Hand-off, Hands-on Learning: Career, Technical, and Agricultural Education in Secondary Schools During the COVID-19 Pandemic

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ABSTRACT

The purpose of this research study was to identify, investigate, and share the best or most effective teaching strategies or techniques utilized by Career, Technical, Agricultural Education (CTAE) teachers in secondary schools for distance or online instruction of psychomotor intense subject matter during the COVID-19 pandemic. The methodology in this mixed methods study provided qualitative insight into a challenging phenomenon by identifying, soliciting, and engaging secondary school CTAE teachers teaching in their respective CTAE areas before, during and after the COVID-19 pandemic and well as quantitative analysis of their self-reporting surveys. The Likert Scale questionnaire delivered via the internet inquired about participants' experiences teaching psychomotor skills and gauged teacher satisfaction with their school district's training, preparation, and support for the forced migration to distance learning. Once analyzed, the researcher identified and described suggested best practices for teaching heavy psychomotor content via distance or online learning.

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DEDICATION

I dedicate this work to my wife and children. To my children, Brittany, Jonathan and Christopher, please believe, if you really want to do something, and you are willing to do the work, you can do it. And to my wife, thank you for riding shotgun through life all of these years, and for being kind enough to wait for me to figure the answer for myself when I couldn't, or wouldn't, hear you giving me the answer.

Chapter I

INTRODUCTION

On March 11, 2020, the World Health Organization (WHO) declared COVID-19 a pandemic (Katella, 2021). Cases worldwide continued to surge the following month as businesses shut down, schools closed, sporting events were canceled, and college students were sent home (Katella, 2021). According to Reich, et al., (2020), by the end of March 2020, all 50 states in the U.S. transitioned to remote instruction. According to Maqsood, et al., (2021), most governments temporarily closed schools to contain the spread of COVID-19. As public health experts and school officials debated scenarios for children safely returning to school, new research from July 2020 showed the pandemic was causing students increased mental health issues due to the implementation of remote learning and the subsequent isolation of the learners in their homes (Katella, 2021). By August 2020, COVID-19 had become the third leading cause of death in the U.S. (Katella, 2021). Engzell, et al., (2021) began documenting the Netherlands' implementation of practices to lock down facilities and utilize social distancing measures to contain the spread of the virus in March of 2020.

A History of COVID-19 and its Impact on Public Schools

COVID-19 emerged as a disease resulting from SARS-CoV-2 infection. This form of infection transmitted more easily than SARS-CoV, which explained why the disease spread to just about all continents ahead of the Public Health Emergency of
International Concern (PHEIC) declaration by the World Health Organization (WHO) on January 30, 2020 (Chan, et al., 2020) In general, coronaviruses led to diseases in the gastrointestinal, respiratory and central nervous systems for both animals and humans,

leading to significant loss of life (Li, 2016). It was also possible for these viruses to adapt to different environments via mutation, which meant that the threat remained over the long term (Li, 2016).

For COVID-19, the primary transmission route was droplets from the respiratory system. It was possible to transmit the virus to a healthy person when that person encountered an infected person or any of an infected person's belongings. Early research found that it was possible to avoid transmission by staying at least two meters away from others, keeping infected persons isolated, and wearing masks outside the home (Maragakis, 2020).

When COVID-19 was in its initial outbreak phase, a study involving 552 hospitals from 30 provinces within China took data from 1,099 patients on January 29, 2020. All the patients had lab-confirmed cases of COVID-19, and over 75% had either been to Wuhan, China or lived there. Only 2% of the patients had been in contact with any animals; at this point, there was no way to predict the infection source or patterns of an outbreak. However, researchers were able to conclude that the incubation period ranged between one and 12 days, with a median period of 4 days (Guan, et al., 2020). The primary symptoms were fever, cough, fatigue, and diarrhea (Guan, et al., 2020). Researchers detected the virus in blood, urine, urine, and saliva before the patients developed viral pneumonia, although some patients showed signs of the virus without developing pneumonia. Still, others lacked any symptoms, making them possible sources of infection (Guan, et al., 2020).

Although the COVID-19 virus was first identified in Wuhan, it eventually spread around the globe. By August 20, 2020, there were over 22 million confirmed cases and over 800,000 deaths worldwide. The average infected person caused between 1.5 and 3.5

infections in others, but the most problematic factor was that most infected persons showed no discernible symptoms while remaining contagious to others (Guan, et al., 2020).

As governments attempted to implement policies to limit the spread of COVID19, two initiatives that were immediately implemented included the movement of K-12 education from in-person education to strictly online learning, and the mandatory wearing of face coverings in public. Initially, the move to online learning was positively received, but almost immediately, there was a push to get children back into the classroom. Again, a convenience factor was involved, as parents accustomed to having their children in school during the day now had to find other arrangements for them, especially if their places of business had remained open. In the first few weeks of the pandemic, many workplaces were closed as well, but as they opened, a need for childcare emerged, and a clamor for in-person learning returned (Scocca, 2022). As the controversy raged on, several hyperbolic claims emerged, such as Nate Silver's infamous assertion that what happened between the spring of 2020 and the spring of 2021 had done more damage than the United States invasion of Iraq (Scocca, 2022).

Moving to the fall of 2020, many schools opened under what was known as a hybrid model. This action brought students back for in-person instruction, but in smaller numbers at a time. A typical example would have half the students coming in person 2 days a week, the other half coming 2 days a week, and then the 5th day used for all online learning as school buildings were disinfected. Other schools returned to a full in-person model, with various requirements such as social distancing and masking. In some areas, particularly those with unionized teachers, in-person learning was delayed longer due to concerns about the spread of the virus. In other areas, particularly those that were part of

"red" (politically on the right) jurisdictions in terms of voting, in-person learning returned sooner. A polarized dynamic emerged, inflamed to some degree by politics during the pandemic. On one side, there was the rhetoric that people who wanted to return to complete in-person learning did not have any concern for the spread of the virus; on the other, there was the rhetoric that people did not want children to learn or that teachers were lazy and simply did not want to work (Scocca, 2022).

As was usually the case in polemic debates such as this, the truth ended somewhere in the middle. Most of the teachers who were resistant to returning to school to work with students who might be asymptomatic carriers of a disease who did not yet have a vaccine and had put many people into the hospital were not lazy but instead simply wanted their classrooms to be safe places of learning. Many parents who wanted their children back in classrooms every day had legitimate concerns about the decrease in quality when it came to the education they were receiving. It was easier to deliver content online in higher grades and college classes. However, it was also more work to verify that students were present and learning was taking place (Scocca, 2022).

Another debate that emerged during this time was about mask mandates within schools. The mask mandate itself, as with the decision to move to remote learning, was one that also excited a great deal of public opposition, especially in the United States and other countries where political leadership did not pursue policies that mirrored the initial findings of the scientific community. A study released in 2021 concluded that countries in which individualism was a prized virtue contained cultures that were more resistant to such public mandates as mask-wearing because the idea of contributing to collective well-being was less attractive than was the idea of maintaining one's identity (McGonaghan, 2021).

As the pandemic began, the United States Centers for Disease Control issued public recommendations for wearing face masks by individuals when in public. The agency spent significant time and resources to educate the public that masks would be a highly effective tool in containing the pandemic. However, the decision to issue mandates was left to lower levels of governmental jurisdiction over time. Leaving matters at the state level (or city or county level) meant various choices. The fact that some states implemented mask mandates while others did not lead to more widespread confusion about the actual seriousness of the disease and how to remain safe from the transmission. Particularly in rural parts of the United States, people did not think wearing masks was that important because they believed that since they did not know anyone who had contracted the disease, they would not be in danger of infection (McGonaghan, 2021).

Early messaging also indicated that COVID-19 would have a disproportionate impact on the elderly members of the population. This meant that among the younger, healthier segment of the population, people felt like they were less likely to catch the disease, and if they did, they would be less likely to suffer from severe complications. Nevertheless, of course, this perspective overlooked that people who were asymptomatic or who suffered from less severe symptoms could still spread the disease to people who were more susceptible to death or other complications. As a result, many young and middle-aged adults were more resistant to wearing masks, even before vaccines against COVID-19 had become publicly available (McGonaghan, 2021).

Several other psychological issues played a toll, especially when inflamed by the winds of political discourse. Such issues led to leaders spreading the notion that wearing a mask projected weakness or fear of the virus when courage might be a more productive response. The decision not to wear a mask also became intertwined with the idea of

freedom of personal expression and other personal liberties (McGonaghan, 2021). These perspectives contrasted with other countries, such as Asia, where people frequently have worn masks in public to avoid the spread of influenza and other diseases (McGonaghan, 2021).

In August of 2021, American schools opened with various plans to keep children and teachers safe. These plans ranged from in-person teaching with social distancing without mask mandates to plans which required mask mandates. Still, other plans allowed remote schooling to continue or offered hybrid models (Katella, 2021). However, according to Basilaia and Kvavadze's study (2020), the pandemic significantly altered the lives of many students. Most were forced to learn online without physical interaction with their teachers or peers.

Eliminating physical or social interaction limited students' learning experiences and negatively affected learners with diverse learning styles. Keeping students at home instead of on campus posed significant challenges for families that had multiple children staying at home at different age levels. Expecting older children to supervise their younger siblings while also attempting to complete their studies was challenging for teachers and students (Lieberman, 2021). Schools became responsible for providing the appropriate learning strategies to limit the virus's spread and assist families that either lacked Internet service or did not have service with sufficient bandwidth (Pokhrel & Chhetri, 2021).

Teachers were expected to contribute to the public health efforts to contain the virus's spread by ensuring that learners could learn online. Transitioning to a remote or online learning environment challenged many teachers on several levels. Some needed more training in the appropriate areas of instructional technology (Turner, 2022).

Teachers lacked the pedagogical savvy to transition from a classroom with students to a Zoom call with 25 boxes, many of which remained back as their school districts did not require students to turn on their cameras. The difficulties were particularly severe in districts where teachers were expected to provide simultaneous instruction to an in-person classroom and a Zoom meeting with students learning remotely. In addition, many teachers had to learn how to use new software packages while providing ongoing instruction (Turner, 2022). Overall, this was a difficult transition for teachers, students, and families.

Background of the Problem

The COVID-19 pandemic necessitated rapid changes in the way teachers taught and students learned, and the implementation of educational distance technology was identified as the vehicle to facilitate those changes. Globally there was a move to remote learning. According to the third paragraph of the overview of the article, *Online Learning vs. Remote Learning, from Kennesaw State University's Digital Learning Innovations* webpage (2021):

Remote learning involves moving content for face-to-face instruction to an online environment for limited or one-time-only course instruction. Remote learning can allow a student to connect to the classroom remotely through an approved app. This method differs from online learning because it does not require the instructor to have the entire course completely available online.

According to Ali (2020), local and state education officials worldwide implemented remote learning policies to facilitate learning on all academic levels during the pandemic. In the United States, similar policies supported the public health policies implemented by the White House's "15 days to stop the spread" (later extended to 30

days to stop the spread). However, the lockdown of March and April 2020 meant that the education sector needed to provide the resources necessary to support students in remote learning since they could not attend school due to travel restrictions and other measures to contain the spread of the virus (Chitra, 2020).

Technologies such as Wi-Fi hotspots became an essential component of each classroom as learning moved online (Engzell, et al., 2021). Ali (2020) noted that online platforms allowed teachers to continue teaching. For example, software such as Microsoft Teams and Google Classrooms provided real-time virtual classes with an improved environment for online teaching and learning (Kidd & Murray, 2020). However, some online learning platforms could experience technical issues, while others sometimes collapsed due to the many simultaneous users (Code, et al., 2020). Teachers struggled to ensure that learners were equipped with the necessary equipment and access that could help in facilitating remote learning. Teachers also had to create online classroom environments for their students to learn and interact as they provided the necessary guidance (Krishnaratne, et al., 2020). Finding ways to navigate the challenges that emerged during this time became the central challenge within the educational system.

