THE INFLUENCE OF A COMPRESSED SEMESTER ON STUDENT PERFORMANCE IN A CAREER AND TECHNICAL COURSE

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Morehead State University, 2022

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Many students value the realistic learning experiences provided by career and technical programs. A focus on critical thinking, modern technologies, real-world settings, hands-on activities, and the application of learning to practical problems, align with an increasing importance on 21st century skills. This is different from the traditional community college student who usually has a visual, aural, or reading/writing learning style. Most academic research looks at the traditional college class as it relates to compressed coursework. However, the educational environment is different in the career and technical classroom and laboratory from the traditional general education classroom. Typically, learning is through direct activities that take time and experience for the student to get the required level of ability of the competencies they must obtain to successful proficiency in the material and the completion of the coursework.

In this research, a case study of a 2-year Community and Technical College in the southeastern United States is undertaken to measure the influence of a compressed semester on

student performance in a career and technical course. In the Fall of 2021, this college developed a class schedule that consisted of 83% of its coursework to be delivered in a compressed format. Each traditional 16-week semester was divided into two eight-week terms. Courses that were not moved to this model stayed on a 16-week semester format as they were dependent upon outside agencies to provide clinical and other work-based learning opportunities that could not be completed easily within an eight-week compressed course timeframe.

This study is focused on a basic electricity course, typical of career and technical education classes at 105 contact hours, delivered at two campuses of this comprehensive community and technical college. Comparisons made of previous regular 16-week semester sections to the eight-week sections delivered in the fall 2021 semester and first eight-week term of the spring 2022 semester. The study results show that students in these eight-week courses fared as well as their predecessors who completed the courses in the 16-week semesters.

Keywords: Chi-Square Test, Two Sample T-Test (Welch's T-test), Career and Technical Education, Compressed Semester, and Student Evaluation of Instruction.

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Chapter 1 Introduction

This research conducts a case study of a 2-year Community and Technical College in the southeastern United States to measure the influence of a compressed semester on student performance in a career and technical course. The name of the college is anonymized as the "*Hub City Community and Technical College*" in the research for confidentiality reasons.

Winter and summer terms are examples of compressed or accelerated courses that are courses typically offered outside of a standard 16-week semester and in which the credit hours offered are the same as a standard 16-week semester or term course. The content and substantive learning outcomes are the same as those in the fall semester or term. These courses must meet the federal, state and bodies for the accreditation of degree-granting higher education institution's policies and definitions of standard instructional minutes and the contact time within the period the compressed version is offered (Miami University, 2021).

By tradition with community and technical colleges, the traditional semester is 16 weeks long. Most collegiate courses have typically three credit hours or 45 contact hours with the instructor during the course timeframe. Characteristically, career and technical education-based courses do not fit the standard allotted timeframe of this course model. The combination of lecture and laboratory activities results in coursework that consists of 60, 75, 105, or more contact hours to meet the requirements necessary for understanding the material. The kinesthetic nature of the coursework necessitates this increase in contact hours.

Compressing this coursework from a standard 16-week semester to twelve, eight, or fewer weeks requires the instructor to examine methods of instruction and make changes pedagogically.

Practical experience during educational activities still requires a certain amount of time on task for the student to acquire a proficiency in the subject material.

Career and technical education instructors have extensive industry experience developed through proven careers. While adapting from the16-week semester to a compressed format, they are drawing from these experiences to form instruction with little to no formal instructor training and concentrating on those competencies necessary for the career path these students are pursuing. Thus, the post-secondary career and technical education instructor's instructional practices can be viewed as instinctive versus learned (Bice, 2019).

1.1 Statement of the Problem

Career and technical education students, like most college students, face a variety of life situations that hamper a student's ability to complete coursework. Having a work and school balance, managing debt and familial demands, and facing other obstacles are common. During the Fall of 2019, an examination of innovative ways to improve student success and retention rates was started by Hub City Community and Technical College leadership. One solution introduced by its college president was to explore the potential to offer courses in a compressed or accelerated format. In this mode of course delivery, coursework is distributed in a shortened timeframe, meeting two days a week for eight weeks at twice the amount of time that the class would meet in a traditional semester. Theoretically, student success would be increased by the student focusing on fewer courses at a time and spending more time on the subject matter within a given amount of time.

The instructional challenge with this type of course is the instructor integrating all the course objectives covered in 16 weeks into a condensed formatted course. They must ensure the course be properly arranged and detailed for time to be capitalized upon and academic expectations

to be clear to the student. Class time is important, and because there are so few meetings, it is virtually impossible to make pedagogical adjustments, modify due dates, or change reading assignments once the course has started. Beginning on the first day of class, the instructor must be well-prepared and make all expectations clear to students for them to be able to complete the course effectively.

The author investigated a typical career and technical course that was taught over eight weeks during the fall semester of 2021 and first eight-week term of spring 2022. The eight-week course includes components of standard classes: readings, quizzes, lectures, assignments, laboratory experiments, and exams. Quizzes were given regularly, homework was assigned regularly, and major exams were given during the term.

The students' performance as assessed by each of the four types of assessment criterion (exams, homework, quizzes, and lab assignments) and their final grades for these courses were comparable to students who took identical courses delivered during the earlier traditional semester, 16-week courses.

1.2 Research questions/objectives and/or research hypotheses

This study was conducted to decide if the performance of students taking the course in an eight-week term is comparable as those taking the same course in a regular 16-week course.

The study also looks to find if the perception of their instructor and classroom instruction by students taking the course in an eight-week term was comparable to the same level as those taking the same course in a regular 16-week term.

Null hypothesis (H_{01})–The Student Performance (Grade) is NOT dependent on the length of the Session (Semester).

Null hypothesis (H_{02})–Within the Student Evaluation of Instruction, the overall rating is NOT dependent on the length of the Session (Semester).

Null hypothesis (H_{03})–Within the Student Evaluation of Instruction, the rating of instructional effectiveness is NOT dependent on the length of the Session (Semester).

Null hypothesis (H_{04})–Within the Student Evaluation of Instruction, the rating of increased knowledge is NOT dependent on the length of the Session (Semester).

Alternative hypothesis (H_{A1})– The Student Performance (Grade) is dependent on the length of the Session (Semester).

Alternative hypothesis (H_{A2})– Within the Student Evaluation of Instruction the overall rating is dependent on the length of the Session (Semester).

Alternative hypothesis (HA3)– Within the Student Evaluation of Instruction the rating of instructional effectiveness is dependent on the length of the Session (Semester).

Alternative hypothesis (HA4)– Within the Student Evaluation of Instruction rating of increased knowledge is dependent on the length of the Session (Semester).

1.3 Significance and/or importance of the study

Most literature found is concentrated on general education collegiate coursework of the standard three-credit hours and 45 contact hours while under-investigated the career and technical education students' coursework, which is instructionally different and is under-investigated. Since a percentage of courses that are taught at public community and technical colleges are career and technical education courses, this research will focus on career and technical courses as compared to their general education counterparts.

1.4 Assumptions

This research makes the following assumptions with the focus on career and technical courses:

1. When compared to earlier completed studies with general education compressed courses, comparable results should be realized as they relate to career and technical courses.
2. Career and technical education students, although thought to have a different learning style from traditional degree seeking students, are initiative-taking and desire to successfully complete their courses as much as their general education counterparts.
3. Career and technical education instructors will adjust their teaching methods to accommodate the change in the pace of the delivery of instructional material from the 16-week semester-long term to the eight-week term without sacrificing the importance of understanding key competencies that the students must master.

1.5 Limitations

To be able to have a comparison of compressed courses to standard courses, it is necessary to have classes that follow the same pedagogical methods, similar student characteristics, and similar course delivery methods. Multiple sections of courses should provide enough data collected, which will evaluate the performance of students in these courses. With only three eight-week terms, compared to the three years of previous 16-week semester classes, a complete analysis of the data could result in skewed data.

1.6 Definitions of Terms

Best Practices are the wide range of individual activities, policies, and programmatic approaches to achieving positive changes in student attitudes or academic behaviors (Arendale, 2021).

The term **career and technical education** is applied to schools, institutions, and educational programs that specialize in the skilled trades, applied sciences, modern technologies, and career preparation ("Career and Technical Education Definition," 2014).

A non-parametric statistical significance test using bivariate tabular data is the Chi-square test. The **Chi-square test** is used to determine if two independent samples differ enough in some attribute or component of their behavior that we can infer from our samples that the populations from which they were drawn differ. The Chi-square test is frequently used to see whether there is a significant difference between predicted and actual values in one or more categories. If the Chi-square value is greater than the critical value at a certain probability of error threshold, the findings show a statistically significant relationship between the test variables

Welch's t-test, also known as the unequal variances t-test, is a type of alternative form test that is used to evaluate the hypothesis that two populations have equal means. When the variances and/or sample sizes of the two samples are unequal, it is more dependable. Because the statistical variables beneath the two samples being compared are fully different or distinct, these tests are sometimes referred to as "unpaired" or "independent samples" t-tests.

