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Online Versus Face-To-Face Nutrition Courses at a Community College: A Comparative Study of Learning Outcomes

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ONLINE VERSUS FACE-TO-FACE NUTRITION COURSES AT A COMMUNITY
COLLEGE: A COMPARATIVE STUDY OF LEARNING OUTCOMES

by

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DEDICATION

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Students have been gravitating towards the Online Learning Environment (OLE). The preference for online learning models (OLM) among students has grown more rapidly than for traditional face-to-face models in community colleges in the United States of America. Research about OLMs has focused on teaching efficiency and effectiveness to support the growth of online education. Administrators and teachers have continually sought to gain more knowledge about this issue, especially with concerns regarding engagement of students in an online learning environment. Increased student dissatisfaction with online learning models, a high withdrawal rate, and inadequate student-learning outcomes are some of the factors that have contributed to this comparative analysis of online versus face-to-face learning models.

Of the 541 student records collected for this post hoc study, initial analysis indicated that learning outcomes of students enrolled in an online nutrition class showed a statistically significant difference from the learning outcomes of the face-to-face section of the same class, although the difference was small.

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In institutions of higher education in the United States, the online enrollment of students as a percentage of total enrollments from fall semester 2010 to fall semester 2011 increased from 29.2% to 32.0%, indicating that 6.7 million students from this academic year took at least one online course (Allen & Seaman, 2013). The new landscape in higher education, characterized by use of social media, wikis, blogs, and modern technological tools, requires new skills of students with the ability to process and connect information (Del Moral, Cernea, & Villalustre, 2013). According to Del Moral and colleagues, these skills will help faculty contribute to the creation of knowledge while providing feedback, and will improve diversity.

The improvement in information and communication technology facilitates implementation of emerging education techniques (Andronie & Andronie, 2014) such as mobile learning. This form of learning is popular with young students because of their receptivity and ability to use these technologies. Considered different from traditional online learning, Mlearning allows students to access information and learn anywhere on any device. Mobile phones, tablets, laptops, and other handheld devices with connections to the Internet give access to content through apps, online and offline, which are particularly attractive to younger students. However, a report by the National Center for Education Statistics (2011) indicated that in the 2007–2008 academic year, only 27% of students enrolled in online computer and information sciences, and online enrollment in natural sciences was at the bottom with 14%. Students 30 years or older were more likely to enroll in distance learning, followed by those in the 24 to 29 age category (National Center for Education Statistics, 2011).

Context of the Study

One of the greatest changes in higher education since the creation of the World Wide Web and the Internet in the 1990s has been an increased use of distance education through online coursework. Over 37% of students in the United States are enrolled in community colleges, and more than 50% of those students are enrolled in an online learning environment (OLE) (Allen & Seaman, 2008, 2010, 2013). Rapid advances in information communication technology and computers have led to the proliferation of OLEs represented by blended or hybrid learning models with elements of the instruction online and some face-to-face interaction in a single course (Button, Harrington, & Belan, 2013). Online learning environments can also be fully online, in which case the OLE entails complete replacement of face-to-face learning environments.

Austin (2010) reported that the increase in delivery of courses online gets its roots from the 1990s when it became obvious that technology was going to have a transformational impact on higher education. Multiple reasons have been proposed for the high demand for online courses including no set class meeting times, low tuition and fees, transferability of credits, accessibility, flexibility, interactivity, and collaboration (Liang & Chen, 2012). Others have suggested that the appeal of online education stems from the fact that it improves faculty-student and student-student interaction in a non-threatening way that fosters less irritation and conflict (Panagakos & Paskey, 2010).

Most community colleges today offer online courses. Great strides have been made to attract students by offering more online courses to increase enrollment at traditional brick-and-mortar institutions (Borden, 2009). Non-Caucasian student degrees have been seen in online granting institutions like the University of Phoenix, Devry University, and other for-profit

institutions (Aslanian & Clinefelter, 2013). In their 2013 report on characteristics of college students in a fully online program, Aslanian and Clinefelter described 1,500 participants across the entire United States. The proportions of respondents in this study of African American (12%), Hispanic (7%), Asians or Pacific Islander (5%), and Native American (1%) origins that take online classes was relatively low compared to their Caucasian counterpart at 73% overall. However, the percentages were reflective of the national population of the listed ethnicities.

The National Center for Education Statistics reported an increase of 34.7% online course offerings from 2007 to 2008 with larger increases in two-year colleges than in four-year universities (National Center for Education Statistics, 2011; Xu & Jaggars, 2011). Xu and Jaggars (2011) reported that the rationales for more online courses at community colleges included expanding and improving the learning prospects of nontraditional students. Perry and Pilati (2011) reported that students were enrolling in more than one online course because of the flexibility to study anytime and anywhere. In their research, they attributed the evolution to the increased affordability of the Internet and of hardware such as personal computers and mobile devices.

Statement of the Problem

Higher education has increasingly abandoned the traditional synchronous face-to-face teaching style for a method of instruction that relies heavily on the use of technology, either through a blended format or fully online classes that are partially or fully asynchronous (Button et al., 2013). Detwiler (2008) posits that despite numerous studies that claim online learning is as effective as the traditional face-to-face teaching method, skepticism still exists from both educators and non-educators on the effectiveness of online education. Embracing and understanding the impact of technology may help students achieve their goal in education.

However exciting and promising technology seems to be, skeptics opposed to change still resist online learning. They believe that proper learning occurs only in a classroom with a teacher-centered model (Renes & Strange, 2011). Due to the contradictory results of studies conducted so far, the debate has not been settled on whether there is a significant difference in student success between online and face-to-face environments.

Online learning offers flexibility but not all students have the organizational skills to take advantage of this factor because they were not ready for an online learning model. Readiness for online education as described by Appana (2008) has been directly linked to the lack of available resources. As reported by Xu and Jaggars (2014), the lack of adequate online support degraded student performance and actually causes regression.

A national report indicates that the need and interest in science, technology, engineering, and mathematics (STEM) is on the rise, but challenges remain in recruitment and retention (Drew et al., 2015). The report stated that students enrolled in the distance education microbiology course performed as well as the on-campus course and that, by offering microbiology online, the University of Florida has increased STEM participation and diversity in STEM without impacting the on-campus programs. The scarcity of research studies on nutrition for science and health professional indicates the need for more research on the subject, as recommended by Cohen, Carbone, and Beffa-Negrini (2011).

According to Wladis, Hachey, and Conway (2015) in a study of community college science, technology, engineering, and mathematics (STEM), Blacks and Hispanics were significantly underrepresented in online STEM courses; males were more underrepresented than females who were heavily represented online. Wladis et al. utilized data from over 2,000 community colleges to establish that important predictors of online enrollment were ethnicity,

gender, and nontraditional factors. A report from the U. S. Census Bureau (2012) indicated that by 2060, the United States will be more racially and ethnically diverse. Inequality in access (Hagedorn & Purnamasari, 2012) could relate to socioeconomic status, shortage of qualified STEM teachers, and lack of access to STEM resources like technology.

The report from Warschauer and Matuchniak (2010) indicates the lowest rates of Internet access were found in Blacks, Native Americans, and Hispanic students at 44.9%, 41.5%, and 43.4%, respectively. Similarly, Wladis et al., (2015) have determined that Black and Hispanic men had the lowest representation in online courses. The overall retention rate in an online course is usually lower in a face-to-face course (Hagedorn & Purnamasari, 2012). As reported by Gazza and Hunker (2014), nursing programs struggle with graduation and retention rates in their online programs. However, the researchers indicate that the problem was inflated in populations of Hispanic and African American students. Lack of adequate research into the relationship between learning outcomes in face-to-face and fully online courses fuel the fear of many students of being left behind as a consequence of improperly designed course.

Slightly fewer minority graduates have taken online courses, as reported by the National Center for Education Statistics (National Center for Education Statistics, 2011). Hispanic, African Americans, and White students had participation rates of 16.4%, 20.2%, and 21.7% respectively in any distance education courses. The gaps in financial status and educational level among Hispanic and African American students affect withdrawal and graduation rates (Warschauer & Matuchniak, 2010).

Support of minority populations requires colleges and universities to engage instructional designers who are culturally sensitive. Few institutions or programs consider culture as a factor when designing online courses. However, colleges with a diverse group of students must

consider the cultures and learning styles of the students as factors when designing an online course (Asino, 2015). Mustafa, Allouh, Mustafa, and Hoja (2013) have demonstrated that students from different cultures learn anatomy in significantly different ways. In their study of medical students in Jordanian and Malaysian medical schools they have concluded that these cohorts of students had different cultures of learning.

Empirical reviews of literature by Perry and Pilati (2011) have identified three issues affecting the effectiveness of online education. The first issue is student perception of online as a viable option to face-to-face learning. The second issue is the acceptance and willingness of instructors to modernize or adopt this new model of teaching as an alternative to the traditional teaching style. Thirdly, research has yet to establish the effectiveness or superiority in teaching online compared to the traditional face-to-face way of teaching.

Purpose of the Study

The purpose of this quantitative study was to compare the learning outcomes of college students enrolled in an online college level nutrition course with the learning outcomes of students enrolled in the face-to-face version of the same course in a community college in South Texas.

The nutrition course was taught from fall semester 2012 to fall semester 2014. A total of 19 classes included seven online and 12 face-to-face. The study considered the role of student grades, grade point averages (GPA), and other demographic variables: gender, ethnicity, completion or withdrawal from courses, financial status as measured by Pell Grant eligibility, and age. Student outcomes were measured as student satisfaction and final grades, which were a compilation of multiple identical exams, research papers, assignments, special projects, and final exams for the nutrition course and student satisfaction with the teaching methods, the course, and

the instructor as assessed with student surveys on the courses and instructors administered by the college at the end of the semester.

Research Questions

The primary research questions identified for this study were as follows:

1. Is method of instruction chosen independent of the student's gender, age, and ethnicity?

2. Is there a difference between instructional methods in student factors of withdrawal status, financial status as determined by PELL grants, and enrollment status?

3. Is there a difference in overall GPA and course grade points earned? And is the difference influenced by whether instruction was offered online or face to face?

4. Is there a difference in student satisfaction between online versus face to face environment?

5. Is there a difference in student's success as determined by final grade between the face-to-face and online method of instruction?

Significance of the Study

Since many students continue to choose to take classes in the online learning environment, this study contributes to the ongoing debate about the impact of some student variables on modality of instruction in higher education from face-to-face to the OLE. Identifying the factors that contributed to student success in the online and face-to-face courses may assist advisors and instructors in guiding students toward a method that would reduce the withdrawal and failure rates. Alleviating these problems may result from faculty understanding and evaluating whether this course could or should be offered online and whether the characteristics of students taking these courses should be restricted. The study sheds light on the

types of students in each environment and provides suggestions for the institution, faculty, and students that may ensure success in both modalities. Armed with this tool, faculty, student counselors, and administrators may be able to advise students to choose the method of instruction best suited for them.

Recommendations of this current study propose creating a better learning opportunity for students. The research provides information on the impact of diversity, enrollment status, and academic standing (GPA prior to registration for the course) on student success in terms of grade; thus the research may guide administrators to the best choice for good outcomes of student learning, either online or face-to-face. The current study enhances the understanding of students' chances for success in the choices they make on delivery modality during the registration process.

Theoretical Framework

Researchers argue that there is no one perfect theoretical framework, but that all the foundations build upon the work of cognitivist, behaviorist, and constructivist approaches (Liang & Chen, 2012). The three theories of connectivism, zone of proximal development, and self-efficacy were used to conceptualize the study. Technology enhanced learning has typically been researched and analyzed using different research designs. The theoretical framework that describes learning that occurs in an online learning environment (Hakkinen, 2013) should be a theory or theories that aptly describes student experiences online. It is important to elucidate the theory because it directly explains the way online learning is practiced in the United States. In TEL, "open, connected, social" (Couros, 2009, p. 232) are words that have been used to describe an environment where social learning, connectedness, and open thinking were encouraged. Online learning has been studied under various traditional theories—some originating from

Europe. However, the American system of education requires unique theoretical models that reflect distance learning as practiced in the United States (Simonson, Schlosser, & Hanson, 1999).

Early distance learning theories. Distance learning is rapidly changing. Because of the fluidity of the system, it is difficult to identify one theory as the theory of online or distance learning. In the past, several theories have been suggested covering independence and autonomy of the students, industrialization of teaching, interaction and communication (Simonson, Schlosser, & Hanson, 1999); these theories tended to focus on distance learning as a type of education isolated from traditional forms of education. Because of the rapid changes, prominent researchers have continued to debate the relevancy of older theories and to contemplate the applicability of newer theories to frame online learning. As stated by Simonson et al., (1999), for greater understanding of distance or online learning to occur, it must be analyzed through a theoretical framework.

Moore (1973) built on the work of Wedemeyer (1973) in developing the theory of independent study by adding transactional distance. Moore later proposed the theory of transactional distance incorporating the idea that learning in an online environment could be student directed or teacher directed. But Moore carefully questioned when the role of the teacher needed to be scaled back to allow students to become independent and autonomous learners.

Peters (1988), was greatly influenced by the industrial revolution, associated distance learning with the theory of industrialization of teaching. This theory aligned somewhat with constructivist views. Other theorists like Holmberg (1989) focused on the interaction and communication aspect of distance learning and how this affected student-learning outcomes. Despite the multitude of theories in the field, there seems to be no consensus on one that is

adequate to call it a theory of distance learning. Table 1 is a summary of the learning theories

used in the development of the current discussions.

Table 1

Early Distance Learning Theories

THEORIES	FOCUS	CHARACTERISTICS
American Theory of Independent Study (Keegan, 1986; Wedemeyer, 1973)	Independence of the student	Operating anywhere, student responsibility, student collaboration, consider individual differences, learning at your own pace
Theory of Independent Study (Moore, 1973)	Learner autonomy and distance between teacher and learner	Two-way communication, responsiveness of a program to the learner's need, autonomous program (learner-determined) or non-autonomous program (teacher-determined)
Theory of Industrialization of Teaching (Peters, 1988)	Comparison of distance learning to industrial production of goods	Rationalization (reduction of cost, time, and money); division of labor (simpler tasks); mechanization (use of technology); assembly line (materials used by teachers and students are not a product of one individual); mass production (large scale production); preparatory work (success depends on readiness); planning, organization, scientific control, formalization, standardization, and centralization.
Theory of Interaction and Communication (Holmberg, 1989)	Teaching effectiveness, belonging, cooperation, and communication.	Interaction between teacher and student, emotional involvement, pleasure and motivation, participating in decision making, strong student motivation and learning, and effectiveness of teaching
Perraton's theory of distance education (1988)	Role of distance learning teacher, communication and diffusion of philosophies of education	Medium to teach anything, far reaching, addresses fixed staffing ratios, can be cheaper and sophisticated
Equivalency Theory (Simonson, 1995; Simonson, Schlosser & Hanson, 1999)	Equivalency of learner experiences	Learning experiences should be tailored to the environment and situations, learner experiences, appropriate applications, students and outcomes
Transactional Theory (Fuegen, 2012; Gorsky and Avner, 2005; Moore, 1993; 1997)	Space of potential misunderstanding between teachers and students	Structure, dialogue, and learner autonomy

Garrison and Baynton (1987) developed the theory of control. The theory of control through the lens of a student and a teacher concluded that the interaction, though complex when applied properly, should determine the student-learning outcome. Garrison (1989) modified the theory of control and indicated that control had to be collaborative and dependent upon student-teacher interaction (Schulte, 2011).

Siemens (2005, 2008) pointed out the limitations of the technology-enhanced instructional environment most often described under learning theories related to behaviorism, cognitivism, and social constructivism. He acknowledged that teachers are impacted by the use of modern technology and the concept of distance learning. Nevertheless, most of the theories he criticized were created long before the influence of technology on learning. And therefore on principle are unable to address learning that occurs as a result of technology. They were inadequate in recognition of value judgments in these technology-enhanced environments. The benefits in distance learning are not exhibited in earlier learning theories.

Constructivism was most often the main framework used in studies employing the use of information and communication technology (ICT), online learning, and/or active learning and knowledge construction (Koh, Chai, & Tsai, 2014; Koohang, Riley, Smith, & Schreurs, 2009). However, Puzziferro and Shelton (2009) recommended that new learning theories be considered in the digital age. They are of the opinion that e-learning or online learning will be driven by connectivist, self-directed, active, and personalized learning. Emphasis is on a concrete learning process.

Connectivism. Siemens (2005) introduced a newer framework known as *connectivism* as an alternative for online learning with eight principles:

1. Learning and knowledge rests in diversity of opinions.
2. Learning is a process of connecting specialized nodes or information sources.

3. Learning may reside in nonhuman appliances.
4. Capacity to know more is more critical than what is currently known.
5. Nurturing and maintaining connections is needed to facilitate continual learning.
6. Ability to see connections between fields, ideas, and concepts is a core skill.
7. Currency (accurate, up-to-date knowledge) is the intent of all connectivist-learning activities.
8. Decision-making is itself a learning process. Choosing what to learn and the meaning of incoming information is seen through the lens of a shifting reality. While there is a right answer now, it may be wrong tomorrow due to alterations in the information climate affecting the decision. (Siemens, 2005, p. 4)

From the connectivist perspective, learning is not entirely dependent on the individual but may originate from the environment, and new knowledge via connections of specialized information. Downes (2005, 2011) contributed to the theory of connectivism by relating it to the function of the brain and its neural connectivity. He referred to connectivism as a theory that relates deep thoughts to the creation of understanding not structured as a model but as a theory, which requires nurturing and growth like a plant. With connectivism, knowledge is fluid and changes as new information is continuously gained. Siemens's work (2005) recounted the value of an individual's capability to pull together, connect, and make meaning out of patterns.

Connectivism, as a framework to study the learning that occurs with the use of technology, generated a change in focus from internal processes, and individualistic learners to the recognition of the learner's use of new tools and environmental influences to determine the meaning of learning. The emphasis on student-centered learning both in content and structure is associated with participatory pedagogy, which is linked to connectivism.

Siemens was the first to test connectivism in the massive open online courses (MOOC) in 2008 that he and Downes taught at the University of Manitoba (Murray, 2013). Since then, there has been a tremendous increase in people who want to take courses and also interact and develop as individual learners, allowing them to process rapidly changing information.

The theory, however, failed to address the central attributes of learning (Kop & Hill, 2008). This failure contributed to the lack of support for connectivism (Clara & Barbera, 2013). Kop and Hill (2008) critically analyzed connectivism as a new model that does not meet the criteria for a learning theory on its own, but would continue to contribute to the improvement and materialization of newer forms of instruction that cater to these different students. There is not sufficient evidence to support a complete replacement of all other learning theories. Because Kop and Hill saw problems in 2008, many researchers continue their quest for a theory or combination of theories. This researcher has sought to use Bandura's *self-efficacy* (social cognitive) theory (Lau, 2014) and Vygotsky's (1978) *zone of proximal development* (ZPD) to explain the context of learning as it occurs in the digital age. It is in this light that they have suggested adding the zone of proximal development and self-efficacy to connectivism when describing any form of online learning. Using connectivism, self-efficacy, and the zone of proximal development presents a perspective that social practices or interactions determine mental development. This combination provides a better picture of the learner.

Zone of proximal development. Vygotsky's ZPD is synonymous to *scaffolding* of learning (Guk & Kellogg, 2007; Rourke & Coleman, 2010). Scaffolding has been associated with students' ability to gain control of features that were beyond their competence. To achieve this stage of scaffolding, a support structure must be in place to facilitate nurturing of specific skills. Group projects must be assigned in the course, and student-student or faculty-student assistance provided during their interaction (Sabet, Tahriri, & Pasand, 2013).

In a study by Gan and Zhu (2007) on constructing a framework for learning in a virtual environment, they postulated that ZPD could be compared to the stages associated with knowledge building (self-guided learning) in the form of negotiation and co-construction. They

also explained that ZPD includes debating, negotiating, and the construction of a deeper meaning. It involves changes, consensus, evaluation, and cognitive intelligence. Balakrishnan and Claiborne (2012) suggested that ZPD was appropriate for studies that involved multiethnic populations. Tharp and Gallimore's modified study (1988) model of ZPD illustrated that ZPD is achieved in four stages of development: students are assisted by resourceful peers, students grows confidence to help self, students internalize and solve problems, and students reflect on past events when values conflict. In ZPD students actively communicate with each other, and utilize the strength and expertise of their peers to broaden the scope of their knowledge. The concept was well supported by technological evolution, which provided the platform for such interaction and for collaborative learning (Dongyu, Fanyu, & Wanyi, 2013).

Teachers have been known to avoid this approach because they think it is not practical to teach each student in a class individually. Vygotsky's (1978, 1986, 1997) zone of proximal development (ZPD) has affected the way we understand learning by involving social interaction and life experience. In a study on the Web Coursework Support System, which facilitated students, completing their coursework within their ZPD, Li and Chen (2009) determined that when students studied within their ZPD, there was an increase in assignment completion. These changes cause the student to develop new ways of thinking and acquiring knowledge (Chen, 2012). Furthermore, Guk and Kellogg (2007) illustrated that instructors needed to become mediators. Mediating the learning experience of the individual student allows the student to interact and facilitate the task with his or her group, furthering student-student mediation.

Bandura's self-efficacy theory. Social cognitive theory describes an online learner as one who learns by observation and replicates appropriate behaviors. The theory describes an individual's belief that he or she has the ability to perform the task (Robb, 2012). In a study on

the application of self-efficacy in nursing students, Robb (2012) was able to correlate the success

of students to the self-efficacy exhibited. Students with high levels of self-efficacy were most

likely to have confidence, perseverance, and a perception of capabilities. In other words, self-

efficacy portrays the confidence of a certain individual towards the task assigned (Van Der

Roest, Kleiner, & Kleiner, 2011). Four categories of self-efficacy have been paramount to the

understanding of student-centered learning:

1. Experience/personal attainment: Past experiences are an important factor in influencing self-efficacy. Simply put, success raises self-efficacy and failure lowers it.
2. Modeling (or vicarious experience): Individuals compare themselves with their peers. If individuals view success in peers, self-efficacy will likely increase.
3. Social/verbal persuasions: This concept relates to encouragement and discouragement. Positive reinforcement or assessments from peers have a favorable effect on self-efficacy.
4. Physiological factors: Physiological responses may influence an individual's self-efficacy. For instance, if individuals become stressed or anxious when using technology, they may view this as a sign of their own inability. However, for those with already high self-efficacy, this nervousness may be perceived as a normal response to pressure (Bandura, 1997).