Pedagogical Challenges

Teaching strategies had to change because schools had to comply with government measures to control the spread of the pandemic (Maqsood, et al., 2021). Methods such as offering students the option of taking classes synchronously or asynchronously were utilized. This migration to online learning led to a need to reconsider and recalibrate policies and procedures for teaching and learning in an online environment, including how to define attendance (simply checking in at some point, attending remote lectures, turning on cameras, etc.) (Turner, 2022). Teachers that

observed situations on student's cameras that appeared to show neglect had to deal with mandatory reporting requirements that were often connected to their certification and, in some states, possible criminal culpability. As the school districts focused on ensuring that learning could continue during the pandemic, closures of the physical campuses affected examinations and learning (Kidd & Murray, 2020). Teachers' challenges during the early months of the pandemic represented significant turmoil within education as a profession and an institution.

COVID-19: Impact on Career, Technical and Agricultural Education

Career, Technical, and Agricultural Education (CTAE) incorporated core academics with occupational and technical skills to equip the next generation of learners for post-secondary education or the workforce. According to Stribling (2021), CTAE helped students to achieve a successful entry into the labor market and made them competitive by equipping them with competitive skills. CTAE was dedicated to ensuring students were appropriately prepared for the 21st-century labor market by providing high-quality educational opportunities for supporting the economy (Stribling, 2021). CTAE helped provide knowledge, tools, and resources necessary to help students make career-related decisions.

The COVID-19 pandemic-dramatically affected how teaching in the CTAE secondary institutions took place (Townsley, 2020). For example, programs implemented social distancing measures that led to classroom changes within the CTAE secondary institutions. Some of these measures included greater distances between desks, plastic shields between desks, and mask mandates for students and teachers, all of which impacted face-to-face interaction. CTAE focused on ensuring student development of real-world job-related skills applicable in career fields in high demand. Learning these

career and technical skills involved high levels of in-person interaction; hence the social distancing measures the pandemic brought forth negatively affected CTAE students' ability to gain real-world skills due to the limited interactions (Dunn, 2020; Zhang, 2020). Indeed, many CTAE secondary institutions were closed and moved instruction online to allow students to help stop the spread of the COVID Virus.

The transition from in-person to distance learning throughout learning institutions created the need for CTAE secondary teachers to develop new ways to deliver education. Mercier, et al., (2021) noted that the professional development of great focus among the CTAE secondary teachers included using accessibility features and practices. The professional development opportunities for the CTAE secondary teachers had been platform-specific, as the various online platforms used in distance learning had differences in teacher interface and student access. The full utilization of the unique features of the online platforms enhanced student engagement and improved human capital (Koçoglu & Tekdal, 2020).

The instructional methods of the CTAE teachers in secondary schools changed during the COVID-19 pandemic to adjust to the new guidelines to control the virus's spread (Koçoglu & Tekdal, 2020). According to Jelińska and Paradowski (2021), the rules during the pandemic made CTAE teachers embrace online learning as the new instructional method. Management of this change was not easy as there was a need for an immediate response to the pandemic (Koçoglu & Tekdal, 2020). The CTAE secondary schools required professional development resources to help teachers guide learners (Juarez & Critchfield, 2021). Many secondary schools lacked the resources to fully support and implement the shift to an online learning environment (Turner, 2022). Some CTAE secondary teachers could adapt to hands-on instruction in remote teaching

formats, maximizing student engagement in experiential learning even when an in-person meeting was impossible (Wahyuni, et al., 2021). However, Townsley (2020) stated that some CTAE secondary school teachers experienced issues with online-based learning in teacher preparedness and technological capability. In many cases, CTAE secondary teachers and students did not have enough access to the internet and digital devices necessary to promote learning during the pandemic (Turner, 2022).

What sets CTAE apart from other areas of education is the necessity of developing psychomotor skills in a hands-on environment. Students must learn physical skills for manipulation through hands-on application of knowledge that involves the use of tools and equipment that are specific to the career a student wants to pursue. This dimension of CTAE instruction became extremely challenging after the movement to online instruction necessitated by the COVID-19 pandemic.

Statement of Problem

The unavailability of remote learning tools and materials, as well as the planned instructional implementation adopted during the pandemic, was especially challenging for teachers in CTAE secondary schools (Ali, 2020). The problem of this study was that CTAE teachers were not able to effectively deliver psychomotor content and skills, as opposed to cognitive content, due to the required shift to the online delivery necessitated by COVID-19 (Konopelko, 2021).

Purpose of the Study

This study aimed to discover the experiences of CTAE teachers in secondary school during the COVID-19 pandemic-driven mass scholastic migration to remote learning and to document newly perceived best practices or the most effective teaching and learning techniques discovered for learning psychomotor knowledge and skills. Once

this information was gathered and analyzed, recommendations were developed for new policies, practices, or procedure that could be better incorporate these practices or techniques into standard practices or techniques to facilitate remote learning in the event of another migration.

Research Questions

The following three research questions guided this study:

1. What were the experiences of CTAE teachers in delivering psychomotor content pre-pandemic?
2. What were the experiences of CTAE teachers in delivering psychomotor content during the pandemic?
3. What were the recommended strategies or techniques to teach psychomotor learning online in case another migration to online learning?

Significance of Study

This study helps provide greater insight into the impacts that the COVID-19 pandemic had on the teaching experiences of CTAE teachers, specifically the teaching of subjects related to psychomotor skills. The study collected data from selected secondary CTAE teachers in the four largest public-school districts in Metropolitan Atlanta, Georgia. This research study collected data concerning the professional perspectives and teaching strategies of the CTAE teachers during the COVID-19 pandemic. In addition, this study examined secondary school teachers' experiences by documenting the differences in the way teachers felt during and after the pandemic. This study contributes toward building a body of knowledge, particularly in providing insights concerning the impacts that the COVID-19 pandemic had on the teaching experiences of CTAE secondary school teachers. The results assisted in addressing the shortage of research in

understanding the professional experiences of CTAE secondary school teachers during the COVID-19 pandemic. This study used the lived experiences of the CTAE secondary school teachers before and during the pandemic to provide new and reflective information to assist in creating the necessary levels of communication, capability, and comfort to continue delivering effective psychomotor instruction from a distance. This study was appropriate because as the teaching and learning mechanisms change, teachers are experiencing many challenges adjusting to a new normal (Chitra, 2020), directly affecting student learning. For example, teachers unfamiliar with teaching via the internet were challenged to guide and teach students online (Code, et al., 2020). Engzell, et al., (2021) argued that CTAE teachers faced challenges as they delivered online learning to students using learning platforms, they were unfamiliar with before the COVID-19 pandemic. The study assisted in understanding the teaching challenges that CTAE secondary school teachers faced in teaching psychomotor skills and adjusting to the new teaching mechanisms. This study is essential. It helps educational administrators and teachers determine the best ways of embracing the online learning environment to improve CTAE teachers' teaching experiences and practices, thereby improving the educational process and education. As established above, the approaches used to deliver content before and during the pandemic have changed.

The results of this research study provide important information that help establish the impacts of the pandemic on CTAE learning, specifically in secondary schools. In addition, this study provides information that could be useful in formulating educational practices and policies to assist secondary schools in enhancing and stabilizing the practices and experiences of CTAE teachers in secondary schools in teaching psychomotor skills, thereby enhancing and stabilizing the educational experiences of

their students. The relevance of the teaching strategies used in teaching online influences attention, confidence, and satisfaction. Therefore, because of this study, the CTAE secondary schools are provided with the information and recommendations necessary to determine if and what type of support was needed to improve online teaching experiences. This study also helps provide information and recommendations for use in formulating or updating educational training policies to assist secondary schools in enhancing and stabilizing the practices and experiences of CTAE teachers in secondary schools, thereby enhancing and stabilizing the educational experiences of their students.

Limitations

The limitations of this study included its narrow scope. This study explored secondary school teachers' teaching experiences in Metropolitan Atlanta, Georgia. Therefore, the generalizability of the results of this study to the experiences of CTAE teachers in other regions are limited. This study was also limited in that it relied on personal subjective perceptual data, thus limiting the validity of the study. Even so, this information was crucial in understanding the shared experiences among CTAE secondary school teachers in other areas.

Positionality Statement

I acknowledge that my 19 years as a classroom teacher prior to the pandemic and the challenges I faced adjusting to online learning not only inspired, but also shaped my perspective on effective or ineffective remote teaching strategies for psychomotor content delivery. In addition, I acknowledge that I may have participants in this study that I have prior contact or relationships with. Both my personal view on the topic and the prior relationships with some participants may influence my interpretation of the data collected. To minimize the potentially negative impact of these aspects, I have chosen to

include open-ended questions during data collections, engage in an iterative, systematic, and collaborative examination of the data, as well as sharing my interpretations with the focus group participants as member-checking.

Conceptual Framework

Theoretical Premises

This research study was based on the educational theoretical premise of constructivism or the argument that students require a content foundation to which they can add levels of complexity after understanding the basics (WGU, 2020). The practicing, experienced CTAE teachers, who were my research subjects, have instructional knowledge for allowing learners to learn their psychomotor skills better. In coursework where, psychomotor skills played an essential role, moving to an online learning environment removes the opportunity for an in-person demonstration and for students to have hands-on practice with job-specific tools and equipment. While demonstration can take place through video instruction, such practices as having the teacher move from student to student and observing physical processes and changes cannot occur online; depending on the technology in use, the teacher may not be able to inspect the student's work as closely through a video class as the teacher could in an in-person classroom. This remote learning environment made moving from one skill to the next impossible; following a constructivist progression, the remote learning of psychomotor skills was severely limited because foundational psychomotor skills cannot be practiced and thus not learned, making for a more challenging instructional context. In many cases, psychomotor skills were instructed with a stepped pedagogical approach before acquisition and performance by each student.

Psychomotor Skills and Learning

Providing instruction in psychomotor skills was-a pedagogical challenge. The necessary psychomotor competencies were unique to the various disciplines and mandatory for delivering beneficial outcomes. The goal was to teach skills so that students could use them after practice and use them skillfully in different occupational settings (Kantak & Winstein, 2012). During the twentieth century, different theorists in psychomotor learning devised the steps for teaching and learning a psychomotor skill or manual task, such as moving from introduction to demonstration to student performance. Since then, several researchers have released models which served as permutations of the initial theoretical ideas, as appears below (George & Doto, 2001). Throughout the skills teaching literature, the main principle argued that a teaching approach that included sequences and steps was the best way to teach these skills, whether the desired end task was simple or complex. Tasks with multiple parts were challenging for teaching, learning, and retaining. Retaining was defined as the ability to recall and execute a task after the period of practice has ended (Kantak & Winstein, 2012).

The George and Doto (2001) model involved five steps, which have worked well for simple processes: overview, demonstration, repeated demonstration, student discussion and student performance. The Walker and Peyton (1998) model involved four steps: demonstration, repeated demonstration, student explanation while the instructor followed student instructions and student performance. Wang, et al., (2004) performed a study that this model increased the efficacy of acquiring simple skills among fourth-year medical students working on learning how to compete for a simple interrupted stitch. Some studies found that when the skill was moderately complex or complex, these processes were less effective. Archer, et al., (2015) performed a study comparing models

of skill teaching that included two, four, and five steps in teaching manual defibrillation working with a mannequin. The researchers concluded that there was no significant difference in acquiring and retaining the skills after 2 months. These findings corroborated results from studies analyzing the teaching of psychomotor skills associated with other medical procedures (Greif, et al., 2010; Krautter, et al., 2011; Orde, et al., 2010;). Even so, the four-step and five-step instructional models limit their usefulness in facilitating the acquisition and retention of skills needed for complex tasks.