Post-Secondary Career and Technical Education are programs of study that A) incorporate challenging State academic standards; B) address both academic and technical knowledge and skills, including employability skills; C) are aligned with the needs of industries in the economy of the state, region, tribal community, or local area; D) progress in specificity

(beginning with all aspects of an industry or career cluster and leading to more occupation-specific instruction); E) have multiple entry and exit points that incorporate credentialing; and F) culminate in the attainment of a recognized postsecondary credential (*Programs of study* n.d.).

Post-Secondary Career and Technical Education Instructors teach vocational courses intended to provide occupational training below the baccalaureate level in subjects such as construction, mechanics/repair, manufacturing, transportation, or cosmetology, primarily to students who have graduated from or left high school (*Career/Technical Education Teachers, postsecondary at my next move* 2022).

The **Student Evaluation of Instruction** is a crucial component of the academic curriculum. The evaluation of instruction by students is an important part of the academic curriculum. This anonymous input is intended to help instructors improve their teaching effectiveness. Students' thoughts and opinions on their courses are heard as part of a continuous improvement process

Compressed or accelerated **courses** are courses typically offered outside of a standard 15-week semester or winter or summer term in which the credit hours offered are the same as full semester or term courses. The content and substantive learning outcomes are the same as those in the full semester or term (Miami University, 2021).

Chapter 2 Review of Literature

2.1 Background

Community and technical colleges use an academic calendar to define terms, academic holidays, and starting and ending dates. The use of two semesters, Fall and Spring, each lasting 15 to 18 weeks is commonplace. Summer sessions, winter mini-mesters and bi-term courses, all which are classified as compressed semesters, are also available at several institutions.

During June 2019, Hub City Community and Technical College, a pseudonym for a 2-year college located in the southeastern United States, began an investigation into potential solutions to low student success and retention rates. The college leadership conducted research examining the effects of compressed or alternate course scheduling methods as a solution to this problem. Over the course of six months, research was conducted and brought to the faculty for their input. There was a faction of faculty members who were opposed to the possibility of changing the academic schedule from 16 weeks to an eight-week schedule. Concerns of longer class sessions, increasing the number of days a week classes met, difficult coordination between programs of study with common courses, prerequisites not allowing students to follow a proper sequence of courses, and difficulty in coordination between divisions with general education courses meshing with technical courses were expressed. When the COVID-19 pandemic created an impossible situation where courses were all moved to a completely online delivery model midway through the semester, the college leadership determined that the move to a compressed schedule would have allowed students to complete many of its courses prior to the change in delivery model. A consensus between the college leadership and faculty enabled the college to pilot an eight-week compressed schedule beginning the fall semester of 2021. Eighty-three percent of all coursework was moved to the compressed schedule. Those courses that were completely delivered online and courses that

were dependent on outside agencies to provide clinicals and other work-based learning activities remained unchanged.

2.2 Historical Review

The concept of compressed term courses is over 150 years old. Summer sessions were the birthplace of compressed courses, which were commonly created to accommodate teachers pursuing higher degrees or qualifications during the 1830s. In 1877, Williamston Female College in South Carolina introduced an intensive calendar system. Williamston divided its school year into seven terms, and students studied one subject each session (Scott & Conrad, 1991).

Buzash 's study (as cited in Daniel, 2000) found that during World War II, the United States and British Armies developed intensive language training programs. This format proved quite successful in training interpreters in a matter of months. The success of this format suggested that an intensive course could be an important, educational alternative.

Even though compressed term courses have the same number of contact hours with students and cover the same content as 16-week semester courses, they are perceived as inferior and ineffective and, as a result, pan out in lower pupil achievement (Anastasi, 2007). Nevertheless, studies have shown that students in both compressed terms and regular courses perform inherently the same. Caskey established in a study conducted in 1994, that student performance did not have a statistical difference in accounting and algebra in compressed courses versus full semester courses (Caskey, 1994).

The results of a study conducted by Guillory indicated that College Algebra and Composition I course retention rates between 5-week, time-compressed, face-to-face summer courses and traditional 16-week, face-to-face fall courses were not statistically different. The results also showed that course retention rates were not statistically different when comparing the

relationship between demographic factors of age and gender. As found in Swenson's study (as cited in Guillory, 2018), it is reasonable to assume that time compressed courses could be a viable option for students, particularly when because there is no research supporting 16-week courses being the best length of time for course to be built around (Guillory, 2018).

In contrast to these findings, Sheldon and Durdella performed a study of 21,000 students in developmental courses and discovered that developmental course duration was related to statistically significant variations in course performance seen across all age, gender, and ethnicity groups. Those enrolling in compressed-format developmental courses outperformed students enrolled in regular-length developmental courses. In all departments, successful course completion rates for compressed courses were higher, with the eight-week version in English having the highest successful course completion rates. Furthermore, students in compressed-format courses were more likely to finish them effectively than their peers in regular-length courses, regardless of age, race, or gender. The findings show that students who enroll in compressed courses gain educationally (Sheldon & Durdella, 2009).

Adrian M. Austin and Leland Gustafson of the University of West Georgia studied the relationship between course length and student learning using a database of over 45,000 observations from the fall, spring, and summer semesters from Spring 2001 through summer 2004. It was discovered that after adjusting for student demographics and other factors, intense courses produced higher marks than standard 16-week semester-length courses. By looking at future performance, they were also able to demonstrate that higher grades represented a genuine improvement in knowledge and were not the consequence of a "lowering of the bar" during intense courses (Austin & Gustafson, 2006).

During his study of the impact of course length, which is later used as a course success predictor at Crafton Hills College, Gamboa discovered a statistical link between compressed and traditional-length courses in terms of student achievement. The practical relationship was not significant according to the effect size statistic. When the effect size and statistical connection of student achievement by course length within instructional divisions and subjects were examined, the favorable practical implications were larger. Six courses, for example, had a substantial and practical relationship: English, reading, history, computer information systems, communications studies, and theater arts. An added five subjects had positive but insignificant relationships: mathematics, college life, allied health, respiratory care, and music (Gamboa, 2013).

Students' performance in intermediate accounting classes delivered in four alternative scheduling arrangements, including one, two, and three days per week across standard lengthy semesters, as well as shortened four-week summer sessions, was investigated by Linda Carrington at Sam Houston State University in Texas during the 2009-2010 academic year. Contrary to the spacing effect, a substantial relationship between course scheduling and student performance was discovered. The spacing effect says that reviewing information or exercising new skills regularly over weeks or months improves recall. Long-term memory of added information/tasks is increased when learning sessions and practice periods are spaced out throughout a particular amount of time rather than compressed together in time. The impact of student age and gender on this relationship was also investigated. The findings showed that students with compressed (summer) or intense (one day per week) schedules perform no differently from students with a two-day per week schedule, which is consistent with prior research findings. The fact that students on the three-day-per-week plan performed worse in intermediate accounting than students on any other schedule was particularly intriguing. Course schedule, on the other hand, did not appear to be related to

student performance for the other three schedules. Contrary to the spacing effect, this shows that the three-day-a-week plan is not an effective approach for students to take intermediate accounting (Carrington, 2010).

In the *Canadian Journal of University Continuing Education* Vol. 40, No. 1, spring 2014, William J. Kops, from the University of Manitoba, supplied evidence of a study he conducted at the University of Manitoba that gave insight into how highly regarded instructors addressed teaching compressed summer session courses, as well as a set of best practices that others may utilize when teaching in similar contexts. In terms of course preparation, classroom delivery, student evaluation, and contact with students, top-rated instructors reported variations in how they taught compressed-format summer session courses. Kops' findings addressed four areas as they related to compressed courses delivered in the summer semester: preparing to teach, teaching in the classroom, interaction with students, and classroom environment.

Most professors reported that they used the same course syllabus in the summer session as they did in the fall, winter, or spring terms, but that they reorganized and altered the course material to better fit the compressed format. To fit the course into a limited period, instructors emphasized ensuring they covered the fundamentals while removing unnecessary material and reducing the frills—for example, by giving fewer illustrations/examples or limiting the number of recommended readings. Instructors demonstrated that they were using more time when preparing to teach compressed courses. Rather than planning a course on a day-to-day or week-to-week basis, they laid out a detailed plan for the entire term before the start of the course. Certain types of tasks, such as lengthy essays and articles, group projects, and research papers that have original research, have been discouraged by certain teachers in summer session courses. Others said they started

assignments earlier in the course, quizzed reading tasks more often, and explained assignment requirements more clearly.

As to teaching in the classroom, during the summer semester, several professors used increased engagement and in-class group discussion. Others asked students to complete extra pre-class work and reading. Several instructors were more selective in assigning readings, cut role-play exercises and/or field trips, relying less on oral reporting in class, and using learning management tools for teaching less frequently. Many teachers thought they could do more in summer term courses due to the intensity and rigor caused by the compressed schedule, where students meet daily or multiple times per week. This provided an immersion opportunity; students were in daily contact with the course material, so it was always fresh in their minds. As a result, there was less need for teachers to spend time reviewing and repeating content, and immediate follow-up on problems and concerns could take place, allowing students to be more involved with the material/content of a course.

Student interaction was also discussed. Academically strong students were those who wished to push ahead (finish degree requirements early) rather than fix inferior performance or repeat failed courses. Students have less time for reflection, assimilation, absorption of course material, and incubation of innovative ideas and concepts. Furthermore, several professors considered students' stamina while deciding on reading requirements, assignments, and course pace to ensure students were not overwhelmed.

