courses, and 35.6% of CAOs believe hybrid learning can yield a better or the same experience than face-to-face learning (Allen & Seaman, 2016). A recent survey of 724 senior higher education leaders reported that 82% of their institutions offer hybrid learning courses as a part of innovative effort (Chronicle of Higher Education, 2017). Another survey reports that 71% of faculty members prefer to teach in a hybrid learning course as their preferred format, over 14% in a completely face-to-face learning format and 9% completely online learning format (EDUCAUSE Center for Analysis and Research (ECAR), 2017a).

Additionally, a meta-analysis of studies on online and hybrid learning reports that students in online and hybrid learning had more gain in their learning, compared to face-

to-face learning, and students in hybrid learning course had the largest gain in their learning among the students in all delivery formats (Means, Toyama, Murphy, Bakia, & Jones, 2010), and highest outcomes (Means et al., 2013). However, researchers warn of the risk of "course-and-a-half" phenomenon, where a simple mix of online and face-to-face instruction without appropriate integration of course design and content would end up as an ineffective course (Diaz & Brown, 2010).

Researchers continue examining the effects of hybrid learning, and the findings include students' academic performance, as well as their persistence. Lopez-Perez, Perez-Lopez, and Rodriguez-Ariza (2011) reported that students in hybrid learning courses had increased final grades and reduced dropout rates, and Al-Qahtani & Higgins (2013) reported increased performance among students in hybrid courses, compared to students in traditional and online courses. Students in hybrid learning courses also had improved exam pass rates (Deschacht & Goeman, 2015). On the other hand, other studies reported that students achieved lower grades (Drysdale et al., 2013; Xu & Jaggars, 2011) and there was an increased attrition rate (Ashby, Sadera, & McNary, 2011) in hybrid learning courses. Also, multiple studies reported "no significant difference" in terms of student performance between those who studied in a hybrid learning course and those who were in face-to-face or fully online courses (Adams, 2013; Bowen, Nygren, Lack, & Chingos, 2013; Kakish, Pollacia, Heinz, Sinclair, & Thomas, 2012; Keller, Hassell, Webber, & Johnson*.,* 2009).

Students' Perception of Hybrid Learning

Regarding the course delivery formats, an overwhelming proportion (79%) of undergraduate students prefer to learn in a blended or hybrid learning course, over

completely face-to-face learning courses (9%) and fully online courses (6%) as their best choice (ECAR, 2017b), while the least portion of students would resist face-to-face course (Buzetto-More, 2008).

Additionally, students may perceive that hybrid learning format carries the same inherent strengths and weaknesses as face-to-face and online approach. Jackson and Helms (2008) asked 58 senior-level business students to conduct Strength, Weakness, Opportunities, and Threats (SWOT) analysis on hybrid learning format as they took their course. The students cited flexibility as both a strength and weakness, time and resources as a strength and the lack of interaction with faculty and peer students, and technology needs as a weakness, respectively. On the other hand, a recent survey indicates that when students are offered a choice of a hybrid course as an alternative to a fully online course, 63% of students would consider a hybrid learning course (Aslanian & Clinefelter, 2016), up from the results that 30% of students would consider a hybrid learning course, in the same series of studies conducted two years before (Aslanian & Ckinefelter, 2014). Jones & Chen (2008) reported that students in hybrid courses develop a positive perception about their hybrid learning experiences. Another study (Beatty, 2010) found that the majority of students who are enrolled in a hybrid course expressed their preference for hybrid format for their future courses.

Students in hybrid learning courses perceive high level of utility, motivation, and satisfaction for hybrid learning and achieved increased final grades (Lopez-Perez et al., 2011). In another study with graduate business students, Butz, Stupnisky, Peterson, and Majerus (2014) reported that positive perception of course delivery formats was

significantly correlated with key dimensions of need satisfaction and perceived success in the course.

Students' Academic Backgrounds

While the findings from recent studies on hybrid learning are mixed in results, a common caveat was assumed in several studies – the comparisons of student achievements are made based on the average grades by classes as the unit of measurement, instead of comparing individual student's records. For example, Deschacht and Goeman (2015) pointed that students who enroll in hybrid learning courses have more diverse backgrounds than those who are in traditional face-to-face courses. The difference in students' backgrounds acts as a moderating factor and may influence their academic performance (Huang et al., 2012). Also, Hachey, Wladis, and Conway (2015) found that students with low prior GPA and students who were unsuccessful in a prior online course tend to be less successful in subsequent online courses, compared to face-to-face courses. Other studies reported that prior GPA could be a strong predictor of student success (Ary & Brune, 2011) and retention (Boston, Ice, & Burgess, 2012) in online courses. Additionally, students who had low pre-course GPA performed better in subsequent face-to-face classes, but in hybrid learning courses, there was a wider gap in their individual performance. High-achieving students, on the other hand, attained higher grades in hybrid learning courses (Asarta & Schmidt, 2017). In another study, students who have a record of high, medium, or low pre-course GPA performed differently in hybrid learning courses. For example, students who had low GPA from previous courses were found to make larger gains than those who initially came with high GPA (Brecht & Ogilby, 2008; Dupuis, Coutu, & Laneuville. 2013; Lambert, Parker, & Park, 2015).

As online students study using the online course materials, such as e-textbooks, online videos, or external websites, students with different levels of previous learning experiences made different levels of gain. In Smith-Chant's study (2010), watching online videos did not impact grades significantly, for 'highly resourceful' students or students who already have enough behavioral or emotional skills to handle stressful situations, but if low resourceful students who usually lack such skills watched the videos frequently and with sufficient time, they made significant gains.

When there is a significant gap in gain in student learning, between students who had high or low level of achievement prior to taking a hybrid learning course, simply averaging individual students' gain as a whole class may reduce the size of effect from implementing hybrid learning, as the gap in achievement can level out the effects of hybrid learning format within the same course.

Another area that may affect students' performance is their readiness for taking online or hybrid courses (Hung et al., 2010). In online or hybrid courses, students are expected to take more control and accountability of their own learning compared to traditional courses and navigate in a technology-mediated environment and how students handle the online portion of the course can affect their performance. Students have varying levels of control over their own learning, depending upon their readiness and the learning context (Moore & Kearsley, 2012). In order to improve student performance in online courses, Xu and Jaggers (2013) recommend that colleges should consider implementing at least four distinct approaches such as screening students' initial readiness, scaffolding learning, early warning of risks, and wholesale improvement of the entire campus services.

As online or hybrid learning is mediated by technology for the delivery of the course content and facilitation of interactions in the course, factors that are related to students' technology skills and attitude toward the use of technology are also identified to have significant effects. For example, individual students' level of technology readiness (Andaleeb, Idrus, Ismail, & Mokaram, 2010), internet self-efficacy (Tsai & Tsai, 2003), confidence in online communication (Roper, 2007; Stewart, Harlow, & DeBacco, 2011), and technology anxiety can affect their success. Brindley (2014) found that when students find their first online course to be more rigorous than they have expected, experience difficulty in adjusting to a self-directed approach and the online environment, and lack academic skill sets and a sense of belonging in the course, a large number of students drop their online courses early in the term. Similarly, in a series of surveys conducted over ten years, asking "unsuccessful" students who received an "F" or "W" grade in online courses at a community college in New York, for the highest ranked reason why students thought they were unsuccessful in the course, 19.7% of the students responded that they "got behind and it was too hard to catch up" (Fetzner, 2013). The study also found that students who are older than 25 years old and those who have earned more college-level credit are more successful to achieve a "C" or better grade than those who are younger and have not taken more college courses.

Additionally, in a large scale longitudinal study of over 40,000 community and technical college students in Washington state, Xu and Jaggars (2013) found that male students who are younger in age, black, and with low GPA struggled in online courses. Xu and Jaggars' findings are in line with general findings on male students, as male students were found to have weaker determination for completion of their study and

weaker study habits (Ruffalo Noel Levitz, 2015). Combined with students' individual background variables, the type of courses and type of college may additionally influence students' performance in online or hybrid learning courses. For example, students in remedial courses find difficulty in online courses (Xu & Jaggars, 2011). Ashby, Sadera, and McNary (2011) reported that students in community college developmental math courses had high attrition rate in online or hybrid learning course, with a low success rate (proportion of students who achieve course final grade of 70% or higher) and low scores in tests. The authors warn that the students in community college developmental courses usually show different behaviors than four-year college students and the findings or suggestions from the studies engaging four-year students may not be suitable to be directly applied to the students in community college developmental courses.

Online Videos in Hybrid Courses

In order to present the major course topics or concepts to the students, online video is often used in hybrid learning courses. Researchers have found that students' perceptions on the value of the online video components may have an effect on their motivation to continue in their study and progress in the course (Merhi, 2015). Also, students' perceived usefulness of online videos or multimedia presentations is linked to the students' academic performance (Wei, Peng, & Chou, 2015). For example, when students decide to be more actively engaged in the course and use online videos to learn and review the course content, their decisions can affect their academic performance (Bolt & Koh, 2001) and satisfaction (Shih, 2006).

Instructors often use online videos originating from various sources including original videos created by the course faculty, captured recordings of classroom lectures,

video clips from the textbook publishers, and videos that are published on the web and curated by the course developers to facilitate learning of the target learning objectives. Depending on where the videos come from, there could be inevitable differences in the production quality and level of the content, due to the different purposes and intended audience for which the video content is originally produced. Current literature indicates that students' perception on the videos differ based on the origination of the video content. A recent study found that students in online classes perceived instructor-created videos valuable, and achieved higher grades (Drauss, Curran, & Trempus, 2014). On the other hand, Mandernach (2009) pointed that while students perceived the value of instructor-created videos positively, the positive perception did not necessarily contribute to increase the course outcomes of the students. Mandernach (2009) implies that while instructor-created videos may have significant value, such as to add a sense of personal engagement among students, not all students used the videos as the main source to enhance their academic performance. An interesting aspect from the Shah et al. (2013) study is that students perceived the pre-recorded lectures that are specifically intended for the class most helpful, over classroom exercises and the selected YouTube videos presented to the class as supplemental contents.

Students' interaction and engagement in hybrid learning course can also affect their learning. Chickering and Gamson (1987) suggested that learners would learn better and more, when they are engaged in their own learning process, beyond just listening to the lectures and passively receiving the knowledge transferred to them. Bonwell and Eison (1991) also suggested integrating active learning strategies in the learning process, in which students are involved in the process of learning and reflect on their own learning

through a metacognitive process. In the online learning environment, Anderson (2008) suggested considering three levels of interaction (faculty-student, student-student, & student-content) for effective learning. Therefore, various strategies for active learning and interaction can be applied to facilitate student learning in hybrid learning courses, and interactive use of online videos could be one of the ways to help students succeed.

While some of the earlier studies reported no significant effect of online video content, it is noteworthy that many of the studies reporting no-significant effect (for example, DeVaney, 2009; Kelly, Lying, McGrath, & Cannon, 2009) used online instructional videos as supplements of course lecture, often used for one-way delivery of the contents. On the contrary, several other studies reported increased learning outcomes, when the courses integrated various types of interaction combined with online videos. For example, in Dupuis et al.'s (2013) study, students were asked to answer questions at the end of each video lecture, and the students took lecture notes while watching the video. Yilmiz & Keser (2016) found that online videos followed by reflective thinking activities were most effective for student learning. In Tune, Sturek, & Basile's (2013) study, students learned more in the courses where online quizzes were integrated at the conclusion of lecture videos, compared to the students who are in the courses with standalone online quizzes. In another study (Delen, Liew, & Wilson, 2014), students who used the in-program interactive notetaking feature increased gain in their learning. Comparing the learning outcomes among students who used interactive video, non-interactive video, and no video, Zhang et al. (2006) found that students who used interactive features made significant gain, while students with non-interactive video and

who had no videos did not. He et al. (2015) also concurred that the interactive mode was most effective.

Online Course Materials and Learning Activities

In hybrid learning courses, a portion of the course content material is specifically designed and delivered through online media, often on the institution's learning management system (LMS). Students therefore need to navigate the online environment, review the course content, and participate in the learning activities, to be successful in the course. For example, students can review the online course materials at their own pace to understand the main concepts and topics discussed in the course and prepare for homework and exams (Brecht & Ogilby, 2008) through active participation in the course learning activities (Huang, Lin, & Huang, 2012). Previous studies indicate that students who access the course materials consistently (Baugher, Varanelli, & Weiboard, 2003; Smith-Chant, 2010), and who accessed a higher number of online course materials presented in the course (Crampton, Ragusa, & Cavanagh, 2012) performed better than those who only accessed the online course materials infrequently and reviewed only limited content. In online courses, Willging and Johnson (2009) found that lack of learner interaction was closely linked to drop-out from the course. On the other hand, student inactivity on the online course site had a high predictive value on student grades, as inactive students had a higher risk of failing the course than those who accessed the course site frequently (Fritz & Whitmer, 2017). Analyzing student online activity data, Zacharis (2015) found that student engagement with learning activities, such as reading and posting on discussion boards, emailing and chatting, as well as taking optional online quizzes, was positively correlated to students' success in hybrid learning courses.