Some of the necessary instructional processes that teach psychomotor skills included cognitive task analysis, which involved splitting a complex task into its skill and knowledge parts ahead of the actual instructional session. Other scaffolding strategies included: putting limits on the number of skills that any single teaching session would include so that students did not go through cognitive overload (Leppink & van den Heuvel, 2015); suggesting that teachers avoid providing coaching and guidance during the practice of skills (Leppink & van den Heuvel, 2015); providing instant correction for errors when a learner practiced a skill incorrectly (Kantak & Weinstein, 2012); providing feedback or results immediately after a performance of skill; and facilitating several short opportunities for practicing skills to provide long-term learning.

As mentioned earlier, the teaching paradigms that were currently used for psychomotor skill instruction took their foundation from motor learning theory, as suggested by Fitts and Switzer (1962), and Fitts and Posner (1967). These researchers, along with others, agreed that a sequenced skill approach for teaching allowed for the acquisition of required knowledge in stages. In almost every medical specialty field, theoreticians had devised models more specific for success with related tasks. In all these

disciplines, skill teaching models that included a series of skill steps were used for manual task instruction.

Terminology

This section provides definitions for key terms used in the paper. According to various related dictionaries:

- *COVID-19* – a novel coronavirus that was first discovered late in 2019 (WHO, n.d.).
- *CTAE* – Career, Technical, and Adult Education (Acronym Finder, n.d.).
- *Online Learning* – an educational method that provides instruction in a completely virtual environment (Top Hat, n.d.).
- *Psychomotor learning* – demonstration of physical skills: coordination, dexterity, manipulation, grace, strength, speed; actions which demonstrate the fine motor skills such as use of precision instruments or tools, or actions which evidence gross motor skills such as the use of the body in dance or athletic performance (Noble, 1968).
- *Remote Learning* – an educational environment in which the student and the educator (or the source of information) are not physically present within a traditional academic environment (Top Hat, n.d.).

Structural Outline

The structure of this dissertation includes an introduction, review of the literature, methodology, findings, discussion, and conclusion. Chapter 1 introduces the research problem, objectives, aims, and significance and briefly discusses the study's limitations. Chapter 2 reviews the current literature on the effects COVID-19 has had on education in primary and secondary schools. The literature was reviewed to identify the results of

published studies about the teaching experiences of secondary school teachers, including CTAE teachers, and relevant student and online pedagogical practices during the COVID-19 pandemic. Chapter 3 discusses the methodology used in the study, including the research approach and design, the data gathering protocols and techniques, and data analysis techniques. Chapter 4 presents the results from the responses of the participating secondary CTAE school teachers concerning their pedagogical experiences during the pandemic, as well as an analysis of the data which was discussed and applied to answer the research questions. Finally, Chapter 5 considers the study's findings and their relation to the theoretical framework to presents the study's conclusions and offers a set of recommendations that educational leaders could use for future online instructional and curricular planning and the effective teaching and learning of CTAE psychomotor knowledge and skills.

Chapter II

REVIEW OF LITERATURE

This chapter reviews the literature on the impacts of the COVID-19 pandemic on CTAE secondary school teachers' preparedness and its consequential effects on student learning. It provides insights concerning relevant previous studies that other researchers have conducted. The literature review will explore insights from earlier studies concerning the experiences of CTAE teachers during and before the pandemic and the related experiences of secondary school students as both groups adapted to the new learning environment simultaneously.

Teaching and learning in CTAE schools were influenced during the pandemic as CTAE teachers were forced to embrace online education. For example, governments introduced emergency policies and programs due to the closure of learning institutions and the suspension of in-person classes that preceded a move to online learning to curb the spread of COVID-19 (de Vries, 2021).

Search Description

The appropriate literature search will focus on articles, books, and journals relevant to the study. Secondary data sources were used to review various experiences of CTAE secondary teachers during and before the pandemic. The selected data sources were relevant and updated to provide reliable information. Google Scholar was used alongside ResearchGate, JSTOR and SAGE for Journals. The Valdosta State University library was accessed for “ERIC” and “Galileo” and books were found using the eBook subscription service, SCRIBD. The researcher used the following search terms, separately and in combination: CTAE, secondary school, remote learning, distance learning, online learning, COVID, pandemic, vocational education.

Morgan (2020) argued that online learning could be described as the learning experiences that involved electronic devices like laptops, smartphones, and computers with the availability of the internet in asynchronous or synchronous environmental conditions. A study conducted by Omang and Angioha (2021) revealed that online learning in secondary schools had been encouraged for many years prior to the COVID-19 pandemic. The rapid arrival and spread the of COVID-19 virus meant that this transition had to take place at breakneck speed and with universal scope. The teachers arranged the best platforms for online learning with the students, where they embraced asynchronous and synchronous interactive activities. Most secondary schools adopted homemade videos where they could share their screens during education to enhance the interactions. (Bashir, et al., 2021) However, the secondary students took time to adapt as they were not used to the online learning platforms. According to Mulenga and Marbán (2020), the sudden change to online learning from traditional learning affected learning effectiveness among secondary students.

Internet connectivity played a crucial role in supporting online learning where secondary students could interact using platforms like Zoom. A study conducted by Ferri, et al., (2020) revealed that secondary students took advantage of the innovations associated with internet technologies to learn remotely. Students used learning platforms as virtual classrooms to interact freely with other peers and teachers in online learning. The secondary students during the pandemic were required to engage in hands-on learning and theoretical learning using the online education delivery platforms.

Online learning became the primary instructional delivery strategy for ensuring education continued in secondary schools during the COVID-19 pandemic. A study

conducted by Rouadi and Anouti (2020) showed that online learning increased information retention among secondary students and enhanced effectiveness in learning. According to Adnan and Anwar (2020), new technologies have made it easy for secondary students to improve their engagement with teachers and other learners during online classes. The changes in secondary school education caused by the COVID-19 pandemic created learning opportunities for secondary students. For example, secondary students interacted with their teachers and accessed reading materials at home (Dhawan, 2020). The teachers embraced digital platforms to share the necessary materials for supporting education where students made the required inquiry any time through the digital media.

Priyadarshini and Bhaumik, (2020) noted that the learning in secondary schools had changed to online education from face-to-face teaching, especially during the pandemic. The primary technologies used in secondary schools to facilitate online learning include broadcast television, audio conferencing, interactive video, and videotape, among other digital platforms like Microsoft Meet. Omang and Angioha (2021) argued that computer-based instruction had become common in secondary schools, where students learned online using the Internet. The students had to adapt to the online instructional settings where the teachers helped them familiarize themselves with the digital platforms used in teaching and learning.

Ferri, et al., (2020) observed that personalized teaching was usually possible through online learning as teachers could be able to understand the learning needs of individual students. The virtual learning experiences in secondary schools enabled learners to learn independently online through the support of the internet. Students were usually connected to their peers and teachers through online learning platforms where

they could collaborate remotely. Digital media made it easy for the students to work as a team in virtual classrooms. (Ferri, et al., 2020)

Verawardina, et al., (2020) revealed that information communication technology *(ICT)* was crucial in enhancing quality, effectiveness, and access to education in secondary schools. It addressed equity and access issues by creating educational opportunities for online secondary students. Secondary schools embraced ICT to make sure they reached students at their homes during the pandemic. This action helped facilitate continued learning in secondary schools despite the pandemic that led to the closure of learning institutions. According to Dhawan (2020), using visual and audio senses in secondary schools assisted in knowledge acquisition using teleconferencing technologies that enabled learning among geographically dispersed students. For example, learners can visualize graphic images displayed with animations during video teleconferencing, making illustrations during learning look real. This instructional strategy could be crucial in enhancing retention among the students as the pictures made using new technologies embraced real-life situations (Priyadarshini & Bhaumik, 2020). The utilization of technology in secondary schools altered the classroom structure. Teachers were expected to function like advocates, coaches, information managers, and mentors to ensure the successful implementation of online learning.

Baber (2020) commented that secondary school students were guided and encouraged to continue embracing online learning through being linked to mentor experts. The school administrators connected the learners with mentor experts using discussion forums and emails to ensure students were equipped with the necessary information to motivate them as they learned online. Teachers in secondary schools could integrate new technologies into an interdisciplinary curriculum that addressed the specific

needs of students. According to Basilaia and Kvavadze (2020), technology helped in providing records for the academic history of students and data needed for individualizing assessment and instructions. The digital libraries used during online learning enabled students to learn and perform research remotely while accessing quality materials. These resources facilitated easy and efficient storage, updating, acquiring, and distributing of learning materials among secondary school students. Verawardina, et al., (2020) argued that modern technologies helped in enhancing student participation and engagement by making sure that the learners were active during online lessons. For example, most students could be comfortable asking questions and making comments when learning online, thus enhancing their engagement and participation.

Guo, et al., (2020) revealed that teachers in secondary schools during the COVID-19 pandemic recorded video meetings to enhance student learning. Using digital platforms, hand-raising markers, and integrated digital whiteboards helped improve student participation. These features were crucial for students to engage and make online lessons lively and interactive actively. For example, features like a digital whiteboard made it possible for teachers to share ideas and brainstorm with the help of visuals. According to Basilaia and Kvavadze (2020), in online learning, teachers could schedule video meetings with students during classes through live chat, and screen sharing made it possible for the teachers and students to interact online effectively. Platforms like Microsoft Teams could support around 250 participants during video meetings, making it appropriate for online classes (Baber, 2020). The teachers who taught online could encourage and engage students to actively ask questions to gain clarity on material they did not understand. The teachers could record video meetings and lessons to share them on class websites for learners who were not present during the synchronous online

classes. Collaboration in online courses had been improved through unique features made available by digital platforms.

These new technologies allowed teachers to get instant feedback from students as they learned online. According to Omang and Angioha (2021), video conferencing modes assisted in replicating feelings of learning remotely among secondary students. For example, Microsoft Teams and Google Meet had video conferencing features necessary to improve remote learning experiences. The teachers collaborated with the instructional teams and IT experts to develop the best ways to embrace digital platforms. They embraced learning management systems to grade assignments and engaged learners as learning took place remotely. According to Almanthari, et al., (2020), Google Classroom proved to be crucial in assisting students in communicating, organizing, and managing assignments. Students during the pandemic were usually invited to the online classrooms using secret codes to participate in the small classes. The communications made by teachers to the students through Gmail enabled them to ask questions and make announcements. Jena (2020) noted that the interactions between teachers and the students were crucial in making it possible for teachers to understand the learning progress. The teachers could assess the learners' academic progress by asking questions after lessons to determine whether the students could understand what was being taught online.

The COVID-19 pandemic dramatically affected learning in CTAE secondary schools, as all relevant stakeholders went through significant instructional change. For example, teachers attempted to develop new methods to ensure that the learning would continue. The moment the CTAE secondary schools were closed due to the COVID-19 pandemic, secondary school teachers were forced to develop new strategies to quickly adapt to the online learning environment (Lestari & Gunawan, 2020). According to Kar,

et al., (2021), secondary school teachers experienced challenges in ensuring that the students had a positive attitude towards learning during the COVID-19 pandemic. Effective employment of ICT was one of the obstacles that teachers faced. The use of information communication technology and its application in teaching among secondary school teachers was crucial for the success of online classrooms. However, during the pandemic, secondary school teachers had a significant deficit in digital knowledge and competence in information communication technology (Lestari & Gunawan, 2020).

Empirical studies showed that teachers needed to improve their digital skills necessary for facilitating learning using new technologies. A survey conducted by Nicola, et al., (2020) revealed that continuous training was crucial for secondary school teachers to make sure that they developed the appropriate teaching competencies for online instruction, including the creation of digital content and ensuring that teachers and students could successfully communicate online. A study conducted by Kidd and Murray (2020) indicated that the teachers' and learners' perceptions of the new technologies in learning were critical in creating a thriving online learning environment. The authors found that teacher and student training was necessary to ensure that online learning was possible, especially in ICT. Finally, Giovannella, et al., (2020) concluded that the contemporary context based on the threat of crisis due to the COVID-19 pandemic had led to several changes in varied economic, labor, and political spheres and social life.