Instructors were asked to comment on the classroom learning environment over the summer semester, particularly on their ability to create relationships with students. Instructors claimed that they were able to get to know their students more quickly and form stronger bonds during the summer term, while students showed that they were able to get to know one another

more readily. This was mostly due to consistency (meetings) and the fact that summer classes are often smaller (Kops, 2013)

Geltner and Logan studied the counter-intuitive idea of students that have high rates of success in compressed courses in a study conducted by Santa Monica College utilizing a database of 446,000 student enrollments from fall 1994 to summer 1999. More than three-quarters of the students were enrolled in traditional semester programs, with the rest divided into eight six-week or eight-week sessions. Students who took the six-week compressed portions outperformed those who took the same courses over a 16-week semester. The outcomes for students enrolled in the eight-week courses fell somewhere in the middle of the two delivery methods.

All teachers and students interviewed stated that some form of cohesiveness emerges in compressed classrooms, which is accompanied by a type of deep mental participation. Although some of their data imply that meeting frequency is connected to success patterns, they could not conclude how relevant that variable is on its own. Also not known was if these findings would hold for all degrees of compression, all sorts of courses, all types of students, or compressed sessions done consecutively. There was inconclusive evidence if compression can be used to help struggling students improve their performance. It was suggested that more trials that would explain these challenges appear reasonable and relevant (Geltner & Logan, 2001)

One of the most recent studies of improving student outcomes using compressed courses was conducted by Ron Sloan of Ivy Tech Community College. The average success rate for 16-week courses delivered in the conventional face-to-face modality, which is by far the most common, was 68.24 percent. This compares to 82.57 percent for eight-week, first-session courses and 81.53 percent for eight-week, second-session courses (Sloan, 2017). In many cases the eight-

week term proved more successful. except the second eight-weeks. This term had the highest failure rates for computer information systems and communications.

Laurie A. Boeding discovered that the compacted course atmosphere generated greater attention, time management skills, and information retention in participants while doing research for her dissertation. During the data analysis, five main themes emerged:

1. Successful completion of compressed courses necessitates time management skills such as study attentiveness, avoidance of procrastination, tenacity, and schedule modifications (both academic and personal/work schedules).

2. The compacted course schedule delivers regular proof of success, which boosts motivation and encourages persistence.

3. Immersion in subject area while taking fewer concurrent classes improves attention and helps students succeed academically.

4. Knowledge retention is the key to success in compressed courses.

5. Academic performance in compressed courses is aided by innovative teaching approaches and supporting teachers (Boeding, 2016).

A crucial factor that may affect student learning is the teacher and the teacher’s attitude. Changing from 16-week courses to eight-week compressed courses could have an impact on student’s evaluations of the effectiveness of their instructors.

In the results of a study conducted by Mehdipour and Balaramulu, they found instructors were happy to be teachers, and faculty members stated that punctuality, honesty, and challenging work are crucial attributes of good teachers. Students were reported to be pleased with their instructors' positive actions. Half of the students said that punctuality, honesty, hard effort, friendliness, confidence, and competency were essential characteristics of their teacher's behavior.

According to the findings of the study, there is a considerable relationship between instructors' conduct and academic accomplishment (Mehdipour & Balaramulu, 2013).

Even at the upper elementary level of education, Blazar and Kraft discovered that upper-elementary teachers had a substantial influence on self-reported measures of children's mathematics self-efficacy, as well as happiness and classroom behavior. Students' attitudes and actions are predicted by teaching techniques that are most directly connected to these factors, such as instructors' emotional support and classroom order. Teachers who thrive at raising test scores, on the other hand, are not necessarily good at changing students' attitudes and behaviors. These findings lend empirical support to well-established theories on the varied nature of teaching and the need to develop approaches for enhancing teachers' diverse range of talents (Blazar & Kraft, 2016).

Kuiper, Solomonides and Hardy conducted an examination of how faculty teaching compressed courses might stimulate student involvement and improve student utilization of learning time despite considerable time and distance constraints. These courses are often required to provide equivalent learning outcomes to their full-semester counterparts and to provide students with the chance to either retake failed units or receive credit for their chosen degrees in expedited time.

Organizing teaching and learning through intense forms of delivery may necessitate different approaches to curriculum creation and pedagogy than traditional unit planning and delivery, particularly when online technologies are used.

They investigated strategies used by effective accelerated mode teachers in development and delivery units to increase student engagement. It reached the conclusion that many of these

strategies are equally appropriate in online and remote education, regardless of whether the course is compressed or not (Kuiper et al., 2015).

Kucsera and Zimmaro studied the effectiveness of instructors from several departments who taught the same course in both accelerated and conventional formats over the same year, while controlling for a variety of confounding variables. When confounding variables were considered, the results revealed that accelerated courses did not differ significantly from conventional courses in overall "teacher" ratings on student assessments of teaching effectiveness. Intensive courses, on the other hand, received much better overall "course" scores on student assessments than ordinary courses, even after controlling for class size and predicted grade in course. These findings provide more evidence that unfavorable stereotypes regarding accelerated courses may be unjustified and that accelerated courses may be as effective as, if not more effective than, normal courses (Kucsera & Zimmaro, 2010).

2.3 Literature Review Summary

As stated previously, most literature is concentrated on general education collegiate coursework, while under-investigating the career and technical education students' coursework, which is pedagogically different. Addressing the concerns of the career and technical faculty in scheduling and execution of an eight-week schedule are not clearly realized in the research previously conducted and reviewed in this literature review. The importance of this research will provide an example of the effects of compressed scheduling on a career and technical course at the community college level.

Chapter 3 Methodology

3.1 Research Design

An exploratory design using a quantitative research method is used to investigate the impact of compressed schedules with a focus on career and technical courses. Additionally, an exploratory design using a qualitative research method is used to investigate the impact of compressed schedules on students' perception of their instructor and classroom instruction. There is little or no earlier research to which to refer. The emphasis is on gathering insights and familiarity for later research or when problems are in the earliest stage of an investigation.

3.2 Instrument

Quantitative research that uses data collected from Oracle Business Intelligence Enterprise Edition Version (12.2.1.3.0) database is analyzed.

Qualitative research that uses student evaluation of instruction surveys is used to analyze four instructors who taught both 16-week term and eight-week term classes of the same class.

3.3 The Population of the Survey

The study population for the quantitative research of grades versus course length consists of students who registered for a basic electricity course at an undergraduate level at Hub City Community and Technical College for eight-week terms during the fall of 2021 and spring of 2022, and full-semester courses during the previous semesters from Fall 2016 to Spring 2021. There were 105 students (95 completers) in the eight-week term and 301 students (281 completers) in the previous semesters from Fall 2016 to Spring 2021 enrolled for this course The instructors for these students were the same during the 16-week full semester courses and the eight-week compressed courses.

The study population for the qualitative study of student's evaluation of instruction consists of results comparing 37 students from eight-week terms during the fall of 2021 and spring of 2022, and 81 students from full-semester courses during the previous semesters from Fall 2016 to Spring 2021.

3.4 Sample

The sample size included in the quantitative study of grades versus semester length is a total population of 412 students and the sample size for the qualitative study of student's evaluation of instruction is 118 students.

3.5 Data Collection Methods

A query for a quantitative study of grades versus semester length was developed and conducted by the community and technical college Institutional Research to supply data necessary for the analysis of the following data points from the sections of basic electricity course from Fall 2016 to present.

- Number enrolled
- Success Rates (Students who passed that completed course)
- Completion Rates
- Overall Success Rates (Students who passed, considering incompletes)
- Grade Distribution

No personal information is obtained from this request.

Qualitative research, which uses data collected from a Class Climate Evaluations database kept by the college, is analyzed.

Student evaluation of instruction surveys is used to analyze four instructors who taught both 16-week term (81 students) and eight-week term classes of the same class from Fall 2016 to present. Three variables overall rating predicted measure of knowledge, and the expected measure of effectiveness of instruction were evaluated. No personal information is obtained from this request.

3.6 Grading Criteria

The course was taught in both eight-week and 16-week semester periods, with similar syllabi. Academic performance in both groups was evaluated using assignments, quizzes, laboratory experiments, and examinations during each term. A weighted average of the assignments, quizzes, laboratory experiments, and examinations was used to compute the final grade. The technique shown in Table 1 was used to convert a student's total numerical grade to a letter grade.

Table 1 *Grading System*

Numerical grade in percentage	Letter Grade
90 -100	A
80-89	B
70-79	C
60-69	D
0-59	E

Note. Grading system used in EET 119 Basic Electricity Fall 2016 to present.

The study's researcher was not an instructor or a class evaluator but served as division head for the Technical Division of this community and technical college. The researcher kept a neutral bias as to the results of the study**.** No personal information is obtained.

3.7 Variables

Student performance (GRADE). The term "student performance" refers to a student’s actual academic performance in class. It was found by the student's letter grade (A, B, C, D, or E)

in the course. To provide a minimum amount of data in each cell in the statistical analysis, the observations for letter grades D and E were compressed into a category called OTHER.