Another interesting finding from the study was that the total time logged in the online course site and total clicks in the course site analyzed as basic quantitative measures were only weakly correlated to students' performance, but participation in optional online quizzes had significant effect, similar to the effects of participation in the required quizzes (Mcfadyen & Dawson, 2010).

Additionally, Fritz and Whitmer (2017) reported that students' access to the gradebook and checking on their progress during the course help students improve their grades. As students learn from the online course materials, use of active learning strategies such as highlighting and annotating the e-textbook contents has significant correlation with the final course grade as a predictive factor (Junco & Clem, 2015). In this context, analyzing the student activity data on accessing and using online materials can offer useful hints to understand student learning progress (Martin & Whitmer, 2016), and where to focus the efforts to provide adequate support to the students who would most benefit for their learning, and especially those who might be prone to drop out or fail the course (Siemens, 2013). Additionally, analyses of student participation in online learning activities indicate that although the total amount of time spent online may not show significant effect on students' learning (Kupczynski, Gibson, Ice, Richardson, & Challoo, 2011), the amount of time that students spent on specific online videos (Smith-Chant, 2010), specific tasks, and the amount of delays in submitting assignments shows significant correlation with students' performance (Cerezo, Sanchez-Santillan, & Paule-Ruiz, 2016).

In addition to the simple amount of time as a measurement, Martin and Whitmer (2016) found that when students are presented with smaller amounts of total available

course materials that they can access through an adaptive release of course modules, in which the course materials are presented by time-released order, students spent more focused time in the sequentially presented content. Also, the point of time during the course term when students access the course material is relevant, as students who only access the course site at the beginning of the course would most often end up dropping the course (Hershkovitz & Nachmias, 2011). For example, undergraduate students in compulsory courses would eventually decrease their access to the course site, leading to increased procrastination (Geri, Gafni, and Winer, 2014). Levy and Ramin (2012) found that delayed access and procrastination would increase drop out from the course.

Active Learning in Hybrid Learning Courses

For the online portion of hybrid learning courses, students are expected to take an active role in their learning by reviewing the course materials, participating in the online learning activities, and interacting with the instructor and/ or with peer students, instead of just passively receiving information from the instructor. Through a meta-analysis of 255 studies in science, technology, engineering, and mathematics (STEM) courses, Freeman et al. (2014) found that active learning increases student performance. Whiteside, Garrett Dikkers, & Lewis (2016) reported that high school students in hybrid learning courses took more responsibility for their learning, asked more questions they thought of, and eventually form study habits as they study in hybrid courses. In this case, the hybrid learning format was a factor to encourage students to take more responsibility and initiative for their own learning. Also, students decide their participation in the online portion of the course, based on their motivation and determination. Regarding student's decisions, Deci and Ryan (1985) explain that individuals act upon internal and external

environment to satisfy their basic psychological needs, such as autonomy, competence, and relatedness. In hybrid learning courses, as students assess how the course would help fulfill their needs, they interact with both internal and external factors. It is noteworthy that when students decide their satisfaction and the quality of online course, they do not necessarily relate their decision to the delivery format of the course (Dziuban & Moskal, 2011), and instead, their perception and implicit expectations would affect satisfaction in online learning environment. For example, Dziuban et al. (2015) found that factors related to engaged learning (students' abilities to participate in their learning process) and agency (students' control of their learning experience) significantly influenced student satisfaction in online learning. On the other hand, other studies report that students' ability to assess and monitor their progress, did not significantly affect students' satisfaction. Based on the psychological contract theory (Argyris, 1960), Dziuban et al. (2015) suggested that students would perceive and respond to the expectations in the course, which are implicit between students and the instructor, and the implicit contract would affect their satisfaction, rather than the explicit conditions. As the psychological contract theory suggests that the match in the implicit contract affects the motivation of the workers whether to continue investing their effort, Dziuban et al.'s hypothesis may offer hints about how students' motivation in the hybrid learning environment in this study could be affected through student perceptions.

As students actively make decisions on their own learning in the hybrid learning courses, students' own beliefs about their potential success based on their self-efficacy could also affect their learning (Bandura, 1994). When students set their self-efficacy, several factors can influence their perception. For example, a student's experience in

prior online courses can contribute toward subsequent courses (Haverila, 2011), and when students perceive more control of their learning, with increased ownership and autonomy, they would have increased self-efficacy (Bandura, 2006). The opposite is also noteworthy, that students would have low self-efficacy when they are enrolled in a compulsory course and feeling averse of the required tasks (Geri, Gafni, & Winer, 2014). In this context, how students perceive and position their hybrid learning course could be affected by the experience from their prior courses, especially if it was an online or hybrid learning course, gauging their competence in the course, and how they relate the course for their needs. Ryan and Deci (2000) explain these decisions with the concept of competence and relatedness. In this context, this study attempts to relate students' motivations in pursuing their studies in hybrid learning courses.

Student Motivations in Hybrid Learning Courses

When a student enrolls in a hybrid learning course, the student would also examine his or her academic background to gauge the level of probable success, assess current progress and achievements, and make a commitment to continue in the course. Also, students comport with various needs, from most basic physiological needs to the needs for self-actualization, and strive to meet their needs accordingly. As Maslow (1943) suggested a hierarchy of human needs that determines different levels of motivation, if a student has mismatching needs, he or she will not start or continue working in the class in which they enroll. Additionally, when a student considers starting to study in a course, the student would develop his or her own self-efficacy (Bandura, 1997) which is based on his or her own idea and projection of how well he or she would perform in the course, based on various factors that he or she can relate to. For example,

a student would establish his or her self-efficacy based on successful or unsuccessful work in the previous online or hybrid learning course, his or her self-efficacy will have a preemptive influence whether the student will continue to be successful or not.

As students compare their expectations and assumptions for the course, which is often unwritten and implicit between the instructor and students, their motivation to continue work and invest effort in the course changes. Argyris (1960) explains through his Psychological contract Theory, that an individual student would make his or her own assessment to match the psychological contract and would develop different levels of motivation. At this phase, instead of external or environmental factors, students' internal reaction toward the fulfilled or violated contract would affect their motivation and work.

Further, students' performance will be influenced by their psychological needs in autonomy, competence, and relatedness, in conjunction with the way they find motivation, by intrinsic or extrinsic motivation, or no motivation (being amotivated). Based on the Self-determination Theory, Deci and Ryan (1985, 2000) explained the relationship between different types of motivation and individual's decision on his or her behavior, to meet one's own psychological needs. In the continuum of different levels of regulation - external regulation, introjection, identified regulation, and integration of intrinsic motivation, a person's decision can be influenced (Deci & Ryan, 2000). When individuals find autonomy, competence, and relatedness in their work or tasks, they would find increased level of intrinsic motivation, which in turn can increase the productivity and level of achievement. The self-determination theory provides a useful framework to examine students' motivation in online or hybrid learning courses, where

their motivation can be influenced by the delivery modes of the course, their competency in the course technology, and their perceived relatedness to the real life.

Summary

As online learning has been increasingly adopted in higher education across the country over the last decade, researchers examine the effectiveness of online learning and how the delivery platform influence student learning. Studies also have reported that online learning may not be suitable for all types of students, as some students make the best use of the resources and learning experiences, while some would even risk academic failure taking online learning courses. In lieu of the dichotomy of course delivery in traditional face-to-face format and fully online format, a balanced combination of both face-to-face and online portions of the course has been suggested, to provide better experience or the benefits of both delivery methods. The results from the hybrid learning courses vary, possibly due to several factors that also affect the students' perception, participation, and eventually motivation to work in such courses. Factors such as individual students' demographic or academic backgrounds, different patterns of participation in the online learning activities, and their persistence in active engagement in the course may have a predictive values toward the students' learning and achievement in hybrid learning courses. The current study aims to share an exploratory overview of the factors that may be useful in predicting students' success in hybrid learning courses, and that may facilitate their learning in hybrid learning courses. The following chapter will introduce the design of the study, and how the study was conducted to address the proposed research questions.

CHAPTER 3: METHODOLOGY

Introduction

This chapter introduces an overview of the research methodology, research questions, hypotheses, and research design established for the current study and provides a detailed description of the settings and participants as well as the data collection procedure implemented for the study.

The purpose of this study was to identify and examine the factors that can predict students' achievement in a hybrid learning course such as: a) students' demographic background variables, b) students' academic background variables, c) students' participation in online activities such as online video quizzes, and d) persistence in completing online and in-class learning activities in a hybrid learning course. For an exploratory investigation of the potential factors that can predict students' success in a hybrid course, the current study reviewed and examined the significance of the factors and predictive values.

Research Questions

The following research questions are prepared to address the needs for study in order to identify the potential factors affecting students' achievement and persistence in hybrid learning courses. The factors include student's demographic backgrounds, academic background, online video quiz scores, persistence in participation in online learning activities, and in-class quiz scores contributing toward their learning in a hybrid

learning course. The research questions that guided the study are:

1. To what extent are the students' demographic background variables such as gender and ethnicity, related to the final course grades of students who are enrolled in a hybrid-learning course in introductory psychology?
2. To what extent are the students' academic background variables such as first year at the university or continuing study, class standings, standard test scores for admission, high school GPA, and pre-course college GPA, related to the final course grades of students who are enrolled in a hybrid-learning course in introductory psychology?
3. To what extent is the students' participation in the online video quizzes related to final course grades of students who are enrolled in a hybrid-learning course in introductory psychology?
4. To what extent are the students' completion of online video quizzes and in-class quizzes related to the final course grades and persistence of students who are enrolled in a hybrid-learning course in introductory psychology?

The null hypotheses to test the quantitative research questions are established as:

1. Ho1: There is no significant difference in the final course grades of students who are enrolled in a hybrid-learning course in introductory psychology, based on their demographic backgrounds.
2. Ho2: There is no significant difference in final course grades students who are enrolled in a hybrid-learning course in introductory psychology, based on their academic backgrounds.
3. Ho3: There is no significant difference in the final course grades or persistency of

students who are enrolled in a hybrid-learning course in introductory psychology, based on students' participation in online video quizzes.

4. Ho4: There is no significant difference in the final course grades of students who are enrolled in a hybrid-learning course in introductory psychology, based on students' completion of online video quizzes and in-class quizzes.

Research Design

Through correlation, linear regression, and multiple regression analyses of de-identified student data exported from the sample course, this study located and tested the potential relationship of student background variables, online video quiz scores, in-class quiz scores contributing to final grades, and examined predictive values of the factors toward students' achievement in a hybrid course, as separate variables. Multiple Regression analysis was used to identify the factors, and test the size of effect, in order to identify the predictive value in consideration of the combined factors.

Setting

For this study, the researcher analyzed student records from an undergraduate class offered at a public university located in southeastern United States. The university is a research-intensive public university, with student enrollment over 29,000. Over 23,900 undergraduate students and 5400 graduate students were enrolled as of the Spring 2017 semester; among them 53.2% are male and 46.8% female. Student data from a large size hybrid course was extracted for analyses. The course, *Introduction to Psychology (PSYC 1101)*, enrolls about 300 students per section and is offered in hybrid format, incorporating online instructional videos and online quizzes to help students check their understanding. The course is structured with online sessions and face-to-face sessions

alternating during the week, where students learn the topical contents online, and follow up with in-class activities and assessments. The Center for Teaching and Learning at the university led large class redesign projects, and the Department of Psychological Science participated in the project to offer an enhanced learning experience to the large number of students that the course serves. During the course development process, a group of faculty members were assigned to review the curriculum development. The curriculum development team had located three series of videos that could be used in the course. The team reviewed each of the video series, with the criteria of 1) topical match between the course and the videos, 2) level of interactivity to engage the students, 3) length of the video clips, and 4) general attractiveness to the students. Based on the review, the team selected the current set of videos for the course, as the videos were matching tightly with the course topics, included online quizzes immediately following the clips, were short in length (less than 5 minutes per clip), and appeared professional and interesting to keep the students' attention.

The course serves as part of the general education requirements for students who are not majoring in Psychology and as a required course for those who major in Psychology. Initial redesign of the course indicated positive outcomes in student learning, so the course has continued to be offered in hybrid format. At the pilot stage in Spring 2011, the hybrid learning course indicated reduced percentage of students (30%) who received D, F, or W grades, compared to the traditional face-to-face section of the course (38%) (van Wallendael, Siegfried, & Spaulding, 2011).

On the other hand, other courses that were redesigned as hybrid courses in the initial project, in other departments or disciplines, found varying results. The findings

from the pilot project invited questions regarding which factors affect students' success in hybrid course format, leading to the different results.

Participants

With the approval from the institutional review board (IRB) of the university and the Department of Psychological Science (the Department), a set of de-identified individual student data of 262 students enrolled in a typical section of PSYC 1101 in the hybrid learning format during Spring 2016 was analyzed for this study. Student data included students' demographic data, first year at the University, class standing (freshmen-senior), major (if declared or undecided). The academic background data included standard test scores for entrance to the college, pre-course college GPA, weighted high school GPA, online video quiz scores, in-class quiz score, and final grades on a 4.0 scale. Freshmen students consisted of about half of the students (128 among 262 students), then sophomores, and finally a small number of upper level students.