Conceptual Framework

This research study is based on the educational theoretical premise of constructivism, or the argument that students require a content foundation to which they can add levels of complexity after understanding the basics (WGU, 2020). The research subjects will be practicing, experienced CTAE teachers who have instructional

knowledge to help learners learn their psychomotor skills effectively. In coursework, where psychomotor skills play an essential role, moving to an online learning environment removes the opportunity for an in-person demonstration and for students to have hands-on practice with job-specific tools and equipment.

While demonstrations can take place through video instruction, such practices as having the teacher move from student to student and observing physical processes and changes cannot occur online. Depending on the technology in use, the teacher may not be able to inspect the student's work as closely through a video class as the teacher could in an in-person classroom. This remote learning environment can make moving from one skill to the next impossible; following a constructivist progression, the remote learning of psychomotor skills is severely limited because foundational psychomotor skills cannot be practiced and thus not learned, making for a more challenging instructional context. In many cases, psychomotor skills are instructed with a stepped pedagogical approach before acquisition and performance by each student.

The psychomotor domain taxonomy was one process used within the CTAE education process. Since the COVID-19 eruption, many tutors had focused on using such techniques to ensure that learners obtained the required knowledge and skills from the education system. The psychomotor taxonomy focused on characterizing the different behavioral levels from observations to a mastery of physical skill. The taxonomy entailed using physical movements, conditions, and motor skills to learn. Many scholars have developed different psychomotor taxonomies. For example, Bloom, et al., (1956) developed a psychomotor taxonomy with seven significant elements. The critical aspects highlighted entailed origination, adaptation, complex overt responses, mechanisms,

guided response, set, and perceptions. It was from this work that other scholars managed to expound their ideas about the psychomotor domains of the learning process.

Simpson (1972) built a taxonomy-based form of Bloom and other people. Her taxonomies entailed the physical movements coordination and use of motor skills areas. The first element within his taxonomy was perception or translated as awareness. This first element depicted the ability to use the sensory system to guide motor activities through simulation, selections, and translations. Some of the keywords entailed detection and selection. The second element was set. With set, student needed to use mental, physical, and emotional aspects for learners to determine a person's response to different situations. The third element was guided responses. This was the initial learning process that involved imitation and trial and error. Simpson's (1972) fourth element was a mechanism that determined proficiency, which depicted the confidence and proficiency gained after the learning process. The fifth element was complex overt response. This level of psychomotor development entailed a tactical performance of the motor activities. Proficiency in this area was guided by quick, accurate, and highly coordinated performances. The sixth level was adaptation. At this level, the skills were well developed such that students could change the patterns to meet various requirements. The highest level was origination which entailed the development of new movements to fit a situation or address a given problem. All these processes were essential to the CTAE psychomotor learning process.

The Simpson (1972) taxonomy was built from other scholars, including Dave's (1970) postulation. Dave (1970) developed a five-element taxonomy with imitation as the first element. Imitation was simply observing and copying what other people did. Another element was manipulation which dictated being guided to perform skills. The

third aspect was precisions that demand accuracy, proportion, and exactness of skills without any source. The fourth aspect under the Dave taxonomy was an articulation that demanded combining two or more skills sequentially. The last element was naturalization, which had two or more combined skills performed consistently without difficulties.

Moreover, Simpson (1972) adopted the Harrow (1972) taxonomy postulation. Harrow (1972), in his taxonomy, alluded to six significant elements: reflect movement, fundamental movement, and perceptual. The taxonomy also had physical activities such as thinking, skilled movements, and non-discursive communication, including body language. From the above-listed scholars, the psychomotor taxonomy could be generalized into four significant aspects, including observing, which entailed actively attending a physical event like a student watching a movie or another person's activities. Another element was imitation, which entailed replicating other words, including physical behavior. With imitation, the person must first learn the skills, and then the learner is directed on what to do with the learned movements. The third element was practicing. Practicing was repeating a given activity until the student gained the stipulated skills. The last element within this psychomotor taxonomy was adapting. After observing, imitating, and practicing the learned activities, the student could make minor adjustments and adapt to the activities perfectly.

Changing CTAE Instructional Methods During COVID-19

CTAE incorporated the core academics with occupational and technical skills and equipped the next generation of learners for post-secondary education or enter the workforce. According to Stribling (2021), CTAE helped students to achieve a successful entry into the labor market and made them competitive by equipping them with viable

occupational skills. CTAE remains dedicated to ensuring students were appropriately prepared for the 21st-century labor market by providing high-quality educational opportunities for supporting the economy (Stribling, 2021). CTAE provided knowledge, tools, and resources necessary, assisting students to make career-related decisions. An educated workforce became aligned with the labor requirements to ensure production was improved. The COVID-19 pandemic dramatically affected how teaching in the CTAE secondary institutions occurred (Townsley, 2020). For example, implemented social distancing measures led to changes in classrooms within the CTAE secondary institutions, some of which included greater distances between desks, plastic shields between desks, mask mandates for students and teachers, all of which impacted face-to-face interaction and could have had negative impact on child mental health (Clemens, et al., 2020). CTAE focused on making sure students developed real-world skills which are in high demand applicable in career fields some of which involved significant levels of in-person interaction. Hence, the pandemic had an adverse effect on their ability to gain real-world skills due to the limited interactions in the area (Dunn, 2020; Zhang, 2020). Indeed, many CTAE secondary institutions were closed to allow students to maintain social distance.

The transition from in-person learning to distance learning throughout learning institutions created the need for CTAE secondary teachers to develop new ways to deliver education. Mercier, et al., (2021) noted that the professional development that had been of great focus among the CTAE secondary teachers included using accessibility features and practices. The professional development opportunities for the CTAE secondary teachers had been platform-specific, as the various online platforms used in distance learning had differences in terms of teacher interface and student access. The full

utilization of the unique features of the online platforms enhanced student engagement and improved human capital (Koçoglu & Tekdal, 2020). According to Dunn (2020), additional training, especially on synchronous online platforms, used to deliver instruction that allowed real-time interaction through distance learning technology, was required during the COVID-19 pandemic. This training was designed to maximize efficiency of instruction during a time when students and teachers could not physically meet in person.

The face of education and the platforms utilized had changed because of the COVID-19 pandemic. CTAE secondary teachers adapted hands-on instruction in remote teaching formats, maximizing student engagement in experiential learning even when in-person meetings were not possible (Wahyuni, et al., 2021). The instructional methods in secondary schools could continue embracing synchronous virtual platforms even after the pandemic. The virtual platforms provided professional development and student learning opportunities.

Despite the severe disruptions in the way secondary schools were being operated, Zhang (2020) noted that the leaders in secondary schools put in place new instructional methods that could help ensure learning continued during the pandemic. CTAE secondary teachers helped develop alternative approaches that could allow them to continue teaching as students could not attend school. These methods were crucial in ensuring that teachers and students were in a safe environment that could help them avoid contracting the virus.

CTAE secondary teachers and students did not have enough access to the internet and digital devices necessary to promote learning during the pandemic (Turner, 2022). Therefore, the US government had to develop effective online education platforms to

focus on alternative methods to ensure learning continued in secondary schools. Mercier, et al., (2021) argued that selecting online educational resources involved vital stakeholders such as CTAE secondary teachers, parents, and students. The leadership in the CTAE secondary schools played a crucial role in ensuring the successful implementation of the online learning platforms. This was because it was through the school leadership that the key stakeholders were engaged in coming up with the best alternative method that could help ensure learning continued in the secondary schools (Barbour, et al., 2020). For example, CTAE secondary teachers, students, and parents were engaged in determining the best instructional methods that could ensure learning in secondary schools continued during the COVID-19 pandemic—designing the instructional procedures for ensuring education continuity in secondary schools involved consideration of the needed educational materials (UNESCO, 2020). Thus, leadership played an essential role in ensuring that the students, CTAE secondary teachers, and parents could implement online education in secondary schools (Jelińska & Paradowski, 2021). This strategy helped mitigate possible resistance to change from the responses made in secondary schools during the COVID-19 pandemic as they shifted to the online learning environment.

The COVID-19 pandemic disrupted learning in CTAE secondary schools, where the teachers had to develop new ways of teaching. The change management in the CTAE secondary schools was not easy as there was a need for an immediate response to the pandemic (Koçoglu & Tekdal, 2020). CTAE secondary schools engaged the stakeholders to help identify online educational resources helpful in supporting continuity of education during the pandemic. For example, education administrators and experts were asked to analyze the educational resources used in facilitating online learning (Mercier, et al.,

2021). This study helped ensure that the quality of education was not compromised as teaching and learning were taking place online during the pandemic.

The curriculum resources that the stakeholders wanted to decide about include learning videos, lessons, and the interactive learning modules necessary for supporting students to acquire skills and knowledge as they learned online. In addition, professional development resources were required for the CTAE secondary schools to help teachers guide learners (Juarez & Critchfield, 2021). The CTAE secondary teachers had the role of supporting students to learn independently in their homes. The students needed proper guidance to adapt to the online learning environment that was part of the changes in secondary schools during the pandemic. As a result, the parents and CTAE secondary teachers had a role to play in helping students learn remotely.

Online learning in secondary schools was made possible by maintaining proper connections among parents, educators, and students. According to Morgan (2020), the relationships among parents, educators, and students helped ensure that the implementation of online education was effective. Communication among the stakeholders involved in online learning performance was crucial in ensuring the successful implementation of education policies.

Teachers embraced video conferencing in secondary schools to facilitate synchronous learning where it took place in real-time. According to Rouadi and Anouti (2020), secondary students usually developed a sense of collaboration with synchronous learning as they became engaged through social interactions online. The ability of secondary students to interact online with their teachers and other learners on a regular basis helped to establish a sense of comfort and normalcy. Teachers in secondary schools were able to reach students using digital platforms. For example, during the COVID-19

pandemic, teachers used such meeting platforms as Microsoft Teams in interacting with the students online. Ferri, et al., (2020) noted that the teachers had enlisted the students in deciding the best digital platform to facilitate online education. This outreach could entail understanding the unique features linked to different digital media and the skills needed by the teachers and students. The ability of the teachers to integrate the various components of the digital platforms was crucial in ensuring the successful implementation of the online (Ferri, et al., 2020).

The instructional methods of the CTAE secondary teachers changed during the COVID-19 pandemic to adjust to the new guidelines put in place to control the spread of the virus (Koçoglu & Tekdal, 2020). According to Jelińska and Paradowski (2021), the rules during the pandemic made CTAE teachers embrace online learning as the new instructional method. The primary concerns for the online learning environment included the lack of advanced training for the students before moving to distance learning. The adjustment of the CTAE teachers to the new instructional methods involved challenges such as the readiness to utilize synchronous learning tools available in the schools. According to Barbour, et al., (2020), helping the students adjust to the online learning environment was difficult due to the lack of resources and skills necessary for facilitating distance learning.

The COVID-19 pandemic forced the CTAE secondary teachers to embrace online learning without advanced training. Many secondary schools lacked the necessary resources to fully support and implement the online learning environment (Turner, 2022). The duration for adjustment was short, making it inadequate to safeguard the trained CTAE secondary teachers. CTAE secondary teachers rapidly adjusted their instructional methods to embrace virtual platforms during the COVID-19 pandemic. According to

Townsley (2020), online-based learning in secondary schools experienced issues like limited technological capabilities and inadequate CTAE secondary teacher preparedness. CTAE secondary teachers tried to tackle the technology issues and fix access difficulties on calls to facilitate online learning on such platforms as Zoom, Google Meet, and Microsoft Teams. The online instructional platforms needed technical skills and resources to ensure remote teaching was possible in secondary schools (Juarez & Critchfield, 2021). One consequence of the need to gain these skills was the expansion of educational opportunities and the ability of CTAE secondary teachers to respond to health emergencies and natural disasters.