An example of Bandura's self-efficacy application was conducted on addicts at Imam

Reza Hospital addiction-quitting clinic. The results from the test and control groups revealed that

the test group was more successful (Heydari, Dashtgard, & Moghadam, 2014). A similar study

conducted on physics students at Florida International University exploring the relationship

between self-efficacy and retention rates indicated a significant relationship. Sawtelle, Brewe,

and Kramer (2012) were able to identify that retention rates of men and women are best

understood through self-efficacy theory. Because their study was conducted on a science course,

they recommended that other studies investigate how self-efficacy influenced persistence in

other science courses like nutrition. Reid (2013) in another study reported that although African

American males generally had lower graduation rates (33%) compared with their female

counterparts (44%), the men who had higher GPAs and stronger self-efficacy were more likely to do well and graduate on time than those with lower self-efficacy.

A combination of these three theories—connectivism, zone of proximal development, and self-efficacy would provide online learning experience with much depth and perspective. This will serve as the theoretical framework for the current study as shown in Figure 1.
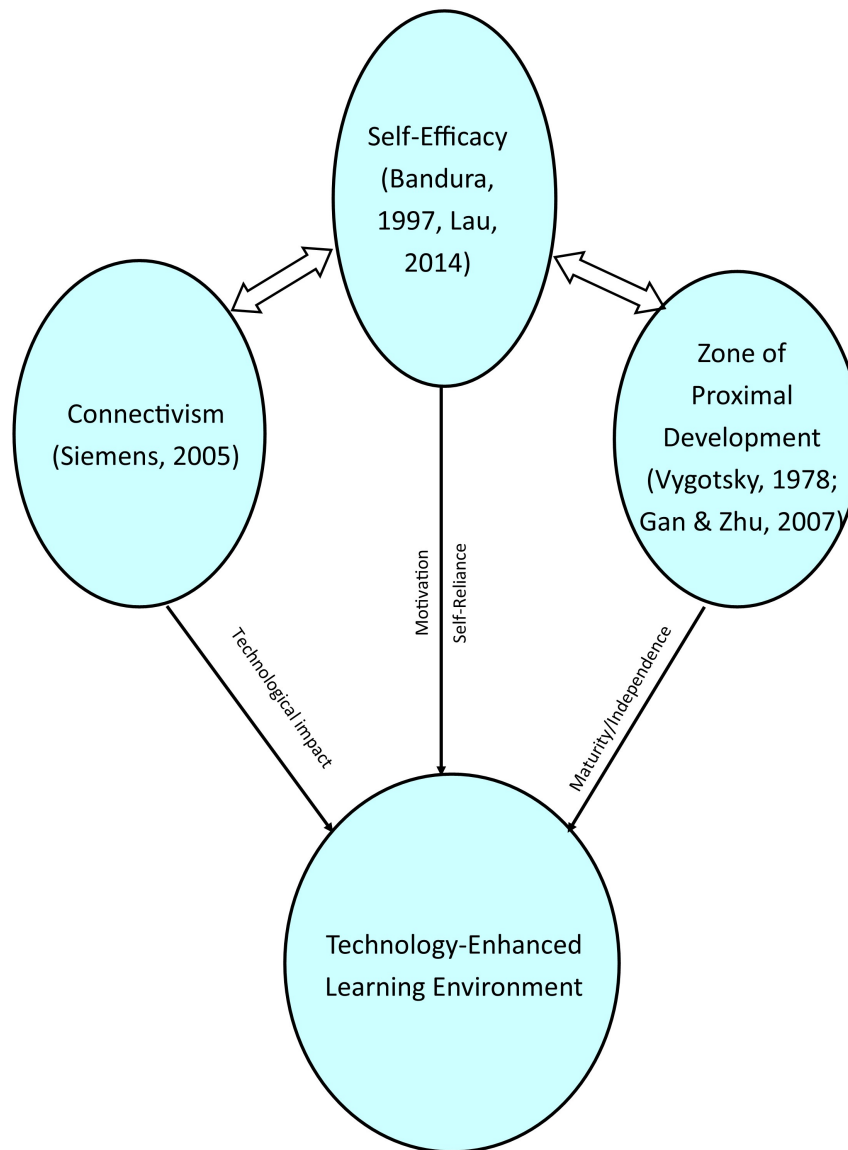
Figure 1. Nfor's model of theoretical framework for technology-enhanced learning environment.

Setting of the Study

The community college utilized in this study had a fact book for 2012–2013 describes five main divisions: Arts and Sciences, Applied Science and Technology, Health Science, Continuing Education and Extended Services, and Interdisciplinary Programs. The college has annual enrollment of more than 10,000 students (females 57%, and males 43%). Of this population, three ethnic groups make up the majority: Hispanic (53%), White (30%), and African Americans (12%). The college includes an Instructional Innovation Center, Instructional Technologies Center, and a Center for Learning Resources. These institutional resources are available to the students and instructors. The institution utilized in this study also has a laptop loan program with a limited number of laptops available for loan on a semester basis to eligible students with a GPA of at least 2.5 and in good academic standing. The school has three brick-and-mortar sites with a total enrollment of more than 10,313 students.

The Department of Natural Sciences at a community college located in South Texas offers a college level nutrition course for science and health profession majors. The goal of this course is to develop student awareness of the contribution of proper nutrition to overall wellness. As part of students' degree and certificate programs, this 3-credit hour course is required for all undergraduate students aspiring to these fields. The prerequisite for students to enroll in the course is to have completed one chemistry course. Topics covered in the nutrition course at the undergraduate level are the science of nutrition that links food, function, and health. In this study, the face-to-face class met in the morning twice a week while the online version of the same course was flexible and students could access the course website from anywhere at any time.

Limitations and Delimitations

The limitations of a study are the constraints the researcher faces that are beyond his control. These factors or conditions may affect the results and conclusions drawn at the end of the study. When considering the limitations of a study, it is important to assess the analysis, instruments, and sample size of the study. Delimitations on the other hand are restrictions or choices the researcher made when conducting the study. These involve explanations of things the researcher deliberately did or did not do, such as reasons for not studying a particular population or using a specific method. They include factors such as choice of research questions, objectives, theoretical frameworks, and choice of variables. It also involves rationale for choice of study area which may impact the generalizability of the study.

Limitations. A limitation to this study is applicability or relevance to a broad audience because the study was conducted in only one 2-year community college with data from a specific academic timeframe (2012 to 2014). Participants used for this study all came from one population (nutrition course). An incorporation of multiple community colleges across the entire South Texas might be more effective.

Participation in the study was limited to those students enrolled in a nutrition class. Therefore, these results would not reflect the opinions and preferences of college students in other subjects or similar courses in other parts of the state or country. In addition, the nutrition course had the same curriculum but was taught by two different instructors, one teaching online, and the other on campus. Despite the exactness of the course, there might be some variation in its effect on the student performance because of teaching style rather than modality.

Data on student satisfaction were gathered from an instrument for which the institution could not provide evidence of validity or reliability testing. An additional limitation is that the

institution for research and planning at the college administered student evaluation surveys and the researcher had no input, which might have led to undetected biases. To account for these biases, some students might have received their survey in junk mail or deliberately deleted them. In addition, because the students are not required to take surveys, the quality of survey results could be affected by pulling results towards either positive or negative direction. This meant that very satisfied and very dissatisfied students were more likely to respond to surveys than mid-range performers. Another limitation to consider would be that those who completed the online surveys were technologically savvy thereby injecting a degree of bias in the data collected (Guarino et al., 2014).

Delimitations. Only students registered for either the face-to-face or online nutrition class were included in the analysis. The study considered students who withdrew from the course or were dropped by the instructor. However, information on whether the student had taken an online course previously was unavailable.

Chapter 2: Literature Review

The purpose of this quantitative study was to compare the learning outcomes of college students enrolled in an online college level nutrition course and the learning outcomes of students enrolled in the face-to-face version of the same course in a community college in South Texas. This literature review covers, rends, challenges, comparisons, and suggestions for improvement of online education.

Researchers are now studying the effectiveness and improvements in learning outcomes of virtual learning environment models as measured, inter alia, by final course grades and/or the grade point average and by comparing these results to those achieved by students in face-to-face courses.

As illustrated by Liang and Chen (2012), courses offered online vary in nature and this difference could affect the quality of online instruction. Other factors affecting the quality of online learning compared to face-to-face learning is related to cheating and academic integrity as described by Miller and Young-Jones (2010). A report by Mitchell and Forer (2009) reiterated that information and communication technology usage to promote education is ineffective, but blended learning was popular with students. While students preferred traditional lectures, they appreciated the flexibility and choices offered by online platforms.

Trends

The increasing availability and affordability of information and communication technologies (ICT) have led many college students to choose to attend school online. Consequently, educators and administrators have had to find innovative ways of delivering course content to these students. Mitchell and Forer (2009) also stated that the types of online learning students chose depended on past experience with technology. Parsad and Lewis (2008)

reported that over 66% of 2-year and 4-year degree-granting institutions offered classes fully online, hybrid, or other formats with over 12.2 million in online learning during the 2006–2007 academic year.

E-learning. A method of studying that utilizes technology; e-learning increases flexibility and convenience, while removing the challenges of space and time (Qin, Zheng, & Li, 2014). As technology and the interactive whiteboard developed, coupled with use of the Internet, ICT in education grew fastest from 1996 to 1999 (Cox, 2013). From the year 2000 to the present, the expansion has involved mobile handheld devices, graphic portable devices, and social software, as well as integration of mobile technology and other learning platforms in the classroom. As a result of the proliferation of information technology (IT), the challenge with e-learning is that faculty and administrators do not know what types of ITs are used by students outside the classroom.

Kellogg (2011) reported that e-learning or online learning is popular for educational institutions because it reduces the stress on building facilities as well as on the cost of higher education. The convenience and flexibility of e-learning in an era when digital and technological advancement has made lifelong learning easier has encouraged many institutions to offer online degree programs. In a U.S. Department of Education study, Kellogg reported that at least 4.3 million students (20% of undergraduates) took at least one class online with 4% taking their entire program online in the 2007–2008 academic year.

Blended learning. A format that combines online or asynchronous teaching with face-to-face teaching with students attending classes on campus and having some lessons online is called blended learning (Al-Qahtani & Higgins, 2013). According to Kiviniemi (2014), the transition of some courses from the traditional face-to-face to a blended or hybrid while maintaining

traditional intellectual content and course evaluation has shown a statistically significant contribution to students learning experiences. A meta-analysis conducted by the U.S. Department of Education in 2010 (Means et al., 2010) indicated blended learning as superior to the face-to-face format. Overall, feedback from the students in the U.S. Department of Education study was positive, predicting blended learning to be of use in improving student learning. The literature projects that blended learning has the potential to reduce the weaknesses of either face-to-face or e-learning. Face-to-face is a form of instruction that is synchronous with student/faculty interaction as opposed to the online asynchronous model, which is fully instructed over the Internet, using modern technology and various tools (Lotrecchiano, McDonald, Lyons, Long, & Zajicek-Farber, 2013).

Although technology is changing in form, substance, and learning in higher education, Rowe, Bozalek, and Frantz (2013) are of the opinion that it is most often used to reinforce face-to-face teaching instead of being used to promote information sharing and communication that might encourage students to participate in knowledge construction. In their study, Rowe et. al. (2013) used Google Drive as a tool in a collaborative online authoring environment. Using this tool, instructors were able to persuade students to change their perceptions of what they can achieve when they take control of their learning. Lancaster, Wong, and Roberts (2011) reported that when students' course grades and individual examination scores in a master of science nurse practitioner course taught in traditional and blended formats were analyzed, students in the blended class performed significantly better than those in the traditional class.

Challenges

Multiple challenges complicate implementation of online courses. The challenges relate to the institution or college, faculty members, and students' readiness to embrace this new form of learning.

Institutional readiness. Online learning environments will undoubtedly be the future of higher education as technological innovation and the Internet become readily available to all, thereby permitting institutions of higher learning to expand academic opportunities. It is, however, important for policy makers to recognize that quick and unstructured online programs and courses do not result in the learning outcomes expected by students just because the school needed to save money (Journell, 2012). Kiryakova (2009) reported that despite the attractiveness of Web-based learning, drawbacks from fear of security bridges, poor or no connectivity, time wasted, and inability to verify the validity or authenticity of information students are presenting, copyrights, and some educational problems persist. Rienties et al. (2012) reviewed the role of information and communications technology in transitional education practices and posited that instructors do not associate content and pedagogical styles with the choice of ICT. Hence, institutions need to invest in infrastructure and training of faculty and staff.

Sometimes schools resist change or are slow to acquire technology or keep up with changes in technology; this lack of shared vision as well as insufficient funding negatively impacts adequate implementation of distance learning to promote success (Simonson, Schlosser, & Orellana, 2011). Aragon and Johnson (2008) also identified failure of the schools to provide adequate counseling, advisement, and drop procedures as further challenges.

Student readiness. The challenges facing online education are not all institutional. As stated by Panagakos and Paskey (2010), some struggles facing administrators and policy makers

are those involving ill-prepared students, trouble with connectivity, and older computers at home. Targamadze and Petrauskiene (2012) conducted a comprehensive study on reported barriers to student's success in the online learning environment. The study's findings suggested that the lack of abilities, motivation, responsibilities, independence, and engagement, along with poor knowledge of information technology, limited Internet access, and time restrictions, could all hinder a students' success in online courses.

In a study by Aragon and Johnson (2008) on completers and non-completers of online course work, 56% of the online students who failed to complete their course online identified challenges like time management, personal problems, lack of motivation, and work conflict. Student readiness is not identical for all students.

Finally, students did not know their learning styles to properly match the instructional format. As illustrated by Tonsing-Meyer (2013) in a study on graduate education students on instructional practices based on learning styles, in order to enhance the learning experience of students in different instructional practices, courses should be designed to respond to the different learning styles. However, Zacharis (2010) reported in a comparative study on the impact of learning styles on student performance that students could be as successful online as in face-to-face classes regardless of their learning styles. Duus and Cooray (2014) were at the forefront of identifying certain key challenges pertaining to students specifically and to faculty. According to their report, student challenges in online or virtual learning platforms included

- anxiety and discomfort with the course due to lack of prior experience;
- resistance to group or collaborative work leading to difficulties reaching agreements;
- unwillingness to share information, resources, or knowledge to facilitate the

success of the group;

- and, finally, failure of the group to thrive or succeed.

As reported by Castro (2013), college readiness is affected by a student's race and socioeconomic factors. Burns (2013) proposed that designing an online class required consideration of the persistence of online learning among different cultural backgrounds, in order to understand better students' readiness within cultural and geographic contexts. Burns' study also projected that a blended course is appropriate for students with low-level readiness because it offered some face-to-face interaction. According to Tayebinik and Puteh (2013), students who had taken courses online before were more likely to succeed or have a passing grade in a subsequent online class.

Technological advances and the high attrition rates in online classes necessitate student counseling for online classes to ensure success. Although many readiness surveys have gauged students' readiness for online classes in the past, Dray et al. (2011) reported the surveys were limited in translation and validity. Dray et al. developed what they thought was a more rigorous e-readiness survey, based on the gap in acquisition and engagement with ICT student readiness; they determined that the survey should incorporate:

1. Basic technology skills, which include the ability to use specific applications in specific ways (e.g., email, Internet, spreadsheets, and documents).
2. Access to technology including ownership of technology and connectivity to the Internet.
3. Usage of technology, for example, nature and frequency of use.
4. Relationship with ICT (e.g., beliefs, values, confidence, and comfort with technology (Dray et al., 2011, p. 43).

Faculty readiness. Readiness or preparedness should not be focused solely on the student. According to Eslaminejad, Masood, and Ngah (2010), the success of any online course depends on the readiness of the instructors as well. Using a 5-point Likert scale instrument that

focused on technical and instructional areas, they studied the knowledge, attitude, skills, and habits of the instructors. They concluded that instructors need continuous training to be well versed on the ever-changing technology; moreover, to implement an effective online program, the organization needs to encourage educational innovations.

Other challenges faced by online education relate to faculty burnout (Bolliger & Wasilik, 2009), attributed to increased demand of colleges for faculty members to include into their vitae the ability to teach online. However, failure to succeed in these online classes is sometimes attributed to the lack of academic integrity, instructor's not properly trained, poor classroom management, and lack of infrastructure (Simonson et. al., 2011). For instructors to design a successful online course, an effort must be made to acquire tools that facilitate such a transition. Many community colleges provide in-house training to faculty, but Lorenzo (2010) indicated that colleges with the increasing demand for online education should plan accordingly for shortages in faculty to teach online. Hung and Jeng (2013) demonstrated that key factors influenced future faculty members to participate in any form of online teaching. They illustrated that the faculty's attitude toward online learning and teaching, age, and online teaching experience were some of the factors to consider. Course design and communication were other challenges that highlighted the instructors' ability to respond in a timely manner, as stated by Aragon and Johnson (2008).

Likewise, Targamadze and Petrauskiene (2012) highlighted barriers from the teachers' perspective. Factors listed by the study included the lack of faculty pedagogical expertise and professional skill for teaching online; instructors who had no idea how to deal with IT issues; or online instructors who did not have computer-based workplaces or continuous Internet connection.

In a study of a faculty development program for nurse educators, Lee et al. (2010) reported, "Faculty acknowledged that teaching online effectively is a skill that can be learned, but that time is needed to prepare for a successful online experience" (p. 23). They also concluded that for a successful transition to online learning, pedagogical and technological training and particulars about workplace expectation, would be crucial. On the other hand, challenges elucidated by Duus and Cooray (2014) related to gaining support for the program, proper communication with other institutions to facilitate the exchange of ideas, and devoting ample time and effort to developing courses.

Challenges with diversity. As reported by Lee (2011) in a study involving Korean and non-Korean students' perceptions of the teacher's role in a multicultural online learning environment in Korea, effective online learning opportunities require the instructor's awareness of the influences of culture on learning environments. There is still a need for information on the success rate of online versus face-to-face learning in a multicultural setting (Lee, 2011). Goold, Craig, and Coldwell (2007) suggested that an understanding of a teacher's role in a multicultural virtual learning environment would provide effective opportunities for diverse populations of students. An understanding of the role of culture in an online learning environment would make instructors more effective in delivering information to a diverse group of students Ethnicity, language, and attitudes towards educational learning, learning styles, and economic background were identified as cultural factors in their study.

A report by Greene, Marti, and McClenney (2008) supported the notion that Hispanics and African Americans do not perform as well as Caucasians in an online environment; despite being very engaged in class, African Americans had a lower academic outcome relative to their

White counterparts. Similarly, the same study asserted that Hispanic students at community colleges with high levels of engagement in the mental activity factor obtained significantly lower grades than the Caucasian students.

From similar research, the lack of proper understanding of the impact on student learning outcomes in either face-to-face or fully online courses may have actually resulted in regression or poor performance by low-income or underprepared students. Despite the appealing characteristics like flexibility, student-to-student interaction, and collaboration, Cavus and Ibrahim (2007) highlighted the impact of students' inability to receive immediate feedback on student learning.

Comparison

The studies reported here compare traditional or face-to-face with fully online and blended courses. Throughout this literature review, more than 80 were reviewed for significance, no significance, and negative or mixed results. The majority of studies conducted so far indicated there were no differences and the few that demonstrated significant results were conditional. To comprehend the debate on this topic, the literature reviewed identified some important studies, which are grouped as stated.

In many two-year community colleges, the vast majority of students are nontraditional. The rationale for more online courses at a community college has been to expand and improve the learning prospects of the nontraditional student as reported by Xu and Jaggars (2011). The increase in online learning has been quicker in two-year community colleges than in four-year colleges throughout the past decade. Xu and Jaggars also identified eight studies of student-learning outcomes of face-to-face in comparison to online learning.

In a survey of students about technology in 2013, Skiba (2014) reported that 76% of students were satisfied that technology helped them achieve their academic outcomes and 71% of students used open educational resources. The report indicated that laptops (89%), smartphones (76%), desktop computers (43%), tablets (31%), and E-readers (16%) constituted devices owned by students. Fifty-eight percent of students owned three or more devices. A reported 63% of U.S. students preferred blended learning classes and only 46% have had any experience with MOOCs

McPhee and Söderström (2012) conducted an inter-country study on student learning outcomes of postgraduate students in Sweden and Scotland. The study investigated differences in students' study mode, length of study, and performance in an online and on-campus classes. Results indicated students in Sweden and Scotland utilized virtual learning environments (VLEs) to gather pertinent information regarding their coursework.

Chen, Jones, and Moreland (2013) conducted a study on course level and its contribution to student learning outcomes in an online versus face-to-face environment. They reported that course level was an important consideration in designing an online or blended course. Their results suggested that there was a significant difference in effectiveness of online and traditional delivery methods depending on course level.

No meaningful difference. Researchers like Simonson, et. al., (2011) concluded that online education was as effective as face-to-face classes when comparing student-learning outcomes. He also pointed out that online learners were highly motivated, abstract learners, with a positive outlook to distance education. The absence of significant difference between the grades or test scores for the two delivery methods implied that online instruction could be as effective as a traditional face-to-face format (McPhee & Söderström, 2012).

In a study of disabled college students registered with the on-campus office of disability accommodation, Barnard-Brak and Sulak (2010) investigated the attitudes of students who requested accommodation in an online versus face-to-face learning environment. The result revealed there was no significant difference in the approaches. A review of literature by Arbaugh et al. (2009) of online and blended learning in the fields of accounting, economics, finance, information systems, management, marketing, and operations/supply chain management revealed that there was no significant difference in student learning outcomes with the different instructional platforms.

A recent study comparing the instructional delivery methods (online versus face-to-face) conducted in an elective course on immunization at the University of Wisconsin School of Pharmacy revealed that students were not opposed to online courses and some changed their course delivery during the semester to online or blended. However, the focus of the study was to identify which method of delivery was better. The study showed no significant difference between the two instructional methods (Porter, Pitterle, & Hayney, 2014). Vigentini (2009), in a study of the use of technology by students in an introductory psychology course, concluded that the academic performance of students who used online resources was considerably higher than those who did not. The report highlighted that student learning styles or usage of online resources are not accountable for student success by themselves; struggling students needed the more strict instruction measures of OLEs, as opposed to capable students who relied on learning opportunities offered by OLE environments.

Bennett, Padgham, McCarty, and Carter's (2007) study on economics students indicated that the average final grade was 10% lower online than in a traditional method of instruction, with micro students online scoring six points less than those in a face-to-face class. However, in

the macro online course, students had significantly higher final averages compared to their traditional face-to-face student counterparts. In addition, students in the macro course had significantly higher GPAs than the traditional on-campus students. In a study of the effects of a blended learning approach at a graduate level course in public health, Kiviniemi (2014) established that the positive feedback received from the students indicated the potential for blended learning to improve student academic outcomes.

Another study of 95 online and 92 on-campus students at a graduate school of public health showed no significant differences in student learning outcomes in terms of final exam scores in an introductory biostatistics course (McGready & Brookmeyer, 2013). Mentzer, Cryan, and Teclehaimanot (2007) in a study of a philosophy course, concluded that there was no significant difference between the students' tests scores in a Web-based and face-to-face class. Students enrolled in the philosophy course online had significantly lower grades compared to those who were assigned to the face-to-face group (Mentzer, et. al., 2007). One reason for this difference, according to researchers, is the failure of students to submit assignments in the online group.