Session (SEMESTER). This refers to the academic year in which a student was enrolled. It was a changeable category with two levels: eight-week (COMPRESSED) and 16-week semester (REGULAR).

3.8 Data Analysis

To quantitatively explore the link between student performance and the semester in which the student enrolled in the course, a best

The formula for calculating Chi-square is:

$\chi^2 = \sum (O - E)^2 / E$

When,

- O = Observed frequency
- E = Expected frequency
- $\sum$ = Summation
- χ^2 = Chi-Square value

Students' evaluation of instruction data collected from a Class Climate Evaluations database kept by the college was used to analyze four instructors who taught both 16-week term and eight-week term classes of the same class from Fall 2016 to present.

The dependent variable in this study was student responses to the question "What overall rating would you give this class?" on a Likert scale of 1-5 (poor to excellent). Other sections of the survey ask for evaluation on aspects of teacher performance such as apparent subject matter expertise, success in expressing or explaining subject matter, and care and respect for students as individuals. However, tenure and promotion committees often place more emphasis on the "overall rating," and it is this item that teachers are most concerned about.

The students' predicted measure of knowledge gained, as indicated by their response to the item: "At this point in the semester, I can determine an increase in my knowledge of the subject matter." is one of the independent variables in this study. There were five response options: Strongly Disagree, Disagree, Neutral, Agree, and Strongly Agree.

The expected measure of effectiveness, as judged by their response to the question "I find the instruction in this course to be effective." was the second independent variable. Strongly Disagree, Disagree, Neutral, Agree, and Strongly Agree were the response options.

A Welch's t-test was used to analyze the three questions that guided this study: whether term length affects the overall evaluation of the instructor, whether term length affects the confidence in learning the material within the term, and whether term length affects the student's perception of the effectiveness of instruction in the course.

Chapter 4 Findings and Data Analysis

4.1 Quantitative Study: Chi-Square Test

This study was conducted to determine if the performance of students taking the course in an eight-week term is comparable to those taking the same course in a regular 16-week course.

- Null hypothesis (H_{01})–The Student Performance (Grade) is NOT dependent on the length of the Session (Semester).
- Alternative hypothesis (H_{A1})– The Student Performance (Grade) is dependent on the length of the Session (Semester).

To address the hypothesis, it is necessary to do a Chi-Square test of independence. The following details have been provided in Table 2.

Table 2 *Cross tabulation of GRADE vs. SEMESTER*

Letter Grade	Count % Within SEMESTER	SEMESTER Regular (16-Week)	 Compressed (Eight-week)	Total
A	Count	136	60	196
	% Within SEMESTER	48.40%	57.14%	
B	Count	76	34	110
	% Within SEMESTER	27.05%	32.38%	
C	Count	29	6	35
	% Within SEMESTER	10.32%	0.06%	
Other	Count	40	5	45
	% Within SEMESTER	14.23%	0.05%	
Total	Count	281	105	386
	% Within SEMESTER	100%	100%	

Note. Cross tabulation of GRADE vs. SEMESTER Fall 2018 to the present

The expected values are computed in terms of row and column totals. The formula is:

$$E_{ij} = \frac{R_i \times C_i}{T}$$

where *Ri* corresponds to the total sum of elements in row *i, Cj* corresponds to the total sum of elements in column *j*, and *T* is the grand total. In Table 3 below are the calculations to obtain the table with expected values:

Table 3 *Expected Values*

Expected Values	16-Week (Regular)	Eight-Week (Compressed)	Total
A	{281 X 196}/ {386} = 142.684386281×196=142.684	{105 X 196}/ {386} = 53.316386105×196=53.316	196
B	{281 X 110}/ {386} = 80.078386281×110=80.078	{105 X 110}/ {386} = 29.922386105×110=29.922	110
C	{281 X 35}/ {386} = 25.479386281×35=25.479	{105 X 35}/ {386} = 9.521386105×35=9.521	35
OTHER	{281 X 45}/ {386} = 32.759386281×45=32.759	{105 X 45}/ {386} = 12.241386105×45=12.241	45
Total	281	105	386

Note. Calculations to obtain the table with expected values

The squared distances may be calculated using the formula $(E\text{-}O)^2/E$ based on the observed and predicted values. The following is a table containing squared distances:

Table 4 *Squared Distances*

Squared Distances	16-Week (Regular)	Eight-Week (Compressed)
A	$\{(136 - 142.684)^2\}/ \{142.684\}$ =0.313	$\{(60 -53.316)^2\}/ \{53.316\}$ = 0.838
B	$\{(76 - 80.078)^2\}/ \{80.078\}$ = 0.208	$\{(34 - 29.922)^2\}/ \{29.922\}$ = 0.556
C	$\{(29 - 25.479)^2\}/ \{25.479\}$ = 0.486	$\{(6 - 9.521)^2\}/ \{9.521\} = 1.302$
OTHER	$\{(40 - 32.759)^2\}/ \{32.759\}$ = 1.601	$\{(5 - 12.241)^2\}/ \{12.241\}$ = 4.283

Note. Based on the observed and expected values, the squared distances can be computed according to the following formula: $(E - O)^2/E$

(1) *Null and Alternative Hypotheses*

The following null and alternative hypotheses need to be assessed:

- Null hypothesis (H_{01})–The Student Performance (Grade) is NOT dependent on the length of the Session (Semester)
- Alternative hypothesis (H_{A1})– The Student Performance (Grade) is dependent on the length of the Session (Semester).

This corresponds to a Chi-Square test of independence.

(2) *Rejection Region*

Based on the information provided, the significance level is α=0.05, the number of degrees of freedom is *df*= (4−1) × (2−1) =3, so then the rejection region for this test is *R*= {χ2: χ2>7.815}.

(3) *Test Statistics*

The Chi-Square statistic is computed as follows:

$$\chi^2 = \sum_{i=1}^{n} \frac{(O_{ij} - E_{ij})^2}{E_{ij}}$$

=0.838+0.556+1.302+4.283+0.313+0.208+0.486+1.601

=9.587

(4) *Decision about the null hypothesis*

Since it is observed that χ^2=9.587≤ χ^{c2} = 7.815, it is then concluded that the null hypothesis is rejected.

(5) *Conclusion*

The null hypothesis (H_{01}) is thus rejected. As a result, at the α=.05 significance level, there is sufficient evidence to conclude that the two variables are dependent.

The Chi-Square value is 9.587. .02243 is the p-value. At p<.05., the outcome is significant.

The test's associated p-value is p=Pr ($^3/_2$> 9.587) =.02243.

Figure 1 depicts the above-mentioned results visually.

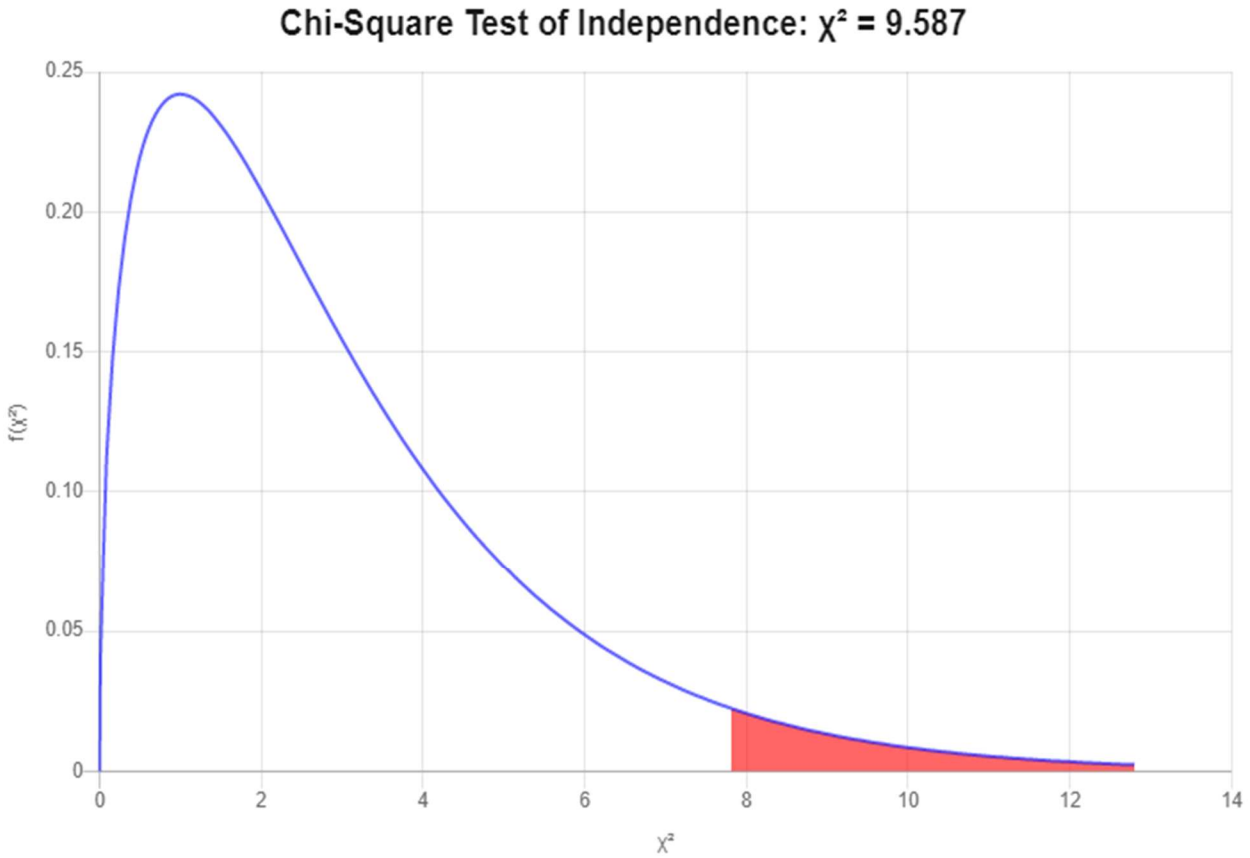

Figure 1 Chi-Square Test of Independence x2=9.587

4.2 Comparison of Completion, Success, Overall Success, and Retention Rates.

A comparison of completion rates, success rates and overall success rates was also completed. Success rates consider only include those students who passed that completed course. Overall Success rates include students who passed and include those students who did not complete the course. This is presented in tabular form in Table 5 and graphically in Figure 2.