For the current study, convenience sampling is used to collect student data. The course used for the study was offered at the same institution the researcher attended, and the Department agreed to provide access to the relevant records. Although convenience sampling has some limitations, the sampling technique provided an adequate data set for this exploratory study.

Data Analysis Procedures

In order to address the proposed research questions and hypotheses, quantitative data analysis methods were used:

1. Descriptive analysis of demographic and academic backgrounds of the students in the sample course included distribution of students' gender and ethnicity, standard test

scores, pre-course college GPA, weighted high school GPA, class standing, major, online video quiz scores, in-class quiz scores, and final grades in a 4.0 scale.

2. To examine the relationship between students' demographic and academic background variables and their final course grade, Analysis of Variance (ANOVA) procedures, and multiple regression analyses were conducted to identify the potential factors that have significant effect.
3. To examine the relationship between students' online video quiz scores and their final course grades, linear regression analyses were conducted.
4. To examine the relationship between students' in-class quiz scores and their final grades, linear regression analyses were conducted.
5. Multiple regression analyses were conducted to test any combined effects among the factors, in relationship with the final grades.
6. In order to compare the predictive values of the combined factors, with or without considering online video quiz scores as a separate factor, results of standardized regression analyses were compared.

Delimitations

The setting and design of the current study may imply some delimitations that could influence the findings of the study. Since this study is conducted using the student record of a single institution, a department, and a course, generalization to the wider range of population cannot be assumed. Also, as the sample data were from a convenient source, where the researcher was granted access, the researcher's familiarity to the research site (the University) and setup (a large urban public institution) may embed assumptions of given situations.

As for the structure of the sample course, the proportional weight for the online video quiz and in-class quiz reflecting the chapters of the course textbook assigned during the online portion of the course were relatively small and thus the size of variance toward the total final grade may reduce the potential size of effect. The weight was intentionally set to be small in the course design, with the aim of having students study on the topics of the course, encouraging their persistency by frequently checking their progress and being aware of their progress in learning.

Ethical Considerations

The students in the sample class were not exposed to the risk of revealing personally identifiable confidential information, nor to any physical or psychological threats during this study. During the data collection, no individual contacts were made. De-identified data were accessed only by the researcher and the advisers and kept secure.

Summary

This chapter presented the purpose of the study, established research questions and hypotheses, explained research design, setting, participants, data collection procedures, data analysis procedures, and addressed the potential limitations of the study and ethical considerations.

The study used quantitative analyses to identify the potential factors, based on students' background variables, online video quiz scores, in-class quiz scores which can affect students' learning outcomes and persistence. Low performing students' records of course grades (final grade of a D grade), unsuccessful students' records of course grades (marked as an F grade), withdrawal records (marked as a W grade), online video quiz scores and number of quizzes taken, in-class quiz scores and number of quizzes taken

were also analyzed. Individual factors and their predictive values were examined, as well as their predictive values in combination of multiple factors.

For this purpose, student data from a large-size hybrid learning course at an urban public university were analyzed. The findings from the analyses of student academic background variables, online video quiz scores, and in-class quiz scores in relation to the final course grades and drop out records are presented in Chapter 4. Chapter 5 presents the conclusion from the findings of this study, as well as the discussions, interpretations, and implications of the findings.

CHAPTER 4: RESULTS

Students Demographic Backgrounds

Table 1 presents the distribution of the students in the sample section of the course (PSYC 1101) by gender and ethnicity. Among the 169 first-year students whose student records included demographic data available for analyses, there were 92 female students (54.4%) and 77 male students (45.6%). Also, 108 students identified themselves as Caucasian (63.9%), 24 students as African Americans (14.2%), 11 as Hispanic (6.5%), and 9 as Asian or Pacific Islanders (5.3%). These four groups of students comprised for 89.9% of the whole section.

Table 1

Student Population by Gender and Ethnicity

Variables	Category	n	%
Gender	Female	92	54.4
	Male	77	45.6
Ethnicity	African American	24	14.2
	Asian or Pacific Islander	9	5.3
	Caucasian	108	63.9
	Hispanic	11	6.5
	International	5	3.0
	Native American	2	1.2

Table 1 (Continued)

Variables	Category	n	%
	Any 2 or more races	6	3.6
	No response	4	2.4
Totals		169	100.0

Students' Academic Backgrounds

Table 2 shows the distribution of the students by class standing. Among the 169 first-year students, the majority of students were freshmen (n=128, 75.7%), followed by 22 sophomore new-transfer students (13.0%), and 10 freshmen-transfer students (5.9%). There were 9 students in other years of study (5.3%).

Table 2

Student Population by Class Standing

Variables	Category	n	%
Year of Study	Freshmen	128	75.7
	Freshmen New Transfer	10	5.9
	Sophomore New Transfer	22	13.0
	Junior New Transfer	5	3.0
	Readmit	2	1.2
	International visitors	2	1.2
Totals		169	100.0

Regarding the students' intended course of study and declared majors (for upper year students), Table 3 shows the distribution of the sample students by their course of

study or declared majors. Among the first-year students, 54 students were studying in the University College (32.0%), 50 were in Pre-Business (29.6%), and 11 were in Pre-Communication (6.5%). Among the upper year students, nine students have declared their major as Psychology (5.3%), four as Computer Science (2.4%), three students (1.8%) in History, Political Science, Social Work Lower Division each, and two students (1.2%) were undecided. Therefore, it is notable that there was a large number of students who were studying in University College, Pre-Business, and Pre-Communication among lower year students totaling 68.1%, and 5.3% were majoring in Psychology among upper year students.

Table 3

Student Population by Course of Study or Declared Major

Variables	Category	n	%
Course of Study	Pre-Accounting	5	3.0
	Pre-Biology	2	1.2
	Pre-Business	50	29.6
	Pre-Communication	11	6.5
	Pre-Criminal Justice	3	1.8
	Pre-Economics	3	1.8
	Pre-Elementary Education	1	0.6
	Pre-Public Health	1	0.6
	Pre-Special Education	2	1.2
	University College	54	32.0

Table 3 (Continued)

Variables	Category	n	%
Declared Majors	Africana Studies	1	0.6
	Biology	1	0.6
	Computer Science	4	2.4
	Dance	1	0.6
	English	1	0.6
	History	3	1.7
	Health Exploration	2	1.2
	International Studies	2	1.2
	Math for Business	1	0.6
	Math	1	0.6
	Political Science	3	1.8
	Psychology	9	5.3
	Sociology	1	0.6
	Spanish	1	0.6
	Social Work Lower Division	3	1.8
	Theater	1	0.6
	Undecided	2	1.2
Totals		169	100.0

For standard test scores required for admission, Scholastic Aptitude Test (SAT) scores from the student records were analyzed. Table 4 displays the average scores and standard deviation by the SAT sections.

Table 4

Average SAT Scores by Section

SAT Sections	Minimum	Maximum	Mean	SD	n
Verbal	390	660	527.2	53.5	105
Math	390	740	531.1	58.7	105
Writing	380	700	521.8	59.9	105

In order to test the normality of the SAT scores, a Shapiro-Wilk test was conducted, as the data was less than 2000 cases. The test result indicated that all sections of SAT scores of first-year students were normally distributed ($p > .05$)

Final Grades

The students' final grades were calculated from a total of 765 points as a sum of points earned from course components and optional extra credit of up to 60 points (3 extra credit assignments with 20 points each). As a result, two students achieved a total score of 787 (102.9%) and 785 (102.6%), exceeding the maximum points. These two students were considered as outliers and removed from the analyses. The course components included 36 online video quizzes, which were weighted for 165 total points (21.57%), calculated out of the best 33 scores over 36 quizzes, 5 points for 5 questions for each quiz, and with 2 attempts allowed for the highest score. The course also included 10 in-class quizzes using an electronic personal response system (also known as clickers), with 6 points each, totaling 60 points (7.84%) toward the final grade.

The average of final grades (N=260) was 642.3 points (84.0%) out of 765 points, with a median of 652.5 (85.3%) and standard deviation of 62.6 points. The average of

total grades, not including the online video quiz scores, was 485.6 (80.9%) out of 600 points, with a median of 494.5 (82.4%) and standard deviation of 56.7 points. The average difference between total points with or without online video quiz scores was 147.8 out of 165 points.

To test the normality of distribution in the final grades, Shapiro-Wilk tests were used on the final grades with or without online video quiz scores and the online video quiz scores, respectively. The scores were negatively skewed with light-tailed distribution, and the null hypotheses for normality of distribution were rejected ($p < .05$).

Research Question 1. To what extent are the students' demographic background variables such as gender and ethnicity, related to the final course grades of students who are enrolled in a hybrid-learning course in introductory psychology?

Analysis on Gender

Among the 260 students who were enrolled in the sample course, background data from the first-year students (n=169) was available for analyses. Of the 169 students, 92 students identified themselves as female, and 77 as male. Background information of the students who were not in their first year (n=91) was not available. Table 5 shows the comparison of final course grades by gender. The average final grade of female students was 28.8 points (3.7% out of the total 765 points) higher than male students' average, with a 9.0 points smaller standard deviation.

Table 5

Comparison of Final Grades by Gender

Gender	Mean	Standard Deviation	Minimum	Maximum	N
Female (First Year)	654.3	58.1	481	759	92
Male (First Year)	625.5	67.1	464	758	77
Total	641.2	63.8	464	759	169

To examine the mean differences in final grades by gender, an ANOVA was conducted. The assumption of homogeneity was met: Levene's $F(1, 167) = 1.9$, $p = .167$. The ANOVA result (Table 6) indicated that there was a statistically significant difference between the groups $F(1, 167) = 8.9$, $p = .003$. The results indicated that female students outperformed male students at a statistically significant level.

Table 6

Summary of ANOVA - Difference by Gender

	Sum of Squares	*df*	Mean Square	*F*
Between Groups	34736.4	1	34736.4	8.9*
Within Groups	649940.3	167	3891.9	
Total	684676.7	168		

* $p < .05$

Ethnicity

Among the students who identified their ethnicity, 154 students identified themselves in one of the four groups: African American (24), Asian or Pacific Islander (9), Caucasian (108), and Hispanic (11). Table 7 shows the comparison of final grades

by ethnicity.

Table 7

Comparison of Final Grades by Ethnicity

Ethnicity	Mean	Standard Deviation	Minimum	Maximum	N
African American	629.1	66.8	520	756	24
Asian	637.8	49.5	573	749	9
Caucasian	646.1	64.9	464	759	108
Hispanic	641.7	61.0	504	714	11
Total	642.61	63.9	464	759	152

To examine the difference among the groups, one-way ANOVA was conducted. Since the four groups comprised 89.9% of the sample, and the differences in the sample size by the groups were too large to make the comparison statistically less valid (for example, comparison of Caucasian students (n=108) with Native American students (n=2)), the other groups were not included in the comparison, and the harmonic mean sample size of 15.8 was used for calculation. The assumption of homogeneity was met: Levene's $F(3, 148) = .63$, $p = .56$. The ANOVA result (Table 8) indicated that there was no statistically significant difference in final grade between the students with different ethnic backgrounds, $F(3, 148) = .477$, $p = .699$.

Table 8

Summary of ANOVA - Difference by Ethnicity

	Sum of Squares	*df*	Mean Square	*F*
Between Groups	5892.9	3	1964.3	.477
Within Groups	609741.4	148	4119.9	
Total	615634.3	151		

Research Question 2: To what extent are the students' academic background variables such as first year at the university or continuing study, class standings, standard test scores for admission, high school GPA, and pre-course college GPA, related to the final course grades of students who are enrolled in a hybrid-learning course in introductory psychology?

First Year vs. Continuing Study Students

Among the sample students, 169 students were attending the course in their first year at the university, and 91 students were continuing in their study. Table 9 shows the comparison of final grades by students' year of study at the university.

Table 9

Comparison of Final Grades by Year of Study at the University

Academic Experience	Mean	Standard Deviation	Minimum	Maximum	N
First Year	641.9	63.8	464	759	169
Continuing Students	644.3	60.4	482	750	91
Total	642.3	62.6	464	759	260

To test if there was any difference based on students' academic experiences in the university, one-way ANOVA was conducted, comparing differences in means between the students who were in their first year at the university and those who are continuing in their study. The assumption of homogeneity was met, Levene's F (1, 258) = .056, p = .814. The ANOVA result (Table 10) indicates that there was no statistically significant difference between the groups, F(1, 258) = .151, p = .698.

Table 10

Summary of ANOVA - Difference by Year of Study at the University

	Sum of Squares	*df*	Mean Square	*F*
Between Groups	591.82	1	591.8	.151
Within Groups	1013279.1	258	3927.4	
Total	1013870.9	259		

Additionally, among the first-year students, those who transferred to the university and those who started as freshmen may show a difference in their final grades. Table 11 displays a summary of the descriptive data on final grades among the students in their class standing.