An examination of the differences between distance learning and face-to-face learning in an introductory statistics course brought a similar conclusion in comparing students' final grades and student satisfaction surveys (Summers et al., 2005) between the two methods of delivery. Frimming, Bower, and Choi (2013) drew a similar conclusion in a study of a physical education personal health science course, which reported no significant difference in how the students perceived the mode of delivery. A comparison of the Web-based class to traditional extended focused assessment with Sonography for Trauma course revealed that physicians appreciated the

flexibility of Web-based instruction and that the online course provided knowledge similar to the traditional classroom environment.

Positive impact of online instruction. In a study on Web 2.0 and emerging technologies, Diaz (2010) reported the use of Web 2.0 activities such Flickr, YouTube, wikis, blogs, Podcasts, Webcasts, and social bookmark or tagging as helpful. At the Sultan Qaboos University in Oman, in a study comparing face-to-face instruction to computer-mediated instruction in an undergraduate educational measurement course utilizing posttests, Alkharusi, Kazem, and Al-Musawai (2010) found a significant difference between the methods of instruction. The results favored the computer-mediated form of instruction; further strengthening the recommendation made by Means et al. (2010) that online learning is as effective if not better than face-to-face classes. In addition, Moazami et. al., (2014) reported, in a comparative study of virtual versus traditional methods of instruction used by Iranian dental students, that the virtual method was more effective than the traditional method of instruction.

Also, Lim, Kim, Chen, and Ryder (2008), using a post hoc Scheffés multiple regressions to study learning environments, reported that students in an online learning environment had a significantly higher level of performance when compared to face-to-face learning environment.

Negative impact of online instruction. The results of a study conducted by Xu and Jaggars (2011) of 23 courses in the Virginia Community College system posited that student grades and perseverance suffered more with online courses compared to face-to-face counterparts. The conclusion drawn from this study indicated that the online format of learning at community colleges might not be suitable for all students because of the significant negative impact. Lu and Lemonde (2013) investigated lower performing students in the same course, the online classes performed significantly poorer than those lower performing students in the face-

to-face class. Students in advanced courses performed better in traditional learning environments than in the online courses. Though student-learning outcomes were not affected by the mode of delivery, the experiences of the nursing students with online was positive at the Ain Shams University in Cairo, Egypt. Most of the 90 students who used e-learning in this study failed to participate in a number of online communication activities because of the lack of computer skills (Abdelaziz, Samel, Karam, & Abdelrahman, 2011). Furthermore, the study recommended that despite students' satisfaction with online forms of instruction, students with limited skills and resources should consider taking a hybrid or blended course to overcome such deficiency. Several studies on online learning have indicated it was an effective option for students except in a science or mathematics course (Toch, 2010). This lack of effectiveness could be a result of age, gender, or ethnicity rather than subject matter.

Morrison's (2011) study on end-of-course critiques or surveys in resident courses revealed that students who took classes online had a significantly lower end-of-course critiques compared to face-to-face students. However, there was no significant difference in the level of favorability for one form of instruction to the other.

Table 2 lists the results of nine studies representative of literature comparing online and face-to-face instruction. The great majority either found no difference or favored online.

Suggestions for Improvement

Higher education has embraced the concept of online learning. Many institutions are spending so much money to upgrade to the level of offering classes online. Mitchell (2014), in a study of online courses and teaching strategies, recommended that online instructors need to engage students by incorporating online teaching strategies that would enhance students' experience and knowledge. Mitchell identified strategies that included online office hours, links

Table 2

Representative Lists of Comparisons between Face to Face and Online Instruction

Author	Comparison	Effect	Notes
Abdelaziz et al., 2011	Evaluation of e-learning program versus traditional lecture instruction for undergraduate nursing students in a faculty of nursing.	No	Blended recommended
Anderson, & May, 2010	Does the method of instruction matter? An experimental examination of information literacy instruction in the online, blended, and face-to-face classrooms.	No	Method of instruction does not matter
Arbaugh et al., 2009	Research in online and blended learning in the business disciplines: key findings and possible future directions.	No	Comparable to face-to-face
Barnard-Brak & Sulak, 2010	Online versus face-to-face accommodations among college students with disabilities.	No	Disabled students
Chen et al., 2013	Online accounting education versus in-class delivery: Does course level matter?	Yes	Course level
Cohen et al., 2011	The design, implementation, and evaluation of online credit nutrition courses: a systematic review.	No	Inconclusive
Emerson & Mackay, 2011	A comparison between paper-based and online learning in higher education.	Yes	Online performed better
Fishman et al., (2013)	Comparing the impact of online and face-to-face professional development in the context of curriculum implementation.	No	Curriculum development
Porter et al., 2014			
Xu & Jaggars, 2011	Comparison of online versus classroom delivery of an immunization elective course.	No	Similar outcomes
	Online and hybrid course enrollment and performance in Washington State Community and Technical colleges.	No	Online classes had lower success

to websites, opening the course at least one week prior to the start of traditional classes, and posting a brief introduction to the course. These course procedures would promote a smoother transition for students. Renes and Strange (2011) stress that educators must maintain strict ethical standards in e-learning environments where innovation and opportunities exist for institutions to reduce cost and expand education in very creative ways. Table 2 illustrates a summary of some of the studies conducted on online learning and its effects.

Chapter 3: Methodology

The purpose of this quantitative study was to compare the learning outcomes of college students enrolled in an online college level nutrition course and the learning outcomes of students enrolled in the face-to-face version of the same course in a community college in South Texas.

Research Design

This quantitative comparative study uses previously collected data to assess the differences and similarities in the student learning outcomes between the methods of instruction. The variables utilized in the current study are final grade obtained in the course; student satisfaction scores with instructor, course experience, and overall course appraisal; grade point average (GPA); enrollment status; gender; ethnicity; age; financial status (by PELL); and withdrawal status. Students who, for one reason or another, withdrew from the class were included in this study.

Population and sample. The sample used for this study came entirely from students at one 2–year community college. The sample consisted of science majors or health professional students taking a nutrition course, either online or face-to-face, as a requirement of their degree plans. The course was college level and transferable to 4-year institutions. The sample generated was randomly selected. The course covered the chemical, physical, and sensory properties of food, nutritional quality, food use, and diet applications, and their relation to health.

The entire college population averaged about 10,000 students enrolled in different programs and taking various courses required for their degree plans. For this study, the sample size was 541 students as determined using the G*Power™ to limit the likelihood of a Type II

error. These students randomly registered for the nutrition course between fall 2012 and fall 2014, and were free to enroll in the instructional method they preferred.

Description of the two modalities. Both courses had the same text (Table 3), course notes, learning objectives, grading criteria, and exams. Both instructors had allotted times for office hours and responded promptly to email queries from the students. Instructor A, who taught the online class, had over 20 years teaching experience. An associate professor certified to teach online classes with a master's degree in biotechnology, Instructor A was certified in CANVAS™ and Blackboard™ and was a certified Master Teacher. This certification offered by the college to all faculties is designed by the Instructional Innovation Center to motivate faculty to be the best at their various disciplines. The certification requires both online and face-to-face guidance with assignments to be completed within a specific time frame. Upon successful completion of the program, the faculty member is recognized with a certificate and his or her name added to a list of master teachers at this college. Meanwhile Instructor B, who taught the face-to-face class, was an assistant professor with extensive training in CANVAS™, Blackboard™, WIMBA™, WEBCT™, Pearson MyLab™ & Mastering, and was also a certified Master Teacher. Instructor B's teaching career spanned more than15 years. The two instructors met regularly to synchronize and redesign the curriculum to minimize any differences in the course design and for better equivalence of outcomes as reflected in the Table 3.

The face-to-face class period revolved around the instructor either lecturing or facilitating group work in the classroom. Outside class time, students completed all homework assignments or group projects; exams and finals were paper-based, administered during class time on scheduled dates. The method of assessment of the students' performance consisted of the average of the highest four exams (40%), attendance and participation (10%), the mastering nutrition

exercise (10%), a research paper (10%), a portfolio of home assignments (10%), and a final exam (20%).

The Web-based or online section was taught via the Internet, which meant all course lectures and materials were delivered online (teacher-centered learning). The first meeting of the semester for the online class was mandatory to orient students virtually to the nature of the course and to respond to questions about the learning management system being used (Pearson MyLab™ & Mastering). Students accessed the course website at any time by using a college username and password.

The face-to-face sections of the courses were taught in a traditional classroom environment with moderate utilization of technology. Technology used included PowerPoint™ presentations, YouTube animations, and videos. Students were required to attend classes on campus. The classes met twice a week for 75 minutes during the regular (16-week) semesters and every day during the summer sessions. The format was essentially lecture-based and included face-to-face lectures and discussions with additional reading materials assigned as case studies weekly.

The online class was offered over the Internet where students utilized computers or any other devices to access the course on CANVAS™. Students were required to log into class on a daily basis to respond to other postings by their peers and to gain access to the materials and links made available to them on the LMS platform. Students worked at their own paces to keep up with weekly homework and assignments. Nevertheless, all students were expected to collaborate on all group projects.

It was imperative that the design of the courses maximized the similarities to ensure that the quality of information delivered to students compensated for differences in the two

instructors' instructional styles. For example, textbooks, exams, assignments, projects, and material coverage were the same across all sections. The design of the course required that one topic be covered each week to help provide structure to the students. All assignments had submission deadlines with penalties for late delivery. Weekly discussions on current issues affecting nutrition were posted; students were required to read and respond to at least three postings each week.

A major project carried out by both modalities involved a service-learning opportunity. Jessica's Project was developed in the spring semester of 2012 to encourage students to identify community members with a nutrition related illness that could be researched by students in collaboration with the community member and his or her family. Students investigated the disease affecting the patients and prepared a professional poster to display during the poster session on campus on the final event day. During the event day, the patients investigated received a plaque of recognition and contribution to student learning, and a basket of health related products. This project has grown to involve multiple departments, faculty, and staff participation. Jessica's Project has now expanded to include partnerships with the City of San Antonio (Project WORTH) metropolitan clinic in its fight against teen and unplanned pregnancy, with the Eastside Community Garden to build curriculum for the nutrition students that includes time spent at the garden throughout the semester, and with local businesses involved in food production. The project in itself has enormous support from the college and its administrators.

Data collection. The college collected the data used for this study from course records in four areas: demographic, academic course performance, student records, and course and faculty surveys. Students who withdrew from the course were included because the information was

Table 3

Differences and Similarities between face-to-face and Online Course

Factors	face-to-face	Online
Instructor differences	Fifteen years teaching experience with over ten years teaching nutrition.	Twenty years teaching experience with over ten years teaching nutrition.
	Master's degrees in zoology and biotechnology; nurse and medical laboratory technologist.	Master's degree in biotechnology; military veteran.
	Taught two face-to-face nutrition courses and three other courses per semester with few administrative duties.	Taught only one online class per semester from fall 2012 to fall 2014 because of extensive administrative duties.
Instruction	Synchronous.	Asynchronous.
PowerPoint Slides	Used in lecture.	Available for student reading.
Discussion format	Round table.	Discussion board.
Research Paper	Yes. With presentation.	Yes. With presentation online.
Case Studies	Yes.	Yes.
Assignment Sheet/Portfolio	Yes.	Yes.
Assessments	Weekly quizzes.	Weekly graded homework.
Community Service Learning	Yes. Jessica's Project, a service-learning project, encouraged research of community individuals with nutritionally related disease through collaboration with student groups, and a final presentation on campus to honor the participant.	Yes. Virtual participation in Jessica's Project by designing posters and flyers for the event.
Mastering Nutrition Exercise	Yes.	Yes.
Exams and Final	Five in class exams. One lowest grade exam dropped. Comprehensive end of semester final exams taken on campus in classroom.	Five online exams. One lowest grade exam dropped. Comprehensive end of semester final exam taken on campus online in computer lab.

available and provided another perspective for the study. Access to the data was achieved by

verbal request and an interview by the dean of the department who was also the chair of the

University of the Incarnate Word Institutional Review Board (IRB) at the college. Both instructors granted permission verbally to utilize data from their classes.

All student demographic information (age, gender, enrollment status, financial status based on PELL grant eligibility, withdrawals, and ethnicity) was collected at the time of enrollment in the college. At the end of the semester, instructors compiled assessments and a final letter grade was entered into the college grade system and made available to the students. The college administered student surveys of the course online and students were encouraged but not required to respond. Every student at the college was given an opportunity to evaluate each course taken, and all surveys were administered online and anonymously. Students' grades were not impacted by the results of the survey and students were not required to take the survey but strongly encouraged by their professors to do so.

Analysis. The appropriate data were identified, coded, and then imported into SPSS for further analysis. The alpha-level was set at 0.05. Descriptive analysis was conducted and reported for all categorical data. Chi-square tests of independence compared several factors: gender, ethnicity, age, financial status, withdrawal status, and enrollment status (full-time and part-time) with instructional method. Repeated Measures Factorial Analysis of Variance (ANOVA) was used to compare differences between GPA and course grade point credit in the online versus face-to-face delivery method. An independent sample T-test of earned grade point and overall GPA versus modality was conducted to compare the differences. Factor analysis was conducted on the student surveys to determine the components and validity using the principal component analysis and reliability established through Cronbach's alpha. Subsequently, a Mann-Whitney U test of the sum of the items was administered for each component identified by modality. A non-parametric Mann-Whitney U test was also performed to determine if there were

differences in performance as measured by student's grades between the face-to-face and online class. Frequency data was analyzed using the Chi-square test of independence.

To determine the effect sizes, Becker's (2000) effect size calculator was used to determine Cohen's *d* and the effect size correlation using the means and standard deviations of two groups or using the *t-* test value between subjects' *t-* tests and the degrees of freedom.

Protection of Human Subjects and Ethical Considerations

The proposal for this study was submitted to the IRB with the names and addresses of the investigator and the supervisor. Permission to collect redacted data from the Research and Planning Division of the college was requested with the IRB's approval. The demographic and GPA information from college data obtained was stripped of student personal information. Both instructors consented to the study. So for this research, student consent was not necessary.

Since the study used historical data, informed consent was not needed, as the information received was redacted of personal identifying information like names and student/faculty addresses or telephone numbers. The participants in this study did not receive any direct benefit from the data collected and no harm was caused to them.

Chapter 4: Results

The purpose of this quantitative study was to compare the learning outcomes of college students enrolled in an online college level nutrition course and the learning outcomes of students enrolled in the face-to-face (face-to-face) version of the same course in a community college in South Texas.

The next step in the process was to analyze the data (n = 541) obtained. The data received was recoded and entered into the IBM SPSS^{TM} version 22 statistical programs so that the program would recognize and be able to work with the numerical data. The data was then cleaned. No outliers or missing values were identified.

The results presented in this section are from the analysis of outcomes from two separate modalities.

Descriptive Analysis

Of the 541 students, 246 were students in the face-to-face class and 295 in the online class. In these courses, 97.8% of the students were sophomores. Approximately 80% of the students enrolled in the classes online with 83.1% females and face-to-face class with 81.7% females as seen in Figure 2. These proportions of females are larger than in the general college population of 57% females and 43% males. Overall, there were more females than males attending the college. This was also reflected in the classes being studied.

The average age of participants for the study was 28 years and the age ranged from 18 to 61 (M = 28.08, SD = 8.225) as seen in Figure 3. Age recorded in years was not normally distributed with skewness of 1.247 (SE = .105) and kurtosis of 1.270 (SE = .210).
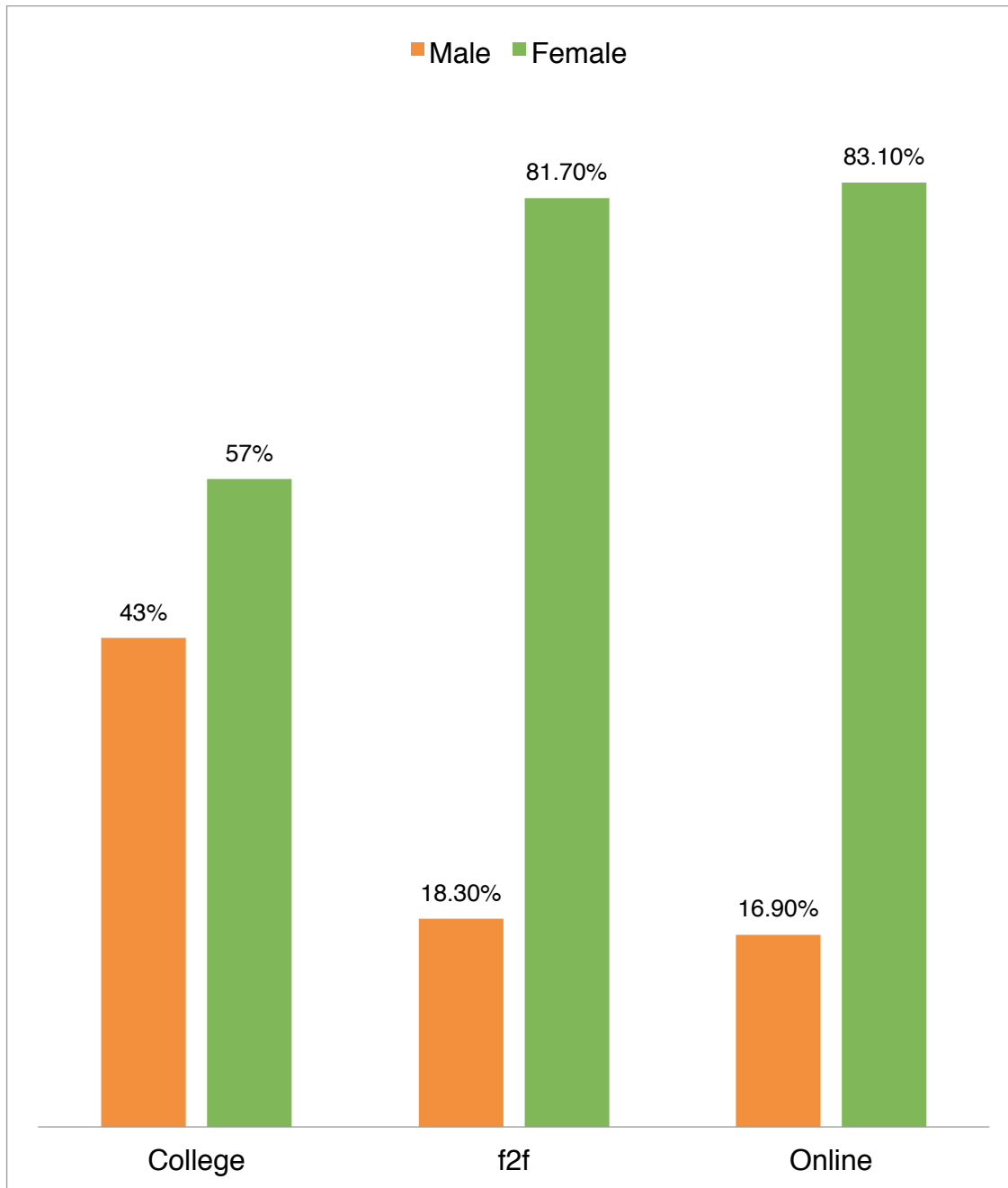
Figure 2. Descriptive representation of gender by method of instruction compared to the college.

Age groups were formed and the data was treated as ordinal. Most students were in the under 25-age group with more of them favoring the face-to-face format. The distribution by age groups mirrors the general college population from the college fact book for the 2013–2014

academic year. Of the over 10,000 students, the categories were regrouped to reflect the age

grouping in this current study.
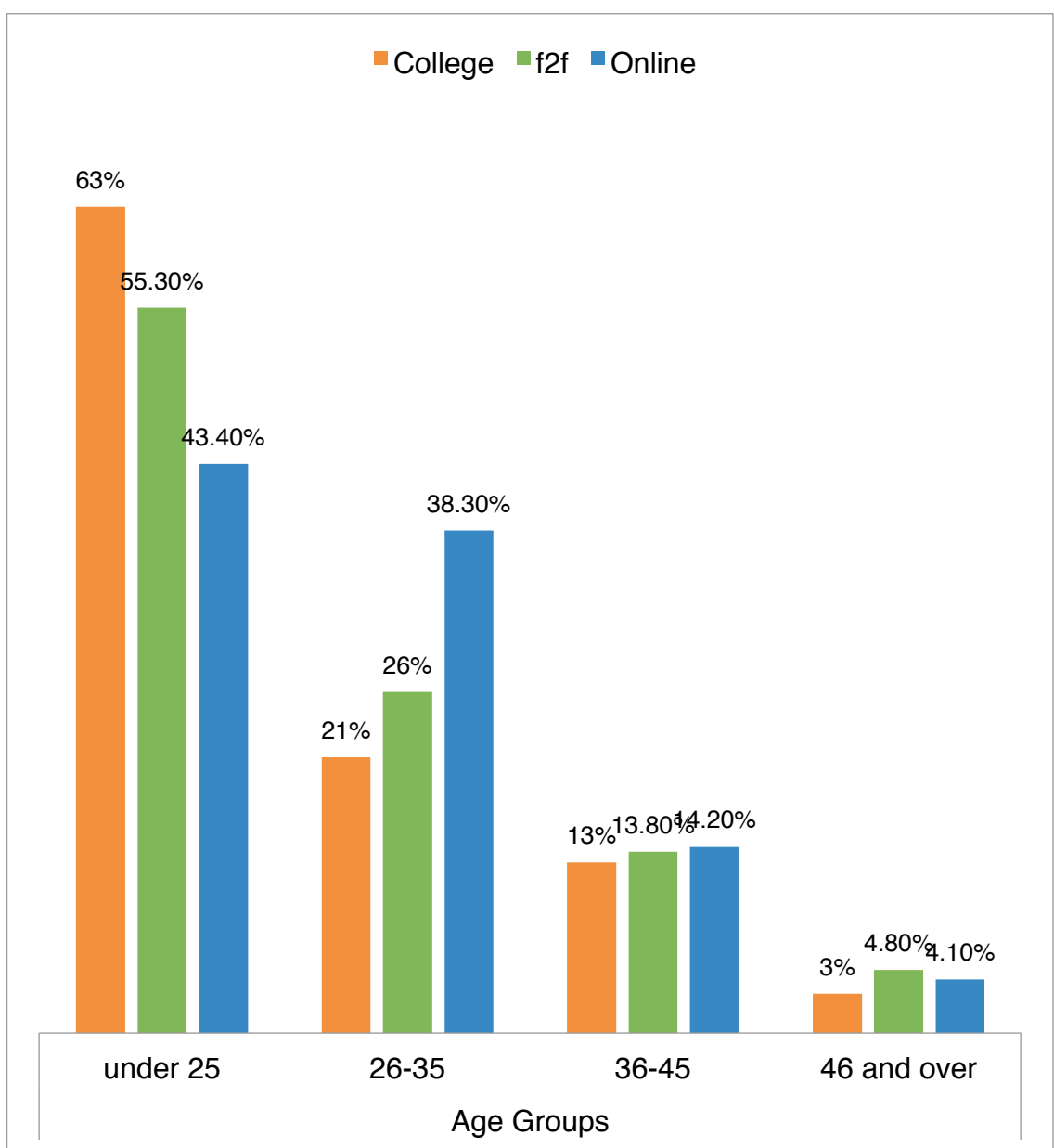
Figure 3. Distribution of age group by instruction method compared to college distribution.

