An Investigation into the Effects of Covid-19 on Career and Technical Education Classrooms**

Jonathan Walker, Randal Wilson, Charlene Atkins, Kemaly Parr

About the Authors

Dr. Jonathan Walker, Culver-Stockton College (jwalker@culver.edu)

Dr. Randal Wilson, Murray State University (rwilson6@murraystate.edu)

Dr. Charlene Atkins, College of Education, University of Central Missouri (catkins@ucmo.edu)

Dr. Kemaly Parr, Murray State University (kparr@murraystate.edu)

Abstract

This ex-post-facto study was conducted on Career and Technical Education (CTE) teachers across the country. Covid-19 has disrupted education, and while studies have concentrated on its effects on K-12 classrooms, few have investigated CTE. Research suggested that Covid-19 had a significant impact on CTE classrooms and teachers' use of instructional strategies. For example, due to Health Sciences dependence on in person interaction for effective completion of program and clinical requirements, those teachers were more affected by Covid-19 than agriculture, business, marketing, and information technology teachers because these teachers had curricula where the usage of technology was already embedded. Consequently, these areas were less affected by Covid-19 than disciplines such as family consumer sciences and human services which required more hands-on interaction. Varying teacher preparation methods as well as different routes to certification could also cause some teachers to be more prepared for online education and pandemic mitigation strategies. Future research should be conducted to identify why Covid-19 has affected CTE classrooms differently by region and subject area.

Keywords: career and technical education, classroom instructional strategies, Covid-19

At the time of this study, more than four million cases of Covid-19 have occurred globally as well as over a million in the United States. John Hopkins University & Medicine (2020) indicated that over 280,000 deaths worldwide were caused by the pandemic. As of January 7, 2022, new strains and variants of the virus have emerged and cases have surpassed 57 million cases and over 800,000 deaths in the United States (Centers for Disease Control, 2022). The pandemic has caused K-12 institutions and universities to pivot between in-seat, remote/online, and hybrid learning (Lederman, 2020). A gap between socioeconomic groups has been exposed, as a lack of devices and Internet access for the lower class became more evident (Wooley et al., 2020).

Many future educators may be unprepared to teach in the classroom. Students preparing to teach at the K-12 level ended face-to-face instruction in March of 2020. Many candidates were not allowed to complete the student teaching component of their education. Students in some areas were forced to delay the experience for a semester. Most teacher candidates were sent home and struggled to stay connected with their teacher mentors due to a lack of high-speed Internet access (Maher & Zollman, 2020).

Importance of CTE

Career and Technical Education coursework provides students with the skills, knowledge, and training required to succeed in the workforce. CTE teachers

transform students into career-ready adults (Career Readiness Partner Council, 2021). During the 2018-19 school year, 12.3 million students were enrolled in CTE courses (Advance CTE, 2021). Stone (2017) stated that CTE could increase student outcomes by

(1) increasing high school graduation,

(2) increasing student preparation for post-secondary studies, and

(3) empowering students with industry-recognized credentials.

This study is a smaller portion of a more extensive study conducted by Walker (2021) that investigated the signature pedagogies of CTE teachers in the United States that involved 1449 CTE teachers in the United States. This study found significant differences in classroom instructional strategies between different teacher demographics and identified questioning, guided practice, demonstrations, lab activities, and whole-group discussion as the five most used instructional strategies by CTE teachers (Walker & Atkins, 2021). Lachlan et al. (2020) stated the pandemic would have negative consequences on all aspects of public education. This study measured the effects of Covid-19 on CTE classrooms in the United States.

Purpose of the Study

The purpose of this study was to investigate the effects of Covid-19 on Career and Technical Education (CTE) classrooms in the United States. Covid-19 caused many schools to suddenly close in March of 2020, some chose to have students attend virtually or offline education. As Hodges et al. (2020) indicated, "emergency remote teaching" was not planned or aimed at specific learning targets (para1). Trujillo-Sáez et al. (2020) stated that the teachers surveyed were more were concerned about their students' emotional response to crisis and developing competencies than students learning content and appropriate development. De La Rosa (2020) indicated that studying natural disasters may lead to predictions about America's schools after the pandemic.