Table 11

Comparison of Final Grades by Class Standing

Grade Year	Mean	Standard Deviation	Minimum	Maximum	N
Freshmen	643.9	64.5	464	759	128
Fresh Transfer	609.4	78.6	505	710	10

Table 11 (Continued)

Grade Year	Mean	Standard Deviation	Minimum	Maximum	N
Sophomore Transfer	650.9	49.0	534	757	22
Junior transfer	629.6	72.2	530	732	5
Readmit	600.0	76.4	546	654	2
International	587.5	14.8	577	598	2
Total	642.02	63.8	464	785	169

To test if there were differences in final grades among students at different years of study, a one-way ANOVA was conducted. The assumption of homogeneity was met, Levene's $F(5, 163) = 1.23$, $p = .30$. The ANOVA result (Table 12) indicated that there was no statistically significant difference between the groups $F(5, 163) = 1.13$, $p = .35$.

Table 12

Summary of ANOVA - Difference by Class Standing

	Sum of Squares	*df*	Mean Square	*F*
Between Groups	22969.538	5	4593.908	1.132
Within Groups	661707.137	163	4059.553	
Total	684676.675	168		

SAT Test Scores

For the first-year students, SAT scores at their admission were available for analyses. To examine the relationship between the test scores at their admission and final grades in the sample course, a correlation analysis was conducted. The result of the

correlation analysis (Table 13) showed that a significant correlation was found between SAT Writing scores and the final grades ($p < .01$), while scores in other sections (SAT Verbal and Math) indicated no statistically significant correlation.

Table 13

Correlations Between SAT Section Scores and the Final Grades

SAT Sections	Pearson Correlation (Final Grade)	Sig (2-tailed)	N
Verbal	.05	.628	105
Math	.15	.116	105
Writing	.31**	.002	105

Note. **p < .01 level

Since SAT Writing scores were correlated with the final grades, a linear regression analysis was conducted to examine the predictive value of SAT Writing score toward the final grades. The result of the linear regression analysis (Table 14) was statistically significant $F(1, 103) = 10.63$, $p = .002$.

Table 14

ANOVA Model Summary - Difference in Final Grades by SAT Writing Score

	Sum of Squares	df	Mean Square	F
Regression	39643.86	1	39643.86	10.63
Residual	384203.61	103	3730.13	
Total	423847.47	104		

Note: $p < .01$

The predicted final grade can be calculated as:

Final Grade = 471.10 + (.33 x SAT Writing) (Table 15).

Table 15

ANOVA Model Coefficients – Difference in Final Grades by SAT Writing Score

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig
		B	Std. Error	Beta		
1	(Constant)	471.10	52.51		8.97	.000
	SAT Writing	.33	.10	.31	3.26	.002*

Note: $p < .01$

The coefficient of determination (R Square) indicated that the variance in SAT Writing score can be accountable for 9.4% of variance in the final grades (Table 16).

Table 16

Model Summary of SAT Writing Scores and Final Grades

Model	R	R square	Adjusted R Square	Std. Error of the Estimate
1	.31[a]	.094	.085	61.08

a. Predictors: (Constant), SAT Writing

Weighted High school GPA

Among the first-year students whose weighted high school GPA was available for analysis (n=128), a correlation analysis was conducted to examine the relationship between the test scores at their admission and final grades in the sample course. The result of the correlation analysis showed that a significant correlation ($r = .39$) was found

between weighted high school GPA and the final grades ($p < .001$).

Based on the correlation between the students' weighted high school GPA and their final grades, a linear regression analysis was conducted to examine the predictive value of weighted high school GPA toward the final grade. The result of the linear regression analysis (Table 17) was statistically significant $F(1, 126) = 22.78$, $p < .001$.

Table 17

ANOVA Model Summary - Difference in Final Grades by Weighted High School GPA

	Sum of Squares	*df*	Mean Square	*F*
Regression	79244.54	1	79244.54	22.78*
Residual	438338.42	126	3478.88	
Total	517582.96	127		

Note: $p < .001$

The predicted final grade can be calculated as:

Final Grade = 449.53 + (51.72 x weighted high school GPA) (Table 18)

Table 18

ANOVA Model Coefficients – Difference in Final Grades by Weighted High School GPA

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig
		B	Std. Error	Beta		
1	(Constant)	448.84	40.64		11.05	.000
	Weighted HS GPA	51.17	10.72	.39	4.77	.000**

**Note: p<.001

The coefficient of determination (R Square), indicated that the variance in SAT writing score was accountable for 15% of variance in the final grade (Table 19).

Table 19

Model Summary of Weighted High School GPA and Final Grades

Model	R	R square	Adjusted R Square	Std. Error of the Estimate
1	.39[a]	.15	.15	58.98

a. Predictors: (Constant), Weighted HS GPA

Pre-course College GPA

Among the first-year students in the sample, 41 students who had previously taken college level courses prior to taking the sample course had their pre-course GPA included in their student record. To examine if there is a difference in students' final grades based on the pre-course GPA, a correlation analysis was conducted. The result indicated that there was a weak positive correlation (r = .297) between the pre-course GPA and final grades; however, the correlation was not statistically significant (p = .059).

Background Variables in Multiple Regression Analysis

Based on the results of the correlation and linear regression analyses, gender was the only demographic background that revealed significant difference. As for the students' academic backgrounds, significant differences were found among first-year students, based on their SAT Writing score and weighted high school GPA.

To examine the contribution of student background variables (gender, first year at the university, weighted high school GPA, pre-course college GPA, SAT Verbal, SAT

Math, and SAT Writing) in predicting the final grade, a multiple regression analysis was conducted. During the calculation, the variables with missing correlations with the final grades, first year at the university and pre-course college GPA, were removed from the calculation. Also, the SAT scores were found to have high VIF and one of the redundant variables, SAT Math scores, was removed from the model, while preserving the value of the coefficient of determination.

The predicted contribution of the background variables was statistically significant $F\ (4, 123) = 8.05$, $p = .000$.

The result of the multiple regression analysis (Table 20) indicated that weighted high school GPA, SAT Verbal, and SAT Writing scores had statistically significant ($p < .05$) predictive value.

Table 20

ANOVA Multiple Regression Model Summary - Difference in Final Grades by Background Variables

	Sum of Squares	*df*	Mean Square	*F*
Regression	103180.37	4	25795.09	8.05
Residual	393968.70	123	3203.0	
Total	497149.07	127		

Note: * $p < .01$

Based on the data, the predicted contribution can be calculated as:

Predicted final grade = 486.26 + (-13.93 x Gender) + (-.23 x SAT Verbal) + (.23 x SAT Writing) + (43.58 x Weighted HS GPA)

Table 21

ANOVA Multiple Regression Model Coefficients - Difference in Final Grades by Background Variables

	Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig
		B	Std. Error	Beta		
1	(Constant)	486.26	44.40		10.95	.000
	Gender	-13.93	10.58	-.11	-1.32	.190
	Weighted HS GPA	43.58	10.78	.34	4.04	**.000**
	SAT Verbal	-.23	.09	-.77	-2.45	**.016**
	SAT Writing	.23	.09	.77	2.45	**.016**

Note: $p < .01$

The coefficient of determination (R Square), indicated that the variances in the variables (weighted high school GPA, SAT Verbal, and SAT Writing scores) were accountable for 21% of variance in the final grade (Table 22).

Table 22

Multiple Regression Model Summary - Difference in Final Grades by Background Variables

Model	R	R square	Adjusted R Square	Std. Error of the Estimate
1	.46[a]	.21	.18	56.60

a. Predictors: (Constant), Gender, SAT verbal, SAT Writing, Weighted High School GPA

Since students' background variables that carried significant predictive values were available for first year students, a separate multiple regression analysis was conducted with only first year students to increase accuracy of the predictive model. First, multiple imputations (Rubin, 1987) were conducted 40 times to impute missing values in weighted highs school GPA (missing 41cases), SAT Verbal, SAT Math, and SAT Writing (missing 64 cases respectively). The variables with missing correlations with the final grades (first year at the university and pre-course college GPA) were removed from the calculation. The predicted contribution of the variables was statistically significant F (5, 5219) = 284.58, $p < .000$.

The result of the multiple regression analysis (Table 23) indicated that gender, weighted high school GPA, SAT Verbal, SAT Math, and SAT Writing scores had statistically significant predictive values. For all variables, collinearity tests were conducted, and the highest level of the VIF did not exceed 1.50.

Table 23

Multiple Imputation Multiple Regression Model Coefficients – Gender, Weighted High School GPA, SAT Verbal, SAT Math, & SAT Writing

	Model	Unstandardized Coefficients		t	Sig
		B	Std. Error		
1	(Constant)	404.12	10.19	39.66	.000
	Gender	-16.13	1.73	-9.36	**.000**
	Weighted High School GPA	40.31	1.74	23.12	**.000**

Table 23 (Continued)

Model	Unstandardized Coefficients		t	sig
	B	Std. Error		
SAT Verbal	-.13	.02	-7.88	**.000**
SAT Math	.09	.01	6.33	**.000**
SAT Writing	.21	.02	14.63	**.000**

Base on the data, the predicted contribution can be calculated as:

Predicted final grade = 404.12 + (-16.13 x Gender) + (-.13 x SAT Verbal) + (.09 x SAT Math) + (.21 x SAT Writing) + (40.31 x Weighted HS GPA)

Research Question 3. To what extent is the students' participation in the online video quizzes related to final course grades of students who are enrolled in a hybrid-learning course in introductory psychology?

In the sample course, students watched 36 short, online videos and took online video quizzes for five points each. The highest 33 scores were counted toward the final score. In order to examine the relationship between the online video quiz scores toward the final grades, a correlation analysis was conducted between the online video quiz scores and final grade without the online video quiz scores included (600 total points). The result of the correlation analysis (N = 260) showed that there was a medium positive correlation ($r = .454$, $p < .001$) between the scores.

Based on the correlation, a linear regression analysis was conducted to examine the predictive value of online video quiz scores toward the final grade without the online

video quiz scores included. The result of the linear regression analysis (Table 24) was statistically significant $F(1, 258) = 67.07$, $p < .001$.

Table 24

ANOVA Model Summary – Difference in Final Grades without Online Video Quiz Scores by Online Video Quiz Scores

	Sum of Squares	*df*	Mean Square	*F*
Regression	172083.62	1	172083.62	67.07
Residual	661917.44	258	2565.57	
Total	834001.06	259		

Note: p<.001

Based on the data (Table 25), the predicted final grade without online video quiz scores can be calculated as:

Final Grads without Online Video Quiz Scores = 121.40 + (2.33 x Online Video Quiz Scores).

Table 25

ANOVA Model Coefficients - Difference in Final Grades without Online Video Quiz Scores by Online Video Quiz Scores

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig
		B	Std. Error	Beta		
1	(Constant)	121.40	44.58		2.72	.007
	Online Video Quiz Score	2.33	.28	.45	8.19	.000

Note: p<.001

The coefficient of determination (R Square), indicated that the variance in online video quiz scores was accountable for 21% of variance in the final grade without online video quiz scores (Table 26).

Table 26

Model Summary - Difference in Final Grades without Online Video Quiz Scores by Online Video Quiz Scores

Model	R	R square	Adjusted R Square	Std. Error of the Estimate
1	.45[a]	.21	.20	50.65

a. Predictors: (Constant), Online Video Quiz Scores

Difference in Student Subgroups by the Final Grade Quartiles

The results of the correlation analysis showed that there was a statistically significant relationship between the online video quiz scores and the final grade without the quiz scores among the students as a whole class. In order to examine if there is a difference in the online video quiz scores among the groups of students who have achieved high or low in their final grades, students were first divided by the quartiles based on their final grades (total 765 points), and their scores in online video quizzes were compared. Table 27 shows the comparison of the means of online video quiz scores by the quartiles. Among these quartile groups, the first group had the widest range in the online video quiz score (64 points difference between the lowest and highest scores) and biggest standard deviation (15.665).

Table 27

Comparison of Online Video Quiz Scores by Final Grade Quartiles

Quartiles	Mean	Standard Deviation	Minimum	Maximum	N
Fourth Quartile	163.0	3.73	147	165	65
Third Quartile	160.5	5.52	141	165	65
Second Quartile	156.8	6.66	137	165	65
First Quartile	146.4	15.67	101	165	65
Total	156.66	11.09	101	165	260

In order to examine the differences among the students grouped by the quartiles in the final grade, one-way ANOVA was conducted. The assumption of homogeneity was not met, Levene's (3, 256) = 45. 12, $p < .001$. The ANOVA result (Table 28) indicated that there was a statistically significant difference among the groups $F(3, 256) = 41.75$, $p < .001$.

Table 28

Summary of ANOVA - Difference in Online Video Quiz Scores by Quartiles

	Sum of Squares	df	Mean Square	F
Between Groups	10458.06	3	3486.02	41.75*
Within Groups	21387.15	256	83.51	
Total	31836.22	259		

* $p < .001$

In order to locate the difference between specific groups, a Post Hoc test was

conducted using Tukey HS procedure (Huck, 2008). Table 29 indicates that, from multiple comparisons of the student groups by quartiles of their final grades, the 1st quartile was significantly different from all other quartiles, and the 2nd was significantly different from the 4th and the 1st quartiles, while the 4th and 3rd were not significantly different from each other.