The distribution by ethnicity of the overall number of students enrolled online (n = 295)

indicated more Hispanic students were in the online class followed by White students, others,

and then African American (Figure 4). However, this distribution may be a reflection of the

student population at this particular college. There were larger percentages of White students

enrolled in the online sections compared to the face-to-face section. Meanwhile, in the Hispanic

or Black African American categories, students were more likely to sign up for the face-to-face

section of the course rather than the online section.
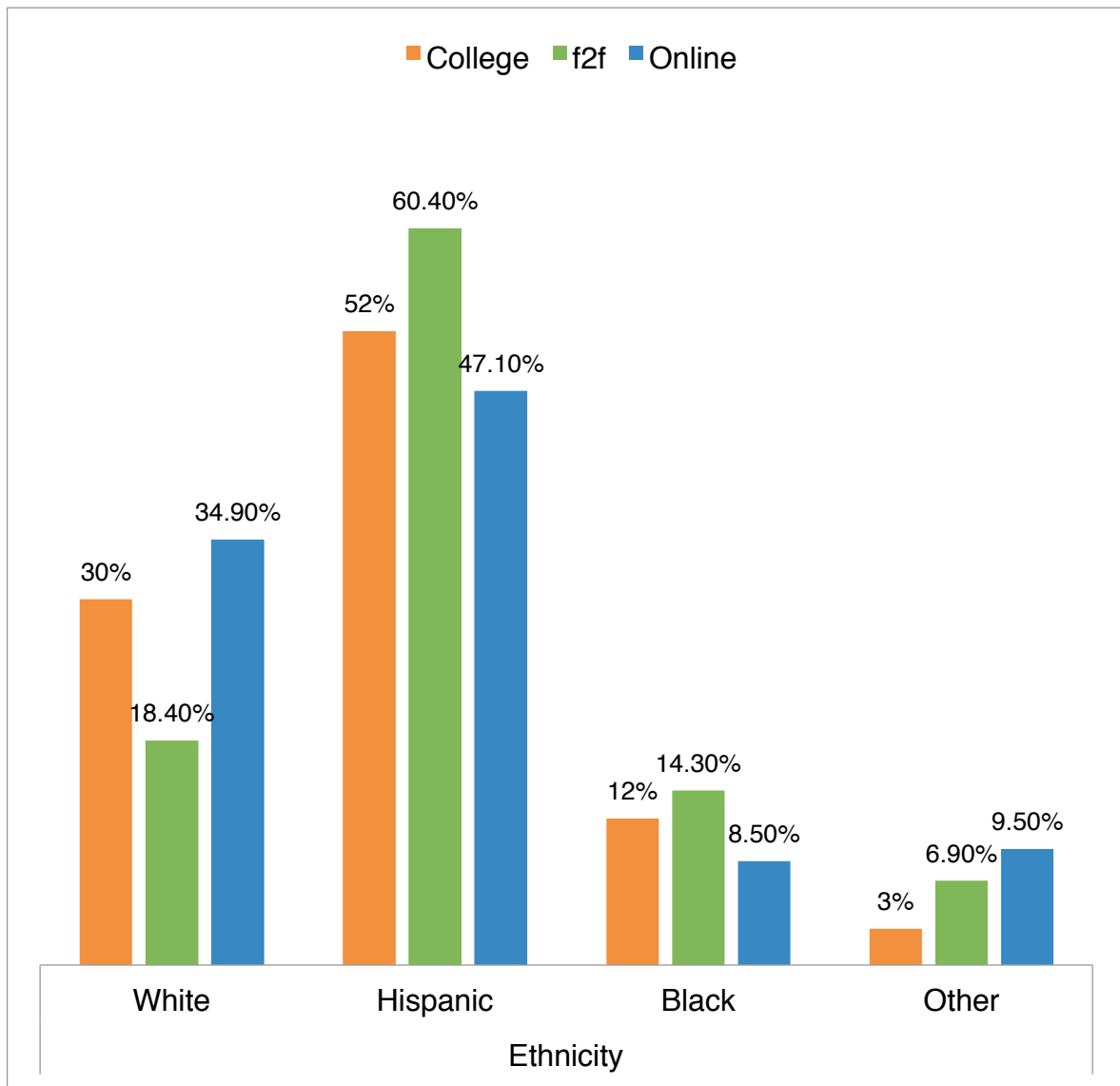
Figure 4. Description of students' ethnicity by method of instruction compared to college demographic.

Information collected by the institution on withdrawal status, how the students financed

their studies, and enrollment status was reported. A significant (98.7%) number of students

registered in face-to-face class persisted to complete the course. Yet, the results were not the

same for online class sections where, despite high completion rates for both modalities, students

were slightly less likely (93.3%) to persist (Figure 5).
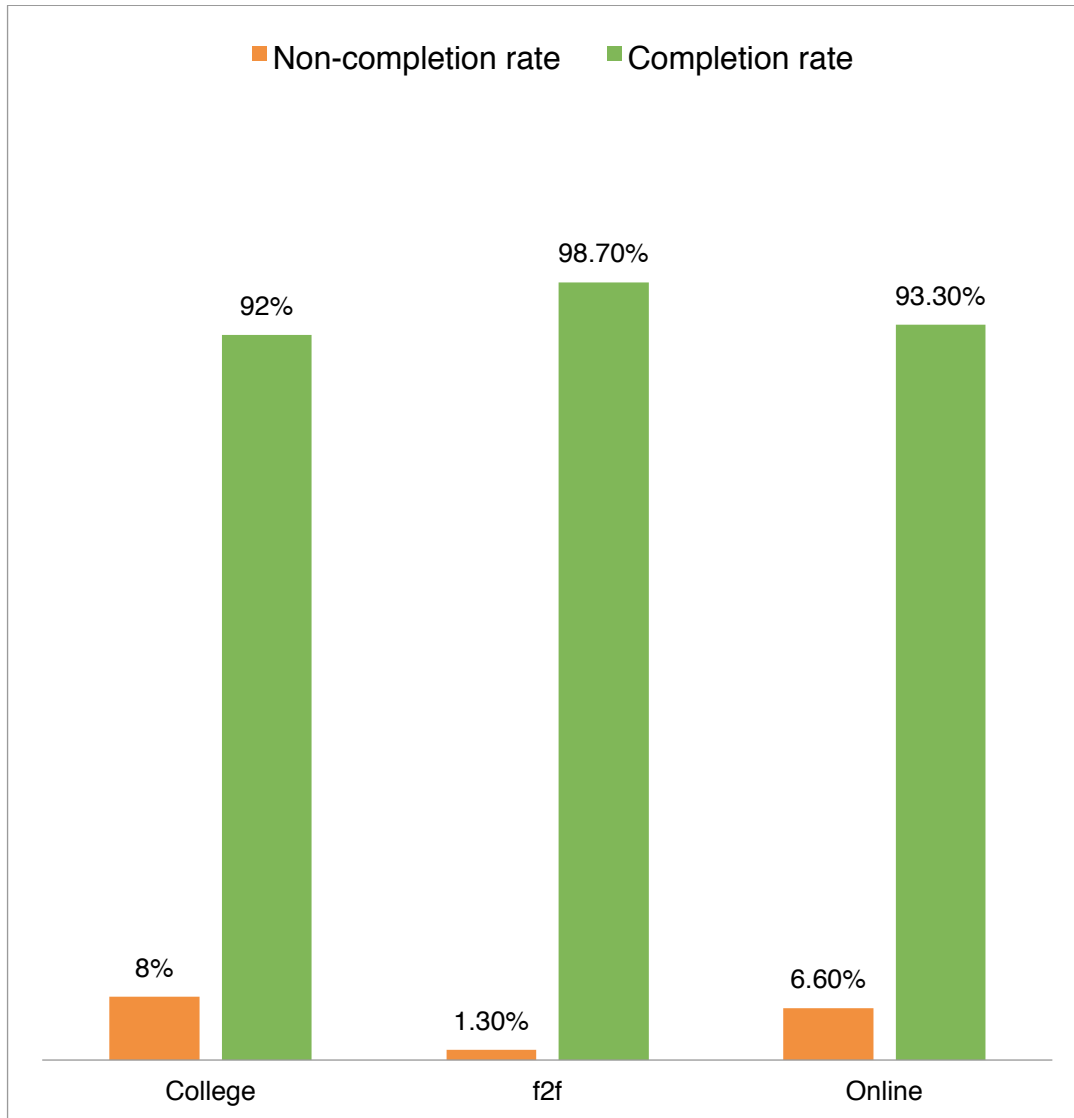
Figure 5. Student withdrawal (non-completion) status from class by method of instruction
compared to college rate.

Additionally, an investigation into a student's financial status was determined by whether

a PELL grant was accepted (Figure 6). PELL grant is a federal program that provides need-based

grants to low-income undergraduates and some post-baccalaureate students to promote access to

higher education. Students who received PELL grants were considered low-income and those who were not on PELL grants were considered high income. The assumption made was that students not on PELL had financial independence and no problem getting resources needed to take the class online. The college had 46.4% of the students on PELL grants and the majority (53.6%) was not on PELL grants. However, the graphic representation of the college student recipients of PELL may not give an accurate picture because it was not clear whether or not the institution offered grants or scholarships to students who did not receive PELL. Distribution of the college financial aid awards was listed as: Grants (69%), Hazelwood (2%), Loans (21%), Scholarships (7%), and Federal Work Study (1%). The data collected, however, did not indicate the financial capabilities of the students who did not receive PELL grant.

Those enrolled half-time represented most students at this institution, with more of these online than face-to-face. According to the college fact book for 2013–2014, of the over 10,000 students, 17% were considered full-time and 83% part-time, with 92% of the entire student population taking some classes over the Internet. Those in the less than half-time category did not have a strong showing in the data (Figure 7) and the college did not report that in their data.

Inferential Statistics

The current study identified key questions that could explain the impact of student variables and school demographic variables on students' choices of instructional method. However, variables such as age, gender, ethnicity, enrollment status, financial status, and withdrawal status were not investigated as to how they directly affect students' performance.
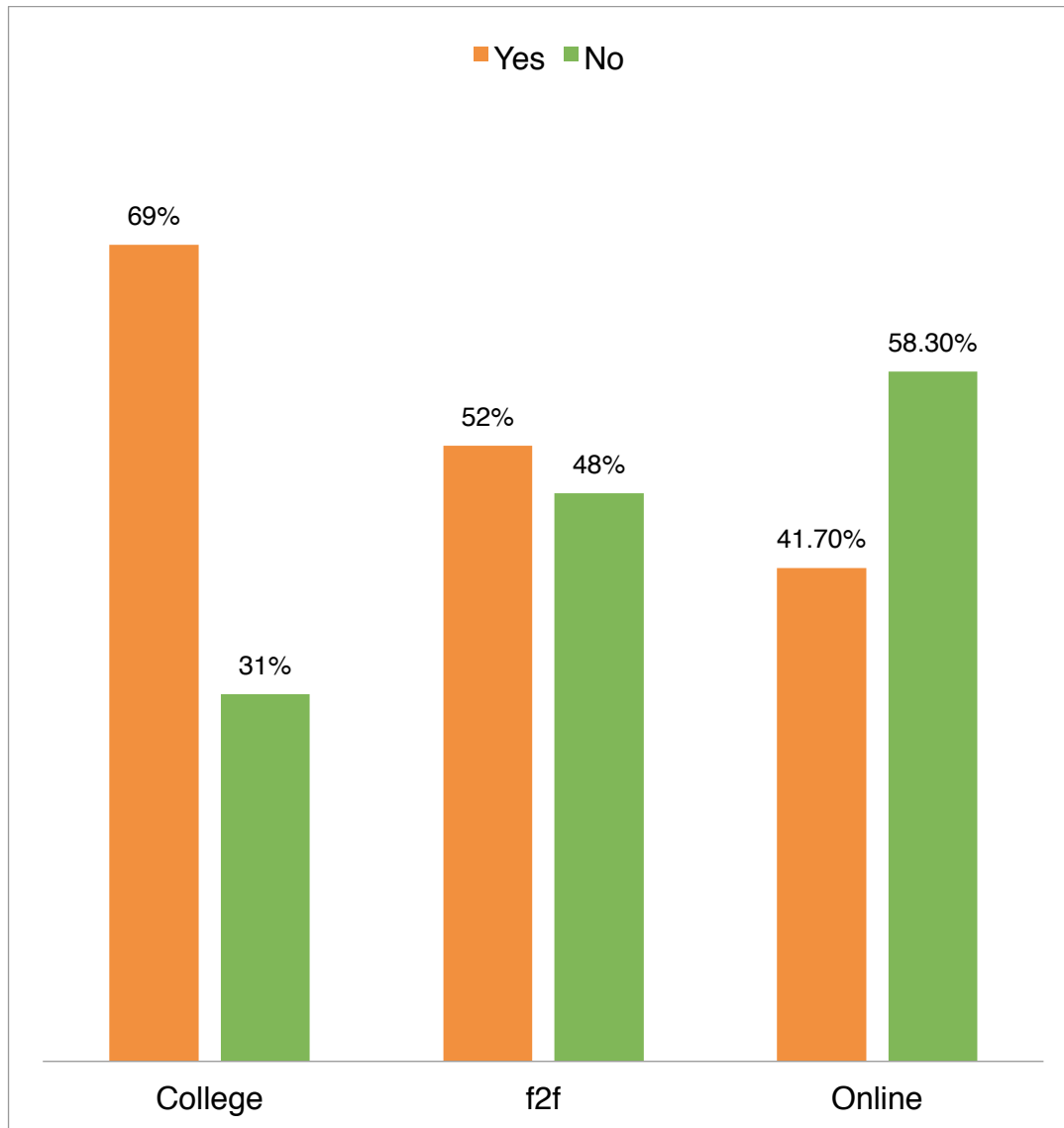
Figure 6. College recipients of PELL by modality compared to the overall college.

Research question 1. Is method of instruction chosen independent of the student's gender, age, and ethnicity?

A Chi-square test of independence was conducted to compare the gender, age, and ethnicity factors to the method of instruction. The results of the analysis presented in Table 4 indicated that gender did not have any statistically significant relationship ($\chi^2(1) = .167$, n = 541, $p = .683$) on the method of instruction with Cramer's V = .018. Registration into face-to-face or online classes was independent of gender.
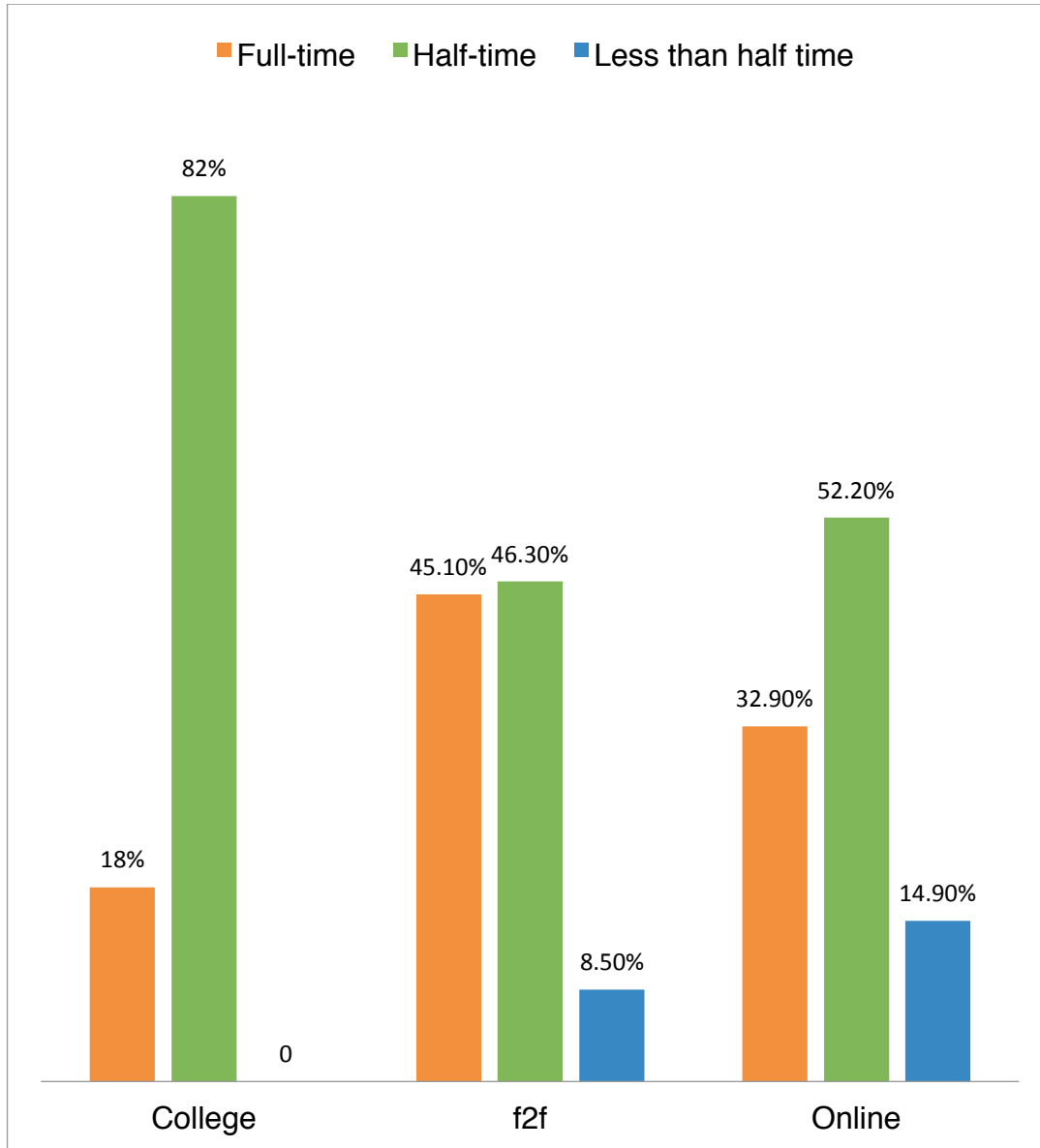
Figure 7. Enrollment status by instructional method compared to college enrollment.

Meanwhile the Chi-square test of independence had different outcomes for ethnicity and age. The test result suggested that there was a statistically significant relationship between ethnicity and the choices of instructional method ($\chi^2(3) = 22.935$, n = 540, $p = .000$) but with a small Cramer's V = .208. As stated by Cohen (1988), effect size of 0.2 is small, 0.5 is medium, and 0.8 is considered large.

The test result indicated that there was a significant relationship between the choices of instructional method and the age groups to which students belonged (χ^2 (3) = 10.296, n = 541, p = .016) with Cramer's V = .138. But the correlation coefficient indicated that the relationship was small. Students who were under 25 years of age were more likely to enroll in the face-to-face class than in the online section. Students 26 to 35 years of age were inclined to enroll or had confidence in an online class. Students in the 36 to 45 years age group were also inclined to take a class online although the difference was not much compared to those choosing face-to-face. In the 46 and over age group, the participation online and face-to-face was equal. The low numbers of students in this age group may be attributed to lack of familiarity with the technology.

Research question 2: Is there a difference between instructional methods in student factors of withdrawal status, financial status as determined by PELL grants, and enrollment status?

In the present study, a Chi-square test of independence-was performed to compare student withdrawals from classes based on instructional format. There was a statistically significant relationship in student withdrawals from classes based on the method of instruction (χ^2 (1) = 10.188, n = 541, p = .001, Cramer's V = .137), as illustrated by Table 5. This result shows that students in an online class were slightly more likely to withdraw than were students in the face-to-face class. However, based on the correlation coefficient, the relationship was small.

A Chi-square test of independence-was conducted on student's financial status as determined by PELL grant acceptance. Based on the results obtained, the relationship between financial status and format of instruction was statistically significant (χ^2 (1) = 5.764, n = 541, p = .016, Cramer's V = .103) but the correlation coefficient depicts that the relationship is small.

Table 4

Instruction Method Correlated with Gender, Age, Ethnicity, and Chi-Square Tests of Independence

	Variable/ (College %)	face-to-face (n = 246)	Online (n = 295)	Test statistics
GENDER	Male (43%)	45 47.4%	50 52.6%	$\chi^2(1) = .167$, $p = .683$, Cramer's V = .018
	Female (57%)	201	245	n = 541
ETHNICITY	White (30%)	45 30.4%	103 69.6%	$\chi^2(3) = 22.935$, $p = .000$, Cramer's V = .208 n = 540
	Hispanic (52%)	148 51.6%	139 48.4%	
	African Amer (12%)	35 59%	25 41%	
	Other (3%)	17 37.8%	28 62.2%	
AGE GROUP	Under 25 (63%)	136 51.5%	128 48.5%	$\chi^2(3) = 10.296$, $p = .016$, Cramer's V = .138 n = 541
	26-35 (21%)	64 36.2%	113 63.8%	
	36-45 (13%)	34 44.7%	42 55.3%	
	46 and over (3%)	12 50%	12 50%	

Note. 0 cells (.0%) have expected count less than 5.

The results indicated that in the face-to-face model, most students were on PELL grants compared to their online counterparts. Students on low financial status were somewhat more likely to take face-to-face classes than those well off financially who favored an online class. The percentages of those not on PELL grants were significantly higher in the online course than in the face-to-face class.

Enrollment status in both sections of the course was determined by the Chi-Square test of independence to compare the various categories (less than half-time, half-time and full-time student enrollment) and the modality. Based on the result obtained, enrollment status was significantly impacted by the method of instruction (χ^2 (2) = 10.701, p = .005, n = 541, Cramer's V = .141), even though the relationship was small. From the results, the majority of the students in this course whether online or face-to-face were enrolled half-time. More students enrolled less than half time or half time chose the online section of the class than chose the face-to-face section. On the other hand, there was an increase in the number of full-time students in the face-to-face section of the course than in the online section.

Research question 3. Is there a difference in overall GPA and course grade points earned? And is the difference influenced by whether instruction was offered online or face-to-face?

A repeated measures factorial ANOVA was conducted to determine whether there is a statistically significant difference between course grade points and overall grade point average and if modality had an influence. The alpha level is maintained at .05 for this analysis. Assumptions of homogeneity of variance, and linearity were satisfactory but normality was not assumed because the distribution of the grades and GPA were not normal.