Many of the changes that resulted through the implementation of synchronous distance learning were positive. A study conducted by Townsley (2020) revealed that as CTAE secondary teachers increased their knowledge, their productivity increased (Thuda, et al., 2019). For example, CTAE secondary teachers acquired skills necessary for embracing new technologies in teaching students, hence improving their productivity. Human capital theory described the importance of individuals increasing their productivity through gaining competitive skills and knowledge (Langelett, 2002).

During the COVID-19 pandemic, the CTAE secondary teachers were forced to train on the best ways of teaching new technologies, creating the need to change their instructional methods. Jelińska and Paradowski (2021) noted that, with respect to the effectiveness of the instructional delivery format, CTAE secondary teachers had continued improving their professional development through the opportunities associated with the use of new technologies. Implementing a virtual learning environment had expanded opportunities for learning as new ways of online interactions among students were discovered. The implementation of such platforms as Google Meet increased the

teaching effectiveness and productivity of the CTAE secondary teachers (Lindner, et al., 2020). The CTAE secondary schools had invested in virtual learning platforms to ensure that the virus was controlled among the students and teachers. This situation created room for human capital development through enhancing the distance education system and achieving effective delivery.

The CTAE secondary teachers during the pandemic needed an understanding of new technologies and instructional methods that were best suited for students. The instructional materials required for all students helped determine the best instructional method used in their courses (Singh, et al., 2021).

The response of secondary schools to the pandemic was different depending on the availability of the needed resources and skills. According to Tomasik, et al., (2021), some educators managed to respond to the pandemic effectively by facilitating teaching remotely, while others could not respond effectively due to the lack of proper internet access and training. CTAE secondary teachers faced modifications or cancellations of school activities and events as the COVID-19 pandemic changed operations in schools. Barbour, et al., (2020) noted that the teaching practices of the CTAE secondary teachers changed to help comply with the COVID-19 regulations that were put in place by the government. Many CTAE secondary teachers experienced job dissatisfaction due to the changes in teaching practices as schools responded to the pandemic. Job dissatisfaction could be attributed to the loss of essential components such as face-to-face instructions and hands-on learning (Yean, et al., 2022). According to Lengyel (2020), the hands-on education nature of CTAE secondary classes was challenged by the shift to remote teaching. CTAE secondary teachers experienced difficulties monitoring the students'

learning progress during the pandemic. However, the CTAE secondary teachers slowly adapted to the new instructional methods embraced to facilitate remote learning.

CTAE secondary teachers also experienced personal distress during the pandemic, as supporting the emotional needs of the students was challenging. According to Conrad (2021), the ability of the CTAE secondary teachers to adapt to the pandemic was highly influenced by the support of the administrators and government, among other relevant stakeholders. When it came to helping students deal with their emotional needs, administrative support often took the form of providing online-friendly versions of social-emotional learning (SEL) lessons, while many teachers used individual conferencing to follow up with students (Conrad, 2021).

Remote instructions embraced by CTAE secondary teachers necessitated training on the new technologies appropriate for facilitating learning (Wahyuni, et al., 2021). The online instructions embraced by CTAE secondary teachers during the pandemic led to frustrations as student motivation to embrace online learning was a struggle (Lindner, et al., 2020).

Tomasik, et al., (2021) noted that CTAE secondary teachers faced challenges in effectively communicating with the students who could not access the internet routinely. They were expected to communicate and connect with the learners to support online learning during the pandemic.

During the COVID-19 pandemic, CTAE secondary teachers encountered communication barriers when communicating with students because classroom learning was not possible. Such barriers as insufficient Internet bandwidth, a lack of adult supervision in the home, and expectations placed on secondary students to supervise their younger siblings in addition to pursuing their own studies all played a role. The teachers

engaged the parents to ensure that the students could participate in online learning (Daher & Shahbari, 2020). Internet connectivity issues limited the ability of the CTAE secondary teachers to share information with the students. However, through coordination with the relevant stakeholders, remote learning was successful in many secondary schools.

Education's Delivery Platforms During the Pandemic

Google Meet, Zoom, and Microsoft Teams were among the education delivery platforms commonly used in secondary schools during the COVID-19 pandemic. According to Conrad (2021), Google Meet was the video communication service developed by Google to facilitate online learning and to replace Google Hangouts. The platform contained essential features that helped facilitate online learning during the pandemic. For example, Google Meet provided multi-way video and audio calls with call encryptions between the users. These features helped CTAE secondary teachers ensure that learning continued during the pandemic (Olszewska, 2021). In addition, the ability to join meetings, primarily through web browsers, integration with Google Contacts and Google Calendar made online learning a possibility. CTAE secondary teachers who used Google Meet found it helpful in improving teaching and learning experiences during the pandemic (Souheyla, 2022). For example, Google Meet had screen-sharing features that helped present documents, presentations, and spreadsheets. According to Lengyel (2020), Google Meet embraced proprietary protocols for data trans-coding, audio, and video. This feature helped CTAE secondary teachers ensure that education quality was improved despite the disruptions brought by the COVID-19 pandemic (Souheyla, 2022).

In addition, CTAE secondary teachers used Zoom as one of the delivery platforms during the COVID-19 pandemic. Zoom involved a teleconferencing software program that Zoom Video Communications developed to facilitate distance education and remote

work. According to Conrad (2021), Zoom could allow over 100 concurrent participants with a time restriction of around 40 minutes. As an instructional method among the CTAE secondary teachers, using Zoom experienced skill gaps such as removing unwanted participants, polling, and breakout rooms. The majority of the CTAE secondary teachers showed low competence, especially in the utilization of accessibility features that were being provided by the PowerPoint applications and Microsoft Word (Alhat, 2020). As a result, these teachers underwent training on teaching students using the new technologies. For example, CTAE secondary teachers were trained on using advanced levels of WebEx features and Zoom to ensure learning in CTAE secondary institutions continued. During the pandemic, Zoom users increased as knowledge went online, where teachers and students started embracing distance learning (Ingraham, et al., 2021). Zoom Cloud Meetings helped CTAE secondary teachers ensure that they followed the students' learning progress during the COVID-19 pandemic (Adipat, 2021).

Many CTAE secondary teachers preferred using Zoom to facilitate learning during the pandemic due to its unique features. According to Lengyel (2020), Zoom was compatible with macOS, Android, Linux, Chrome OS, and iOS. Zoom's simple usability and interface made it standard in many online learning environments. Zoom's features preferred among many CTAE secondary teachers included group video conferences, one-on-one meetings, browser extensions, meeting recording abilities, and screen sharing. The CTAE secondary teachers who used Zoom as the education delivery platform were able to increase online interactions with the students (Souheyla, 2022). CTAE secondary teachers could see the students when using Zoom on their computer screens at once. This feature helped CTAE secondary teachers improve their ability to control learning among the students while learning remotely (de Vries, 2021). Luke (2021) argued that the

security features associated with Zoom, such as password-protected meetings, locked meetings, randomly generated IDs, participant screen sharing, waiting rooms, and the ability to manage disruptive attendees, made the platform effective in facilitating learning during the COVID-19 pandemic, particularly in the area of student and teacher online security (Luke, 2021; Ingraham, et al., 2021) through Zoom, CTAE secondary teachers were able to engage students online to make sure they could monitor the learning progress among different students. For example, CTAE secondary teachers could know the students who were not active or absent during the online classes.

CTAE secondary teachers also used Microsoft Teams during the COVID-19 pandemic as an education delivery platform. Microsoft Teams was a communication platform developed by Microsoft (Palloff & Pratt, 2013). CTAE secondary teachers during the pandemic embraced the unique features of Microsoft Teams and ensured learning continued despite the closure of schools. For example, CTAE secondary teachers could conduct video conferencing to enable understanding to enhance monitoring and the learning process. Raes, et al., (2020) noted that Microsoft Teams allowed CTAE secondary teachers to engage the students through video chats and sharing documents for learning. For example, using Microsoft Teams, CTAE secondary teachers were able to utilize video-based online lessons, allowing the students to learn collaboratively. Alhat (2020) noted that Microsoft Teams integrated other learning tools to enhance remote learning, thus making it easy for educators and teachers to incorporate various online tools. This platform offered online collaboration spaces for CTAE secondary teachers and students to share notes, meetings, chats, and assignments. Teachers also created groups to add student-to-student interaction to the teaching and learning experiences.

CTAE secondary teachers could set assignments and communicate live to the students through Microsoft Teams using the Class Notebook. Microsoft Teams presented features such as SharePoint that enabled automatic storage of the shared files for future reference and learning. According to Sintema (2020), texts made real-time conversations between the CTAE secondary teachers and students possible. Video chat among the users of Microsoft Teams was also available for communicating with the individual student and the entire class. Microsoft Teams was utilized on Android phones and tablets as an online-based platform, making it accessible for students to learn online. It offered classroom tools like assignments making the education delivery platform convenient for online learning during the pandemic (Olszewska, 2021).

The information already in the school system was used when embracing Microsoft Teams to make learning effective. During the COVID-19 pandemic, teachers built their classes manually, and students were added using invite codes. The CTAE secondary teachers could customize the platform set up by adding team pictures, creating channels for group collaboration, and adding apps necessary for enhancing learning like Quizlet (Daher & Shahbari, 2020). Therefore, the new technologies helped CTAE secondary teachers adjust to the COVID-19 pandemic and facilitate online learning.

Video calls became essential in the communication of CTAE secondary teachers during the COVID-19 pandemic. CTAE secondary teachers could embrace video calls to communicate with students and make sure they could monitor the students as they learned. Palloff and Pratt (2013) observed that video instructions were being used to level up the student's understanding. The teachers could post assignment instructions on education delivery platforms to make the necessary adjustments anytime. Alhat (2020) noted that the students during the pandemic could get updates online and communicate to

the teachers using the online platforms. This online platform features assisted schools in implementing distance learning as they complied with the regulations set to assist in controlling the spread of the virus. Luke (2021) noted that the unique online features found in most education learning platforms helped bring classrooms right to the homes of students and teachers. For example, some of the features associated with the education delivery platforms necessary for online learning included assignment sharing abilities, projects sharing, the ability to chat, and online meetings (Olszewska, 2021). CTAE secondary teachers could share assignments with the students before submission, encouraging peer marking. This feature helped students keep their projects and course reading materials in a single, convenient location for access. As a result, during the pandemic, secondary teachers throughout the West chose the education delivery platform that could best meet the learning needs of the school, depending on its online learning features (OECD, 2020).

The virtual classroom solutions were crucial for CTAE secondary teachers to help in the transition to online learning during the pandemic. The online teaching platforms helped CTAE secondary teachers make sure that they followed the students' learning progress remotely. Raes, et al., (2020) noted that teaching in real time was common among CTAE secondary teachers, where students and teachers could be online simultaneously. This made it possible for teachers to actively engage students during online learning. In some cases, CTAE secondary teachers used the teaching platforms to deliver reading materials even when the students were not online. The students could later download the reading materials as well as the instructions provided by the teacher.

Google Classrooms helped CTAE secondary teachers to ensure they shared files with students and collected submissions in an orderly manner (A'Yun, et al., 2021). Luke

(2021) noted that the teachers using Google Classroom could edit and grade documents conveniently using learning management platforms. The effectiveness of learning was improved by the actual interactions of the CTAE secondary teachers and students. Therefore, CTAE secondary teachers embraced the online teaching platforms to develop personal connections with the students during the pandemic (A'Yun, et al., 2021).