This study was a part of a more extensive study by Walker (2021) with 1449 teacher participants who were CTE teachers to determine how Covid-19 affected CTE classroom instructional strategies. The effects of Covid-19 were examined by using a modification of a survey used by Fletcher et al. (2014) to investigate the classroom instructional strategies used by Career and Technical Education teachers in their classrooms. This investigation was to determine if Covid-19 had an effect on CTE teachers' use of classroom instructional strategies comparing teacher demographics and subject areas. De La Rosa (2020) indicated that studying natural disasters may lead to predictions about America's schools after the pandemic. The following research question was presented for this study: Has Covid-19 had any effect on a CTE teacher's use of classroom strategies?

Literature Review

Effects of a Pandemic

The Office of Civil Rights (OCR) (2021) stated that classrooms and campuses across the country were "upended" (p. 3) by Covid-19. The pandemic has caused K-12 institutions and universities to pivot between in-seat, remote/online, and hybrid learning (Lederman, 2020). A gap between socioeconomic groups has been exposed, as a lack of devices and Internet access for the lower class became more evident (Wooley et al., 2020). Students of color have decreased opportunities and access, including technology, making virtual classrooms harder to stay engaged with (OCR, 2021). OCR (2021) stated that English Language Learners and students with disabilities had their learning and access to resources significantly disrupted by Covid-19.

The Covid-19 crisis has caused a resurgence in assessment of teacher education and teacher practices (Lachlan et al., 2020). Even before the Covid-19 pandemic, the field of education identified the need to reassess itself. The most important school-based factor in student achievement is teacher quality (McCaffrey et al., 2003). Monk (2019) stated that for the field of teacher education to improve, determining what is the best practice for preparing future educators needs more research. Rigler (2016) stated that professional associations and universities have indicated that what is happening in their teacher preparation programs and what is occurring in school may be deterring individuals from entering the teaching profession. Welty (personal communication, Dec. 19, 2016) indicated that he observed a mismatch between what was being taught in teacher education programs and what he observed during student-teacher observations. Hodgman et al. (2021) stated that high-poverty and rural school districts struggled with regular check-ins and maintaining contact with students during virtual settings.

Impact on Teacher Preparation Programs

A fundamental linkage exists between teacher preparation programs, quality teaching, and student learning (Feuer et al., 2013). McCaffrey et al. (2003) stated that the effects of teachers on student learning are long-lasting and cumulative. Feuer et al. (2013) stated that "exactly how differences in

instructional method and style affect student learning and how differences in teacher preparation affect instructional quality are not fully understood" (p. 80). The Council for the Accreditation of Education Preparation (CAEP) (2021) stated that teacher education programs continually assess their program and conduct research on their efficacy.

Conceptual Framework

Shulman

The larger study investigates the signature pedagogies of Career and Technical Education. Shulman (2005b) stated that signature pedagogies are the principles of teaching for future professionals. Shulman indicated three critical aspects of education: how to think, how to perform, and how to act with integrity. Signature pedagogies shape the future character and practice of each profession. Shulman (2005b) stated that signature pedagogies are vital because they become pervasive in a content area. Signature pedagogies impart what is essential, how knowledge is imparted, and how understanding is criticized, accepted, and analyzed.

Weinstein and Mayer

Weinstein and Mayer (1983) defined learning strategies as " behaviors and thoughts in which a learner engages, and which are intended to influence the learner's encoding process" (p. 1). Learning strategies may be intended to affect student motivation or the way a student "selects, acquires, organizes, or integrates new knowledge (p. 1). Weinstein and Mayer (1983) define good teaching as "including teaching students how to learn, how to remember, how to think, and how to motivate themselves" (p. 1). A shift in classroom learning strategies to helping students learn how to learn could have important application for teachers. Weinstein and Mayer (1983) stated that teachers enter a classroom with two goals. The first goal revolves around what a student should be able to do as a result of the learning. The second goal involves teaching students the process of learning. Weinstein and Mayer (1983) classify learning strategies into some major categories: (a) rehearsal strategies, (b) elaboration strategies, (c) organizational strategies, (d) comprehension monitoring strategies, and (e) effective strategies. Weinstein and Mayer (1983) indicate that as educational research evolves, implications for classroom teaching, and educational practice will further develop.