Table 5 *Completion/Success/Overall Success/Retention rates*

Term		Complete	Completion %	Success%	Overall Success%	Total Enrolled	Retention Rates to next semester
16 (Regular)	Week	281	94.18%	87.25%	82.15%	301	79.97%
		105	95.48%	94.61%	90.26%	111	92.21%
Differences			1.31%	7.36%	8.11%		12.24%

Note. 8-week (Compressed) Term versus 16-Week (Regular) term compared completion, success, overall success, and retention rates from fall 2018 to the present

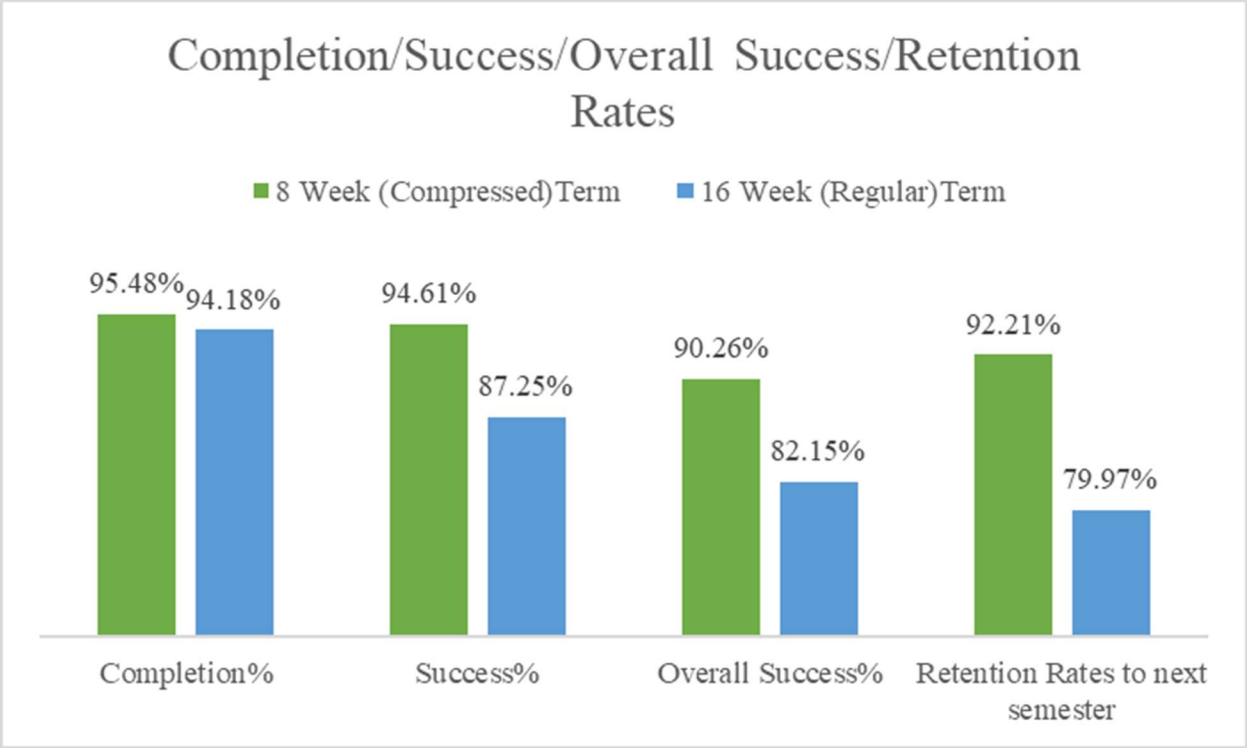

Figure 2 Completion/Success/Overall Success/Retention rates from fall 2018 to the present

4.3 Qualitative Study: Two Sample T-Test (Welch's T-test)

The study also seeks to determine if the perception of their instructor and classroom instruction by students taking the course in an eight-week term (37 students) was comparable to those taking the same course in a regular 16-week term (81 students).

- Null hypothesis (H_{02})–The Student Evaluation of Instruction overall rating is NOT dependent on the length of the Session (Semester).
- Alternative hypothesis (H_{A2})– Within the Student Evaluation of Instruction the overall rating is dependent on the length of the Session (Semester).

The first variable examined in this study was student responses to the question "What overall rating would you give this class?" on a Likert scale of 1-5 (poor to excellent). Other portions of the survey request feedback on the teacher's perceived subject matter knowledge, ability to articulate or explain subject matter, and care for and respect for students as individuals. The "overall rating," which teachers are most concerned about, is frequently prioritized by tenure and promotion committees.

The students' predicted measure of knowledge gained, as indicated by their response to the item: "At this point in the semester, I can determine an increase in my knowledge of the subject matter." is another variable in this study. There were five response options: Strongly Disagree, Disagree, Neutral, Agree, and Strongly Agree.

The expected measure of effectiveness, as judged by their response to the question "I find the instruction in this course to be effective." was the third variable. Strongly Disagree, Disagree, Neutral, Agree, and Strongly Agree were the response options.

A Two Sample T-Test (Welch's T-test) was used to investigate the three questions that guided this study: whether term length affects the overall evaluation of the instructor, whether term length affects the confidence in learning the material within the term, and whether term length affects the student's feeling of the effectiveness of instruction in the course.

Based on an automated recommendation from Statskingdom.com, Welch’s t-test was determined as a method to examine these variables. This test requires that both groups of data are

drawn from populations with a normal distribution, but it does not assume that the variances of the two populations are the same.

4.4 Qualitative Study: Two Sample T-Test (Welch's T-test) Variable 1 (Overall Rating)

The first variable examined is the responses to the question, "What overall rating would you give this class?" We want to evaluate the following hypothesis:

- Null hypothesis (H_{02})–The Student Evaluation of Instruction overall rating is NOT dependent on the length of the Session (Semester).
- Alternative hypothesis (H_{A2})– Within the Student Evaluation of Instruction the overall rating is dependent on the length of the Session (Semester).

The sample data used for this is in Table 6 from Campus Climate, commercial course evaluation software used by the college.

Table 6 *Sample Data for Variable 1 (Overall rating)*

Group name:	1 (16-Week (Regular) Term)	2 (8-Week (Compressed) Term)
Sample average (X)	4.6	4.4
Sample size (n)	81	37
Sample σ (S	0.7	0.6

Note. Sample data for Two Sample T-Test (Welch's T-test) Overall Rating

With this information, the following interpretations of the data can be obtained:

Two sample t-test (Welch), using T distribution (DF=80.6520) (right-tailed)

1. (H_{02}) - hypothesis Since p-value > α, (H_{02}) is accepted. The average of Group-1's population is less than or equal to the average of the Group-2's population. In other words, Group-2's average population is greater than Group-1's average population, but not by enough to be statistically significant.

2. P-value-p-value equals 0.0576296, ($p(x \leq T) = 0.942370$). This means that if we reject H_{02}, the chance of type I error (rejecting a correct H_{02}) would be too high: 0.05763 (5.76%). The larger the p-value the more it supports H_{02}.
3. The statistics-The test statistic T equals 1.592167, is in the 95% critical value accepted range: [-∞: 1.6640]. x -x =0.20, is in the 95% accepted range: [-∞: 0.008232]. The statistic S' equals 0.126.
4. Effect size -The observed standardized effect size is small (0.30). That shows that the magnitude of the difference between the Group 1 average and Group 2 average is small.

The distribution for Two Sample T-Test (Welch's T-test) Variable 1 (Overall Rating) graphically, the T Distribution is depicted in Figure. 3.

The Averages for Two Sample T-Test (Welch's T-test) Variable 1 (Overall Rating) for Group 1 and Group 2 are presented graphically in Figure 4.