Table 29

Tukey HSD Multiple Comparisons Between Group Differences by Quartiles

(I) Quartiles	(J) Quartiles	Mean Difference (I-J)	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
4th Quartile	3rd Quartile	2.538	1.603	-1.61	6.68
	2nd Quartile	6.169*	1.603	2.02	10.31
	1st Quartile	16.646*	1.603	12.50	20.79
3rd Quartile	4th Quartile	-2.538	1.603	-6.68	1.61
	2nd Quartile	3.631	1.603	-.51	7.78
	1st Quartile	14.108*	1.603	9.96	18.25
2nd Quartile	4th Quartile	-6.169*	1.603	-10.31	-2.02
	3rd Quartile	-3.631	1.603	-7.78	.51
	1st Quartile	10.477*	1.603	6.33	14.62
1st Quartile	4th Quartile	-16.646*	1.603	-20.79	-12.50
	3rd Quartile	-14.108*	1.603	-18.25	-9.96
	2nd Quartile	-10.477*	1.603	-14.62	-6.33

* $p < .01$

Also, the correlation between the online video quiz scores and the final grade without including the video quiz was statistically significant for the 2nd quartile, with medium negative correlation (r = -.35, p < .005). The general direction of the correlation was that students in lower quartiles in their final grades (1st through 3rd quartiles) had a negative correlation between the online video quiz scores and the final grade without online video quiz scores.

As the correlation was statistically significant among the students in the 2nd quartile, a linear regression analysis was conducted. The result of the linear regression analysis (Table 30) was statistically significant F (1, 63) = 8.97, p = .004.

Table 30

ANOVA Model Summary - Final Grades without Online Video Quiz Scores by Online Video Quiz Scores in 2nd Quartile

	Sum of Squares	*df*	Mean Square	*F*
Regression	1759.158	1	1759.158	8.966*
Residual	12360.780	63	196.203	
Total	14119.938	64		

Note: * p<.01

The predicted final grade without online video quiz scores was calculated for the 2nd quartile students as:

Final Grade without Online Video Quiz Scores = 596.97 + (-.79 x Online Video Quiz Scores).

Table 31

ANOVA Model Coefficients – final grades without online video quiz scores by online video quiz scores in 2nd quartile

	Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig
		B	Std. Error	Beta		
1	(Constant)	596.97	41.29		14.46	.000
	Online Video Quiz Score	-.79	.26	-.35	-2.99	.004

The coefficient of determination (R Square) indicated that the variance in online video quiz scores was accountable for 13% of variance in the final grade without online video quiz scores, among students in the 2nd quartile (Table 32).

Table 32

Model Summary - Online Video Quiz Scores and Final Grade without Online Video Quiz Scores among Students in 2nd Quartile

Model	R	R square	Adjusted R Square	Std. Error of the Estimate
1	.35[a]	.13	.11	14.01

a. Predictors: (Constant), Online Video Quiz Scores

Difference in Online Video Quiz Scores by Gender

To examine the difference in final grade without including online video quiz scores by gender, a one-way ANOVA was conducted. The assumption of homogeneity was met, Levene's $F(1, 167) = 2.98$ $p = .086$. The ANOVA result (Table 33) indicated

that there was a statistically significant difference between gender, F (1, 167) = 9.42, p = .003.

Table 33

Summary of ANOVA - Difference in Final Grades without Online Video Quiz Scores by Gender

	Sum of Squares	*df*	Mean Square	*F*
Between Groups	30539.719	1	30539.719	9.415
Within Groups	541692.672	167	3243.669	
Total	572232.391	168		

* p < .01

However, the video quiz scores between male and female students were not significantly different (p = .26), as most students were able to achieve high scores with only small variances among them. The difference in average score was only 1.8 points between female (158.1 points) and male students (156.3 points) with a difference in standard deviation of 1.8 points. Therefore, the difference between the gender was rather due to other components of the course grade, instead of the difference in their online video quiz scores.

Table 34

Comparison of Online Video Quiz Scores between Gender

Gender	Mean	Standard Deviation	Minimum	Maximum	N
Female	158.12	9.403	120	165	92
Male	156.32	11.211	101	165	77
Total	157.30	10.274	101	165	169

Difference in the Final Grades without Online Video Quiz Scores by Ethnicity

To test if there was a difference in the final grade without including the quiz scores among students with different ethnic backgrounds, One-way ANOVA procedure was conducted on the final grade without the online video quiz scores among the students with different ethnic backgrounds.

The assumption of homogeneity was met, Levene's $F(3, 148) = .68$, $p = .56$. The ANOVA result (Table 35) indicates that there was no statistically significant difference among the students with different ethnic backgrounds, $F(3, 148) = .52$, $p = .67$.

Table 35

Summary of ANOVA - Difference in Final Grades without Online Video Quiz Scores by Ethnicity

	Sum of Squares	df	Mean Square	F
Between Groups	5353.75	3	1784.58	.52
Within Groups	509082.72	148	3439.75	
Total	514436.47	151		

Note: $p > .05$

Also, to test if there was a difference in online video quiz scores among students with different ethnic backgrounds, one-way ANOVA procedure was conducted on the online video quiz scores. The assumption of homogeneity was met, Levene's $F(3, 148) = .11$, $p = .95$. The ANOVA result (Table 36) indicated that there was no statistically significant difference in the online video quiz scores among the students with different ethnic backgrounds, $F(3, 148) = .07$, $p = .98$.

Table 36

Summary of ANOVA - Difference in Final Grades without Online Video Quiz Scores by Ethnicity

	Sum of Squares	*df*	Mean Square	*F*
Between Groups	22.83	3	7.61	.07
Within Groups	16654.85	148	112.53	
Total	16677.68	151		

Note: p > .05

Based on the results, gender was the only student demographic background variable that had a significant relationship with the final grade without the video quiz grades.

Difference in Final Grade without Online Video Quiz Scores by Year at the University

To test if there was a difference in the final grades without including the quiz scores between first year students and non-first year students, one-way ANOVA procedure was conducted on the final grade without the online video quiz scores.

The assumption of homogeneity was met, Levene's $F(1, 258) = .47$, $p = .49$. The ANOVA result indicated (Table 37) that there was no statistically significant difference in the final grade without the online video quiz grade between first year students and non-first year students $F(1, 258) = .46$, $p = .50$.

Table 37

Summary of ANOVA - Difference in Final Grades without Online Video Quiz Scores by Year at the University

	Sum of Squares	*df*	Mean Square	*F*
Between Groups	1474.25	1	1474.25	.46
Within Groups	832526.81	258	3226.85	
Total	834001.06	259		

Note: p > .05

However, Table 38 shows that among non-first year students, there was a medium positive correlation between the online video quiz scores and the final grade without including the quiz scores (r =.45), which was statistically significant (p = .000).

Table 38

Correlations between Online Video Quiz Scores and Final Grades without Online Video Quiz Scores of Non-First-Year Students

	Pearson Correlation (Final Grade)	Sig (2-tailed)	n
Online Video Quiz Scores	.45**	.000	91

Note. **p < 0.01

Based on the correlation, a linear regression analysis was conducted to examine the predictive value of online video quiz scores toward the final grade without the online video quiz scores among the non-first year students. The result of the linear regression analysis (Table 39) was statistically significant $F(1, 89) = 22.87$, $p < .001$.

Table 39

ANOVA Model Summary - Final Grades without Online Video Quiz Scores of Non-First-Year Students

	Sum of Squares	*df*	Mean Square	*F*
Regression	53214.52	1	53214.52	22.87
Residual	207079.90	89	2326.74	
Total	260294.42	90		

Note: * p<.01

Based on the data (Table 41), the predicted final grades without online video quiz scores can be calculated for the non-first year students as:

Final Grade without Online Video Quiz Scores = 184.72 + (1.96 x Online Video Quiz Scores).

Table 40

ANOVA Model Coefficients - Final Grades without Online Video Quiz Scores of Non-First-Year Students

	Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig
		B	Std. Error	Beta		
1	(Constant)	184.72	63.80		2.90	.005
	Online Video Quiz Score	1.96	.41	.45	4.78	.000*

Note: * p < .01

The coefficient of determination (R Square), indicated that the variance in online video quiz scores was accountable for 20% of variance in the final grades without online video quiz scores, among the non-first year students.

Table 41

Model Summary - Online Video Quiz Scores and Final Grades without Online Video Quiz Scores of Non-First Year Students

Model	R	R square	Adjusted R Square	Std. Error of the Estimate
1	.45[a]	.20	.120	89.24

a. Predictors: (Constant), Online Video Quiz Scores

Difference in Final Grade without Online Video Quiz Scores by Class Standings

To test if there was a difference in the final grade without the online video quiz scores among students at different class standings, one-way ANOVA was conducted on the final grade without the online video quiz scores.

The assumption of homogeneity was met, Levene's $F(5, 163) = 1.16$, $p = .33$. The ANOVA result indicated (Table 42) that there was no statistically significant difference in the final grade without the online video quiz grade among students at different class standings $F(5, 163) = 1.13$, $p = .35$.

Table 42

Summary of ANOVA - Difference in Final Grades without Online Video Quiz Scores by Class Standing

	Sum of Squares	df	Mean Square	F
Between Groups	19164.716	5	3832.943	1.130
Within Groups	553067.675	163	3393.053	
Total	572232.391	168		

Note: $p > .05$

Difference in Final Grade without Online Video Quiz Scores by Students' Weighted High School GPA

To determine if there was a difference in final grades without online video quiz scores by students' weighted high school GPA, a correlation analysis was conducted. The result of the analysis indicated that there was a statistically significant correlation between the weighted high school GPA and the final grades ($r = .386$, $p < .001$).

Based on the correlation, a linear regression analysis was conducted to examine the predictive value of weighted high school GPA toward the final grade without the online video quiz scores. The result of the linear regression analysis (Table 43) was statistically significant $F(1, 126) = 22.10$, $p < .001$.

Table 43

ANOVA Model Summary - Difference in Final Grades without Online Video Quiz Scores by Weighted High School GPA

	Sum of Squares	df	Mean Square	F
Regression	64560.78	1	64560.78	22.10*
Residual	368019.66	126	2920.79	
Total	432580.44	127		

Note: * p<.01

Based on the data (Table 44), the predicted final grade without online video quiz scores can be calculated as:

Final Grade without Online Video Quiz Scores = 310.27 + (46.19 x Weighted High School GPA).

Table 44

ANOVA Model Coefficients - Difference in Final Grades without Online Video Quiz Scores by Weighted High School GPA

	Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig
		B	Std. Error	Beta		
1	(Constant)	310.27	37.23		8.33	.000
	Weighted High School GPA	46.19	9.82	.386	4.70	.000

The coefficient of determination (R Square), indicated that the variance in online video quiz scores was accountable for 15% of variance in the final grade without online video quiz scores, among the sample students (Table 45).

Table 45

Model Summary - Final Grades without Online Video Quiz Scores by Weighted High School GPA

Model	R	R square	Adjusted R Square	Std. Error of the Estimate
1	.39[a]	.15	.14	54.04

a. Predictors: (Constant), Weighted High School GPA

Additionally, there was a medium positive correlation (r =.25) between the online video quiz scores and weighted high school GPA at a statistically significant level (p = .001). While the correlation would not have causal effect on the other variable, it would be worth to note the correlation between the scores.

Difference in Final Grade without Online Video Quiz Scores by Students' Pre-course College GPA

Among the students in the sample course, 42 students have taken college courses prior to attending the sample course. To test if there was a difference in final grades without online video quiz scores by students' pre-course college GPA, a correlation analysis was conducted. The result of the analysis indicated that there was a medium positive correlation, at a statistically significant level between the Pre-course college GPA and the final grades without online video quiz scores ($r = .33$, $p > .05$).

Based on the correlation, a linear regression analysis was conducted to examine the predictive value of pre-course college GPA toward the final grade without the online video quiz scores. The result of the linear regression analysis (Table 46) was statistically significant $F(1, 39) = 4.84$, $p = .034$.

Table 46

ANOVA Model Summary - Final Grades without Online Video Quiz Scores by Pre-course College GPA

	Sum of Squares	*df*	Mean Square	*F*
Regression	15033.66	1	15033.66	4.84*
Residual	121212.15	39	3108.0	
Total	12136245.81	40		

Note: * p<.05

According to the data (Table 47), the predicted final grade without online video quiz scores was calculated as:

Final Grade without Online Video Quiz Scores = 431.66 + (19.21 x Pre-course College GPA).

Table 47

ANOVA Model Coefficients - Final Grades without Online Video Quiz Scores by Pre-course College GPA

	Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig
		B	Std. Error	Beta		
1	(Constant)	431.66	25.29		17.07	.000
	Online Video Quiz Score	19.21	8.74	.33	2.20	.034

The coefficient of determination (R Square) indicated that the variance in online video quiz scores was accountable for 11% of variance in the final grade without online video quiz scores (Table 48).

Table 48

Model Summary - Final Grades without Online Video Quiz Scores by Pre-course College GPA

Model	R	R square	Adjusted R Square	Std. Error of the Estimate
1	.33[a]	.11	.09	55.75

a. Predictors: (Constant), Pre-course College GPA

Based on the results, two variables among students' academic backgrounds, weighted high school GPA and college level pre-course GPA, had significant predictive

values toward the final grades without the online video quiz scores.