Gap in Literature

Significant studies have been published concerning the effects of Covid-19 on K-12 and post-secondary classrooms. Students have been forced to sit and study in front of screens in settings other than at school while dealing with "illness, loss, and economic hardship stemming from the global pandemic" (McElrath, 2020, p.1). During the transition to virtual learning, Malkus (2020) stated that high-poverty districts were less likely to check in on their students than low-poverty districts (Gross & Opalka, 2020). Hodgman et al. (2020) stated that Covid-19 has significantly affected teacher-student relationships and, in some cases "eradicated" (p. 5) them. A few studies used case analysis to explore educational practices of samples of teacher during the pandemic (Hall et al., 2020; Iivari et al., 2020; Koçoglu and Tekdal, 2020; Rasmitadila et al., 2020). Echeverria et al. (2022) indicated that few studies have researched what actually took place during the early months of the pandemic.

Walker and Atkins (2021) and Walker (2021) have found significant differences in the use of instructional strategies in CTE classrooms. Pokhrel and Chhetri (2021) acknowledged that several studies of the impact of Covid-19 have been implemented in developed countries, but recommend that further research explore middle, secondary and higher education. Even though Career and Technical Education has a substantial impact on economic development locally, statewide, and nationally, few studies have examined what is occurring in the CTE classrooms. At the time of this study, no study was found that investigated CTE and the effects of Covid-19.

Research Design and Methodology

Design

The research used a convenience sampling of CTE teachers and was a descriptive study. A constructivist philosophical approach to how experiences are interpreted and perceived by individuals at a certain point in time creates a need for quantitative research (Bodgdan & Biklen, 2007). The research design for this research was ex post facto. Leedy and Ormond (2016) suggested that ex post facto design allows the researcher to determine how specific variables affect a dependent variable.

Sample

The study used a non-probability convenience sample attempting to survey (Etikan et al., 2016) all CTE teachers in the United States. The U.S. Department of Education and National Center for Education Statistics (2020) indicated that 98% of all public schools offered CTE programs to high school students in the 2016/17 school year. CTE programs offered classes in agriculture, business, health science, family consumer sciences, human services, marketing, skilled technical sciences, and technology and engineering.

Regarding instructors employed at career and technology shared-time centers, the U. S. Bureau of Labor Statistics (2020) indicated that in 2019, 209,000 CTE teachers were employed nationwide. Of those, 74,520 were employed at the secondary level, 112,210 were post-secondary teachers, and 22,270 were middle school teachers.

Survey

The researcher collected data using a web-based survey using SurveyMonkey. The survey was a modification of a survey used by Fletcher et al. (2012), who developed their base survey to determine signature pedagogies used in the higher education setting. The original survey consisted of a list of 14 demographic details and 107 instructional strategies and other areas that it was designed to measure. The researcher received approval from Fletcher to modify their instrument for the purpose of this research on August 10, 2018. Both Fletcher's research and this research used a survey instrument that collected data through demographic categories and Likert-type scale questions on instructional strategies used by participants, with response options that range from Never/Rarely to Almost Always/Always. The survey was designed to take 10 minutes or less of the participant's time and averaged 8 minutes and 22 seconds to complete.

Modification to the Data Collection Instrument

The researcher modified the survey to include six questions in the demographic section to address the research question. The first modification was to add a question that evaluates whether having an older family member who was a teacher would impact the strategies a current teacher uses in the classroom. The second modification was to add a question that determined which type of CTE certification the current teacher possesses. The third modification added was to determine in which state the respondent teaches. The fourth modification added was to determine how many years the respondent has been teaching.

The following survey questions were added to the data collection instrument to address the focus of this research study. The original survey question number 14 was changed to determine if having a teacher as a parent or guardian or how a teacher became certified might affect what teaching strategies are used in the classroom. Several questions were omitted from the survey because they did not serve any purpose in this research.