Table 5
School Demographic Information and Chi-Square Tests of Independence

	Variables (Colleges %)	face-to-face (n = 246)	Fully Online (n = 295)	Test statistics
FINANCIAL STATUS	PELL (69%)	128 51%	123 49%	$\chi^2(1)=5.764, p = .016$, n = 541 Cramer's V = .103
	NO PELL (31%) **a**	118 40.7%	172 59.3%	
WITHDRAWALS	NO (78%)	243 46.9%	275 53.1%	$\chi^2(1) = 10.188$, $p = .001$, n = 541 Cramer's V = .137
	YES (8%) **b**	3 13%	20 87%	
ENROLLMENT STATUS	Less than half-time (not represented in college data)	21 32.3%	44 67.7%	$\chi^2(2) = 10.701$, $p = .005$, n = 541 Cramer's V = .141
	Half-time (82%) **c**	114 42.5%	154 57.5%	
	Full-time (18%)	111 53.4%	97 46.6%	

Note. **a** Students may or may not have received scholarships, loans, Hazelwood, or federal work study program.
b Non-productive grade rate of 14%. **c** Percentage includes Less than half-time category

However, ANOVA was used because of the large sample size and the robustness of the

ANOVA with respect to normality. The results from multivariate tests showed interaction

between credit points and modality, Pillai's Trace = .017, F (1, 539) = 9,472, *p* = .002, as shown

in Table 6. Therefore main effects results may be unreliable.

Table 6
Multivariate Tests of the Credit Points between Modalities

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[a]
Credit points	Pillai's Trace	.002	.875	1	539	.350	.002	.875	.154
Credit points by Modality	Pillai's Trace	.017	9.472	1	539	.002	.017	9.472	.867

a. Design: Intercept + INSTRUCTION_METHOD_DESC
    Within Subjects Design: Credit Points

Figure 8 is the graphic of the repeated measures of Table 6 depicting a box plot

comparing between face-to-face and online grade points earned with grades and overall GPA.

An independent sample *t*-test of the difference between face-to-face and online course

grades and GPAs indicated that there was no difference in GPA of the students between

modalities (t (539) = -.879, *p* = .380, r = .0377) as seen in Figure 11. There was, however, a

statistically significant difference in the grade points earned by the students by modality (t (539)

= 2.329, *p* = .020, r = .0998) with a small effect size as represented in Table 7. The effect sizes

were calculated using Cohen's (1988) formulation, which describes r = 0.1 as small, 0.2 as

medium, and 0.3 as large effect sizes.

Figure 8. Comparison of grade point earned, overall GPA and method of instruction.

Table 7

Difference in GPA by Modality

	face-to-face				Online						
	n	*M*	*SD*	*SE Mean*	*n*	*M*	*SD*	*SE Mean*	*t*(539)	*p*	*r*
Overall GPA	246	3.125	.537	.034	295	3.17	.533	.031	-.878	.38	.038
Course Grade Points	246	3.21	.944	.060	295	3.01	.979	.057	2.329	.02	.099

Research question 4. Is there a difference in student satisfaction between online versus face-to-face environment?

Factor Analysis. Assessment of the reliability and validity of the student survey instrument was necessary to gain knowledge as to whether the survey data was collecting the intended information. It is worth noting that the strength of survey results most often relies on the statistical reliability and validity. The reliability of an instrument is the degree to which the questions represented in the survey relate to the attitudes and perceptions the researcher was studying. Reliability was assessed via factor analysis that employed principal component analysis with Varimax rotation. To determine the students' overall impression of the course, the factor analysis focused on the 15 questions that were a Likert-type scale. Questions 16 through 19 were qualitative questions that were not appropriate for the factor analysis. Of the 541 students' data collected, a total of 274 students responded to the online survey (50.6%).

No univariate outliers were found associated with the data. The factor analysis yielded three components with Eigenvalues above 1, explaining 80.6% of the variance for the set of variables. The components were identified as measuring satisfaction with the instructor, the course experience, and overall appraisal. Each component was then analyzed separately.

Questions 2, 3, 4, 5, and 6 addressed the satisfaction with instructor category. Questions 8, 9, 10, and 11 addressed the course experience aspect. Finally, questions 1 and 7 addressed the overall course appraisal, combined as shown in Table 8.

PCA and alpha results indicate that it is appropriate to use the sums of the Likert scale items as measures of satisfaction with instructor and course experience. The results on overall course appraisal would be interpreted by looking into each of the questions that contributes to this category.

Table 8

Principal Component Analysis for Reliability and Validity of Instrument

Factor	KMO	Eigenvalue	% of Variance	Question	Factor Loading	Alpha
Satisfaction/w Instructor	.895	4.045	80.902	2	.91	.940
				3	.85	
				4	.92	
				5	.86	
				6	.90	
				8	.90	
Course experience	.849	3.380	84.6	9	.91	.939
				10	.92	
				11	.85	
Overall course appraisal	.5	1.378	68.902	1	.79	.548
				7	.82	

Satisfaction with instructor. The sum of items 2 through 6 indicated a reasonable measure of satisfaction with instructor. To analyze further student satisfaction with the instructor, a Mann-Whitney U test was conducted on the sum of the items 2 through 6 in Table 8 above. The result was statistically significant ($U = 7863.00$, $Z = -2.385$, $p = .017$, r = .14). A t-test was not used because the data failed the essential normality test. The Mann-Whitney U test was chosen because the four assumptions of the test were met:

(a) The dependent variable is measured at the ordinal level. The ordinal variable includes Likert scale questions from *unsatisfactory* to *outstanding*.

(b) The categorical variable (method of instruction) has two independent groups (online and face-to-face categories).

(c) There is independence of observation. The two groups of students were totally independent of each other.

(d) The shape of the distribution of data was different. When it comes to the satisfaction with the instructor, the face-to-face instructor had significant but small edge (mean rank = 148.52) over the online instructor (mean rank = 126.32).

A box plot of the satisfaction with instructor and the instructional format categories is presented in Figure 9 with the face-to-face median score of 24 versus online class with a median score of 22. Although the median score represented that face-to-face had a slightly higher satisfaction score with the students relative to the online class, the effect size was relatively small (r = .14).

Course experience. To determine students' satisfaction with the course experience, the sum of items 8 through 11 represented a reasonable measure of the course experience. A Mann-Whitney U test (assumptions met) of the sum of these items indicated a statistically significant effect of the method of instruction on students' course experience ($U = 3740.00$, $Z = 8.66$, $p < .001$, $r = .52$). The results are presented in a graphical format in Figure 10. The mean rank of the face-to-face class (178.40) was larger than the mean rank for the online class (96.00). The median score for face-to-face class was 16.0 as opposed to a median score of 5.0 in the fully online class and the effect size was large ($r = .52$) as defined by Cohen (1988).

Overall course approval. Based on the results obtained above, Mann-Whitney U test was calculated to examine the instructional format preferred by students. As exhibited in Table 9, there was a statistically significant difference in the overall appreciation of the course. Students overwhelmingly had a better impression of the face-to-face class compared to the online class when two questions (1 and 7) were examined.
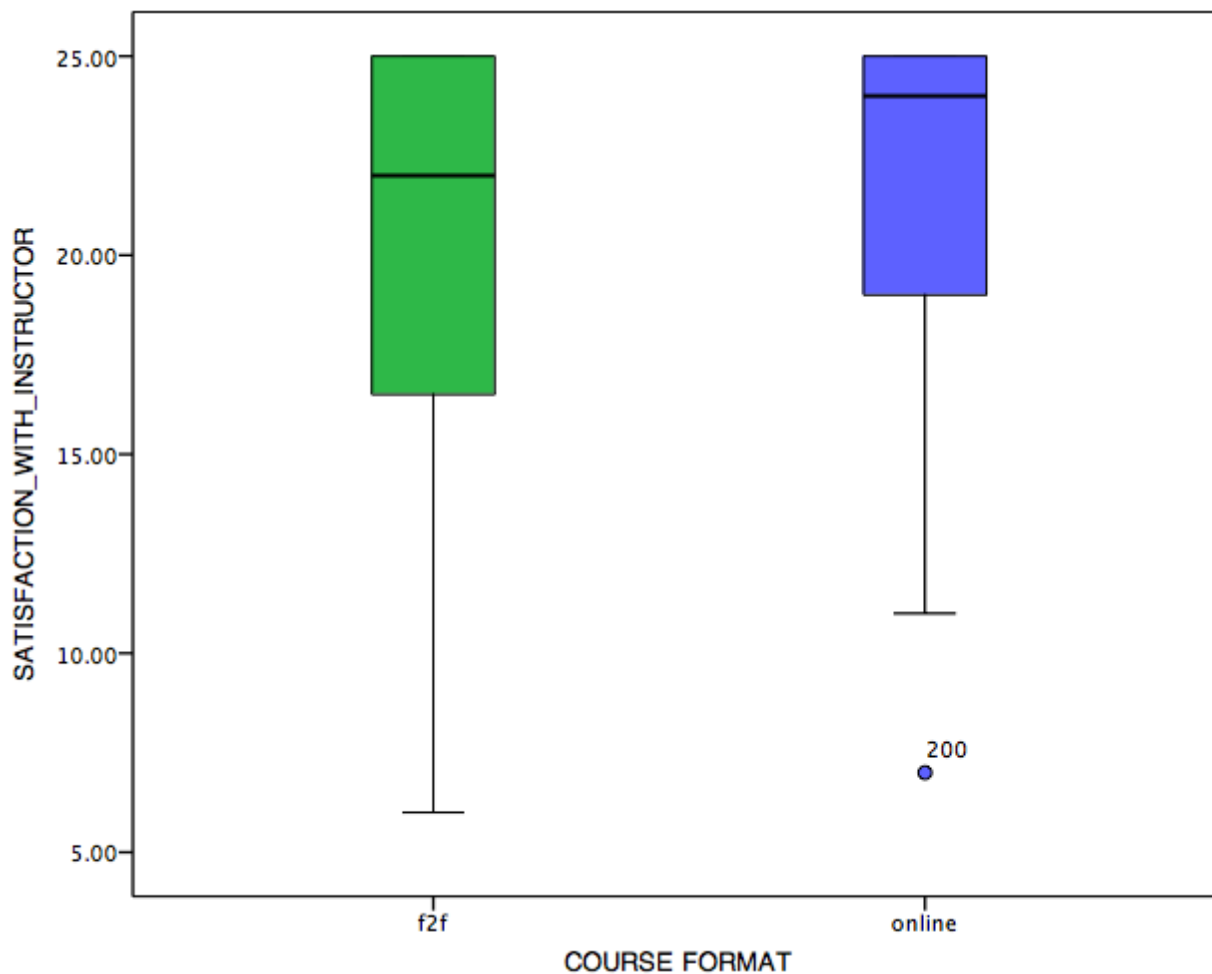
Figure 9. Sum of satisfaction with instructor by course format.

For question 1 of the survey (*this course has been . . .*), the mean rank of the face-to-face class (175.7) was greater than the mean rank of the online section (98.8). The result yielded a large effect size ($r = .508$) according to Cohen (1988). The effect sizes were determined using Becker's (2000) effect size calculator.

Both courses were well appreciated by the students in the different cohorts. This result was further reinforced in question 7 (*my overall rating of this course is . . .*). Again, there was a statistically significant difference in the overall student perception of the nutrition course taught in the face-to-face (mean rank = 152.9) and online section (mean rank = 121.8), but the effect

size (r = .220) was small. This result reinforces the assumptions that face-to-face nutrition classes were preferred to the online classes at this particular college.
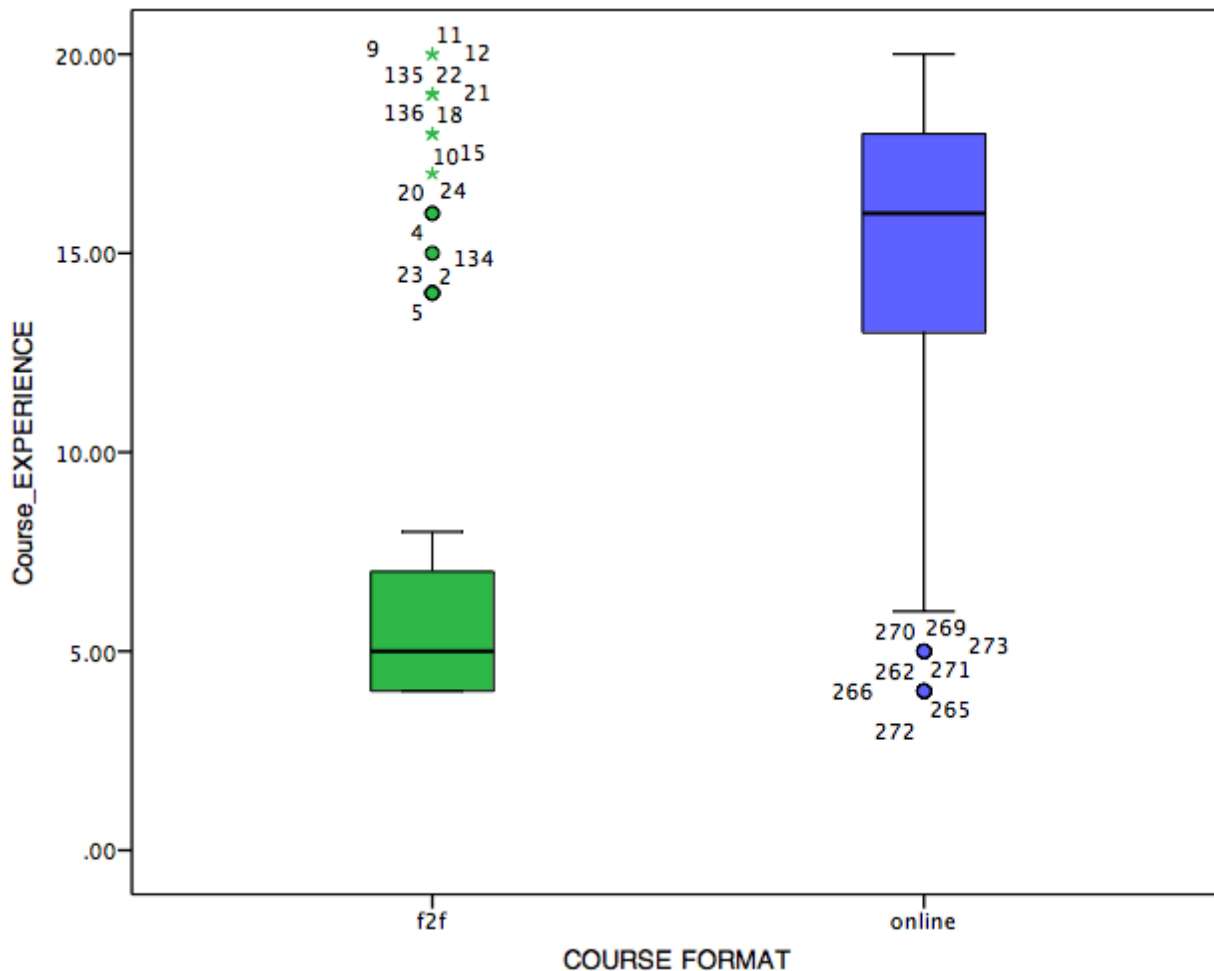
Figure 10. Sum of course experience items by instructional format.

In fact, more students in the face-to-face class responded to question one of the survey and regarded the class as *outstanding* and no student rated the class *marginal* or *unsatisfactory* as seen in Figure 11. The online section of the class had quite a number of students appreciating the course even though it was not as strong as in the face-to-face class. However, the online class opinions were broadly distributed in all characterizations in the survey.

Table 9

Student Course Appraisals and Instructional Format

	Mean Rank	n	M	SD	MEDIAN	U	p	r
This course has been . . . *unsatisfactory* to *outstanding*								
face-to-face	175.7	138	4.73	.52	5	4114.5	.000	.508
ONLINE	98.8	136	3.76	1.04	4			
My overall rating of this course is . . . *unsatisfactory* to *outstanding*								
face-to-face	152.9	138	4.43	.845	5	7252.5	.000	.220
ONLINE	121.8	136	3.99	1.09	4			

Note. 1 and 7 are question numbers on the instrument in the Appendix B.
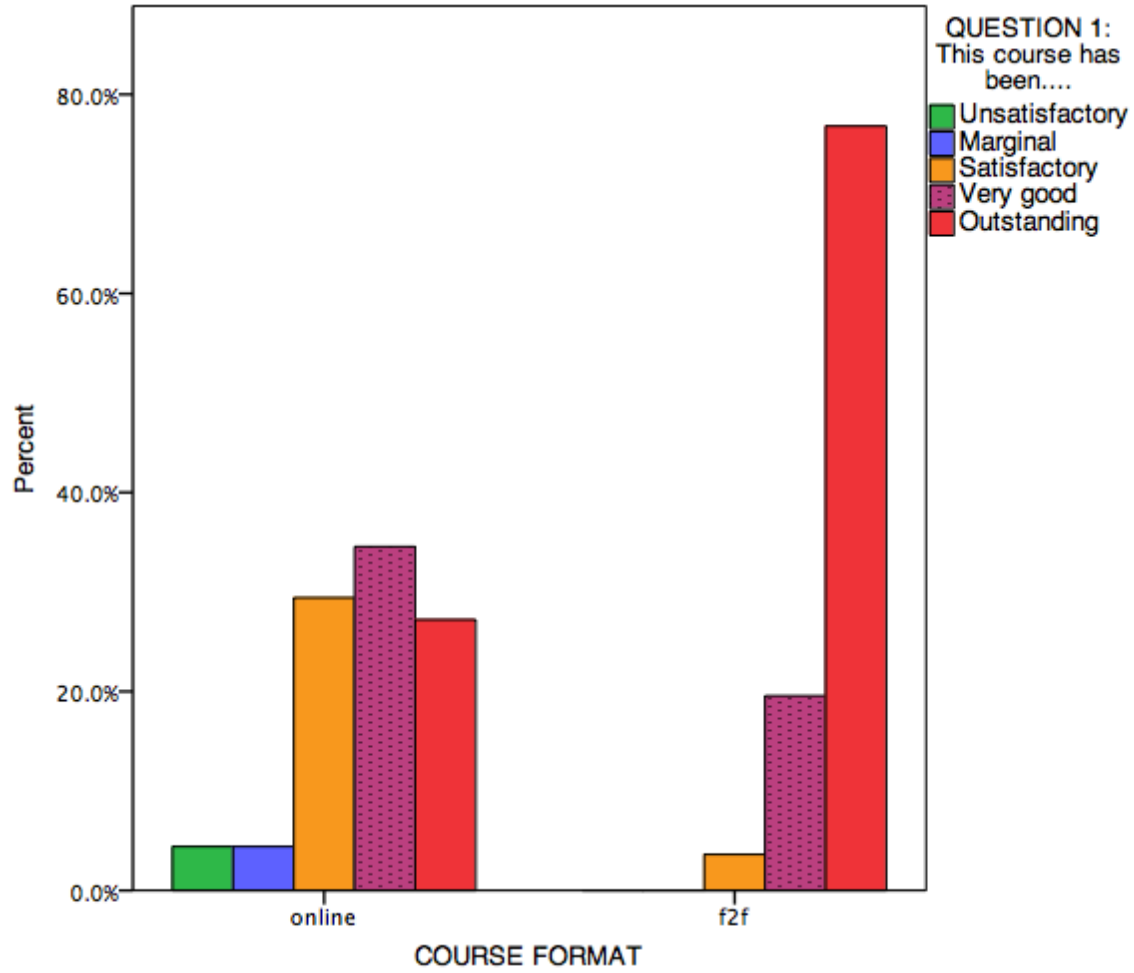
Figure 11. Question 1 responses and instructional formats.

On the other hand, question 7 of the survey demonstrated, as shown in Figure 12, that students overall rated face-to-face classes as *outstanding* with a higher percentage compared to students' ratings of the online section. More students in the online class rated the course as *satisfactory* and fewer students in the face-to-face class had this characterization.
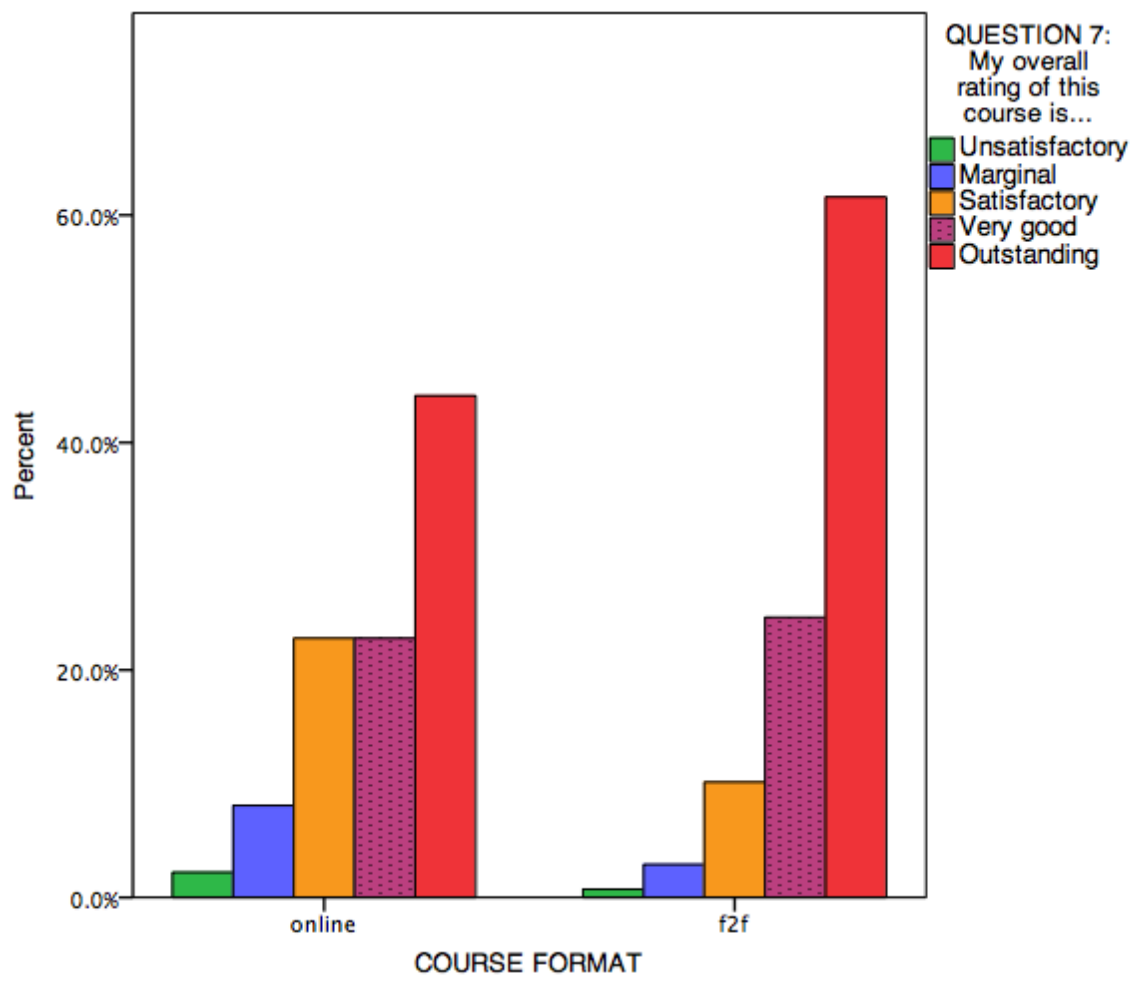
Figure 12. Question 7 responses and instructional formats.