Online Video Quiz Scores and Student Background Variables in Final Grades - Multiple Regression Analysis

According to the results of analyses, there was a significant correlation between online video quiz scores and the final grade, and the variance in the online video quiz scores was accountable for up to 22% of the final grade without the online video quiz scores. When students were compared by quartiles in their final grades without the online video quiz scores for differences in their online video quiz scores, the students in the second quartile indicated a negative correlation between their online video quiz scores and their final grades without the online video quiz scores, and the linear regression was established in the negative direction.

Based on the results of the correlation and linear regression analyses, gender was the only demographic backgrounds that revealed statistically significant predictive value. As for the students' academic back grounds, weighted high school GPA and pre-course college GPA had statistically significant predictive values toward students' final grades without online video quiz scores included.

To examine the contribution of online video quiz scores as a standalone variable and the student background variables (gender, first year, weighted high school GPA, SAT Verbal, SAT Math, SAT Writing, and online video quiz scores) in predicting the final grade without the online video quiz scores, a multiple regression analysis was conducted. During the calculation, the variables with missing correlations with the final grades without the online video quiz scores (first year at the university and pre-course college GPA) were removed from the calculation. Table 49 indicates that he predicted

contribution of the background variables was statistically significant $F(5, 122) = 12.54$, $p = .000$.

Table 49

ANOVA Multiple Regression Model Summary – Online Video Quiz Scores & Background Variables

	Sum of Squares	df	Mean Square	F
Regression	138854.20	5	23770.84	12.54
Residual	270096.13	122	2213.90	
Total	408950.33	127		

Note: * p < .001

According to the data (Table 50), the predicted contribution can be calculated as:

Predicted final grade without Online Video Quiz Scores = 79.65 + (28.90 x Weighted High School GPA) + (-13.33 x Gender) + (1.91 x Online Video Quiz Scores) + (-.19 x SAT Verbal) + (.21 x SAT Writing)

Table 50

Multiple Regression Model Coefficients - Online Video Quiz Scores & Background Variables

	Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig
		B	Std. Error	Beta		
1	(Constant)	79.645	65.711		1.212	.228
	Gender	-13.331	8.796	-.117	-1.516	.132

Table 50 (Continued)

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig
	B	Std. Error	Beta		
Weighted High School GPA	28.903	9.181	.249	3.148	**.002**
Video Quiz Score	1.912	.390	.374	4.899	**.000**
SAT Verbal	-.194	.079	-.716	-2.475	**.015**
SAT Writing	.205	.078	.754	2.628	**.010**

Note: p<.05

Based on the result of the multiple regression analysis of the predicted contribution of online video quiz scores and background variables, the online video quiz scores, weighted high school GPA, SAT Verbal, and SAT Writing scores had statistically significant (p <.01) predictive value.

The coefficient of determination (R Square) indicated that the variance in the combined variables was accountable for 34% of variance in the final grade without online video quiz scores (Table 51).

Table 51

Multiple Regression Model Summary - Online Video Quiz Scores & Background Variables

Model	R	R square	Adjusted R Square	Std. Error of the Estimate
1	.58[a]	.34	.31	47.05

a. Predictors: (Constant), Online Video Quiz, Gender, Weighted HS GPA, SAT Section scores

Since students' background variables that carried significant predictive values were available for first-year students, a separate multiple regression analysis was conducted with only first year students to increase accuracy of the predictive model.

First, multiple imputations (Rubin, 1987) were conducted 40 times, to impute missing values in weighted highs school GPA (missing 41cases), SAT Verbal, SAT Math, and SAT writing (missing 64 cases respectively), and the variables with missing correlations with the final grades (first year at the university and pre-course college GPA) were removed from the calculation. Based on the data (Table 52), the predicted contribution of the variables was statistically significant $F(6, 6858) = 670.88$, $p < .000$. The predicted contribution can be calculated as:

Predicted final grade = -51.86 + (22.47 x Weighted HS GPA) + (-15.62 x Gender) + (2.23 x Online Video Quiz Score) + (-.11 x SAT Verbal) + (.09 x SAT Math) + (.23 x SAT Writing)

The result of the multiple regression analysis (Table 52) indicated that gender, weighted high school GPA, online video quiz scores, SAT Verbal, SAT Math, and SAT Writing scores had statistically significant predictive values. For all variables, collinearity tests were conducted and the highest level of the variance inflation factor (VIF) did not exceed 1.50 level.

Table 52
Multiple Imputation Multiple Regression Model Coefficients - Online Video Quiz Scores & Background Variables

	Model	Unstandardized Coefficients		Standardized Coefficients Beta	t	Sig
		B	Std. Error			
1	(Constant)	-51.861	10.927		-4.746	.000
	Gender	-15.624	1.225	-.134	-12.751	.000
	Weighted HS GPA	22.472	1.276	.189	17.614	.000
	SAT Verbal	-.112	.012	-.104	-9.406	.000
	SAT Math	.089	.011	.090	8.383	.000
	SAT Writing	.230	.011	.242	21.486	.000
	Online Video Quiz	2.226	.057	.392	39.286	.000

Comparison of Standardized Predictive Models

In order to compare the predictive models established through the analyses of student variables and online video quiz scores, standardized models were established using the standardized scores and conducting multiple regression analyses.

First, to examine the contribution of student backgrounds (gender, first year, weighted high school GPA, pre-course college GPA, SAT Verbal, SAT Math, and SAT Writing) in predicting the standardized final grades, a multiple regression analysis was conducted. During the calculation, the variables with missing correlations with the final grades (first year at the university and pre-course college GPA) were removed from the calculation.

Based on the data (Table 53) the predicted contribution of the combination of background variables toward the standardized final grades was statistically significant $F(5, 99) = 6.40$, $p = .000$.

Table 53

ANOVA summary of Multiple Regression Model – Standardized Final Grades by Background Variables

	Sum of Squares	*df*	Mean Square	*F*
Regression	2.195	5	.439	6.400
Residual	6.790	99	.069	
Total	8.985	104		

Note: * p < .01

The predicted contribution of the student background variables toward the standardized final grades was calculated as:

Predicted Standardized final grade = -1.132 + (-.086 x Gender) + (.178 x Weighted HS GPA) + (-.001 x SAT Verbal) + (.001 x SAT Math) + (.001 x SAT Writing)

The result of the multiple regression analysis (Table 54) shows that the predicted contribution of background variables toward the standardized final grade, such as weighted high school GPA, and SAT Writing scores had a statistically significant ($p < .05$) predictive value.

Table 54

Multiple Regression Model Coefficients - Standardized Final Grades by Background Variables

	Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig
		B	Std. Error	Beta		
1	(Constant)	-1.132	.343		-3.296	.001
	Gender	-.086	.057	-.146	-1.514	.133
	High School GPA	.178	.057	.296	3.114	**.002**
	SAT Verbal	-.001	.001	-.142	-1.421	.158
	SAT Math	.001	.000	.102	1.042	.300
	SAT Writing	.001	.001	.263	2.568	**.012**

The coefficient of determination (R Square) indicated that the variance in the combined background variables was accountable for 24% of variance in the final grade without online video quiz scores (Table 55).

Table 55

Multiple Regression Model Summary - Standardized Final Grades by Background Variables

Model	R	R square	Adjusted R Square	Std. Error of the Estimate
1	.49[a]	.24	.21	.26

a. Predictors: (Constant), Gender, Weighted HS GPA, SAT Verbal, SAT Writing

Since students' background variables carried significant predictive values were available for first year students, a separate multiple regression analysis was conducted with only first year students to increase accuracy of the predictive model.

First, multiple imputations (Rubin, 1987) were conducted 40 times, to impute missing values in weighted highs school GPA (missing 41cases), SAT Verbal, SAT Math, and SAT writing (missing 64 cases respectively), and the variables with missing correlations with the final grades, first year at the university and pre-course college GPA, were removed from the calculation. Based on the data (Table 56), the predicted contribution of the variables was statistically significant F (5, 6859) = 414.46, $p < .000$.

Table 56

ANOVA Summary of Multiple Regression Model – Standardized Final Grades by Background Variables (Multiple Imputation)

	Sum of Squares	*df*	Mean Square	*F*
Regression	136.798	5	27.360	414.464
Residual	452.775	6859	.066	
Total	589.573	6864		

Note: * p < .001
a. Dependent Variable: Standardized Final
b. Predictors: (Constant), SAT Writing, Gender, High School GPA, SAT Math, SAT Verbal

The predicted contribution can be calculated as:

Predicted standardized final grade = -1.067 + (.186 x Weighted HS GPA) + (-.084 x Gender) + (-.001 x SAT Verbal) + (.000 x SAT Math) + (.001 x SAT Writing)

The result of the multiple regression analysis (Table 57) indicated that gender, weighted high school GPA, SAT Verbal, SAT Math, and SAT Writing scores had statistically significant predictive values. For all variables, collinearity tests were conducted and the highest level of the VIF did not exceed 1.50.

Table 57

Multiple Regression Model Coefficients - Standardized Final Grades by Background Variables (Multiple Imputation)

	Model	Unstandardized Coefficients		Standardized Coefficients Beta	t	Sig
		B	Std. Error			
1	(Constant)	-1.067	.041		-26.151	.000
	Gender	-.084	.007	-.143	-12.345	**.000**
	HS GPA	.186	.007	.310	27.004	**.000**
	SAT Verbal	-.001	.000	-.129	-10.612	**.000**
	SAT Writing	.000	.000	.087	7.319	**.000**
	SAT Math	.001	.000	.232	18.681	**.000**

The coefficient of determination (R Square) indicated that the variance in the combined background variables was accountable for 23.2% of variance in the final grade without online video quiz scores (Table 58).

Table 58

Multiple Regression Model Summary - Standardized Final Grades without Online Video Quiz Scores by Background Variables (Multiple Imputation)

Model	R	R square	Adjusted R Square	Std. Error of the Estimate
1	.482[a]	.232	.231	.256

a. Predictors: (Constant), Gender, Weighted High School GPA, SAT Verbal, SAT Writing

To examine the contribution of online video quiz scores as a standalone variable with other student background variables (gender, first year, weighted high school GPA, online video quiz scores, pre-course college GPA, SAT Verbal, SAT Math, and SAT Writing) in predicting the standardized final grade without including the online video quiz scores, a multiple regression analysis was conducted. During the calculation, the variables with missing correlations with the final grades (first year at the university and pre-course college GPA) were removed from the calculation.

Based on the data (Table 59), the predicted contribution of the background variables was statistically significant $F(6, 98) = 35.68$, $p < .001$.

Table 59

ANOVA Summary of Multiple Regression – Standardized Final Grades without Online Video Quiz Scores by Online Video Quiz Scores and Background Variables

	Sum of Squares	*df*	Mean Square	*F*
Regression	1.562	6	.260	35.682
Residual	.715	98	.007	
Total	2.277	104		

Note: * p < .001

According to the data (Table 60), the predicted contribution can be calculated as:

Predicted final grade without Online Video Quiz Scores = -.115 + (-.211 x Gender) + (.069 x Weighted High School GPA) + (.001 x Online Video Quiz Scores) + (.000 x SAT Verbal) + (.00 x SAT Writing) + (-1.646E-5 *x SAT Math)*

Based on the result of the multiple regression analysis of the predicted contribution of online video quiz scores and background variables, the background variables gender and weighted high school GPA had statistically significant ($p < .001$) predictive values.

Table 60

Multiple Regression Model Coefficients - Standardized Final Grades without Online Video Quiz Scores by Online Video Quiz Scores and Background Variables

	Model	Unstandardized Coefficients		Standardized Coefficients	*t*	Sig
		B	Std. Error	Beta		
1	(Constant)	-.115	.165		-.694	.489
	Gender	-.211	.018	-.712	-11.417	**.000**
	High School GPA	.069	.019	.228	3.607	**.000**
	SAT Verbal	.000	.000	-.039	-.600	.550
	SAT Math	-1.646E-5	.000	-.007	-.102	.919
	SAT Writing	.000	.000	.068	1.031	.305
	Online Video Quiz	.001	.001	.054	.927	.356

Note: p<.05

The coefficient of determination (R Square) indicated that the variance in the background variables and online video quiz scores was accountable for 68.6% of variance in the standardized final grade without online video quiz scores (Table 61).

Table 61

Multiple Regression Model Summary – Standardized Final Grades without Online Video Quiz Scores by Background Variables

Model	R	R square	Adjusted R Square	Std. Error of the Estimate
1	.828[a]	.686	.667	.085

a. Predictors: (Constant), Gender, Weighted HS GPA, Online Video Quiz

The students' demographic and academic background variables, gender and weighted high school GPA, had statistically significant predictive values toward the standardized final grades.

For the standardized final grades without including the online video quiz scores, multiple imputations were conducted 40 times, to impute missing values in weighted highs school GPA (missing 41cases), SAT Verbal, SAT Math, and SAT writing (missing 64 cases respectively), and the variables with missing correlations with the final grades, first year at the university was removed from the calculation. Based on the data (Table 62), The predicted contribution of the variables was statistically significant F (7, 1632) = 439.05, $p < .000$.