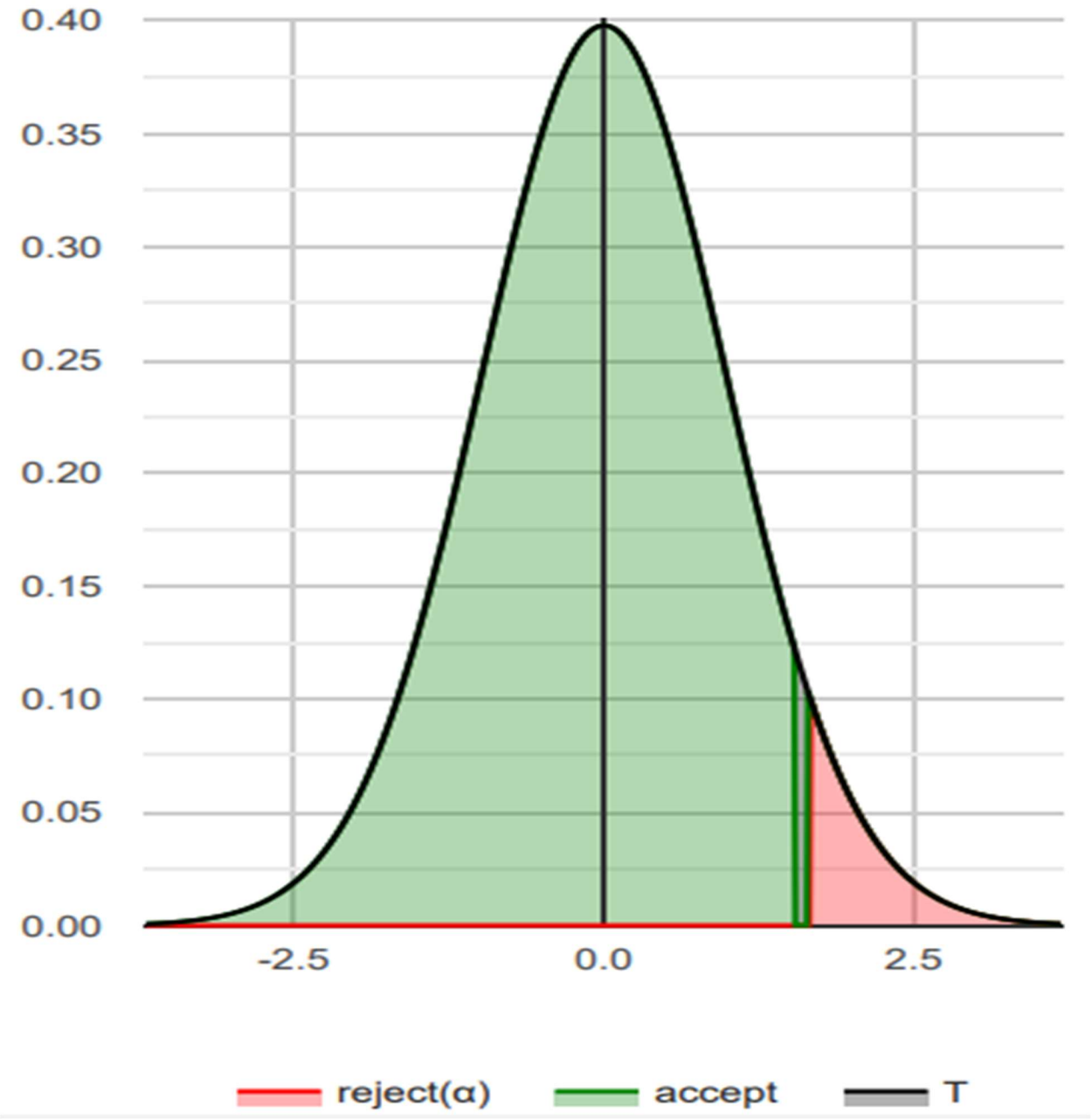

Figure 3 T Distribution for Two Sample T-Test (Welch's T-test) Variable 1 (Overall Rating)

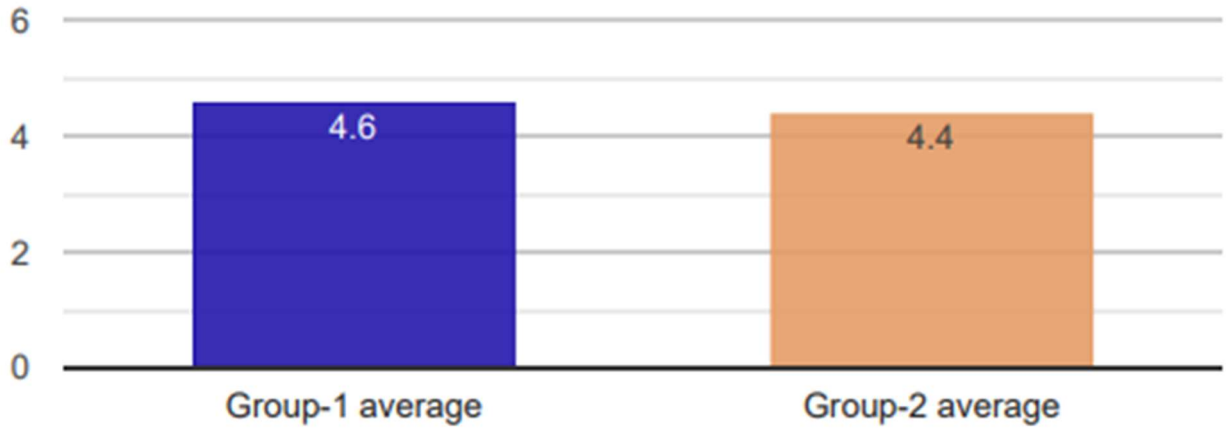

Figure 4 Averages for Two Sample T-Test (Welch's T-test) Variable 1 (Overall Rating)

4.5 Qualitative Study: Two Sample T-Test (Welch's T-test) Variable 2 (Effectiveness)

The second variable examined is the responses to the question, "I find the instruction in this course to be effective," The sample data used for this in Table 7 is from Campus Climate, the same commercial course evaluation software used by the college.

Null hypothesis (H_{03})–Within the Student Evaluation of Instruction, the rating of instructional effectiveness is NOT dependent on the length of the Session (Semester).

Alternative hypothesis (H_{A3})– Within the Student Evaluation of Instruction, the rating of instructional effectiveness is dependent on the length of the Session (Semester).

Table 7 presents the sample data for the Two-Sample T-Test (Welch's T-Test) Variable 2 (Effectiveness).

Table 7 *Sample Data for Variable 2 (Effectiveness)*

Group name:	1 (16-Week (Regular) Term)	2 (8-Week (Compressed) Term)
Sample average (X)	4.7	4.6
Sample size (n)	81	37
Sample σ (S	0.6	0.5

Note. Sample data for Two Sample T-Test (Welch's T-test) Effectiveness

With this information, the following interpretations of the data can be obtained:

Two sample t-test (Welch), using T distribution (DF=69.8426) (right-tailed)

1. H_{03} hypothesis - Since p-value > α, H_{03} is accepted.

   The average of Group 1's population is less than or equal to the average of the Group-2's population. In other words, the average of the Group-2's population is bigger than the Group-1 population, but not enough to be statistically significant.

2. P-value - p-value equals 0.201903, ($p(x \leq T) = 0.798097$). This means that if we reject H_{03}, the chance of type I error (rejecting a correct H_{03}) would be too high: 0.2019 (20.19%). The larger the p-value the more it supports H_{03}.

3. The statistics - The test statistic T equals 0.839946, is in the 95% critical value accepted range: [-∞: 1.6670]. x -x =0.10, is in the 95% accepted range: [-∞: 0.009550]. The statistic S' equals 0.119

4. Effect size - The observed standardized effect size is small (0.17). That indicates that the magnitude of the difference between the Group 1 average and Group 2 average is small.

The distribution for Two Sample T-Test (Welch's T-test) Variable 2 (Effectiveness) graphically, the T Distribution is depicted in Figure. 5.

The Averages for Two Sample T-Test (Welch's T-test) Variable 2 (Overall Rating) for Group 1 and Group 2 are presented graphically in Figure 4.