Research question 5. Is there a difference in student's success as determined by final grade between the face-to-face and online method of instruction?

The first objective of the study was to determine if there was a statistically significant difference in students' success (determined by final grade as ordinal data) between students

enrolled in a traditional face-to-face nutrition classes compared to students enrolled in a fully online nutrition class. Before proceeding with the Mann-Whitney U test, Table 10 and Figure 13 represent the grade distribution as seen in terms of pass or fail in the online and face-to-face classes. A non-parametric Mann-Whitney U test was calculated to determine if there was a statistically significant difference in student performance between the instructional methods. The results suggested that the method of instruction had a significant difference on student performance ($U = 29906.0$, $Z = -3.77$, $p < 0.05$, r = 0.166) with the face-to-face model's mean rank at 245.07 and the fully online model's mean rank at 292.62. The effect was relatively small.

Though the overall performance indicated that the online class had a slightly higher proportion of students with passing grades, it was not much different from the face-to-face class. However, the quality of the grades was not as comparable to the face-to-face class. Worth noting was the higher percentage of students (Figure 13) with failing grades in the online class. The overall effect size was small.

It could be inferred that struggling students were more likely to get a failing grade or withdraw from an online section of class. As reflected by the Chi-Square results ($\chi^2(3) = 21.603$, n = 541, $p = .000$) in Table 10, there was a statistically significant difference in the students not passing the class online versus the face-to-face class. The table illustrates that more students were likely to get a better grade in the face-to-face class than online. The effect size however was small (Cohen, 1988).

A bar chart of the regrouped grades of students' success and instructional methods represented in Figure 14 shows the relationship between the method of instruction and the success or failure of students. Students were considered unsuccessful if they earned a failing grade or withdrew from the class.
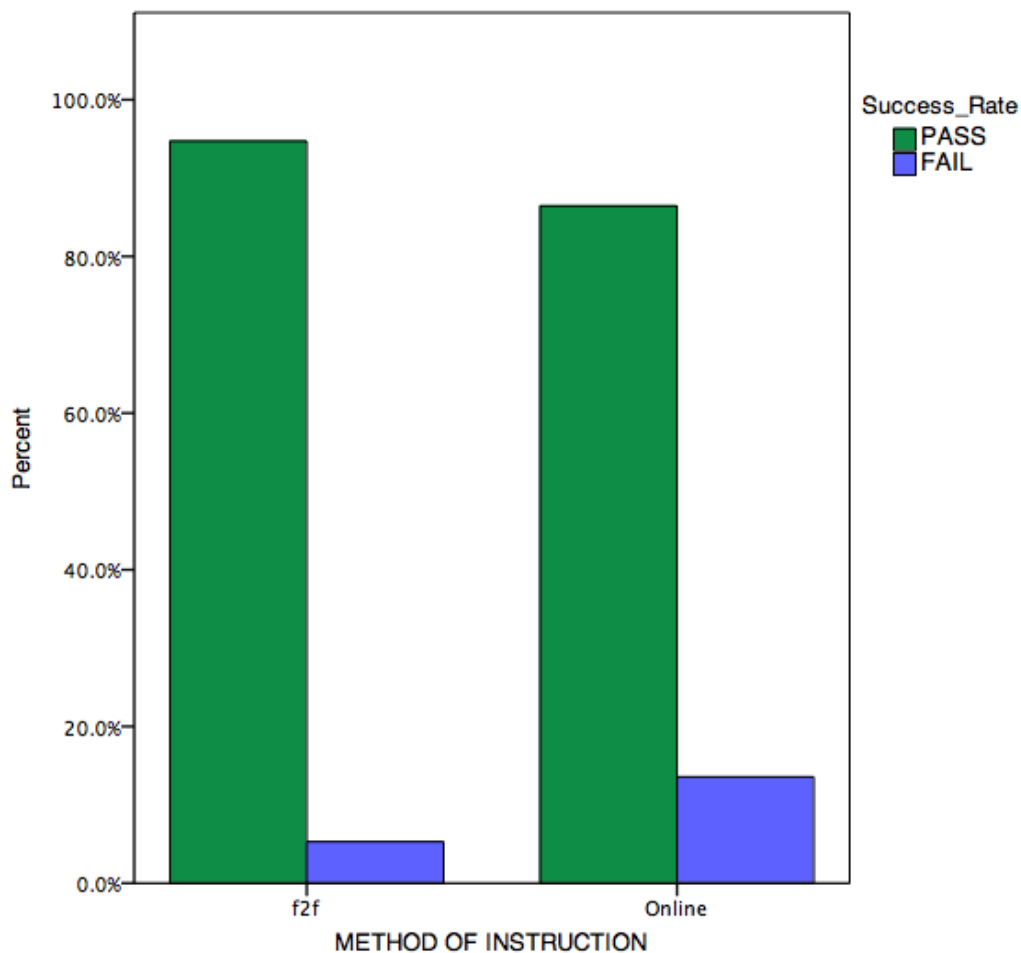
Figure 13. Pass or fail graph by method of instruction.

Table 10
*Method of Instruction * Success Crosstabulation*

| | | | GRADES | | | | |
			A	B	C	not passing	Total
Modality	face-to-face	Count	111	92	30	13	246
		%	45.1%	37.4%	12.2%	5.3%	100.0%
	Online	Count	87	138	30	40	295
		%	29.5%	46.8%	10.2%	13.6%	100.0%
Total		Count	198	230	60	53	541
		%	36.6%	42.5%	11.1%	9.8%	100.0%

Note. 0 cells (0.0%) have expected count less than 5.
$\chi^2 (3) = 21.603$, n = 541, $p = .000$, Cramer's V = .200.

There were more students in the online class with a *B* grade or *Fail* grade. Similarly, face-to-face classes had high *A* grades and low *Fail* grades compared to the online class. As for the *C* grade, the line indicated that there was little difference between the face-to-face and the online class.
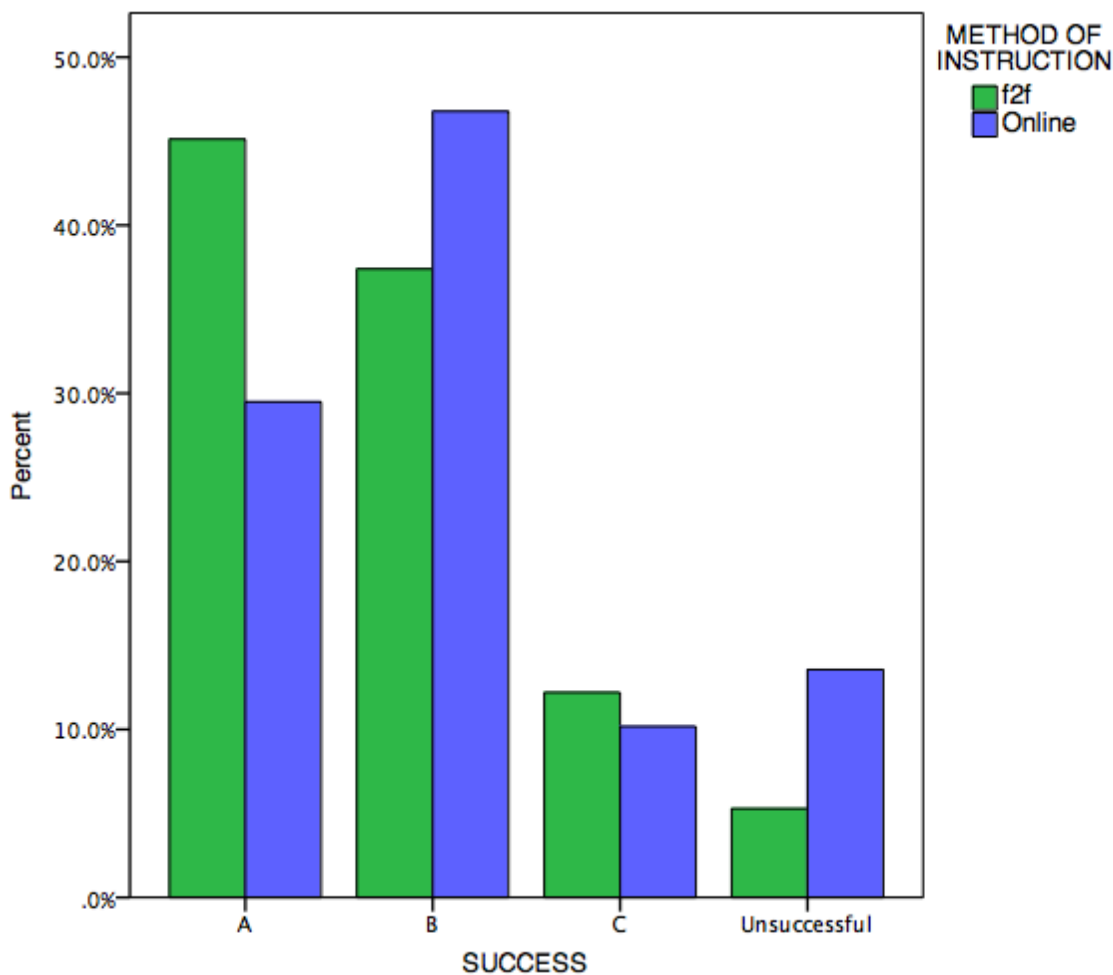
Figure 14. Student success in terms of grades by method of instruction.

Summary

The information analyzed in the current study mirrors reports that have indicated mixed results with small effect sizes. This study supported research that stated that face to face classes were more efficient than online class when measured in terms of grade. The study also supported studies that depicted online students as less satisfied with the online environment. There were

some differences between the face-to-face and the fully online classes when it comes to academic performance by grades. The current study also indicated that the choice to participate in an online class differed by ethnicity and age but was not influenced by gender. Worth noting also are the perception of the instructor, course experience, and overall appraisal of the courses. Most students were happy with their instructors in their individual settings. However, the cohort of students surveyed only reflected on the class they were in and only evaluated that instructor, not both at the same time. Similarly, the course experience indicated that students in the face-to-face class really liked the course modality compared to the students in the online class environment who were not too impressed with the course experience. Overall, independent analysis of each group of students indicated that the face-to-face class had a slightly more favorable experience compared to the online section.

As to the question that compared earned grade points to overall GPA, there was no significant difference in the overall GPA between modalities but the student grade points at the end of the semester were slightly higher in the face-to-face compared to the online section. Nevertheless, the conclusion from this study reveals that other characteristic factors collected after a student registers in the class may serve as predictors of the student's success in either face-to-face or online class as indicated in Table 11.

Table 11

Summary of Findings from Current Study

	Factor	Type of test	Effect size
Relationships			
	Gender	$\chi^2(3) = 0.167$	Cramer's V = .018
	Age group	$\chi^2(3) = 10.296$	Cramer's V = .138
	Ethnicity	$\chi^2(3) = 22.935$	Cramer's V = .208
	Withdrawal status	$\chi^2(3) = 10.188$	Cramer's V = .137
	Financial status	$\chi^2(3) = 5.764$	Cramer's V = .103
	Enrollment status	$\chi^2(3) = 10.701$	Cramer's V = .141
	Modality by success (final grade)	$\chi^2(3) = 0.729$	Cramer's V = .200
Comparisons			
	GPA-grades (Credit points)	Repeated measures ANOVA	η^2_p (Partial eta squared) = 0.17
	Course Grade Points	t-test	r = .099
	Overall GPA	t-test	r = .038
	Satisfaction/w Instructor	Mann-Whitney U	r = .148
	Course Experience	Mann-Whitney U	r = .520
	Overall Course Appraisal	Mann-Whitney U	r = .508[a] r = .202[b]

Note. [a] Represents effect size for Question 1 of the survey.
[b] Represents effect size for Question 7 of the survey.

Chapter 5: Discussion, Implications, Recommendations, and Conclusion

The purpose of this quantitative study was to compare the learning outcomes of students enrolled in an online nutrition course and the learning outcomes of students enrolled in the face-to-face (face-to-face) version of the same course in a community college in South Texas.

Overall findings from the current study revealed a small to moderate advantage of the face-to-face classes in both the performance and perception of students enrolled in the nutrition course. A more in-depth interpretation of the results necessitates the embodiment of the theoretical framework to contextualize the outcome of the study. This chapter covers relationship between theory and outcomes, impact of demographic characteristics, and satisfaction.

Relationship Between Theory and Outcomes

This section covers the theoretical framework and the implications for student satisfaction and success as measured by grades and GPA. The findings from the study indicate that face-to-face course in actual classroom settings earned generally higher grade points than their online counterpart in a virtual classroom. However, the interpretation of the results must be related to the theoretical framework proposed by the study. The connectivism theory Siemens (2005) explains how technology is used to expand the students' zone of proximal development (ZPD) (Vygotsky, 1978). The instructor uses information about students ZPD to create an environment where learning can occur. Scaffolding is a form of instruction by which the students are provided the support needed to expand knowledge into their ZPD. The face-to-face instructor was perhaps more able to understand the ZPDs of students with direct interaction not filtered through technology. Both instructors used technology to expand knowledge into new areas of the students' ZPDs. Perhaps the face-to-face instructor was able to scaffold learning

more closely. This could have translated to better grades, high praises for the instructor, and a favorable perception of the face-to-face course by the students. Care must be taken to design technology to facilitate interaction that maximizes instructor awareness of student needs and progress.

Relating the principles of connectivism, self-efficacy, and the zone of proximal development to these outcomes reaffirms the notion that proper planning and implementation of an effective course design depends on a number of factors such as institutional readiness, faculty readiness, and the student readiness. Aligning these factors in a manner that increases effectiveness of course delivery can facilitate success in student learning outcomes and satisfaction with the instructor as well as the course. The results from this study is portrayed in three main areas; comparisons of grades, comparison of satisfaction between face-to-face and online, and the impact of demographics on the choices between the two instructional modalities.

Females were the majority in both face-to-face and online sections of the course; however, gender had no impact on choice of instructional method. Student characteristics such as ethnicity, age, financial need, and whether enrolled fulltime did influence significantly the choice of modality. Self-efficacy theory may play a role in the influence of these factors. Students more mature, self-reliant, and independent from the majority culture, with less financial need, between the ages of 26 to 35, and enrolled only part time at the college were more likely to choose the online sections of the course. These are the same groups that are identified as often possessing higher levels of self-efficacy.

Figure 15 depicts the relationship between the theory postulated and the outcome of this study
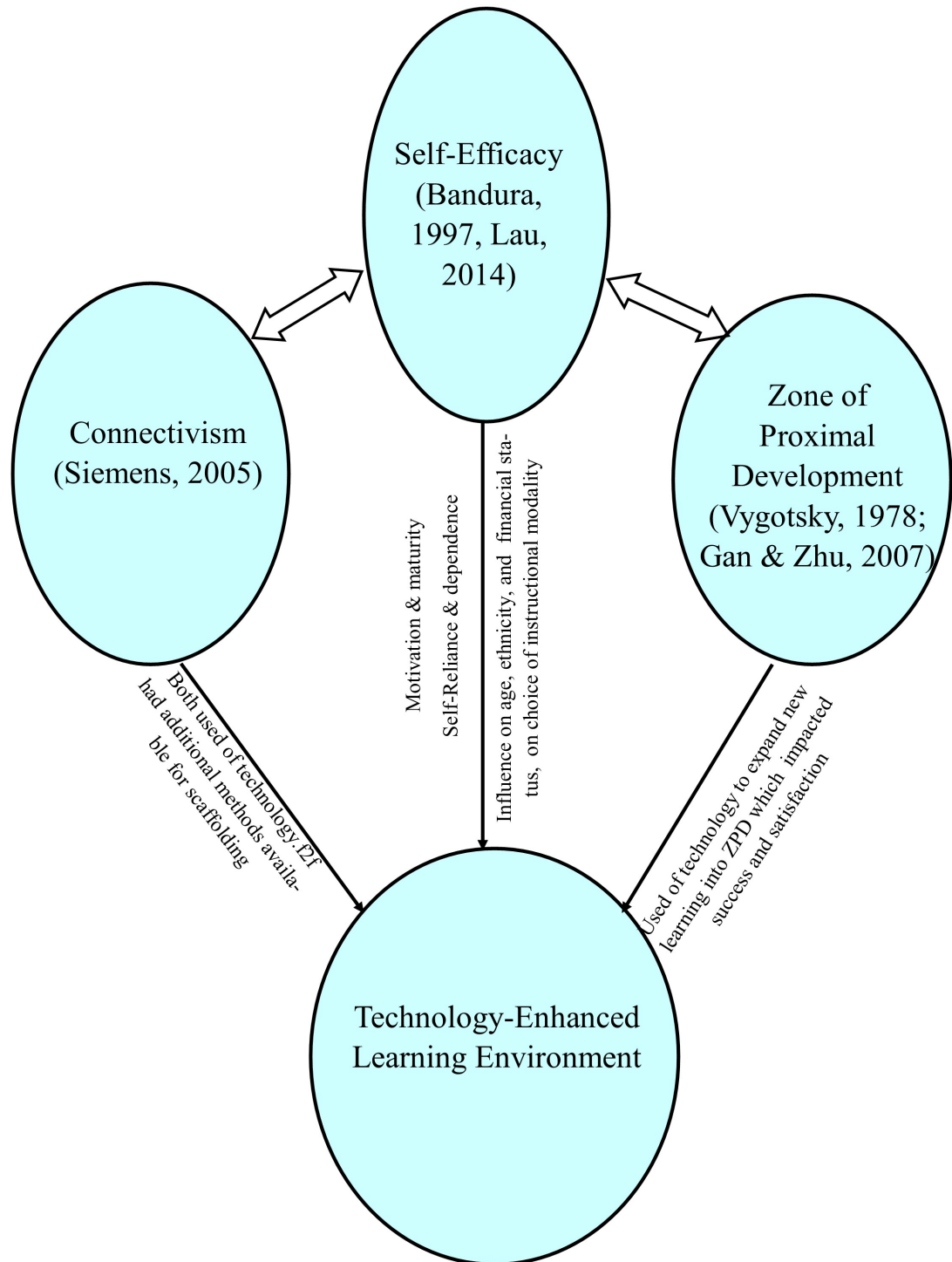
Figure 15. Relating the theoretical framework to the outcome of the study

As a result of determination and self-confidence, students with high levels of self-efficacy—regardless of the choice of modality—often perform better (Bandura, 1997).As proposed by Williams, Kessler, and Williams, (2014), the ability of self-efficacy to motivate change in an individual is significant; self-efficacy (Kakudate et al., 2010) can influence an individual's behavior, perhaps giving confidence to approach the zone of proximal development (Vygotsky, 1978). Relating Bandura's self-efficacy theory, the lens of the four categories of Bandura's theory could shed light on student success. The first category called for *experience* or personal attainment. It is likely that students with previous online class experience had a positive outlook and would encourage each other. These students would also be less stressed and have high self-confidence, which would translate to high efficacy and better performance under any modality. The second category called for *modeling*, which implies that students with high regard for their peers' achievements would likely improve the chances of their own self-efficacy increasing. Regarding *social/verbal persuasions*, Bandura explained that students who are positively encouraged through their learning process tend to have high self-efficacy. Bandura stated in the fourth category that *stress* as a physiological factor could have an impact on the self-efficacy of the student. However, stress could result from an inability or lack of readiness to use technology as a learning tool or from pressure as a normal response.

The presence of self-determination and efficacy alone is not a guarantee of student success. Students ready to take an online class are presumed to have attained a level of maturity that allows them to enhance their own ZPD. These students utilize resources provided by the online environment to work within their zone of proximal development. There are expectations that students have the ability to conceptualize the constant changes in an online environment,

build consensus with peers, evaluate their input, and possess cognitive intelligence that relates to success in any modality.

Students who have mastery and knowledge of learning abilities enhance their zone of proximal development. For students to achieve a mature stage of scaffolding, instructors must create an environment that nurtures their individual skills and potential.

Comparison to the Literature

Results from the current study add to the debate in the literature on the value of online instruction. The minimal advantage of face-to-face classes over online classes may be better interpreted as alignment with those who show no difference in outcomes between the modality.

Face-to-face effectiveness. Comparing results of the present study to previous research, final grades were significantly higher in the face-to-face class, though the effect was small to moderate. The current study validated McPhee and Söderström (2012) study with students in Sweden and Scotland, which revealed that the lack of difference in grades or test scores between the two instructional methods was an indication that online learning was as effective as face-to-face. The conclusion of no significant difference in instructional methods on learning outcomes was also reported by multiple studies by Porter et al. (2014), McGready and Brookmeyer (2013), Frimming et al. (2013), and Summers et al. (2005). This current study reaffirms studies by Ashby, Sadera, and McNary (2011), which suggested that, in a developmental math course, student performance in online-based and blended classes was poorer than in the face-to-face class; and Morrison's (2011) study on end-of-course critiques that reportedly had students in the online section performing worse than those in face-to-face class. A study by Xu and Jaggars (2011) was also validated here. According to Xu and Jaggars, online education was less effective and even resulted in an adverse impact on community college students. More affirmations

appeared in Mitchell and Forrer's (2009) study, which reported that students enrolled online utilizing ICT had ineffective learning and that that is why they preferred traditional face-to-face class. Mentzer et al. (2007) also reported that online philosophy students had lower grades compared to their face-to-face counterparts.

In the current study, the success of the students was also correlated with GPA as would be expected. Although the effect was very small, the power was strong indicating that students who took a class face-to-face earned a statistically higher grade but their overall GPA was not significantly different from the online class. As for the online section, the course grade point average was significantly lower than the overall GPA. This result suggests that students who took face-to-face classes had the greater chance of increasing their GPA compared to the online section.

This result was consistent with previous research on the subject conducted by Thompson, Klass, and Fulk (2012), who reported that students in the face-to-face class also had a slightly higher course grade point average (3.11) than the online section (2.92). However, the difference in overall GPA by modality was not significant. Consideration of student readiness by investigation of self-regulated learning (Wang, Shannon, & Ross, 2013), and technology self-efficacy only increased the potential for student success. As demonstrated in Wang et al. (2013), students who demonstrated significant knowledge skills and self-efficacy with technology and satisfaction performed better. The results from the current study contribute to the body of knowledge on this subject with emphasis on the recommendation that with proper counseling, the choice of instructional method could have a great impact on the course outcome and GPA.