Table 62

ANOVA Summary of Multiple Regression Model – Standardized Final Grades without Online Video Quiz Scores by Online Video Quiz Scores and Background Variables (Multiple Imputation)

	Sum of Squares	*df*	Mean Square	*F*
Regression	23.307	7	3.330	439.046
Residual	12.377	1632	.008	
Total	35.684	1639		

Note: * p < .001

According to the data (Table 63), the predicted contribution can be calculated as:

Predicted standardized final grade (Multiple Imputation) = -.091 + (.33 x Weighted HS GPA) + (-.218 x Gender) + (.001 x online video quiz) + (-3.871E-5 *x SAT Verbal) +* (2.464E-5 *x SAT Math) + (.000 x SAT Writing)*

Table 63

Multiple Regression Model Coefficients - Standardized Final Grades without Online Video Quiz Scores by Online Video Quiz Scores and Background Variables (Multiple Imputation)

	Model	Unstandardized Coefficients		Standardized Coefficients Beta	t	Sig
		B	Std. Error			
1	(Constant)	-.091	.043		-2.122	.034
	Gender	-.218	.005	-.734	-45.205	**.000**
	High School GPA	.033	.005	.109	6.684	**.000**
	SAT Verbal	-3.871E-5	.000	-.014	-.844	.399

Table 63 (Continued)

Model	Unstandardized Coefficients		Standardized Coefficients Beta	t	Sig
	B	Std. Error			
SAT Math	2.464E-5	.000	.010	.602	.547
SAT Writing	.000	.000	.047	2.742	**.006**
Online Video Quiz	.001	.000	.081	5.343	**.000**
College GPA	.009	.002	.063	4.191	**.000**

Through multiple imputation on missing values, this model predicted contribution of the variables toward the standardized final grades without online video scores. The coefficient of determination (R Square) indicated that the variances in the variables were accountable for 65.3% of variance in the final grade without online video quiz scores.

Table 64

Multiple Regression Model Summary – Standardized Final Grades without Online Video Quiz scores by Online Video Quiz Scores and Background Variables (Multiple Imputation)

Model	R	R square	Adjusted R Square	Std. Error of the Estimate
1	.808[a]	.653	.652	.087

a. Predictors: (Constant), Gender, Weighted HS GPA, Online Video Quiz, SAT Verbal, SAT Math, SAT Writing

Research question 4. To what extent are the students' completion of online video quizzes and in-class quizzes related to the final course grades and persistence of students who are enrolled in a hybrid-learning course in introductory psychology?

Persistence in Online Video Quizzes

In this sample class, there were four students who dropped out of the course (marked "W" as their final grade). Among them, two students participated in the online quiz until the 19th quiz out of 36 and another student until the 13th. These students stayed later than the early drop period, but eventually withdrew from the course, before passing the formal withdrawal deadline, to receive a "W" grade, rather than possible a "F" grade.

Also, there were twelve students (4.3%) who failed from the course, who received an "F" grade as final. Interestingly, five students among them participated in the online video quizzes until the end of the course (total 36 quizzes), and six students until the 34th quiz out of 36, which is still one more quiz than the fully counted number of quizzes toward the grade calculation (the highest 33 quizzes were to be calculated for the final grade). Therefore, eleven students out of twelve students who received an F grade still participated more than the required number of online video quizzes throughout the semester. Among the 21 students who received a "D" grade, 13 students (62%) completed 33 or more online video quizzes, and all of the students who received a "D" grade completed at least 23 quizzes (70%) of the required 33 quizzes. Although the reasons and motivations of the unsuccessful students to persistently complete the online quizzes more than 70% of the number of quizzes over the entire term are beyond the scope of the current study, it would be helpful to understand what components of hybrid

courses and what kind of support would be most effective to facilitate students to succeed in hybrid learning courses.

Persistence in In-class Clicker Quizzes

In addition to the online video quizzes, the students in the sample course also took six in-class quizzes with ten points each, using a personal response system (PRS), also known as "clickers". The quizzes were used to check students' understanding of the readings assigned during the online portion of the course, and also as a measure of attendance verification during the face-to-face sessions.

The in-class clicker quiz scores were statistically significantly correlated ($r = .38$, $p < .01$) with the final grades not including the points from the same item. Based on the correlation, a linear regression analysis was conducted to examine the predictive value of the in-class clicker quiz scores toward the final grades without the in-class quiz scores. The result of the linear regression analysis (Table 65) was statistically significant $F(1, 258) = 44.03$, $p < .001$.

Table 65

ANOVA Model Summary - Final Grades without In-class Clicker Quiz Scores by In-class Clicker Quiz Score

	Sum of Squares	*df*	Mean Square	*F*
Regression	128913.83	1	128913.83	44.03*
Residual	755426.39	258	2928.01	
Total	884340.22	259		

Note: * p<.001

Based on the data (Table 64), the predicted final grades without online video quiz scores can be calculated as:

Final Grade without Online Video Quiz Scores = 500.58 + (2.40 x In-class Clicker Quiz Score).

Table 66

ANOVA Model Coefficients - Final Grades without In-class Clicker Quiz Scores by In-class Clicker Quiz Scores

	Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig
		B	Std. Error	Beta		
1	(Constant)	500.58	15.45		32.40	.000
	In-class Clicker Quiz	2.40	.36	.38	6.64	**.000**

The coefficient of determination (R Square) indicated that the variance in online video quiz scores can be accountable for 15% of variance in the final grade without the in-class clicker quiz scores (Table 65).

Table 67

Model Summary - Final Grades without In-class Clicker Quiz Scores by In-class Clicker Quiz Scores

Model	R	R square	Adjusted R Square	Std. Error of the Estimate
1	.38[a]	.15	.14	54.11

a. Predictors: (Constant), In-class Clicker Quiz Score

The pattern of participation in the in-class quiz among the twelve students who received an "F" grade was distinct. Seven out of twelve students started the course by missing the first in-class quiz, and one student never completed any of the in-class quizzes. Also, four students completed three to five quizzes, and two students completed the quiz only once. As a whole, seven students completed less than half of the quizzes, and received an "F" grade at the end of the course. The data indicated that students' participation pattern of in-class quizzes was correlated (r = .38) with their final grades and had a predictive value, consistent with previous findings of persistence patterns of unsuccessful students (Levy & Ramin, 2012).

Summary

In this chapter, the results of data analyses described the relationships between students' demographic and academic background variables in regard to the final course grades, and the relationship between online video quiz grades and final grades (without including the online video quiz grades) combined with student background variables. Descriptive statistics showed the differences in the students' final grades analyzed by the background variables, and the mean differences among the groups were analyzed by ANOVA. The results indicated that students' gender, SAT scores, and weighted high school GPA were correlated with their final grades. Linear regression analyses by the background variables also provided an explanation of how much the variance in the background variables were accountable for the variance in the final grades. Additionally, standardized scores and multiple imputation technique for replacement of the missing values in the variables were used to establish predictive models. The result of the

multiple regression analyses indicated that gender, SAT scores, and weighted high school GPA had statistically significant predictive values.

Next, the relationship between the students' online video quiz scores and the final grade without including the quiz scores was examined for the correlation and the differences by the background variables. The results indicated that, when online video quiz scores were counted as a standalone variable, there was a statistically significant correlation between the final grade without including the online video quiz scores and the quiz scores. Specifically, the students who were ranked in the 2nd quartile (25th-50th percentiles) in their final grades had a statistically significant and negative correlation between the scores.

Regarding the students' academic background variables, weighted high school GPA, online video quiz scores, and SAT scores had statistically significant correlation with the final grades without the online video quiz scores. The result of the multiple regression analysis indicated that online video quiz scores, weighted high school GPA, and SAT scores had statistically significant predictive values toward the final grades.

Regarding the persistence in taking the online video quizzes, the students in the sample course had extremely high participation, and even the majority of the students who failed in the course participated in the activity at near-complete level. In-class quiz scores were also correlated with the final grade, and the direction of the correlation was consistent with the general trends of students' final grades. Therefore, students in the sample course did not indicate any unique difference in their study behavior for the in-class quiz, but the quiz itself had a significant predictive value.

The relationship between students' background variables and final grades and the relationship between the online video quiz scores and the final grades are discussed in the following chapter in the context of a large hybrid course.

CHAPTER 5: DISCUSSIONS AND CONCLUSION

In this chapter, the findings from the analyses are summarized, and the implications are discussed in the context of current literature and practical applications for hybrid courses and programs. The limitations of the current study are reviewed and recommendations for future studies are also included.

Discussion of Findings

Students' Demographic Backgrounds

The student data in the sample course indicated that the final grades did not significantly differ based on the demographic background variables, except by gender. When gender was a single variable to compare the groups, female students in the sample course outperformed male students in terms of their final grades. Previous studies reported that male students struggle in fully online courses (Xu & Jaggars, 2013) due to weaker study habits and lack of determination completing their work (Ruffalo Noel Levitz, 2015). Contrary to the research studies in the context of fully online courses, studies on hybrid learning courses have reported that gender does not have a significant effect on student learning (Du, 2011; Keller, Hassell, Webber, & Johnson, 2009; Kintu, Zhu, & Kagambe, 2017). In this study, female students scored significantly higher than the male students on the final grade, but the results indicated that academic background variables, such as online video quiz scores, high school GPA, and SAT scores, had more significant predictive values than gender does as a demographic background variable.

Also, other variables (such as ethnicity, first-year or continuing study, or class standing) did not have a significant difference and concurred with existing literature reporting weak or inconsistent effect of such variables (Keller, Hassell, Webber, & Johnson, 2009). Therefore, except the current finding that female students outperformed male students in this sample course, it could be implied that students with other backgrounds did not perform differently in the hybrid learning environment, without systematic advantages or disadvantages based on the course delivery method. This finding supports the goal of widening student access by offering online or hybrid learning courses (Legon & Garrett, 2018).

Additionally, the data from the study indicated that when gender was combined with academic variables to calculate the predictive models, its contribution to the model was not statistically significant, despite the fact that it still contributed to increase the efficacy of the models. As each student comes to the class with a combination of multiple backgrounds, it would be recommended to consider the predictive values of background variables in such context.

Students' Academic Backgrounds

The results from the analyses indicate that students' existing academic background, in terms of their weighted high school GPA and SAT Scores, had a significant predictive value for their success in the sample course. Compared to the results from previous studies that report pre-course GPA as a strong predictor, the data from the students in the sample course did not show a significant difference by their pre-course GPA in college (Ary & Brune, 2011) or current GPA in college (Verhoeven & Rudchenko, 2013). However, a significant difference in final grades was found based on

the sample students' weighted high school GPA. Also, SAT Writing section scores were significantly correlated with students' final grades and had a statistically significant predictive value. The results from the multiple regression analyses concurred with the findings of Keller et al. (2009), regarding the association between SAT scores and student performance in hybrid learning course.

Due to the demographic composition of the sample course, with a larger number of freshmen enrolled who had only a short record of academic performance in college, high school GPA served as a representative measure of students' prior success in their studies. In this context, the findings reinforced the position that students' prior academic background variables are more relevant in predicting their success in hybrid learning courses, rather than just the course delivery formats (Keller et al., 2009). Also, when both demographic background variable (gender) and academic background variables (high school GPA, and SAT scores) were combined in a predictive model, the result of multiple regression analysis showed that the predictive model fit with a statistical significance. This results from the analyses implied that the students who had a record of high performance in their high school continued to do well in hybrid learning courses, and the innate advantage or disadvantage of delivery format is not as significant (Harmon, Alpert, & Lambrinos, 2014; Keller, Hassell, Webber, & Johnson, 2009; Larson & Sung, 2009; Powers, Brooks, & Galazyn, 2016).

The results also implied that it is not sufficient to predict students' success in hybrid learning courses based only on the delivery format. Instead, it would be imperative to include students' academic background variables into the predictive models, in order to effectively predict students' success in hybrid learning courses and to

prepare adequate and effective support. The findings from this study indicated that students who have previous record of academic success continued to be successful in a hybrid course. On the other hand, the students who were relatively less successful (for example, those who had their final grades in the second quartile or between 25th -50th percentile within the course) completed as much online video quizzes as possible and increased their learning. The data also confirmed that online video quiz scores had significant predictive value toward students' final grades. Therefore, instead of depending on the delivery format of the course as the only factor to predict students' success (Holley & Oliver, 2010), students' academic background variables should be included (Deschacht & Goeman, 2015) to establish an effective predictive model for success in hybrid learning courses.

Online Video Quizzes

As students watched online videos and completed the following quizzes during the online portion of the sample course, the online video quiz scores carried a significant predictive value toward the students' success in the course. The results of a linear regression analysis indicated a correlation between the students' online video quiz scores and their final grades and showed that the video quiz scores had a statistically significant predictive value toward their success in the sample course. Additionally, the data indicated that the majority of low-achieving students completed the online video quizzes more than required and many of them also tried multiple attempts to attain high scores. It may be possible that the low-achieving students in the sample course was willing to invest their effort to get the best scores they can achieve, as they considered that the quizzes are useful for their study and success in the course, and with low stakes for

trying. The findings from this study showed a unique tendency, in which the lower performing students actively participated in the online learning activities (in this case, the online video quizzes), compared to the findings from the existing studies reporting that less successful online students shows lack of participation starting as early as the second week of the course term (Dziuban et al., 2016).