After receiving IRB approval from Murray State University, the survey was sent to the CTE state association in all 50 states, the state association of CTE directors in all 50 states, and each national career and technical student organization to be forwarded to their members and then onto CTE teachers on March 1, 2021. The actual number of teachers to whom surveys were actually forwarded is unknown because several national associations declined to participate, and several state associations did not respond to the email requests. The National Business Education Association agreed to forward the survey to 2000 members. A census was not achieved as the survey had 1,449 respondents, of which only 69% completed the entire survey.

Survey Deployment

The first email was sent out on March 1, 2021. Seven days after the first round of emails were sent, the researcher sent a reminder email to the recipients of the original email. Fourteen days after the original email, the researcher sent a final reminder email to the recipients of the original email. The survey closed on March 31, 2021, with 1,449 responses. The number of teachers who received the email with the survey embedded and chose not to participate is unknown.

The original email to administrators described the research and requested them to forward the email to their certified teaching staff. The email included a link to the online survey, which contained an embedded consent form. Participants were required to acknowledge the consent form before entering the survey. The email stated that the data collected would be anonymous and would have no impact on their employment status. At the bottom of the email was a link to the online survey that provided the participants with an informed consent form before they began the survey. The recipients were asked to complete the survey within 48 hours of receiving it. There were 989 responses to the survey instrument. The instrument for this study used Likert-type scale questions that ranged from 1 ("No affect) to 5 ("Always affected").

Data Analysis

The researcher analyzed the data by the demographic categories, including which state the teacher worked in, the geographical setting of the school the teacher worked in, the type of school the teacher worked in, the subject area the teacher taught, the teacher's certification route, number of years of experience, and if the teacher had a person of significance in their life who was a teacher to identify possible relationships between demographic attributes. Participants were coded to a region of the United States according to the state they stated they were teaching in. The regional affiliation was then used to compare teachers' data from one region to other

regions. Following the initial non-statistical data analyses, data were analyzed using descriptive and inferential statistics. The nominal and ordinal level data were examined by using Kruskal-Wallis H tests with post hoc tests performed on the data to identify if any significant differences exist. The Kruskal-Wallis test is a nonparametric test used to identify any significant differences in ordinal data by ranking the data and comparing "the median ranks for all groups with the individual group medians" (Aldrich, 2019, p. 189).

Results and Discussion

Results

The following research question was presented for this study: Has Covid-19 had any effect on a CTE teacher's use of classroom strategies? The data collected and analyzed for this study suggest that demographics have an impact on classroom instructional strategies used by CTE instructors in their classrooms. Survey questions 19 and 20 addressed this study's research question using Likert-type scale questions.

Teacher Demographic Data

Teacher demographics were collected that indicated the participants' region, content area, setting, route to certification, and years of experience. Data were collected from 1106 participants from 48 out of 50 states, with the largest data set identifying from the state of Missouri. There were no participants from Hawaii and North Dakota.

Participants Region.

Participants were grouped into regions, with the Midwest region having the largest participation and the Pacific region having the least number of participants. The largest data set of participating CTE teachers identified as teaching in the state of Missouri. Three respondents indicated they were unsure of which state they were teaching in, and eight preferred not to answer the questions. Over half of the survey participants identified as teaching in a rural setting. The number of participants responding by geographical area may have been impacted by the state associations that forwarded the survey and which state CTE Administration association forwarded this research. The impact of the associations on the number of survey responses is unknown. See Table 1.

Participants' Setting.

The survey participants indicated the type of school in which they were teaching. Over 60 percent identified they were teaching in a comprehensive high school. The researcher concluded this to be a high percentage of teachers located in a comprehensive high school compared to the 26.2% indicating they were in an area career center may have been the result of the National Association of High School Principals forwarding the survey to their members. Comprehensive high school teachers would have an administrator that could have been a member of the National Association of High School Principals, while area career center teachers would have a director that could be a member of their state's directors' association. The researcher concluded that Higher education teachers did not have a high participating percentage because their administration may not have received the survey to forward to staff. The 29 participants that indicated they were not sure what type of school they were teaching in may have had an impact on the results of the data analysis. See Table 2.