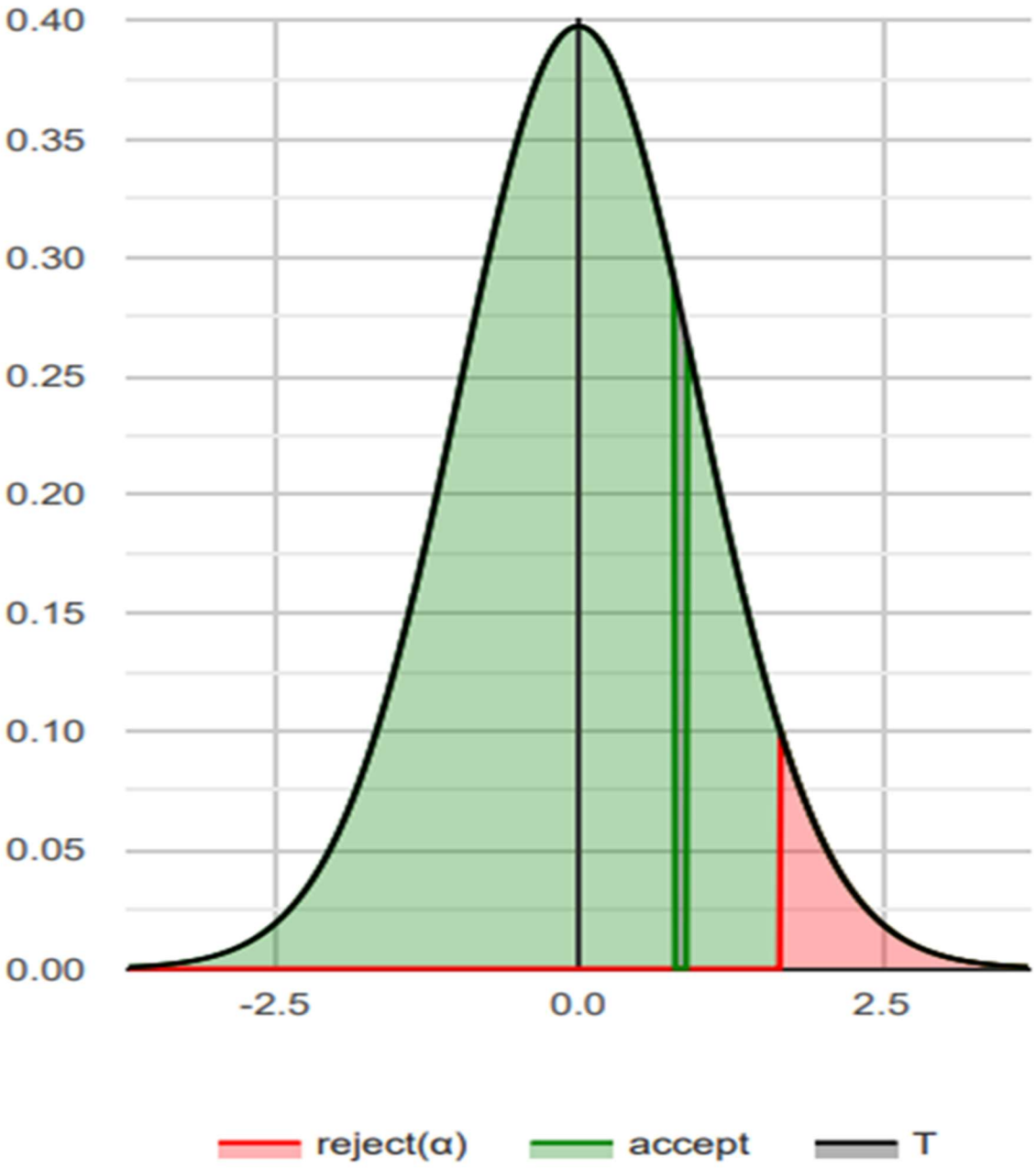

Figure 5 T Distribution for Two Sample T-Test (Welch's T-test) Variable 2 (Effectiveness)

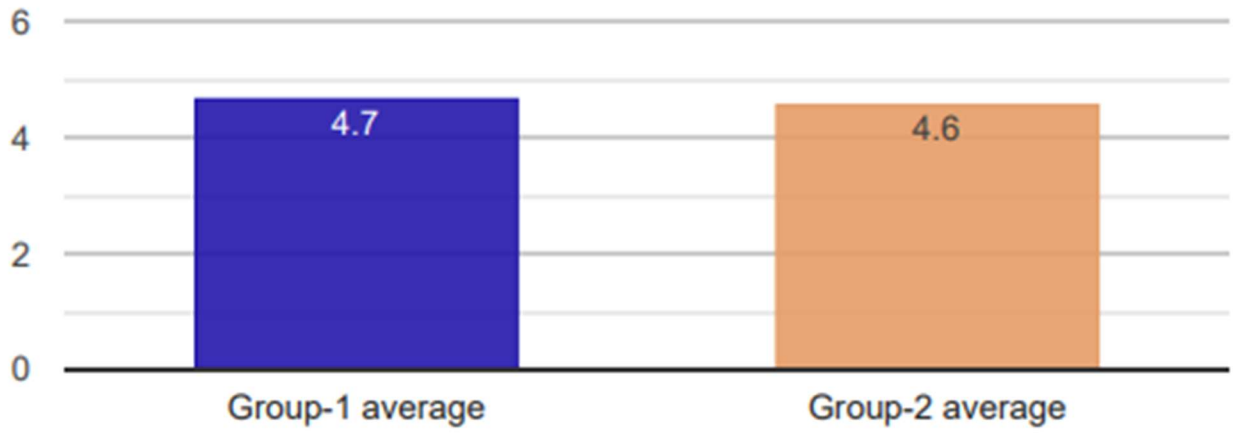

Figure 6 Averages for Two Sample T-Test (Welch's T-test) Variable 2 (Effectiveness)

4.6 Qualitative Study: Two Sample T-Test (Welch's T-test) Variable 3 (Student Knowledge)

The third variable examined is the responses to the question, "At this point in the semester, I can determine an increase in my knowledge of the subject matter." The sample data used for this is in Table 8 is from Campus Climate, the same commercial course evaluation software used by the college.

Null hypothesis (H_{04})–Within the Student Evaluation of Instruction, the rating of increased knowledge is NOT dependent on the length of the Session (Semester).

Alternative hypothesis (H_{A4})– Within the Student Evaluation of Instruction, the rating of increased knowledge is dependent on the length of the Session (Semester).

Table 8 *Sample Data for Variable 3 (Student Knowledge)*

Group name:	1 (16-Week (Regular) Term)	2 (8-Week (Compressed) Term)
Sample average (X)	4.8	4.6
Sample size (n)	81	37
Sample σ (S	0.5	0.5

Note. Sample data for Two Sample T-Test (Welch's T-test) Student Knowledge

With this information, the following interpretations of the data can be obtained:

Two sample t-test (Welch), using T distribution (DF=59.7562) (right-tailed)

1. H_{04} hypothesis-Since p-value < α, H_{04} is rejected. The average of Group 1's population is greater than the average. of the Group 2's population. In other words, the average of the Group 2's population is bigger than the Group1's population, and the difference is big enough to be statistically significant
2. P-value-p-value equals 0.0411967, ($p(x \leq T) = 0.958803$). This means that the chance of type1 error (rejecting a correct H_{04}) is small: 0.04120 (4.12%). The smaller the p-value the more it supports H_{04}.

3. The statistics-The test statistic T equals 1.766653, is not in the 95% critical value accepted range: [-∞: 1.6708]. x -x =0.20, is not in the 95% accepted range: [-∞: 0.01122]. The statistic S' equals 0.113.
4. Effect size -The observed standardized effect size is medium (0.38). That indicates that the magnitude of the difference between the Group 1 average and Group 2 average is medium.

The distribution for Two Sample T-Test (Welch's T-test) Variable 3 (Student Knowledge) graphically, the T Distribution is depicted in Figure. 7.

The Averages for Two Sample T-Test (Welch's T-test) Variable 3 (Overall Rating) for Group 1 and Group 2 are presented graphically in Figure 8