Secondary Students' Adaptation to Online Learning

The experiences among the secondary students during the mass adoption of online learning due to the COVID-19 pandemic were different. The secondary students started using digital platforms such as virtual tutoring and video conferencing in the process of supporting online learning. The ability to use digital media determined the students' online learning experiences. Guo, et al., (2020) argued that many students needed training on the best ways to use new technologies to facilitate learning. The teachers engaged the students in determining the best digital platforms to facilitate online learning. Like any change, students' resistance was high, as many were reluctant to embrace the new way of learning online. Hillmayr, et al., (2020) noted that the initial perceptions of remote learning were highly negative among the secondary students as they missed the social interactions they experienced in traditional classrooms. The sudden shift to an online learning environment created some challenges among secondary school students due to the change that was being implemented. Almanthari, et al., (2020) noted that secondary schools implemented online learning to ensure that education continued during the pandemic, but such challenges as loss of interpersonal contact, loss of extracurricular activities, and dealing with intermittent Internet service made the adaptation problematic for many students.

Korkmaz and Toraman (2020) revealed that the rapid and unplanned shift to online learning among secondary students during the pandemic created less than optimal learning experiences. The students needed training before the change to the online learning environment, but there was insufficient time for proper training. Little preparation, lack of exercise, and inadequate bandwidth created negative perceptions among the students towards online learning. According to Dhawan (2020), the secondary students who lacked reliable internet access struggled as they participated in online learning. This inadequacy created a learning gap among the students, as those who did not have the necessary resources to support online learning failed to learn remotely thoroughly.

Moreover, the students in rural areas could not correctly access stable internet connectivity, thus making it a challenge to learn online (Wright, 2021). Baber (2020) argued that secondary students started learning using media organizations as they were straightforward sources of information, often coming to the top of search engines such as Google, but these media sources that had previously supplied some supportive resources were now being tasked with supplying far more and struggled to adapt to the changes that schools were implementing. For example, students could take lessons online through the media, where powerful virtual learning was provided. Hillmayr, et al., (2020) argued that the integration of IT in secondary school education helped move to the online learning environment. This strategy helped students learn remotely at their pace, re-reading, going back, skipping, and accelerating through the learning concepts they chose. For example, secondary students could engage with teachers online to access learning materials and records of the previous lessons through digital platforms.

The shift to the online learning environment in secondary schools was essential for creating effective learning methods during the pandemic's lockdown. According to Adnan and Anwar (2020), secondary schools that made online learning part of the new normal were likely to experience learning benefits. For example, reading materials were made available online through digital platforms. The COVID 19 pandemic forced secondary education systems globally to embrace online learning as an alternative to face-to-face instruction. Online learning and teaching were utilized in secondary schools to allow education to continue during the pandemic. Jena (2020) argued that the critical stakeholders in secondary schools collaborated to make sure that they identified the best online education methods that were effective for online learning.

The effectiveness of online learning was realized by placing digital platforms suited for learning in different schools. Mailizar, et al., (2020) explained that the suitability could be determined based on the skills and resource requirements for the digital solutions used as education delivery tools. The secondary students and teachers required knowledge concerning the use of the learning platforms for distance learning to be effective. As a result, the different digital platforms were used based on the ability of the schools to provide the needed resources and training to teachers and students.

Teachers and parents played essential roles in providing the necessary support for the students to shift entirely to the online learning mechanisms. According to Mulenga and Marbán (2020), education policy interventions in secondary schools were put in place to assist in the move to digital learning. Digital learning during the COVID-19 pandemic proved crucial in reducing social contacts among students. The COVID-19 crisis made it necessary for secondary schools to embrace digital learning and teaching.

Olowo, et al., (2020) observed that online knowledge in secondary schools assisted in making sure that even though schools closed, education continued. Online schooling was an excellent tool for sustaining skills, and knowledge developed during school closures. However, the unique demands posed by online learning made it challenging for students and teachers to adapt.

Education administrators developed policies to support teachers and students in effectively embracing an online learning environment. The OECD (2021) wrote that it was important to encourage enterprises that provided educational technology to open up their resources to the public, to vary their distribution methods according on audience and capability, and to promote teacher cooperation. While post-secondary schools were accustomed to offering courses online, and had access to a wealth of internet resources, this was less consistently true in primary and secondary education (OECD, 2021). According to Basilaia and Kvavadze,(2020), creating strong positive attitudes among students toward online learning was crucial in overcoming challenges related to distance learning. For example, the students could stay focused to shift to the online learning environment through positive attitudes. The parents and teachers needed to ensure that the secondary students had sufficient motivation to learn using digital platforms.

Mailizar, et al., (2020) revealed that the secondary students needed support to learn the best ways of using communication technologies for learning online. Intrinsic motivation and self-regulation among the students were necessary to ensure that they could fully understand online. The students' support from their teachers and families influenced their attitudes as learning went online. For example, teacher enthusiasm and parental emotional consent were crucial in ensuring students were supported in distance learning. According to Guo, et al., (2020), parents struggled to ensure their students kept

up with their schooling during the pandemic because they lacked sufficient digital skills to use the new technologies needed in online education. In addition, curricular guidelines were lacking as secondary schools shifted to online learning environments. The education experts and policymakers focused on developing education systems that strengthened the engagement between the parents and schools. This effort was focused on improving information sharing and guidance to teachers and parents on the best ways of supporting students.

Jena (2020) proposed that using the needed digital resources and promoting online teaching practices supported online learning in secondary schools. Many education systems had adopted online learning on unprecedented scales using a range of digital platforms (OECD, 2021). Korkmaz and Toraman (2020) noted that the primary concern was that learning online was mainly possible for students who could access broadband connections in their homes. The private sector network operators helped ensure stable internet connections during the pandemic to support online education. The school leadership and governments incorporated online skills that could facilitate instruction activities. These actions involved providing teachers with instructional tools and methods to provide the necessary motivation and guidance for active learning in secondary schools. Pedagogical practices used by teachers in secondary schools embraced digital technologies that corresponded to the needs of the learners. Baber (2020) revealed that the teachers were usually expected to guide students to assist them in remaining focused on successfully learning online. The guidance provided by the teachers to students was crucial in enhancing the students' attitudes towards embracing new technologies to continue learning remotely. Active learning could be possible through developing motivations for online education.

Positive attitudes towards using new technologies in learning were crucial drivers for secondary students to improve their performance in online education. The online education environment needed to convey the appropriate enthusiasm toward helping students adopt distance learning. According to Morgan (2020), enthusiastic teachers were likely to instill positive experiences in secondary students to enhance academic performance. The parents and teachers ensured the secondary students followed the set curriculum to achieve the set educational goals. As a result, familiarity with online learning and the reading materials was crucial for parents and teachers to provide the needed assistance and support to the students. Hillmayr, et al., (2020) noted that parents were essential in assisting secondary students benefit from digital learning and teachers.

This instructional strategy required setting clear goals to assess the level of understanding among the students' using lessons offered online. The teachers needed to work with the parents to ensure students were provided with the appropriate environment to help them switch to online education. According to Mailizar, et al., (2020), secondary students required assistance to understand the optimal methods for utilizing communication technology in online learning. To ensure that they could fully comprehend online, it was vital for the pupils to have intrinsic desire and self-control. As learning moved online, the children's perspectives were influenced by the support of their family and teachers. As an illustration, teacher excitement and emotional support from parents were essential in ensuring that children were supported in remote learning. Guo, et al., (2020) claimed that parents found it difficult to keep up with their children's academic progress during the epidemic because they lacked the digital literacy necessary to use the cutting-edge tools required for online learning. Furthermore, as secondary schools moved to online learning settings, there were no curricula. Education experts and

policymakers had concentrated on creating educational systems that could increase parental involvement in schools. The improvement of information sharing, and advice provided to teachers and parents on the best ways to support pupils had been the main goal of this work (Guo, et al., 2020).

Educational administrators provided relevant information to key stakeholders like parents and teachers on the best ways to support students learning online. For example, during the COVID-19 pandemic, collaboration among the key stakeholders was critical to helping the secondary students learn online. According to Verawardina, et al., (2020), the federal government provided resources to develop creativity, critical thinking, and technical and disciplinary skills. In addition, low-income families were provided with the required financial help to purchase digital devices that enabled access to online learning. As aforementioned, Mailizar, et al., (2020) noted that education systems focused on creating proper engagement between teachers and parents to provide appropriate guidance to the students. Secondary students required immediate support to adapt to the online teaching practices embraced in distance learning. Learning the technologies, Olowo, et al., (2020) proposed that ambitions among secondary students were crucial drivers for improving educational performance in a manner that was effective. The teachers ensure that the students have ambitions and positive attitudes toward online learning. They encourage active learning among students and ensure all learners are making progress in online learning (Turnbull, et al., 2021).

Digital education advisers helped in providing advice concerning the best digital platforms that could effectively facilitate online learning in secondary schools. According to a study conducted by Morgan (2020), the shift from face-to-face learning to distance learning required the collaboration of all stakeholders in the education system. For

example, education advisers on digital learning supported school principals and teachers by training them on various education delivery platforms. This training was crucial in making important decisions concerning the appropriate resources that could help ensure high-quality education in secondary schools utilizing online learning.

Almanthari, et al., (2020) argued that new technologies were crucial in facilitating online learning in secondary schools as students relied on the internet, media, and digital platforms to learn. For example, homeschooling broadcasts primarily on social networks and broadcast and cable television helped implement online learning. Infrastructure was expanded to assist teachers and students in embracing online technologies and tools in education According to Priyadarshini and Bhaumik (2020), new technologies helped in giving personal connections by enhancing communications among the students and teachers.

The Pandemic and the Shift in Learning

The impact of this shift was immense in terms of the number of students affected. A study conducted by Kar, et al., (2021) revealed that in 2021, approximately 825 million learners in the U. S. were impacted academically due to the COVID-19 regulations like social distancing that were being implemented. Since 2020, countries launched countrywide closures of in-person instruction in schools to help control the spread of the COVID-19 virus (Nicola, et al., 2020). In addition, numerous countries implemented local closures affecting approximately 47% of the student population internationally (Kuhfeld, et al., 2020). A study conducted by Mukhtar, et al., (2020) indicated that in the year 2020, educational institutions, including secondary schools, went to online learning, and the teachers embraced these methods to ensure students could learn while at their homes. The

authors noted that educational administrators also worked towards Internet-supported solutions that could facilitate education during the pandemic.

Kar, et al., (2021) argued that apart from affecting families, secondary school teachers, and students, the closure of schools and early childhood education and care facilities led to far-reaching societal and economic impacts while highlighting multiple issues. For instance, attempts to address internet connectivity, digital learning, and student debt have brought additional attention to homelessness, food insecurity, housing, healthcare, childcare, and access to disability services. The effects of the COVID-19 pandemic were more adverse for the disadvantaged families and children, leading to considerable economic expense, childcare problems, compromised nutrition, and interrupted learning among this group. Mukhtar, et al., (2020) stated that due to school closures, the utilization of online platforms, open educational applications, and distance learning programs had been recommended by UNESCO to enable teachers and schools to minimize the disruption of learning to reach students remotely. Krishnaratne, et al., (2020) noted that there remained a need for a coordinated and considerable international effort to navigate the impacts of the COVID-19 pandemic effectively.

Nicola, et al., (2020) conducted a study revealing that the changes introduced in the new normal required searching for further training and education strategies and new ways to live and work. For example, some of the ways different aspects attributed to CTAE secondary education were affected include a higher attention level to the well-being needs of secondary school learners and rapid changes in digital skills needed to teach via the internet.