Online effectiveness. The U.S. Department of Education meta-analysis and review of online learning studies (Means et al., 2010), reported that online learning was as effective if not

better than a traditional method of instruction. The current study challenges an exploratory study on technologies and academics conducted by Gargallo-Castel, Esteban-Salvador, and Marzo-Navarro (2010) in which they focused on the success rate between Web-supported students and non-Web supported students. Gargallo-Castel et al. revealed that 78.14% of the online students had a higher success rate than the 60% for the non-Web supported students. The current study also contradicts multiple studies that proposed that online learners were as good as, if not better than, their face-to-face counterpart (Alkharusi et al., 2010, Bennett et al., 2007, Lancaster, et al., 2011, Lim et al., 2008, Moazami et al., 2014 & Vigentini, 2009).

No difference. The results from this study contradict studies that indicated that there was no significant difference between the two modalities. A detailed review of literature on multiple courses by Arbaugh et al. (2009) concluded that economics, finance, information systems, management, marketing, and operations/supply had the same learning outcome whether the class was taught online or face-to-face. Lyke and Frank's (2012) study suggested that there was no significant difference in learning outcomes of students in the different instructional methods.

Impact of Demographic Characteristics

This section relates the demographic factors studied to the choice of modality. Increased student usage of nonhuman appliances to interact and learn may help self-directed learners develop confidence and familiarity with this form of education. Students' readiness to engage in this novel method of study may be a component worth mentioning as a contributor to success online. Nevertheless, some demographic characteristics, such as age, ethnicity, financial status, enrollment status, and withdrawal status, may impact the overall performance of a student in any environment.

Age. With age, according to Bandura's (1997) assumptions, self-efficacy and determination should increase as a result of exposure to years of experience and dealing with multiple challenges in life, which further increase confidence. Still, this assumption may not be true in the context of technology, as older adults tend to lack confidence in their ability to use these resources. The present results indicated that age had an impact on the choice of instructional method. From this study, students under 25 years of age more often choose online classes than other age groups. However, students in the 26–35 years age group showed more confidence and self-determination for taking classes online. Students in the 36–45 years age group, on the other hand, did not have a preference. Meanwhile, older students (46 and over) had the least interest in online classes, with many having greater preference for face-to-face classes and very few with working computers at home.

In the theory of connectivism, learning is possible when the individual has the potential to interconnect ideas and concepts, to nurture and maintain connections, to continuously adapt, and to utilize nonhuman appliances to seek knowledge. Some key tenets of connectivism are lost with the aging process if Downes' (2005) assertions relating the characteristic to the brain and neural connectivity are correct. As individual ages, neural connectivity becomes more difficult. Key elements contributing to the success of any student whether online or face-to-face, depends on readiness, which was not measured in the current study. A combination of readiness and self-direction has the potential to optimize a student's learning. The current research suggests that the digital divide may have a substantial impact on the effectiveness of an online class for older students. This divide may also complicate the level of communication between the more tech-savvy young adults and the tech-challenged older students.

Course completion. Students were slightly more likely to withdraw or fail in an online class than in the traditional face-to-face method. This result could not, however, be interpreted simplistically. Reasons for the students' withdrawal or failure in the course were not explored by this study; student motivations provide avenues for more in-depth study. It is possible that a very self-confident and capable student withdrew from the course because the design fell short of being academically challenging, or because the student lacked skills and/or potential in areas explored by Siemens's connectivism and Bandura's self-efficacy theories, which have strong guidance to the chance of success.

The higher withdrawal rates in the online nutrition class could relate to a number of factors associated with a struggling student. Student success depends on readiness, motivation, self-discipline, independence, and skills to deal with IT problems, time management, and the ability to acknowledge your capabilities. Most of the time, students do not recognize the limits to their learning and require guidance from the institution. Hence, the institution needs fixed criteria to evaluate the potential of each student for taking specific courses online.

Gender. On the issue of gender, the results suggest that enrollment into the face-to-face or online class was independent of whether the student was male or female. This result contradicts previous research by Wladis, Hachey, & Conway (2015), which indicated that gender had a statistically significant difference in the choice of method of instruction with Black and Hispanic men less likely to enroll in an online class compared to their female counterparts. In the current study, the selection of method of instruction seemed to be independent of gender.

Ethnicity. There was a statistically significant difference among ethnic groups in the choice of instructional method. This result contributed to the previous literature that determined that student ethnicity affected the choice of method of instruction (National Center for Education

Statistics, 2011). Neuenschwander, Abbott, and Mobley (2012) explained that this low participation from the Black population, compared to their White counterparts, might result from not having computers or Internet access at home. Could the lack of access to resources that would foster connectivism be the reason for the choice of predominantly face-to-face rather than an online class? Is it possible that other reasons exist for the lack of success of minority ethnic groups, such as the absence of skills, self-efficacy, and nurturing that could have identified the learner's ability, hence placing the student in the appropriate instructional setting attuned to their ZPD? Most Hispanic and Black African American populations in this study had a preference was for face-to-face classes.

Financial status. The theory of connectivism relates well with financial needs as determined by PELL grants. According to the theory proposed by Siemens (2005), a student's ability to learn and acquire knowledge of any kind resides in the ability of the student to have an open mind, respect different opinions, and have the potential to make accurate thoughtful decisions with the understanding that nonhuman appliances may facilitate learning. As related to the current study, students with financial difficulty or on PELL grants may not have the potential to buy the necessary tools needed to succeed in an online class; thus despite their skills, determination, and ability to interconnect ideas, the students would rather take a face-to-face class.

Students with PELL grants preferred to take their class face-to-face on campus, while those not on PELL grants were inclined towards an online course. This difference, however, was not very high based on the effect size. Students on low financial status fall in the minority group of students who are already underrepresented online. Ozdagli and Trachter (2011) reported that low-income students were at least 27% more likely to drop out than their wealthier counterparts.

Some students, despite their abilities and capabilities to perform well in an online class, may face problems acquiring the hardware or Internet services required for the course. At the institution involved with the current study, laptops are loaned to students and special low-cost Internet access is provided to students who qualify.

Enrollment status. Whether a student was enrolled full time or less had a small but significant relation to the modality. Overall, the distributions were almost equal between the face-to-face and the online class. Half-time students predominantly most often signed up for the online class. The full-time students who slightly preferred the face-to-face class followed the half-time group. Students in the less than half-time category were more prone to taking an online class than the face-to-face class. These results may reflect the type of students attending the institution. Assumptions could be made that students who were most confident in their ability, and had the maturity to manage their own ZPD, time, and who were part-time would most likely take an online class. Some had the aptitude to interact with peers and faculty facilitated their achievement of independence and zone of proximal development. As reported by Mamiseishvili and Deggs (2013), full-time enrollment at a two-year community college increases the chances of that student persisting to graduation or transferring to a four-year college. The typical students at the community college in the current study are low-income workers, mothers, or caretakers of sick parents; and they only sign up for part-time enrollment, which explains why some take more than two years to go through the college. Bandura (1997) calls for modeling or vicarious experience for the students, but fails to acknowledge that some students are in college for the first time and many come from a household where they are the first to attend college. There may be great resistance to the idea of choosing college rather than gainful employment to support the family.

Satisfaction

Both the face-to-face and online section of the course were surveyed to get the student perspective of the instructor and the course. The institution incorporates student surveys in evaluation of faculty for tenure or for effectiveness in their job functions. To understand the scope of answers from the 274 respondents in this study, a factor analysis facilitated grouping into three categories; student's satisfaction with the faculty, course experience, and overall course appraisal. A course designed to enhance creative thinking could only enhance the positive perception of the instructor and the course as a whole. Several barriers associated with the course instructor were listed by Targamadze and Petrauskiene (2012): lack of pedagogical and professional skills, lack of knowledge to deal with technology, limited Internet access, unpreparedness or unsatisfactory knowledge and computer skills, and lack of time to prepare for class. It is imperative that designers of online courses consider providing proper ongoing training for faculty and students, faculty needs, and adequate technical support. Meeting adult learners' needs, encouraging faculty to integrate technology and pedagogy, and providing model mentor / mentee relationships would enhance the students' experience.

Satisfaction with faculty. Although the student survey rating for both face-to-face and online instruction in this study was outstanding, it was more so in the case of face-to-face than the online method of instruction in all three components rated (satisfaction with instructor, course experience, and overall course approval). This result supports previous research that suggested that online instructors received less favorable satisfaction surveys and that face-to-face students slightly favored the face-to-face instructor (Mentzer et al., 2007). Reasons for the poor evaluation of faculty sometimes is not due to poor performance of the online instructor, but to inherent technical issues that the students may encounter during the course of the semester.

Sometimes it is the student's frustration with the learning management system, as they were not adequately prepared to navigate the tools. However, because students only evaluated their own instructor, the argument would be better made in future studies if the same instructor taught the class online and face-to-face, and was evaluated by the same group of students.

Perception of course experience. Most students in the face-to-face class indicated that they learned or gained much from the face-to-face class. Online students were of the opinion that their instructor was not available to offer help when they needed it. This supports previous studies that indicated that online learning was considered less favorable to students in the convenience segment despite their satisfaction with the quality (Callaway, 2012). Accordingly, instructors with high self-efficacy, superior technology skills, and great ability to interact with students will have a positive effect on the students. It should also be acknowledged here that sometimes the positive perception of a course is not as a result of a well-designed course, but as a result of an experienced teacher with great online presence. Meanwhile Bandura's (1997) theory of self-efficacy emphasizes that students with the most experience, interacting with successful peers, being encouraged rather than discouraged, and with less anxiety had the potential for increased self-efficacy and determination, which would translate to a positive course experience. Another aspect for consideration is the experience of the student in previous online course(s). A student taking the course online for the first time is most likely to have a less than favorable perception compared to an experienced online student.

Overall course approval. The current study's results revealed that a small number of face-to-face students assessed their classes as more effective than did students in the online section of the class. The results reinforce Summers et al., (2005) indication that online students were less satisfied with the online course. The current study also supports a previous report by

Pena and Yeung (2010) that indicated that students were more satisfied with the face-to-face model than the online version.

Readiness

Explaining the success of the students just in terms of their ability to interact effectively with technological tools, interconnect with critical information, and relate it to diversity of opinion is not enough. Some students in the online class who had the necessary technology skills failed or withdrew from the online course at a higher rate than did students in the face-to-face course. Though the fraction of students who withdrew or failed was small, this observation merits further inquiry.

Another strong indicator of success in the course is readiness, which is a measure of how prepared the student is in terms of technology proficiency and familiarity with the learning management system. Linking readiness to success in either method of instruction is imperative as a well-prepared student is more likely to achieve success than an ill-prepared one.

The technological nature of online education may be exclusionary in that it requires more advanced technological skills than face-to-face. Although use of the Internet is widespread, disparities in the quality of and ease of access to the Internet and supporting equipment may be linked to socioeconomic differences. These differences may in turn be associated with financial status, ethnicity, age, and enrollment status, which contribute to variation in levels of readiness for success in online versus face-to-face education. The results from the current study point to the fact that these factors affect the choice of modality. Siemens's principle of the ability to connect between fields, ideas, and concepts could be related to readiness of the students.

Students without the readiness component may not achieve their goals, primarily because of the lack of skills, as readiness is a learned rather than an inherent attribute. Lack of success in

a course also potentially links to the lack of a learning strategy and the inability to organize and manage time for virtual classroom studying. Whether in an online or face-to-face environment, the aforementioned barriers to student success may ultimately connect with the inadequate understanding of current technology and the inability or reluctance to embrace social media as a relevant educational tool.

Furthermore, lack of readiness could also be an issue on the part of faculty; and may, for example, stem from the instructor's inability to design an online course that replicates the stimulation and engagement attained in face-to-face classes, which more typically incorporate debates between the peers (student–student) and substantially more faculty–student interaction (Cowan, Neil, & Winter, 2013). However, the online instructor in the current study had 20 years of experience in teaching; in addition, from the nature of the responses from the student survey, students were happy with the teacher's delivery of information.

Implications of the Current Study

On the overall question of which instructional method is superior, the answer is still elusive. The study points to a slight superiority of face-to-face over online instruction where success is measured in terms of final grades. As stated earlier, several reasons could explain the outcome: one being students' relationship to the instructor or the instructor's experience with the course since different instructors taught the classes. Proficient guidance from faculty is crucial in any learning environment but more so in the online environment where a greater burden is on the student to participate actively in the learning process in order to succeed.

Despite the push for community colleges to incorporate online learning into every class, course designers need to identify factors influencing the choice of instruction. Consideration of motivation, previous experience, communication, and self-efficacy would be instrumental to

improving course design. Additionally, the college should consider allocating resources and personnel to provide continuous training to students interested in taking online classes. Student readiness may be enhanced by prior assistance tailored to preparing first-time online students for the virtual classroom.

Another implication from the study is that administrators need to provide infrastructure and ongoing technological training with a support staff to assist faculty. Instructors should be encouraged to participate in faculty development workshops. Furthermore, evaluation of faculty who teach online cannot depend on traditional surveys designed for face-to-face classes. Other learning outcomes need to be considered when developing and considering online faculty course evaluation. Incentives should be provided for faculty to redesign courses once every year or two. Newer forms of pedagogy are made available to instructors but the reluctance in starting something new constrain acceptance.

It is recommended that considerable attention be given to the type of course being offered online. Community colleges need to consider offering more difficult STEM classes as blended courses rather than fully online courses in order to increase success rate. Blended STEM courses would balance face-to-face and online instructional methods, thereby mitigating withdrawal rates. Students with previous exposure to online courses, good learning practices, and resilience have a higher chance of getting a better grade online.

A combination of all three theories provided in this research—connectivism, self-efficacy, and zone of proximal development—paint a seemingly comprehensive picture of online students, the obstacles they face, and their expectations for success. With a tool that screens students' technological skills and coaching to nurture students' abilities to work independently

and productively, colleges offering online courses will increase students' success and reduce early withdrawal from or failure in courses.

It would, therefore, be vital to modify course designs to incorporate increased student-to-student interaction, and student to faculty communication to diminish the dissatisfaction. Administrators would also strongly encourage faculty cultural sensitivity, respect for all students' backgrounds, and understanding that some students from different cultures may not respond to or actively participate in a virtual classroom environment as they would in a traditional setting. Instructors must learn strategies for reaching out and encouraging them. As studies have shown, minorities are more likely than White students to withdraw from an online class. Low retention in online classes has a negative effect on the student, faculty, and the college. Financial loss by the student as well as by the college justifies identification of methods to address the problem of retention, which would alleviate the risk on both sides.

Future studies might conduct detailed investigations into course withdrawals, such as:

- Students' ethnic distribution by financial status to determine exactly what category of students and from what ethnic background actually withdrew from the class.

- Whether student, faculty, or student counselors initiated withdrawal from the classes.

Through an online early alert system, faculty might constantly alert counselors about students at risk of failing the class.

The results of this study suggest that online course design needs to address cultural sensitivities as well as ensure an increase in participation from the less-represented populations. As recommended by Sue (2006) and Seeleman, Suurmond, and Stronks (2009), three broad areas—knowledge, attitudes, and skills—need to be addressed. Knowledge competence deals with the epidemiology of the problem and with how ethnic groups are treated differently (Sue,

2006). Attitude competence deals with understanding a student's awareness of how behavior and thought processes are influenced by cultural background. Awareness of the lifestyle of various ethnic groups would provide contexts on relationships and therefore impact the student's awareness of individual biases and stereotypical behaviors. The last cultural competence deals with skills related to communication with others not from the student's cultural background. The ability of the student to adapt to new and fluid situations demands resourcefulness and flexibility thereby enhancing cultural sensitivity.

These recommendations impact the learning environment and student learning outcomes on four fronts: institutional readiness, faculty readiness, course design, and student readiness. The focus of every course should be on the successful completion by the students with some satisfaction at the end of the semester. Far too often students in the online class are dissatisfied, most often with the instructor, because of experiences that may jeopardize the students' participation in future online courses. However, the low retention or high dropout rates in online classes do not necessarily mean the learning environment is poor. It may be that the course designers and the institution did not do a good job, or that the students and faculty members had little mastery of the learning platform.

Based on the results from this current research, it is recommended that colleges adopt a conceptual framework to guide technology-enhanced learning environments. Such a framework would influence course designers, faculty, and students to optimize online learning experiences.

Recommendations for Practice

The current research proposes recommendations for practice that involves institutional, faculty, course design, and student readiness. A successful student experience in an online class depends on the smooth integration of all key factors.

The recommendations for practice between the theoretical framework and the areas of recommendations are developed from the theoretical framework as shown in Figure 16. Bandura's self-efficacy theory and Siemens' connectivism describe the aspects of faculty readiness that allows faculty to use technology as a tool to educate students. As for student readiness, self-efficacy theory offers the best explanation of the necessary preparedness of a student. Connectivism strongly related to institutional readiness, providing the rational for infrastructure, user-friendly learning management system, and technical support. The zone of proximal development theory governed the course design, which takes into consideration the academic and readiness levels of the student and how to nurture them into the expected zone of learning within the context of the course.

The three-step process (institutional readiness, faculty readiness, and student readiness) to a better online course requires student readiness at the core in order to reduce the number of students who fail to complete the course. Because students regardless of age, financial need or enrollment status refuse to acknowledge shortcomings with taking classes online, and not being responsible for their learning, promotes the notion that online classes do not do as well as their face-to-face counterpart.

Recommendations for institutional readiness and course designers. Participation in course design often requires institutional support, highly enthusiastic faculty members, the time to incorporate new ideas, and the technology to convert traditional face-to-face classes to an online version. A well-designed course has as its main focus, clarity in the assignments, smooth navigation of technology, and intellectual stimulation. However, the institution must provide the infrastructure, funding, a simple and effective Learning Management System (LMS), and training for course designers and faculty members.
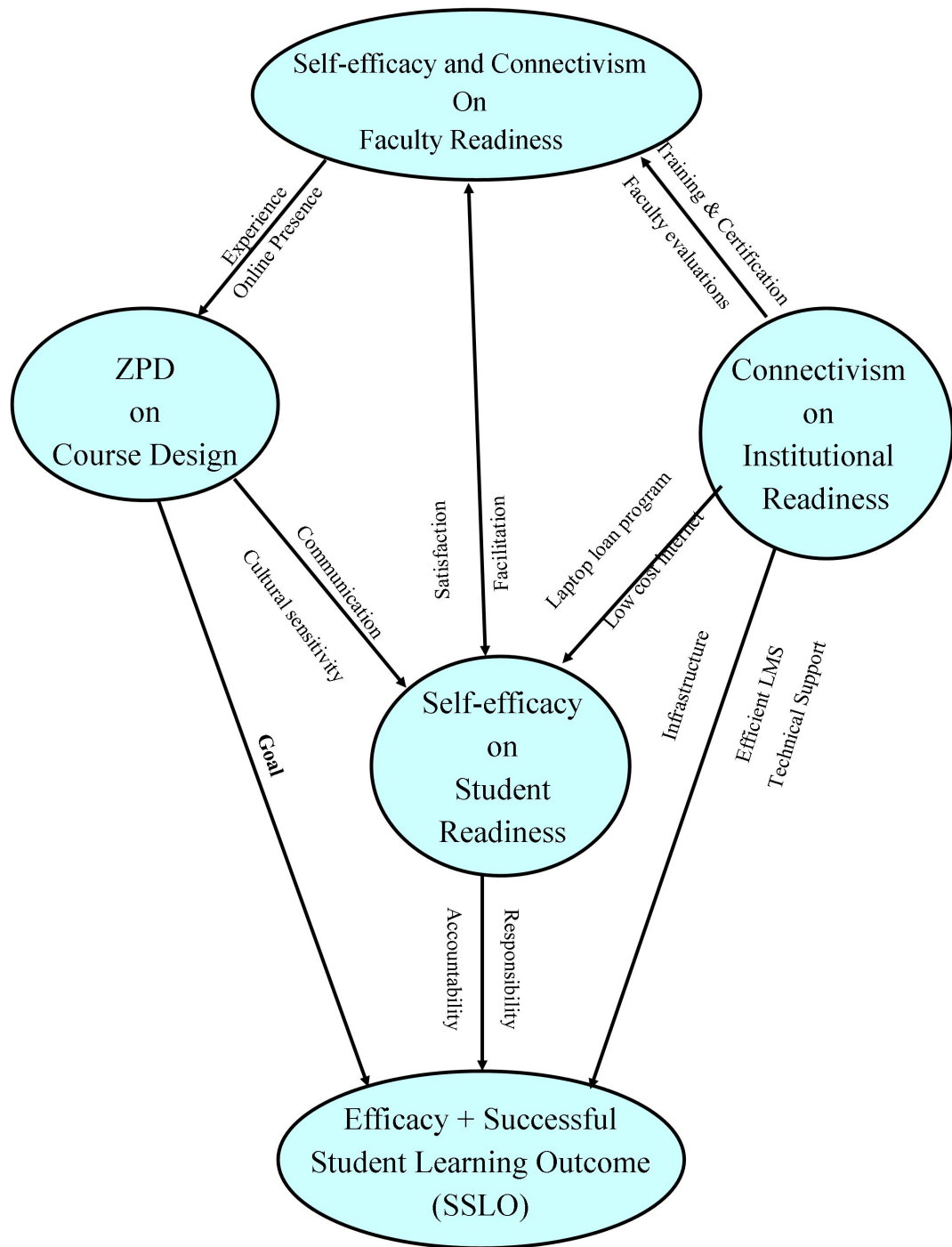
Figure 16. Relating Nfor's theoretical framework to the recommendation for practice.

Effective course design depends on the readiness of the institution to provide funding towards acquisition of equipment and hiring of technical support staff. Navigating the icons on the course Web page should not be tedious and labor intensive. Institutional readiness requires laptop computer loan programs, low-cost Internet connectivity for students with limited financial status, and an investment in faculty trainings and student learning outcomes. Institutions need to develop newer faculty evaluation tools reflective of the online learning environment, rather than continuing to use face-to-face faculty evaluation questionnaires for online instructors.

The success of a course is based on how challenging and intellectually motivating it is. Students are delighted with courses that promote critical thinking. Course designers need to focus on assignments and case studies that provoke thinking outside the box. Another strategy to consider is a course aimed at improving learning by evaluating student readiness for an online course (evaluation tools), which the institution can provide in order to select or educate students on their capabilities to take a class online. This tool would inform the instructor on computer, writing, and communication skills of students in the class.

To avoid the problems of content-based imagery dumping and information overload, instructors should incorporate Websites with information that enhances the course. Images embedded in the Website should relate to the course, without becoming a site for depositing anything the instructor finds interesting with no relation to the course. The institution should provide adequate technical support to both faculty and students, with a 24/7 technical support specialist who can help students with hardware, software, and connectivity problems. Designers should consider creating a course that welcomes students and nurtures their learning experiences with adequate safeguards to protect students and faculty.