Table 1

Participant Demographics by Region

Regions	Frequency	Percent
Northeast	72	6.5
South	353	31.9
Midwest	461	41.7
Pacific	206	18.6
Total	1,092	98.7

Table 2

Participant Demographics by Type of School

Type of School	Frequency	Percent
Area career center	290	26.2
Comprehensive high school	704	63.7
Community college	49	4.4
Four-year university	22	2.0
I am not sure	29	2.6
Total	1,094	98.9

Teacher content areas represented. The survey participants indicated the subject area in which they were teaching. Survey participants represented all subject areas. Of the survey participants, the largest subject area participating was business, marketing, and information technology with over 30.9%, and Skilled Technical Science teachers were the least represented with 22.4%. The teachers and the subject area participating may have been influenced by access to technology. The research was conducted in March of 2021, when some schools were closed. Potentially, business, marketing, and information teachers may have had more access to the Internet during the study than other subject areas. See Table 3.

Certification type represented. The survey participants indicated their route to achieving teacher certification. The traditional method with a four-year university with a teaching component was the largest group represented with 51.4%. The career-education certification method: traditional CTE coursework (e.g., based on industry, clinical or military experience) was the second largest group of teachers represented with 20.8%. The large number of participants with a traditional method with a four-year university with a teaching component is consistent with the number of teachers represented in a comprehensive high school. Comprehensive high schools typically require a traditional method with a four-year university with a teaching component as a requirement for employment, while area career centers often recruit individuals with industry experience that pursue the career-education certification method: traditional CTE coursework (e.g., based on industry, clinical or military experience). The career-education certification method: traditional CTE coursework (e.g., based on industry, clinical or military experience) may replace the bachelor's degree requirement with industry experience. See Table 4.

Years of experience. Survey participant responses indicate that the largest group of teachers represented had over 23 years of teaching experience. The U.S Department of Education (2020) reported in the 2017-18 school year that 40% of all teachers had between 10-20 years of experience and 23% of all teachers had over 20 years of experience, and the largest group of teachers had more than 20 decades of experience. The percentages of teachers participating in the study closely align with the national averages. See Table 5.

Table 3

Participant Demographics by Subject Area

Subject Area	Frequency	Percent
Agriculture	114	10.3
Business, Marketing, and Information Technology	342	30.9
Family Consumer Sciences & Human Services	248	22.4
Skilled Technical Sciences	101	9.1
Health Sciences	124	11.2
Engineering and Technology	177	16.0
Total	106	100

Table 4

Participant Demographics by Teaching Certificate Method

Certification Method	Frequency	Percent
Traditional method through a four-year university with a student teaching component	569	51.4
Alternative or innovative method (e.g., post-baccalaureate with teaching internship; ABCTE; other state-approved program)	217	19.6
Career education method: traditional CTE coursework (e.g., based on industry, clinical, or military experience)	230	20.8
Career education method: CTTE cohort courses (e.g., based on industry, clinical, or military experiences)	90	8.1
Total	1,106	100.0

Table 5

Participant Demographics by Years of Teaching Experience

Years of Teaching Experience	Frequency	Percent
0–3 years	123	11.1
4–7 years	169	15.3
8–11 years	145	13.1
12–15 years	132	11.9
16–19 years	163	14.7
20–23 years	138	12.5
more than 23 years	234	21.2
Total	1,104	99.8

Effects of Covid-19

Effect of Covid-19 by Region.

The research suggests that Covid-19 significantly affected teachers in the Pacific (mean rank = 525.76) and the Northeast regions (mean rank = 566.55) more than teachers in the Midwest (mean rank = 460.54) (x^2(3) = 14.180, p < .01).

Effect of Covid-19 by Subject Area.

The results of this study suggested that Covid-19 affected classroom instructional strategies used by family consumer sciences and human services teachers (mean rank = 541.91), engineering and technology teachers (mean rank = 550.62), and health sciences teachers (mean rank = 602) significantly more than it affected business, marketing, and information technology teachers (mean rank = 423.16). The research suggested that Covid-19 significantly affected classroom instructional strategies used by health sciences teachers (mean rank = 602.18) more than agriculture teachers (mean rank = 459.81) (x^2(5 = 51.298, p < .01).

Other Covid-19 Findings.