In addition, secondary school teachers were greatly affected by the COVID-19 pandemic (Omang & Angioha, 2021). A study conducted by Omang and Angioha (2021)

revealed that the COVID-19 pandemic crisis had interfered with education systems, impacting almost 1.6 billion students on different continents. Kuhfeld, et al., (2020) noted that in the middle and lower-income nations, the closure of learning institutions had affected almost 99% of the student population. As a result, the pandemic exacerbated the prevailing education disparities by minimizing the educational opportunities for many of the most vulnerable adults, youth, and children, especially the displaced people, disabled people, refugees, and those living in rural or rural poor areas.

International Impacts

Kuhfeld, et al., (2020) stated that the COVID-19 pandemic had a devastating impact on CTAE secondary school teachers. The CTAE teachers experienced challenges in the digital skills and technologies necessary for implementing online teaching and learning. The study conducted by Kuhfeld, et al., (2020) revealed that CTAE teachers were forced to embrace new strategies as they switched to the online learning environment. The changes witnessed in secondary education, however, went beyond the methodology. These changes had significant implications globally as they transformed the overall educational system by altering the instructional methods used by CTAE teachers (Psacharopoulos, et al., 2020).

IT technologies were being integrated to help CTAE teachers facilitate learning during the pandemic while helping curb the virus's spread. Nicola, et al., (2020) observed that different changes affected the teaching profession, requiring educators to adapt effectively to the new normal. For instance, due to the pandemic, teachers needed to effectively utilize ICT tools in their teaching and learning process (Omang & Angioha, 2021). Therefore, secondary school teachers needed to undergo training to understand

different ways of utilizing information and communication technologies effectively, leading to new teaching styles.

Psacharopoulos, et al., (2020) found that secondary school teachers were responsible for putting in place distance learning modalities, even without adequate resources, training, or guidance. In several contexts, the professional development of secondary school teachers had shifted online through video and telephone applications. Yet, marginalized teachers lacked the necessary support in their professional development.

Internationally, most secondary school teachers were unprepared to adapt well to the new teaching methods and support student learning in the new normal. A study conducted by Syauqi, et al., (2020) revealed that around 64% of the secondary teachers had acquired minimum training that infrequently included essential digital skills. Even in areas with sufficient connectivity and infrastructure, many educators did not have basic ICT skills. This reality implied they were likely to struggle with their professional development to promote distance learning. In an article published by Oxford University, "Addressing the Digital Divide" (Cullen, 2001) the author showed that the move to online education was not an international success, and that those from disadvantaged homes suffered disproportionately. Even "beacon areas" encountered difficulties; according to a Proceedings of the National Academy of Sciences of the United States of America (PNAS) poll, the Netherlands, which only had a brief eight-week lock-down and had the most equitable system of school funding in the world, suffered a learning loss of nearly one-fifth of a school year (Cullen, 2001). In addition to making little to no progress during those eight weeks of independent study, students from disadvantaged homes had losses in learning that were 60% higher than those from better educated

homes (Cullen, 2001). These factors considered; the implication was that teachers were lacking professional preparation to deliver the requirements. This point was reinforced by Mueller, et al., (2020) who noted how the COVID-19 Pandemic drew attention toward the initial training of teachers in delivering technology.

Syauqi, et al., (2020) revealed that psychological support had been incorporated into contingency guides, manuals, and plans for local teachers and associations. For secondary school teachers to adequately satisfy the students' needs, they required psychological support. Therefore, without providing secondary school teachers with the necessary psychological support, their strain could result in educator burnout, leading to high absenteeism rates or even causing some teachers to resign, which dramatically undermined school resilience (Omang & Angioha, 2021).

Lestari and Gunawan (2020), argued that the COVID-19 pandemic led to significant socioeconomic disruptions; hence education systems in different nations were forced to respond and adapt effectively to the new normal. For instance, some governments had quick responses to ensuring continuity of education and safeguarding the educators and learners by closing learning institutions. On the other hand, Mueller, et al., (2020) observed that there was a possibility for the unequal offering of learning modalities to create long-term inequities during the school closures. During this period, the primary focus of governments across the globe was facilitating learning continuity, whereby CTAE secondary school teachers were required to shift from face-to-face teaching to online teaching. As a result, CTAE teachers had adapted to the online learning environment despite the challenges faced, such as inadequate digital skills and resources for implementing online education (Keeling, et al., 2021). Some of the

significant problems experienced by teachers included a lack of technical skills, absence of support in teleworking, unclear instructions, and many bureaucratic tasks.

Kaden (2020) reported that the challenges encountered by secondary school teachers included:

- the complex home environment
- absence of teacher training
- information gap
- poor infrastructure for online teaching

Furthermore, the author noted a regional tendency for some teaching modalities. In the regions with low Internet connectivity, governments applied the traditional learning modalities and sometimes a mix of print materials, radio programming, and educational television. The areas with high Internet connectivity could use educational television and radio programming in online education. Unfortunately, only a few nations monitored the efficient utilization of distance learning modalities. According to Kidd and Murray, (2020), distance learning covered below 50% of learners in low-income nations but almost 80% in high-income countries. This variation was mainly brought about by the digital divide, in which the disadvantaged societies had low digital literacy levels among teachers, parents, and learners. In addition, according to Keeling, et al., (2021), poor teachers and students had limited access to essential household services like electricity and technology infrastructure.

Approaches to assessment also changed because of the pandemic. Due to the changes brought about by school closures, conventional methods of evaluating students had been significantly disrupted in favor of online assessment models. For example, alternative modalities like online testing replaced continuous evaluations in several

nations. Kidd and Murray (2020) revealed that the progress of CTAE secondary school learners might be monitored in different ways, such as performance statistics, tracking usage, and mobile phone surveys based on the learning apps and platforms. Learning gaps also were identified by implementing appropriate learning evaluations. Kaden (2020) noted the CTAE, and technical apprenticeship schemes and the work-based learning institutions could be modified for distance learning.

Many higher learning institutions had taken distance learning as a chance to expand and made their learning modalities more flexible. Lestari and Gunawan, (2020) reported that due to the exceptional situation brought about by the COVID-19 pandemic, many schools in different nations had been closed. Even though the governments had facilitated the remote training of learners, the teaching staff needed practical training to impart the necessary skills of utilizing various technological tools in teaching students in the new normal.

Teaching of Psychomotor Knowledge and Skills During the Pandemic

Much of the research in this area was undertaken within health studies, making further research for this something valuable in educational studies. A journal search on this theme showed that medical practice had been the central area for papers such as Seymour-Walsh, et al., (2020). The research for schools needs to be focused on the education of children. This lack of research became clear when the research directed on education was often focused on higher education. There were very few sources relating to secondary schools. Future research points toward the need for the case that instructors and course designers could advance psychomotor skill instruction while working virtually.

Psychomotor learning was the formation of structured muscle patterns influenced by environmental cues. Driving a car and activities requiring eye-hand coordination, such as stitching, tossing a ball, typing, using a lathe, and playing the trombone, were behavioral examples. They were investigated as specialized issues in the experimental psychology of human learning and performance and were also known as sensorimotor and perceptual-motor skills. Particular focus was placed on the learning of coordinated movement involving the arms, hands, fingers, and feet in research on psychomotor abilities (verbal processes are not emphasized) (Noble & Giebler, 2020).

Training schedules in postsecondary, in-service, and approved professional courses reflected the undeniable fact that psychomotor skills were simpler to teach and acquire face-to-face (Seymour-Walsh, et al., 2020). Thus, in situations of social exclusion and physical isolation, this feature of Health and Physical Education (HPE) is significantly at risk. A face-to-face skill session was only one technique to develop the complementary parts of learning and performing new skills because psychomotor skills were far more complicated than the physical motor outputs alone might imply (Seymour-Walsh, et al., 2020).

The incremental growth of mastery, whereby the learner advances to a subject that used prior knowledge as a foundation, was reflected in Vygotsky's zone of proximal development *(ZPD)* (Vygotsky, 1978). In this area of proximal development, the subject was engaging enough to keep students from getting bored but not so advanced as to overwhelm their brains (1978). Online media presented unique problems for this to occur. Do the students enter the ZPD in an online development, for example, was a key point. Whether the learner could learn a physical skill online was even more open to question, where there was no excuse for the activity itself. To implement Vygotsky's principle,

online media should lead a student through a developmental process step-by-step, allowing them to continuously reflect, create new meaning for themselves, include modifications, and reorganize previously held assumptions and lessons.

During the pandemic, as previously noted, learning media that could meet the demands of learners were used throughout the deployment of remote learning. Teachers therefore had to be able to adapt to the rapidly evolving technology since the online learning process could not be as effective as it could be if the technological growth was not supported by the skill to manage the learning utilizing technology. The attitude and technological proficiency of teachers had an impact on the motivation and learning of the students, particularly for early motor skills that required active learning to maximize the students' growth. Therefore, there were several key features about psychomotor knowledge and skills that made them worthy of research today, post-pandemic.

The lack of current papers looking specifically at psychomotor learning in secondary schools during the pandemic was marked. The research papers that existed and related to those training in medicine were only of passing relevance for those looking at secondary schooling. It was also useful to consider how effectively education could take place outside the traditional classroom Zone of Proximal Development (ZPD) where the student came into close proximity with the “informed other,” the teacher. The wider questions over whether physical skills could be taught without proximity, online, was important in looking at the physical development of children and the pedagogical approaches to this during a crisis such as the pandemic.

Chapter III

METHODOLOGY

The focus of this study was on uncovering the impacts of the COVID-19 pandemic on CTAE teachers' teaching experiences in secondary schools. In particular, the research questions focused on contrasting the degree to which psychomotor skills were taught and the strategies teachers used to teach the skills in face-to-face CTAE classrooms before (RQ1) and during (RQ2) the pandemic. Furthermore, CTAE teachers' recommendations for teaching psychomotor skills via distance technologies were explored (RQ3).

In this chapter, the methodological approach used in this study is described. It begins with identification of the study's research design and methodological premises. Then the sampling and participant recruitment process (identification of the target CTAE career clusters, participant recruitment, survey participants, and focus group interview participants) are explained. After that, the instrumentation, teacher survey (online), teacher focus group interview (online), and pilot tests are discussed, and finally, the data collection, data analysis, and research timeline are reviewed.

Research Design

This descriptive study provides insight into a challenging phenomenon by identifying, soliciting, and engaging secondary school CTAE teachers teaching in their respective CTAE areas before and during the COVID-19 pandemic. This study uses a two-step mixed methods study design. The data gathering begins with the administration of a Likert Scale questionnaire delivered via the internet to inquire about participants' experiences teaching psychomotor skills and to gauge teacher satisfaction with their school district's training, preparation, and support for the forced migration to distance

learning. The results from the survey form the basis for the qualitative data gathering portion of this study, which uses focus groups and personal interviews yielding narrative inquiry and phenomenology that then explore the responses to gain greater insight and answer the research questions. According to Maxwell (2013), qualitative research entailed collecting and analysis of data that was non-numerical such as text, to help understand the participants' experiences. Narrative inquiry made it possible to make the study subjective (Maxwell, 2013). The research study used the subjectivity of qualitative research to provide specific information about teaching experiences and attitudes during the pandemic. This data was crucial in understanding the teaching experiences of CTAE secondary school teachers.

This study explored the personal and professional experiences of secondary CTAE teachers before and during the forced migration to remote teaching and learning due to the COVID-19 pandemic. As such, this study partially used a narrative inquiry genre, which was the appropriate approach as it allowed participants to reflect deeply and in meaningful ways. Creswell (2012) identified a defining characteristic of narrative inquiry, which was its ability to "explore an educational research problem by understanding the experiences of an individual" (p. 505). This study referenced the COVID-19 pandemic as the phenomenon or catalyst for the mass scholastic migration to remote learning and used it as a reference point.

This study constructed an understanding of the effects of this phenomenon through in-depth interviews with multiple individuals. Through these narratives, this researcher was able to gain insight into the teachers' rationales and strategies in a way that were insightful. According to Wang and Geale (2015), narrative inquiry was first

used by Connelly and Clandinin (2000) as a methodology to describe the personal stories of teachers.