Considering the predictive value of the online video quizzes, it is noteworthy that during the course redesign process, the Department had formed a curriculum development team to review the relevant video packages that were available for adoption for the sample course. The selection process not only reviewed the topical contents of the videos, but also envisioned students' use of the videos for their learning in the course and thus focused on students' perspectives. The selection concurred with the recommendations from the existing literature suggesting that it would be most effective when online videos were followed by reflective activities (Yilmiz & Keser, 2016) or online quizzes (Tune, Sturek, & Basile, 2013). In this case, the selection of the video by the curriculum development team possibly had a positive influence on students' decision on the usefulness of the videos and using them for their learning. Also, as the Department selected the particular series of the videos in favor of the online video quizzes that immediately followed the clips, the curriculum development team embraced the activities to the overall structure of the course. The existing literature supports that careful integration of learning activities, such as followed in this sample course would facilitate students' learning (Zacharis, 2015).

In this course, the online video quizzes served as a "safe" activity to facilitate students' learning. The quizzes were low-stakes in terms of the weight of individual quiz

and each question, with two attempts and no time limit. Therefore, the quizzes had relatively low cognitive and affective barrier, while allowing students to keep track of their learning and follow the pace of the course. This intentional design and student-focused planning of the course would distinguish the course from other courses that lack adequate instructional design (Willging & Johnson, 2009).

Students' Background Variables and Online Video Quiz Scores

Although female students slightly outperformed male students in the online video quizzes, the difference was not significant. Also, the differences in the online video quiz scores among students of different ethnicities, and between first-year students and continuing students, were not statistically significant. One possible reason for the small differences among the different groups of students in their online quiz scores is that the majority of students completed the online video quiz throughout the course and the majority of students who received a lower grade retook the quiz to get higher scores. Therefore, it could be implied that the online video quizzes served as a form of low-stakes online activity that most students could complete without overwhelming difficulty, which in turn helped students to stay in the course and follow the pace of the course. This finding concurs with Zacharis' report (2015) on the effect of safe learning environment that integrates low stakes assignments. Also, since the students' background variables did not have a direct influence on their quiz scores, the predictive value of the online video quiz can be associated with the students' individual efforts to complete the quiz and continue in the course (Du, 2011).

Regarding students' academic backgrounds, there was a statistically significant correlation between the students' weighted high school GPA and their online video quiz

scores. Interestingly, the data indicated that students in the second quartile in their final grades achieved the biggest gain among the entire group of students and the finding concurred with Dupuis et al. (2013) about different levels of gain in learning among lower performing students.

It is also possible that those students who were at the lower portion of the second quartile in final grades, completed as many online video quizzes as possible, and even took the second attempt to improve their scores, were able to add additional points toward their final grades to be able to move up from the first quartile or the lowest performing group. On the other hand, the students in the first quartile or below the 25th percentile had a wide gap in their online video scores and many of them scored significantly lower in the online video quizzes. In this case, it may be possible to infer that the differences in final grades by individual students or subgroups may contribute to the inconsistent outcomes, or no-significant difference in outcomes (Goette et al., 2017; Olitsky & Cosgrove, 2014) frequently reported from hybrid learning courses, when the average of the whole class was used a unit of measurement, comparing different delivery modes (Bowen, 2013; Kwak, Menez, & Sherwood, 2015).

Furthermore, when the online video quiz scores and the background variables (gender, SAT scores, and high school GPA) were combined to establish a predictive model, the result of multiple regression analysis indicated that the sample students' online video quiz scores had a statistically significant predictive value. In addition to the students' background variables, the online video quiz scores can be associated with individual students' own effort and persistence with a significant predictive value toward

their success in a hybrid learning course. In this case, the sample students' agency and locus of control on their own learning played an important part for their success.

Persistence in Online Video Quizzes

One of the interesting findings from the students in the sample course was that the majority of the students completed almost all 36 of the online video quizzes, which is beyond the 33 quizzes to be calculated toward the final grade. Persistence in completing the online video quiz was particularly evident among students in the second quartile, and even among the students who received a failing grade (F), of which 11 out of 12 students completed more than the number of quizzes to be counted for the final grade (33 out of 36 quizzes). On the other hand, many students in the top quartile took just the exact number of quizzes that are counted for the final grade (33 out of 36) and stopped. The persistence among low-achieving students in this sample course can be contrasted with the findings reported in previous studies in online or hybrid learning courses (Olitsky & Cosgrove, 2014; Roscoe, 2012). Previous studies illustrated that differences in participation in online activity started as early as the second week of the course term, and the gap widened as the course went on (Dziuban et al., 2016), or the students dropped out of the course early in the term (Brindley, 2014). Based on the high level of participation and persistence in the online video quizzes among the low-achieving students, and the variances in the final grades that the variance in online video quiz scores are accountable for, it seems that low-achieving students were willing to complete the online video quizzes as best as they could, and their persistent completion of the quizzes in turn, helped them stay in the course for the full term and contributed enough additional points toward the final grades so that they could avoid the risk of failing the course. In contrast

to other studies that reported lower achievement in hybrid learning courses, where no required learning activities were assigned during the online portion of the course (Verhoeven & Rudchenko, 2013), the difference in this sample course can be contrasted that each presentation of course topics in short video was immediately followed by online quizzes to review the points to learn (Du, 2011), and most of the sample students persistently completed the quizzes, even beyond the required minimum number of quizzes. Students' persistent participation and completion of the quizzes could be a possible factor to keep students from falling behind in the course, as losing the pace of the course is one of the main reasons why students drop out of the course (Fetzner, 2013). Lopez-Perez et al. (2011) also reported that persistence in online activity also contributes to the reduced dropout rates in hybrid learning course, whereas Ashby, Sadera, and McNary (2011) reported that when students fall behind the pace of the course, the chance of their withdrawal from the course would also increase.

A possible explanation for students' persistence in the sample course can be linked to Ryan and Deci's (2000) explanation of regulatory styles through internalization of motivation. According to Ryan and Deci, a person would invest his or her effort if the task or action is perceived to be helpful for achieving his or her goals. In college classes, Merhi (2015) reported that students would adopt course components when they perceive the relative advantage and usefulness for their learning. Another possible explanation can be found in Bandura's (1997) self-efficacy theory. According to the self-efficacy theory, an individual will persist in his or her work when the work is perceived to be helpful to achieve his or her own goals. Based on this view, it is possible that if the students decided that the course activities were useful for their learning, their motivation

to complete the quizzes were heightened, and their persistent work would have increased learning in the course (Tseng & Walsh, 2016; Hung et al. 2010).

Discussions and Suggestions for Future research

Longitudinal Studies on Student Background Variables

The findings from this study implied that students who had stronger academic records as early as in high school would continue to do well in hybrid learning courses. However, some students who were not as successful in their earlier study in high school or in college persistently completed online learning activities, carefully designed for the sample course. The data and results of analyses in the sample course indicated that persistence in completing online learning activities had a significant predictive value in regard to students' success in a hybrid learning course. To further investigate the students' motivation and decision to complete the online learning activities and the effects resulting from their work, it would be helpful to conduct longitudinal studies following individual students' performances in different courses to examine the factors that affect students' success in different course formats and delivery modes and compare with the predicted outcomes.

Within-group Differences in Participation Patterns in Online Activities

The data from this study indicated that there were within-group differences among the students who were in different subgroups by achievement levels in the sample course. Compared to Owston et al.'s study (2013) reporting that lower performing students performed worse in hybrid learning course, the majority of sample students, and especially lower performing students in this study completed the online video quiz persistently to contribute toward their final grade. It would be helpful to examine if the

pattern of within-group difference is also present across the different delivery formats or if it is a unique pattern in hybrid course. Also, it would be helpful to examine if there is a difference in student participation due to the nature and type of online activities (Olitsky & Cosgrove, 2014), and the gap in the amount of time and efforts they estimate and the amount that students actually invest. For example, some students tend to complete the tasks that they perceive to be easier than those that would require more substantive work, especially among the lower performing students. In this perspective, future research can be suggested to examine student perception and participation in online activities in different types and nature.

Students' Motivation and Strategies

In addition to the focus on the course delivery format and course components, it may also be helpful to examine the motivations of the students affecting their decision to complete the online activities in hybrid learning courses and the strategies they use to succeed in hybrid courses. Is there a difference among higher or lower performing students using different strategies in following the pace of the course? Do students have different reasons to complete the online or in-class activities in hybrid learning courses? Is there a difference in students' motivation to complete work in the face-to-face sessions, compared to online portion of hybrid courses where they don't actually meet the instructors in person? In what condition do students find motivation to invest their best effort and persist in the course to do better? For these topics of investigation, a mixed methods or qualitative approach can be useful to learn about students' decisions and their rationale behind their decisions.

Limitations

Due to the limited scope of this study, it would be necessary to review the limitations that were applied. First, the student data used in the study was collected from a single section of a hybrid learning course, which the Department voluntarily shared to the researcher for study. Since a convenient sample was used in this study, the result of the study cannot be generalized outside the context of the sample course, or in other disciplines or institutions. Another limitation of the study was that this study relied part of the student background data exported from the student database, matched with the grades and activities from the sample course, thus the scope of the study was limited to descriptive only. Additionally, the data used in this study were limited to quantitative information only. As suggested for the future research, individual students' personal responses explaining their motivation to choose to complete the online video quizzes, and reasons for their persistence in completing the course learning activities and assignments can add valuable information on students' motivation and decision-making process in planning hybrid learning courses or programs.

Finally, the data and results of analyses in this study cannot be used to imply the causal effects of the variables. The results of correlation and regression analysis are limited to describe the potential relationship only and cannot be assumed for the causal effects. Empirical studies with an experimental design would add explanation on students' control of their learning in hybrid learning course, and mixed method studies to address both the quantitative and qualitative perspectives would add explanations through triangulation and validation of the findings.

Conclusion

In response to the dichotomous comparison of effectiveness between traditional face-to-face courses and fully online courses, hybrid learning courses are perceived as a synthesis to combine the benefits from the formats, to offer an effective delivery mode to facilitate students' success. The findings from the existing literature reported a mixed results or lack of significant difference among the delivery modes. Using the data from a sample large-size hybrid learning course, this study investigated to see if there were factors that can predict students' learning in a hybrid course, such as students' demographic and academic background variables and their participation and persistence in online and in-class learning activities. The results of analyses indicated that students' academic background variables such as weighted high school GPA and SAT test scores had statistically significant predictive value toward students' final grades. Also, online video quiz scores, representing students' participation and persistence in online learning activities, had a statistically significant predictive value, contributing to establish a predictive model. The data also indicated that different subgroups of students showed different patterns of participation and persistence in online activities, creating within-group differences. The within-group differences may influence the size of effect, if measured by the average of the class. The data revealed that many students in low-achieving groups invested their effort to complete the online activity (online video quizzes), throughout the course. Persistent participation among the students in low-achieving group was evident, even among the students who failed the course or dropped from the course. Further studies are suggested to investigate the variables that may

encourage student participation in hybrid learning courses and what motivates students to be persistent in the course and improve their learning.

Reflecting the findings from this study, a few practical recommendations can be suggested. First, hybrid learning programs can invest their efforts to understand the academic backgrounds of their incoming students to offer adequate support and appropriate adaptation in the course design. According to the results of the analyses conducted in this study, students' academic background variables such as weighted high school GPA and SAT scores, indicated significant predictive values for their success in hybrid learning courses. Therefore, program administrators may analyze the potential level of success for the incoming group of students, and proactively prepare the courses to effectively facilitate success. The focus will then transition from a class or section to individual students and maximizing their learning in the course.

Secondly, in order to serve students more effectively, hybrid learning programs can focus on intentional planning and preparation. As was the case in the sample course, selecting the course materials with a focus on students' perspectives, could make an important contribution to the student learning by keeping their interest in participating in learning activities and stay abreast with the pace of the course. A careful set of criteria can be prepared and applied in selection of course materials, resources, and methods of presentation during the course.

Thirdly, an effective hybrid learning course should apply instructional design to the course structure, course activities, and feedback to the students, for both online and face-to-face portion of the course. In this study, one of the unique findings was that the majority of students completed the online video quizzes to the end of the course,

exceeding beyond the minimum requirement. The online video quizzes were distributed throughout the entire semester, offering frequent measure of students' understanding and progress. Designing the course to embrace a safe learning environment with multiple opportunities to complete the learning activities without high stakes, high cognitive or emotional distress would be helpful for students, especially those who were not highly successful previously. In the safe environment, students would take the agency on their own learning, by actively deciding whether the learning materials and activities are useful for their learning and make decisions on their persistence.

Finally, hybrid learning courses should actively engage the multiple stakes holders in the design, operation, and evaluation of the course. In the sample course, the instructional designers from the university's Center for Teaching and Learning collaborated with the faculty for the initial redesign of the course from face-to-face to a hybrid learning course, a group of faculty members reviewed multiple series of vides to select for the course, and although actual students were not included in the course design process, their perspectives were considered in the course design and selection of the videos. As effective hybrid learning courses would integrate online and face-to-face learning perspectives and numerous original and curated materials, taught in classroom and online on the technology platform, and supported by multiple campus departments, close collaboration and support from the entire campus would ensure students' success in hybrid learning courses.

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