The institution and online course designers should recognize the cultural amalgam that the college represents and emphasize collaboration and cultural awareness among students. An online course requires student–student as well as student–faculty interaction with a high degree of cultural sensitivity, which can only be fostered in a learning environment that promotes open communication and responsible online etiquette.

Online orientation for students should be held either face-to-face or virtually online on the first day of class. Faculty should be advised not to start teaching course content on the first day of class; rather they should provide an orientation by navigating the LMS to be used by all the students. Students need to test their computers and practice communication on the discussion board. In addition, they should utilize an outside communication format such as Skype™, Google Hangout™, or Face Time™ as backup in case there are problems with the LMS one day.

Recommendations for faculty readiness. Online teaching certification and ongoing refresher training programs should be offered for instructors to maintain sharpness and competitiveness. Interested faculty must be certified in the appropriate Learning Management System used by the institution. Recertification should be required every two years to maintain a high skill level. Moreover, faculty should be encouraged to attend training programs on newer technologies and online learning educators conferences and workshops. As much as personal responsibility is expected from the students, greater responsibilities also rests with the faculty for maintaining knowledge of the tools and software available.

Students expect a designated online presence by the instructor to relieve the stress level especially during the first week of class. Moreover, students appreciate faculty members who indicate what block of time daily he or she will be online to help students or respond to questions. Students are often knowledgeable about the newest technology and applications. An

attempt by faculty to understand newer technologies and applications would facilitate his or her integration into the students' world and increasing student–faculty interaction, and peer interaction. Clear communication of assignment deadlines and attendance policies is imperative. Setting expectations on the first day of class would alleviate stressful situations during the semester.

Most often faculty members translate their face-to-face practices directly into the online learning environment, which may not work. Faculty members need to facilitate, and not dictate student-led discussions online. Instructors who encourage students to lead the discussion and serve as the facilitator promote student maturity and growth.

Some faculty members never update or change course content for several years, but a yearly makeover to add creative activities, videos, and stimulating discussions is necessary. To neglect this makeover is an indication of lack of readiness or motivation on the part of the instructor. Instructors also need to provide feedback on a reasonable timeline. Student frustrations become apparent when they do not receive a prompt response to a query. Timely feedback on assignments lessens frustration and promotes a smooth learning environment.

As promoted by Williams and Brown (2013), development, adaptation, and implementation of an appropriate self-directed learning readiness scale to measure the readiness of students would be beneficial. Before taking an online course, the institution needs to administer the online evaluation tool to understand students' readiness for an online course. Emphasis for students is on accountability and responsibility towards their learning.

Students need to be familiar with the Learning Management System and technological knowledge, as well as highly organized, disciplined, and self-motivated. Navigating the LMS prior to the course to find assignments, modules, and how to post on the discussion board would

alleviate anxiety and uncertainty. A driven, self-determined, and self-motivated student with excellent time management skills has the highest chance of succeeding in an online class. Online education demands that students be self-reliant and independent.

Knowledge of basic computer operations, along with writing and communication skills, forms the foundation for a successful online experience. There is a difference between cell phone navigation skills and the tools required for an online course. Students are advised to seek help from faculty members and peers, and to utilize college resources such as the library and the help desk. Knowledge of online etiquettes creates appropriate sensitivity to peers and cultural backgrounds. Lastly, students are encouraged to read carefully the syllabus for assignment deadlines and to allocate specific study times. If the online format is not appropriate, the student should take the course face-to-face. Students are accountable for their actions in an online learning envrironment, which may or may not guide them to a highly efficient online experience culminating in success in the course. Based on the aforementioned recommendatons for practice, this researcher proposes a conceptual framework for a technology-enhanced learning environment (Figure 17).

Recommendations for student readiness. Overall, the goal of an online nutrition course is to educate students to a level of comprehension that governs their success and the efficacy of the course. The institution, faculty readiness, and course designs influence student readiness for an online course. Regardless of the modality, all students should be evaluated for their level of readiness for college level courses, especially their abilities to take courses online.

Modifying the face-to-face curriculum to fit the characteristics of students who attend online classrooms requires fast, less expensive, and more effective learning opportunities. Indeed this study was inadequate in its explanation of all possible variations that could affect the

learning outcome, but was able to contribute to the overall depth of knowledge in this field and

the ongoing debate. Institutions need to recognize technology's value and its impact on higher
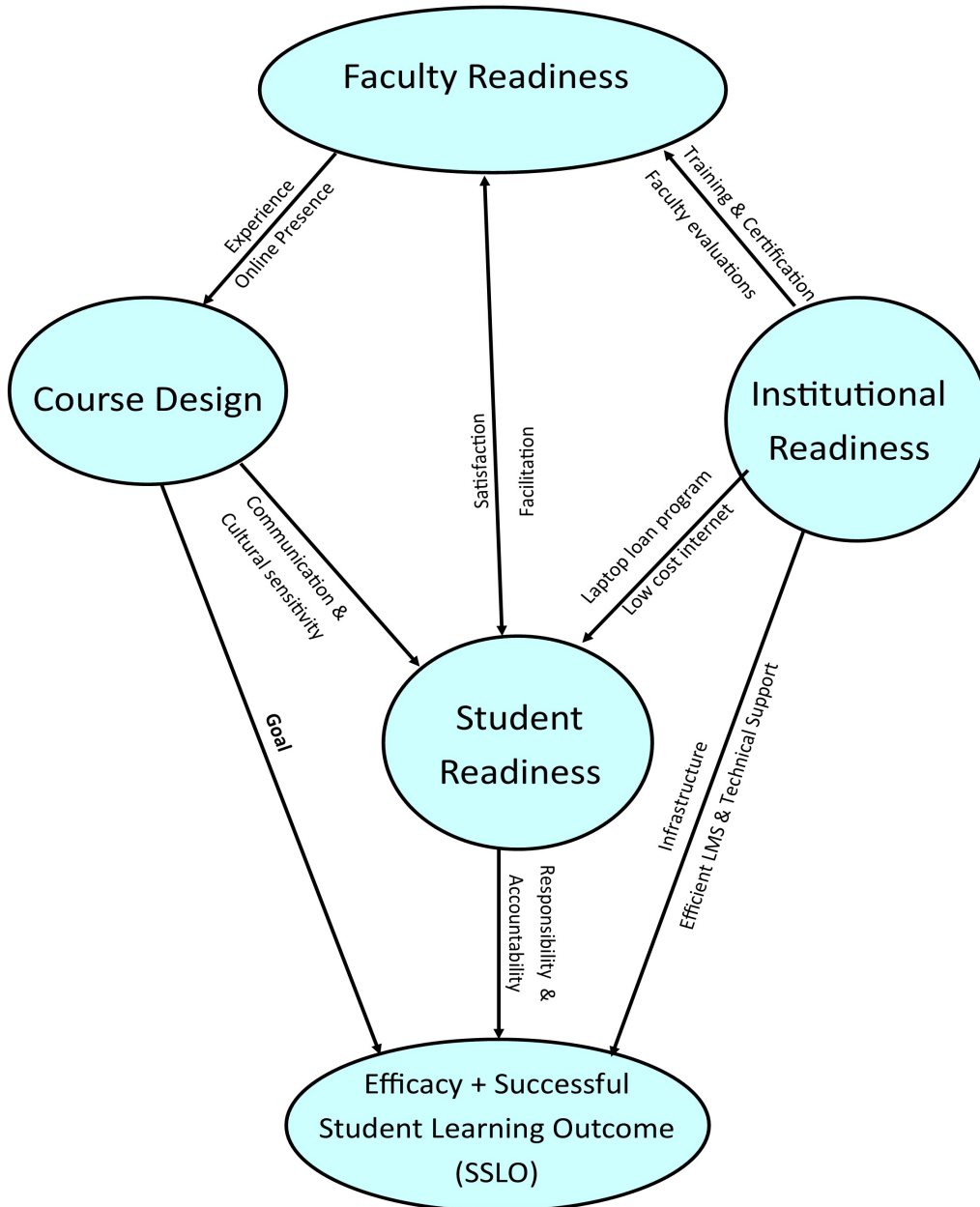

Figure 17. Nfor's technology-enhanced learning environment with focus on efficacy, student
success, and satisfaction.

education today by providing training sessions. This training would facilitate use of technology in the classroom, peer mentoring, and increased communication and interaction through group projects online.

As indicated by Allen and Seaman (2013), the need for online classes is only growing. For schools to remain competitive in this highly technical world, dealing with sophisticated students born into the use of technology, faculty and administrators have only one option: adapt to mobile devices, social media platforms, MOOCs, and other techniques used in the academic arena. Rather than preventing students from using mobile devices in the classroom, instructors should enhance their courses to encourage the usage of the devices students have. By surveying students at the beginning of the semester to determine what forms of technology and devices they have, instructors may then educate them on how to utilize the device in class.

Recommendations for Future Research

Future studies should include larger samples and broader participation. In addition, using the same instructor—or a random sample of instructors—in both the face-to-face and the online section of the same course would eliminate variations due to differences in teaching style and student–faculty rapport. Likewise, future studies should investigate the satisfaction of students and faculty with the learning management system (LMS) to see how easy is it for the instructors to master its functions and the ease with which students can navigate the site. Other recommendations would be to conduct the study on multiple community colleges to increase the chances of generalization of the outcome, and to investigate the relationship between the background variables and students' performance in terms of grades.

As higher education continues to confront rising costs, community colleges continue to enjoy an increasing number of students knocking on their doors because of the low-cost

education they provide. But low graduation and high dropout rates call for comprehensive studies to understand better graduation rates from the two modalities and factors that drive higher attrition in online courses.

Connectivism as a theory fails to explain instances when some students without technology (computers, handheld devices, or personal Internet connectivity) succeed and even outperform those who have these resources. Future studies should investigate the performance of students with limited software and hardware to correlate the theory of connectivism.

Conclusion

Higher education is at a crossroad where learning is facilitated by the use of technology to deliver content even though the effectiveness of online learning remains controversial. The cost of higher education continues to rise as well as the demand for higher education as younger students aim for degrees in higher education. Despite the high demand, low completion rates, and failure of higher education institution to be accountable, more are leaning towards the use of technology as a solution to education. However, much needs to be learned about its effectiveness and impact. Although it has great promise to expand education while lowering cost, much study needs to be conducted to understand the best way to use online learning in higher education.

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Appendices

Appendix A Application for Institutional Review Board Approval Form
University of the Incarnate Word

UNIVERSITY OF THE
INCARNATE WORD

2/17/2015

Solomon K. Nfor
9811 Lauren Mist
San Antonio, Texas 78251

Dear Solomon:

Your request to conduct the study titled *An Analysis of Online Versus Face-To-Face Nutrition Course at a Community College: A Comparative Study of Learning Outcomes* was approved by exempt review on 2/17/2015. Your IRB approval number is 15-02-003. Any written communication with potential subjects or subjects must be approved and include the IRB approval number. Electronic surveys or electronic consent forms, or other material delivered electronically to subjects must have the IRB approval number inserted into the survey or documents before they are used.

Please keep in mind these additional IRB requirements:
- This approval is for one year from the date of the IRB approval.
- Request for continuing review must be completed for projects extending past one year. Use the **IRB Continuation/Completion form**.
- Changes in protocol procedures must be approved by the IRB prior to implementation except when necessary to eliminate apparent immediate hazards to the subjects. Use the **Protocol Revision and Amendment form**.
- Any unanticipated problems involving risks to subjects or others must be reported immediately.

Approved protocols are filed by their number. Please refer to this number when communicating about this protocol.

Approval may be suspended or terminated if there is evidence of a) noncompliance with federal regulations or university policy or b) any aberration from the current, approved protocol.

Congratulations and best wishes for successful completion of your research. If you need any assistance, please contact the UIW IRB representative for your college/school or the Office of Research Development.

Sincerely,

Rebecca Ohnemus, MAA, CRA

Rebecca Ohnemus, MAA, CRA
Research Officer
University of the Incarnate Word IRB

Appendix B A copy of Survey Instrument used by the College

ALAMO COLLEGES STUDENT SURVEY FORM

Northeast Lakeview College * Northwest Vista College * Palo Alto College * St. Philip's College * San Antonio College

Call Number

College
- ① SAC
- ② SPC
- ③ PAC
- ④ NVC
- ⑤ NLC

Year

Term
- ① Fall
- ② Spring
- ③ Summer I
- ④ Summer II

Student surveys of faculty will be used primarily for the purpose of improvement of instruction. The faculty member desires your honest opinion to help improve instruction and to help verify the positive aspects of instruction. Completed surveys will be given to the department chairperson. Once reviewed, surveys will be given to the faculty member (after final grades have been submitted).

Read each statement and respond in the manner that best reflects your evaluation of the behavior. Use the following definitions to determine your rating of the faculty member.

A	Outstanding:	Performed very well; a model for other instructors.
B	Very good:	Performed well; demonstrated above average performance.
C	Satisfactory:	Performed in middle range; demonstrated average performance.
D	Marginal:	Demonstrated minimally acceptable performance; some changes should be made to improve instruction.
E	Unsatisfactory:	Did not meet minimum requirements; major changes must be made to improve performance.

MARK ONLY ONE BUBBLE PER QUESTION WITH A PENCIL OR PEN. ALL MARKS SHOULD DARKEN ENTIRE SPACE. ERASE MISTAKES COMPLETELY, LEAVING NO STRAY MARKS.

1. The course has been...
   Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ

2. The instructor's presentation of the materials...
   Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ

3. The instructor's methods of keeping me informed of my progress and grades have been...
   Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ

4. The instructor's efforts to motivate me to learn in this course were...
   Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ

5. The instructor's methods of treating the students with fairness and respect have been...
   Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ

6. My overall rating of the instructor is...
   Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ

7. My overall rating of this course is...
   Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ

8. If possible, I would enroll in another class taught by this instructor...
   Ⓐ Definitely
   Ⓑ Highly probable
   Ⓒ Maybe
   Ⓓ Not likely
   Ⓔ Under no circumstance

9. This instructor was available to provide help when needed.
   Ⓐ Willingly, anytime I needed.
   Ⓑ Often when I needed.
   Ⓒ Occasionally when I needed.
   Ⓓ Unwillingly provided.
   Ⓔ Never.

10. Considering what you have learned from this course, would you say...
    Ⓐ I learned or gained more than expected.
    Ⓑ I learned or gained a great deal.
    Ⓒ I learned or gained enough to make it worthwhile.
    Ⓓ I learned or gained very little.
    Ⓔ I learned or gained nothing.

Appendix B A copy of Survey Instrument used by the College–continued

11. I have completed the following semester hours...

0-15	16-30	31-45	46-60	60+
Ⓐ	Ⓑ	Ⓒ	Ⓓ	Ⓔ

12. Are you taking this course as a requirement?

Yes   No
Ⓨ   Ⓝ

13. I have the following number of absences in this course...
    Ⓐ None
    Ⓑ One week or less
    Ⓒ Two weeks
    Ⓓ More than two weeks

14. In this class I expect to make a grade of...
    Ⓐ   Ⓑ   Ⓒ   Ⓓ   Ⓔ

15. Is this course in your major?
    Yes   No
    Ⓨ   Ⓝ

Official Use Only

①②③④⑤⑥⑦⑧⑨⓪
①②③④⑤⑥⑦⑧⑨⓪
①②③④⑤⑥⑦⑧⑨⓪
①②③④⑤⑥⑦⑧⑨⓪

FACULTY MEMBERS BELIEVE THAT COMMENTS OR EXAMPLES ARE EXTREMELY VALUABLE. PLEASE ANSWER THE FOLLOWING QUESTIONS.

16. Aspects of this course I found most helpful were...

17. Aspects of this course I would most like to see changed are...

18. Your instructor would like to know some specific things he/she did particularly well...

19. Your instructor would like to know some specific thing you did not like about the course that he/she should change to improve his/her teaching...

THE FOLLOWING SECTION IS FOR DEPARTMENTAL USE; PLEASE ANSWER BASED ON THE QUESTIONS PROVIDED TO YOU BY THE INSTRUCTOR FURNISHING THE SURVEY.

20.	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ		31.	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ		42.	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
21.	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ		32.	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ		43.	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
22.	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ		33.	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ		44.	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
23.	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ		34.	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ		45.	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
24.	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ		35.	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ		46.	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
25.	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ		36.	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ		47.	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
26.	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ		37.	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ		48.	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
27.	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ		38.	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ		49.	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
28.	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ		39.	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ		50.	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
29.	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ		40.	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ		51.	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
30.	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ		41.	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ		52.	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ

DRC ScanDocs™ 10109-54

Appendix C CITI Collaborative Institutional Training Initiative

COLLABORATIVE INSTITUTIONAL TRAINING INITIATIVE (CITI)
STUDENTS CONDUCTING SOCIAL AND BEHAVIORAL RESEARCH CURRICULUM COMPLETION REPORT
Printed on 08/04/2014

LEARNER

Solomon Nfor (ID: 2350156)
9811 Lauren Mist
San Antonio
TX 78251
USA

DEPARTMENT Education
EMAIL nfor@student.uiwtx.edu
INSTITUTION University of the Incarnate Word
EXPIRATION DATE 08/03/2017

STUDENTS CONDUCTING SOCIAL AND BEHAVIORAL

COURSE/STAGE: Basic Course/1
PASSED ON: 08/04/2014
REFERENCE ID: 6401464

REQUIRED MODULES	DATE COMPLETED	SCORE
Belmont Report and CITI Course Introduction	08/04/14	3/3 (100%)
Students in Research	08/04/14	8/10 (80%)
History and Ethical Principles – SBE	08/04/14	5/5 (100%)
Defining Research with Human Subjects – SBE	08/04/14	5/5 (100%)
The Regulations – SBE	08/04/14	5/5 (100%)
Assessing Risk – SBE	08/04/14	5/5 (100%)
Informed Consent – SBE	08/04/14	5/5 (100%)
Privacy and Confidentiality – SBE	08/04/14	5/5 (100%)
Research with Prisoners – SBE	08/04/14	4/4 (100%)
Research with Children – SBE	08/04/14	4/4 (100%)
Research in Public Elementary and Secondary Schools – SBE	08/04/14	4/4 (100%)
International Research – SBE	08/04/14	3/3 (100%)
Internet Research – SBE	08/04/14	5/5 (100%)
Research and HIPAA Privacy Protections	08/04/14	5/5 (100%)
Vulnerable Subjects – Research Involving Workers/Employees	08/04/14	4/4 (100%)
Conflicts of Interest in Research Involving Human Subjects	08/04/14	4/5 (80%)
University of the Incarnate Word	08/04/14	No Quiz

For this Completion Report to be valid, the learner listed above must be affiliated with a CITI Program participating institution or be a paid Independent Learner. Falsified information and unauthorized use of the CITI Program course site is unethical, and may be considered research misconduct by your institution.

Paul Brunschwiger Ph.D.
Professor, University of Miami
Director Office of Research Education
CITI Program Course Coordinator

Appendix D Application for Institutional Review Board Approval Form from the College

St. Philip's College
summary cover Sheet
Protocol for Human Subjects in Research

Please check< oft or provide details on the following (enter NIA if not applicable)   ✕ ___ Exemption Requested
                                                                                          See Page 2

Principal Investigator Name: Solomon Nfor M.S. Doctoral Candidate _____

Affiliation: Faculty n/a   Student ✕ (must include signature ol committee chair on protocol)   ACCD professional n/a Other _

College /Dept. / Organization University o f the Incarnate Word Dreben School of Education

Contact: Home Phone 210-449-0252   Work Phone   210-486-2754 Email: snfor@alamo.edu

Project Title: An analysis of online versus face-to-face nutrition course at a community college: A comparative study of learning outcomes.

Subjective Estimate of Risk to Subject: Low   Moderate   High ____   None __X__

Gender of subjects: Male_   Female_____   Both __X__

Age(s) of subjects: 18 and older

Total Participants (est.) 1,000

Source of Subjects: **Subject Recruitment**:

              Classroom   Direct. Person to person contact
              campus (General)   Telephone solicitation
              Posted notices (attic h).   **Newspaper advertisement (attach)**
        X   Other _Office of Inst1tuuonal Research, Plann1ng and Effectiveness__   Letter (attach)
                                                     Other _Previously collected data_____
Will subjects be compensated?   Yes ___ (If yes, attach compensation conditions and schedule of payment) No X_

Will any means of deception be utilized?   Yes__   . No X ____

Location of Experiment: St. Philip's college

Will invasive or sensitive procedures be utilized?   yes ___ (if yes, indicate type below)   No __X__

          --Blood Samples —— Urine Samples --Stress Exercise --Physical Measurements --Psychological Inventory

          —— Review of Medical Records   rDNA ____ Other (Speciffy) —
Will research involve sensitive subject matter?   Yes ___(if yes, indicate type below)   No x____

          ——Alcohol, Drugs' Sex —— Depression/Suicide --Learning Disability

          ___Other (Specify)   —
Use of Video or Audio tapes (indicate type)_   No ·· _ ·· _ _ _ _

          Retained? Yes   No   Length of time retained   Destroy/ Erase? Yes   No

          Other (Explain)
          Is use specified in consent?

          Use/Access to tapes:
Provisions for Confidentiality /Anonymity = ---------------------------

          Replies Coded?   Yes __x __   No   Secure Storage? Yes _X___   No

          Anonymous Response? Yes _X_   No   Confidential Response? Yes _It_ No

          Exact location where consent forms will be filed· . .   .
          (Must be kept on file for 3 years after completion: g

Appendix D Application for Institutional Review Board Approval Form from the College–
continued

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REQUEST FOR EXEMPTION FROM IRB REVIEW

Some research projects involving human subjects are exempt from a review by the IRB. See the attached sheet on research categories
exempt   from   full   IRB
review.

Basis for Exemption [Refer to attach "Categories Exempt From Full IRB
Review"]

Established educational settings/normal educational practice (a letter of approval from a school official must be obtained before the
study can be conducted; send copy to the IRB).

Use of educational anonymous test (cognitive, diagnostic, aptitude, advancement; attach copy).

Survey or interview procedures, [unless subjects might be identified, put at legal or personal risk, and unless survey or procedures
Deal with sensitive matters of personal behavior]

Observations of public behavior [unless subjects might be identified, put at legal or personal risk, and unless observations deal with
sensitive matters of personal behavior]

_X_ Anonymous collection or study of existing documents, records, pathological or diagnostic
specimens.

Taste and food quality evaluation and consumer acceptance studies.

The U.S. population is becoming increasingly culturally, linguistically, economically, and ethnically diverse. The research needs to
make a concerted effort to ensure that research subjects reflect the population demographically, including these groups who have
been traditionally underrepresented. However, it is recognized that the available pool of subjects may preclude having a balanced
population. If you cannot use a diverse population in your research, you must justify why not.

2|18|2015

Solomon Nfor,
M.S., Principal Investigator Signature and Date

_____

Student Committee Chair- Signature and Date

18 feb. 2015

Department Head Signature and Date

19 Feb 2015

Human Subject Review Committee Signature and Date