The data from this study suggest that business, marketing, and information technology teachers (ranked means = 423.16) were less affected by Covid-19 than teachers of any of the other subject areas and that health sciences teachers (ranked means = 602.18) were impacted the most by Covid-19 (x^2(5 = 51.298, p < .01). The Northeast region (566.55) was affected the most by Covid-19, while the Midwest region (460.54) was the least affected by Covid-19. No significant differences were found between methods of certification and the effect of Covid-19 and the use of classroom instructional strategies.

Discussion

The Effects of Covid 19

Covid -19 caused prolonged school closures due to safety concerns for students and staff. Hoffman and Miller (2020) stated that Covid-19 affected teachers, food service workers, students, and other building staff. The data from this study indicate that Covid-19 had a significant impact on teacher strategy usage by region of the United States and the subject area taught. At the time of this research the total effects of the pandemic on students and student learning are unknown

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Effect of Covid-19 by Region

The data from this study suggest that Covid-19 significantly affected teachers in the Pacific and the Northeast regions more than teachers in the Midwest. The data from this study suggest that Covid-19 affected classroom instructional strategies used by family consumer sciences and human services teachers, engineering and technology teachers, and health sciences teachers significantly more than it affected business, marketing, and information technology teachers. The data from this study suggest that Covid-19 significantly affected classroom instructional strategies used by health sciences teachers significantly more than agriculture teachers. The study further analyzed the data to find that business, marketing, and information technology teachers were less affected by Covid-19 than teachers of any of the other subject areas and that health sciences teachers were impacted the most by Covid-19. The Northeast region was affected the most by Covid-19, while the Midwest region was the least affected by Covid-19. No significant differences were found between methods of certification and the effect of Covid-19 and the use of classroom instructional strategies.

Significance

The data from this study identify significant differences in how Covid -19 has affected CTE classrooms in different regions and different subject areas. Potential significant differences may reveal differences in teacher preparation methods in different regions in the United States. Different states have different requirements and different routes to certification (National Education Association, 2020) which could cause some teachers to be more prepared for online education and pandemic mitigation strategies. The nature of this study adds to the body of knowledge about how pandemics affect K-12 schools and can lead to further studies that identify the reasons why classrooms in the different areas and different subject areas are affected differently. Cohen and Wyckoff (2016) posed the question of how institutions can create data systems that compare graduates of different teacher preparation programs. Further research could improve current teaching practices, change signature pedagogies, and improve student outcomes. With further research best practices can be identified that could modify how teachers are taught to improve student learning during pandemics. This research could be the beginning of that database that allows CTE teacher preparation programs to compare their practices, practitioners, and student outcomes. With this knowledge, further examination as to why the differences exist should be conducted. Effects on Strategies Used by Region. The data from this study indicate that differences exist in instructional strategy usage between regions of the United States during the Covid-19 pandemic. The data from this study show that significantly more teachers in the Northeast and Pacific regions indicated that their use of classroom instructional strategies was affected by

Covid 19 than did teachers in the South and Midwest regions. Most schools closed for the first time the week of March 16, 2020, with permanent closure for the 2019/2020 school year ranging from March 17 in Kansas to May 6, 2020. Reopening of schools for the 2020/21 school year varied by date depending on the modality, state, and school district. Covid-19 likely affected regions differently based on the severity of the outbreaks in the region. The coastal regions of the United States were affected by Covid-19 more than the Midwest and the South regions. The study suggests that the timing of the survey may have affected the participants' responses and acknowledges that at the time of the survey dissemination, not all schools were back in seat.

The data from this study suggest that the rate of response and instructional strategy usage was impacted by Covid-19. Some teachers did not have Internet access to participate because they were not allowed to be at school. Social distancing and Covid-19 safety protocols may have affected the responses provided about the pedagogies they were using. For the 2020/21 school year, many of the participants had been teaching virtually, in a hybrid setting, or in A/B day setting. Social distancing and Covid-19 safety protocols were implemented according to school district policies, which may have affected participants' responses.

Effects on Strategies Used by Subject Area.