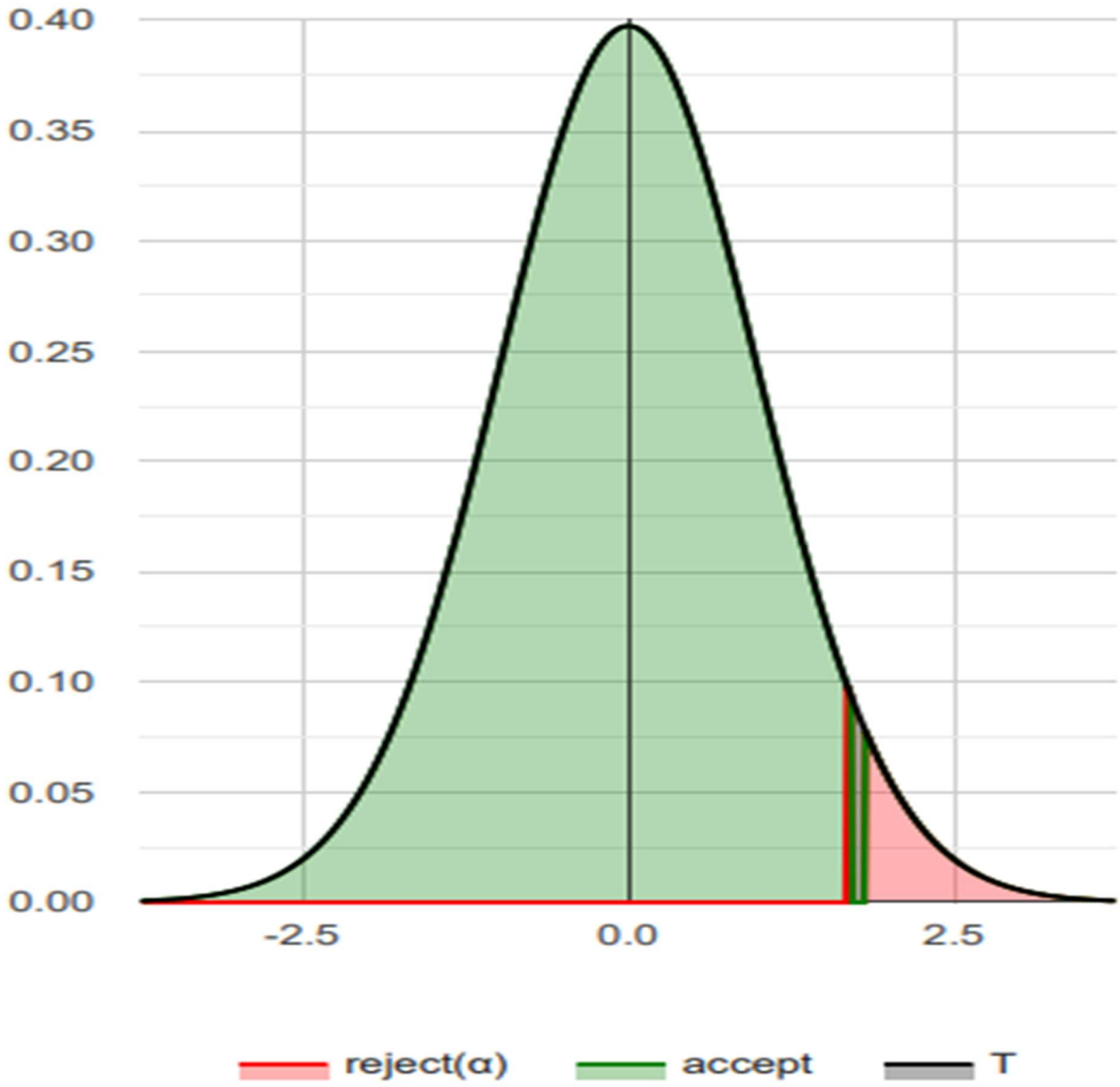

Figure 7 T Distribution of the Two Sample T-Test (Welch's T-test) Variable 3 (Student Knowledge)

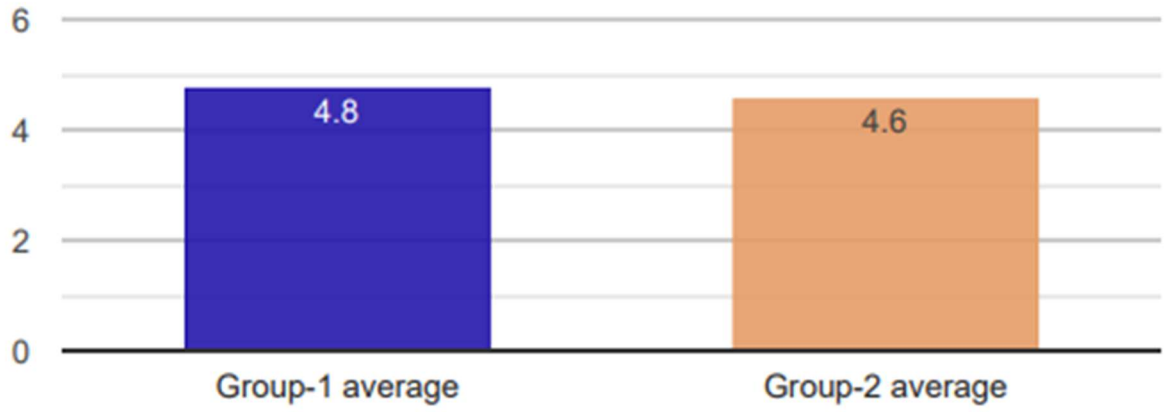

Figure 8 Averages for Two Sample T-Test (Welch's T-test) Variable 3 (Student Knowledge)

Chapter 5 Summary, Conclusions, Recommendations, and Implications

5.1 Summary

The statistical analysis' findings support the premise that students enrolled in an eight-week (compressed) term class perform statistically better than those enrolled in the same course during a 16-week (regular) term class. Students completing a basic electricity course at a community and technical college in an eight-week term have a higher mean grade than students taking the course in the 16-week term, according to the study. However, the explanation for such a disparity in student marks was unclear. Other studies suggest that instructors often lower the rigor of teaching a course in an abbreviated semester that results in increased student performance (Choudhury, 2017). In our study, however, the instructors' curriculum, teaching methods, and evaluation processes were the same for both the 16-week (regular) term classes and eight-week (compressed) term classes.

Additionally, the effects of the current pandemic were not included in the results. When a student showed symptoms of COVID-19, they would be absent from class for at least a two-week period after diagnosis. The effect of this is amplified due to the compressed schedule. When a student misses two weeks during a regular semester, that student may miss one eighth of the course. When a student misses two weeks during a compressed term, the student may miss one fourth of the course.

Increased student focus in an eight-week term is one argument that may be provided. During the condensed session, none of the students took more than two courses; they had to focus only on the two courses. Being in class for longer academic hours every day the class met in person helped them get to know one another better, resulting in a more congenial culture. This encouraged greater classroom engagement and in-depth conversations, which resulted in an appearance of a

deeper grasp of the course subject. It may have finally opened the path for improved student achievement.

As noted by Culver, “Given their role as participant observers in classrooms, students are in an excellent position to provide feedback regarding classroom teaching and overall performance of an instructor” (Culver, 2010). Students are with the instructor more than anyone during the course. Their perceptions of effectiveness and overall quality are the best assessment from their participant observer role. Murray (as cited by Culver) recommended, given the “symbiotic relationship between professors and students, it is not only in our best interests to respect what they can tell us about our teaching, but also in their best interests to assist us to improve our teaching.”

5.2 Conclusions

According to the findings in the quantitative study, there is a statistically significant difference in academic success between students who enroll in an eight-week (compressed) term class and those who enroll in a 16-week (regular) term class. Students who take an eight-week (compressed) term class perform better than those who take a 16-week (regular) term class. The eight-week (compressed) students grasped the concepts and topics as quickly as their colleagues and were able to apply them more successfully during the exams. The grade distribution was indicative of this. Course completion, success, overall success (including withdrawals) and retention rates were all higher with the eight-week (compressed) term classes. The longer time during each class session may have contributed to a connection between the students and their instructor. Peer to peer connections may have been stronger because of the intensity that compression brings to the course environment.

The statistical data from the qualitative study does not indicate if the student's perception of their instructor and course is influenced by term length. Despite the diversity of instructors, a veteran instructor (10 years of experience), a female, an adjunct and a new instructor, students expressed the same rating of these four instructors in both term length courses. Each instructor made modifications to only the date within the term that materials were covered. Each of these courses are delivered in a hybrid format. This may have contributed to the ability of the instructor to keep a certain sequence within each course that remained constant between the different terms.

Each class is different in the individuals that make up the composition of the student population. Each student brings a level of understanding of the material. Each has different objectives in learning. Individual levels of enthusiasm and desire to learn are present in each one

Each instructor is different, placing emphasis on those competencies they are most familiar with or believe most important, while drawing on their own experiences. Each has a different voice and unique experience teaching.

One of the primary purposes of this research was to decide if career and technical education students perform as well in compressed courses at the same levels as students in traditional length 16-week courses. Another goal of this study was to address the lack of empirical information on the effect of compressed schedules on career and technical education students. The findings of this brief study should stimulate enough interest to drive added study into student success prediction.

5.3 Recommendations

The study's conclusions, on the other hand, should be treated with caution. The results cannot be generalized because they were only completed for one course in three terms. Further analysis of eight-week sessions would give a larger sample population upon which a more conclusive comparison can be made. Further investigation into demographics such as gender, age,

ethnicity, and educational level may supply added insight into why the higher mean grade value is present.

The first recommendation would be to expand the quantitative study to check for demographic information as it applies to grade distribution. An examination of gender, age, race, and previous educational level could bring with it a better understanding of the grades each student receives. These demographic statistics would supply useful information for instructors and the institution.

Secondly, within the quantitative study, an expansion in the assessment of additional career and technical courses would provide a more diverse picture with additional faculty and additional students assessed. Career and technical education courses cover a vast number of pathways in which students have different attitudes and attributes. Different skill sets are needed for each career pathway. One course is more theory and heavily based in mathematics and physics, another may be more kinesthetic requiring a more physical skill set.

For the qualitative study, an expansion on the questions used in the student's evaluation of instruction would supply a greater depth of understanding the students' perception of the quality of instruction and of their instructor.

For the qualitative study, an expansion in the number of instructors included in the survey by adding more courses and pathways could give a more diverse understanding of the students' perception of the instructor and class effectiveness. This expansion could increase the diversity of the instructor pool as well as the student pool.

Lastly, extending this to other schools and other disciplines could provide more conclusive evidence that compressed scheduling is as effective or better than using standard semester long

courses. This course might be expanded to 16 colleges in the community and technical college system.

5.4 Limitations

This study may have had flaws in that it did not account for student demographics. However, the author found no significant differences in any demographic between the two groups of pupils. However, it is unclear whether this aspect manages improved student performance during a shortened semester. There is no sign that any special population has an impact on student performance.

This study has a few limitations that may have affected the outcomes contained within the quantitative and qualitative studies. The size of the student pool was limited to 105 students who completed the course during the eight-week (compressed) term. This was compared to 281 students who took the same course during the 16-week (regular) term.

Additionally, the effects of the current pandemic were not included in the results. When a student showed symptoms of COVID-19, he/she would be absent from class for at least a two-week period from diagnosis. The effect of this is amplified due to the compressed schedule. When a student misses two weeks during regular semester, he/she may miss one eighth of the course. When a student misses two weeks during a compressed term, the student may miss one fourth of the course.

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