Technical Assistance Center of NY (2022) stated that CTE is "not a single subject area, but a group of distinct programs" (para. 1). The group of programs emphasize different technical skills for multiple career areas through the use of different instructional strategies. The data from this study show that health sciences teachers were significantly more affected by Covid-19 than agriculture teachers and business, marketing, and information technology teachers. The data from this study suggest this may be caused because health sciences courses require in-seat hours for effective completion of the program and for clinical hour requirement. The data from this study suggest that business, marketing, and information technology classrooms and agriculture classrooms present fewer challenges to social distancing and Covid-19 safety protocols. Engineering and technology teachers and family consumer sciences and human services teachers' use of classroom instructional strategies were significantly more affected by Covid-19 than business, marketing, and information technology teachers. The data from this study suggest that business, marketing, and information technology courses often involve the usage of computers and technology that was already embedded into the coursework could be the reason, and information technology teachers' use of classroom instructional strategies were significantly less affected by Covid-19 than the engineering and technology and family consumer sciences and human services teachers. The data from this study suggest that engineering and technology teachers' and family consumer sciences and human services teachers' classroom instructional strategies would incorporate more work that requires on-site completion than business, marketing, and information technology teachers.

The significant differences in classroom instructional strategies between teachers of different demographics are an important finding because it will allow further research into reasons why the differences exist. The investigation of different strategies could develop a more effective system of providing professional development for teachers through differentiated instruction by subject area or other teacher demographics. For example, teachers with over 19 years of experience may identify as needing more professional development on technology-based instructional strategies, while teachers with less than three years may determine they that need professional development on classroom management techniques. Shulman (2005b) indicated that teachers could learn from teachers from other subject areas.

The data from this study have identified significant differences in instructional strategy usage that may benefit all subject areas. Teachers in business, marketing, and information technology may identify that health sciences teachers do not have access to on-the-job training because of HIPAA protections of a patients' personal health information (Center for Disease Control, 2021). Additionally, the data suggest that significant differences in usage between subject areas and regions of the United States could be due to resource availability in different regions. Perhaps providing broadband Internet access or electronic instructional devices to rural or underserved school districts might allow those teachers to use the instructional strategies that require the Internet or computers.

Limitations and Recommendations for Future Research

Limitations

Limitations of this study of CTE teachers nationwide resulted from a varied number of participants from each state. Large numbers of teachers from Georgia and Missouri participated, while there were no participants from North Dakota and Hawaii. Three participants identified they were unsure what state they were teaching in, which may indicate that they

were changing jobs. A second limitation of the study is that only 620 of the participants answered how often they use lectures. The reduced number of responses to this question could have a significant impact on the results of the data analysis. A third limitation of the study could be how the participants indicated they earned their teaching certificates. The survey did not explain the differences between the four routes to certification participants were given to choose from. This means that a participant may have indicated a route different from the one the participant actually used to earn certification.

A fourth limitation of the study was that some vague answers were not added to the statistical analysis and the possible misinterpretation of the data by the researcher. A fifth limitation of the study could be a lack of understanding of terminology for different classroom instructional strategies. For example, one teacher may define a specific learning strategy as project-based learning, while another may describe the same strategy as on-the-job learning.

A sixth limitation of this study was that it was conducted during the Covid-19 pandemic. The study was sent out during uncertain times while some schools were conducting in-person learning, some were conducting virtual learning, and some were conducting hybrid learning. Under those circumstances, there is uncertainty about whether the participant's answer reflected their usage in the pandemic classroom setting or the pre-pandemic classroom settings. Because of that, data about pedagogy usage in their current classroom setting may not be applicable for future studies.

Recommendations for Further Research

Based on the analysis of the data, the study found the following recommendations for future research. On recommendation is for more research to determine the effects of Covid-19 or any future pandemic on student achievement. Future research should investigate professional development on the use of different pedagogies to mitigate the effects of a future pandemic on student learning. As the data analysis from this study suggest that significant differences of classroom instructional strategies exist between subject areas and teacher demographics, the study suggests further research to examine what is going on inside the CTE classrooms through case study analysis to provide greater insight into the actual classroom teachers' practices. As this study does not investigate which classroom instructional strategies have the greatest effect size on student learning, another recommendation for future research is to determine which classroom instructional strategies are the most effective.

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