In the *British Journal of Applied Science & Technology,* Joshi, et al., (2015) stated, “Likert scale is applied as one of the most fundamental and frequently used psychometric tools in educational and social sciences research” (p. 1). Once ascertained through quantitative analysis of the data from the questionnaires, the primary or most common points of concern were used to structure focus group questions that allowed each participant to fully express his/her opinions and ideas about his/her pandemic-related experiences. The narrative inquiry made it possible for this researcher to make a portion of the study subjective, where its findings were presented in a non-numerical format (Maxwell, 2013). Furthermore, a narrative inquiry helped to understand any changes in the teachers' attitudes toward teaching post-COVID-19 pandemic because they expressed changes themselves. This insight was vital in understanding and preparing teachers new to CTAE in secondary school. Administrators gained insight into the teachers’ rationales and differing strategies through these narratives.

Methodological Premises

Narrative inquiry, based upon preliminary survey data, was the best way to further explore the attitudes and beliefs held by these experienced CTAE teachers. By providing these veteran CTAE teachers an opportunity to openly share experiences in the unrestrictive verbal format of storytelling, they realized or recalled information that could benefit all. Narrative inquiry provided valuable insights into relevant situations that involved affective relational aspects (Thompson & Campbell, 2010). Taking the time to go into the depths provided by narrative inquiry allows for a more complete exploration of the questions under study.

Sampling and Participants

Purposive sampling was used in this study to identify and recruit teacher participants. According to Otzen and Manterola (2017), using purposive sampling allowed researchers to judge the selection of the participants in a study. Areas of CTAE programs with a higher chance of psychomotor learning opportunities were identified. Then, teacher participants were recruited from the four largest public-school districts in the State of Georgia. The sampling process is detailed below.

Identification of the Target CTAE Career Clusters

According to the State of Georgia's Department of Education website, CTAE programs in public secondary schools are divided into 17 Career Clusters. Career Clusters are occupational groupings based on required skills and shared knowledge used in specific careers. For example, the Information Technology Career Cluster includes pathways for Computer Science, Game Design, Programming, Cybersecurity and eight other computer related fields of study. The Agriculture, Food, and Natural Resources Career Cluster includes pathways for Veterinary Science, Food Animal Systems, Forest Mechanical Systems, Environmental Agricultural Science, Commercial Fishing Management and 30 other nature related fields of study.

In secondary schools, a pathway consists of three courses, to be taken in sequence, that are arranged to give more in-depth knowledge about a student's specific area of interest. For example, the Architecture and Construction pathway included 13 fields of study related to building and construction, each with a different three course combination. The Masonry pathway included three courses: Industry Fundamentals and Occupational Safety, Introduction to Construction and Masonry 1. The Welding pathway includes Industry Fundamentals and Occupational Safety, Introduction to Metals and

Welding 1. The Heating, Ventilation, and Air Conditioning (HVAC) Electrical pathway included Industry Fundamentals and Occupational Safety, Introduction to HVAC Systems and Low Voltage Electrical. The GA DOE offered 149 possible pathway options within 17 career clusters.

Since the focus of this study was on the teaching of psychomotor skills, the researcher sought teachers in the six CTAE areas. These subject areas were chosen for two reasons, first, because of the more psychomotor nature of these areas, compared to other CTAE areas such as Entrepreneurship, Business, Accounting, or Computer Science, and secondly, these programs exist at multiple secondary schools within the school districts. Initially, six CTAE Career Clusters of Allied Health and Medicine, Audio Visual Technology and Film, Culinary Arts, Engineering and Technology, and Air Force and Navy Junior ROTC were targeted. Due to similarity in the nature of the content taught, Air Force JROTC and Navy JROTC were combined into one category of JROTC.

Participant Recruitment

According to Quick Facts on Georgia Education 2021-2022 on the Georgia Department of Education's website, in the fall of 2021 there were 530,550 students enrolled in the state of Georgia's public high schools. According to the school district websites for the Metro Atlanta school districts of Cobb, DeKalb, Fulton, and Gwinnett, over 28.95% of this population attended school in one of those four districts. For this reason, the CTAE teachers in those four school districts were selected as the target population for this study. These findings were the results of the tabulation and calculation of the responses from CTAE teachers operating in Metro Atlanta who taught one of five specific subjects within the sample population. The researcher obtained Institutional

Review Board (IRB) approval to electronically distribute surveys and organize focus groups (See Appendix A).

To ensure a sufficient number of teacher participants, CTAE teachers in the four largest public-school districts in Georgia: Gwinnett, Cobb, Fulton, and DeKalb County Schools, were targeted for recruitment for this study. According to Quick Facts on Georgia Education 2021-2022 on the Georgia Department of Education's website, in the fall 2021, the Metro Atlanta school districts of Cobb, DeKalb, Fulton, and Gwinnett accounted for 28.95% of the 530,550 students enrolled in Georgia's high schools.

Table 1

High School Enrollment in Metro Atlanta School Districts Fall 2021

School Districts	9th Graders	10th Graders	11th Graders	12th Graders	Total Enrollment
Atlanta Public Schools	4,314	3,243	3,044	2,693	13,294
Clayton County Schools	4,978	4,082	3,995	3,284	16,339
Cobb County Schools	10,386	8,953	7,921	8,662	35,922
DeKalb County Schools	9,267	6,391	5,808	5,773	27,239
Fulton County Schools	8,319	7,792	7,305	7,136	30,552
Gwinnett County Schools	16,825	15,244	14,219	13,625	59,913

The largest school district in the state of Georgia in terms of student enrollment, Gwinnett County, did not give a total number of teachers, but the other three school districts report a combined total of 20,882 classroom teachers. Of this number 543 CTAE teachers in these four school districts in the previously defined five CTAE areas were contacted via their public email addresses available on the school websites.

Survey Participants

Of the 543 teachers emailed, 26.33%, 143 teachers responded to the survey. Of this group, 80%, 115 teachers completed the survey. All of the respondents who completed the survey did not qualify to participate in the study. To qualify for the study teachers needed to have been certified in any of the six aforementioned areas and teaching in that area before, during and after the pandemic. Of those 115 teachers, 76.52%, 88 teachers, met these criteria, resulting in 16.20% of the target audience. Of the 88 teacher survey participants, 51.13% were men and 48.86% were women. Over half of them were aged 51 or older (51.10%), followed by 20.5% were ages 46 to 50, 10.2% were ages 36 to 40, 8% were ages 41 to 45, 8% were ages 31 to 35, and 2.3% were ages 26 to 30.

Most of them had a master's degree (44.82%) or a bachelor's degree (26.43%). Some had a doctoral or terminal degree (16.09%) or a specialist's degree (12.64%). Moreover, 21.59% had one to three years of experience, 21.59% had four to six years of experience, 20.45% seven to nine years of experience, 19.32% had 10 to 15 years of experience, 5.68% had 16 to 20 years of experience, and 5.68% had 21 to 25 years, and 5.68% had 26 or more years.

Collectively over 73% of these participants had at least a master's degree, over 56% had at least seven years of teaching experience in their particular subject area, and 100% of the participants had pre- and post-pandemic teaching experience in the specified subject area. Taking these facts into consideration, it was believed that this group of participants should have a profound and valuable perspective on the subject and should be able to provide the researcher with great insight. The only foreseeable conflict would be the presence of luddites or technophobes within this group, but that was believed to be unlikely with teachers who focus on psychomotor-heavy subject areas.

The Focus Groups

From September 5th to October 13th, 17 focus group opportunities were held via Zoom and made available to all participants. The first round of seven meetings had a low participation rate. Two sessions had no attendees; two meetings had one attendee, two meetings had two attendees, and one meeting had three attendees. Of these nine attendees, six work in the same school building as the researcher. In addition, two of the researcher's coworkers were responsible for recruiting the other three participants.

To increase participation, a second round of focus groups was held. The second round of sessions consisted of 10 separate meetings held at 4 p.m. and 6 p.m. on five consecutive weekdays, open to all CTAE teachers in any of the five subject areas of the study. No CTAE teachers attended any of the second round of meetings. Despite the low participation, the decision was made to continue the project with the data from the first round of sessions.

As the interviews from the first group of meetings were analyzed, it was discovered that two of the nine participants needed to be certified to teach in their subject areas before the pandemic. Those two participants were disqualified from the study. The first disqualified person was an Audio-Visual Technology teacher who had interviewed alone. That interview was not used. The second disqualified person was an Engineering teacher in a two-person focus group. That person had been a Para-professional (Teaching Assistant) and had become a licensed teacher in the past few months. That person's comments were recorded as part of the transcript but were not used in this study.

In total, the focus group participants included five females and two males. Six participants were 51 years of age or older and one participant was between the ages of 46 to 50. For their educational accomplishments, three had earned a master's degree, two

had earned a bachelor's degree and two were beginning the dissertation phase of their doctorates. For their teaching experience, two had seven to nine years of experience, two had 10 to 15 years of experience, one had four to six years of experience, one had 16 to 20 years of experience and one had 26 or more years.

Instrumentation

Teacher Survey (Online)

The researcher-developed survey included six respondent background questions (e.g., gender, age, highest degree earned, years of teaching), one yes-no filter question (e.g., In your opinion, did the content of the CTAE class you were teaching require primarily psychomotor or hands-on learning?), and fifteen 5-point Likert scale items on CTAE teachers' teaching experiences during the pandemic. (See Appendix B)

Table 2

Summary of Participants

CTAE Area	Survey	Focus Group Interview
Audio Visual Technology and Film*	17	0
Culinary Arts	14	4 (Anne, Karen, Lisa, Betty)
Junior ROTC	15	2 (David, Carl)
Engineering*	32	1 (Susan)
Allied Health and Medicine	10	0
Automotive Maintenance	0	0
Total	88	7

* Had 1 disqualified teacher participant.

These Likert scale items focused on three areas: CTAE teacher perceptions about student abilities during the pandemic (5 items), perceptions about school support during the pandemic (6 items), and perceptions about the online teaching of content that require physical manipulation (4 items – tools, equipment, computers, self). The final survey question focused on recruiting focus group interview participants.

Qualtrics was utilized to administer the survey instrument and to track responses. The 5-point Likert scale ranges from 1) Strongly Disagree, 2) Disagree, 3) Neither Agree nor Disagree, 4) Agree to 5) Strongly Agree was utilized. Babakus and Mangold (1992) reported that using a 5-point Likert scale format reduced the respondent's frustration level, and thereby increased the response rate and the quality of the responses. The survey instrument was pilot tested for its wording, readability, understandability, clearness of directions, and other related concerns by the nine CTAE teachers at the secondary school in which the researcher was employed at the time of this study. The survey results from Qualtrics were collected for descriptive nonparametric data analysis.

Teacher Focus Group Interview (Online)

Patton (2014) describes three types of qualitative interviewing: 1) conversational or informal interviews; 2) semi-structured interviews; and 3) open-ended, or standardized interviews. This study utilized a semi-structured format. This researcher used open-ended semi-structured interview questions to begin the discussions among the participants. (See Focus Group Questions in Appendix C). The semi-structured interview format then allowed the interviewer to probe and explore areas of interest, once identified by the participants. The research participants gave insights about the phenomenon under research that comprised the needed data. In addition, semi-structured interviews enabled the respondents to share their experiences before and during the pandemic (Kakilla, 2021).

During the focus groups, the seven open-ended questions that would be asked were displayed via a shared screen for the duration of the conversation. This was done to give participant time to consider each question before their turn to speak and to hopefully allow each participant to respond freely. Ideally, as each participant answers a question,

their response would initiate an organic conversation with their peers about that topic and allow each participant to give their opinion. The first and second questions, "What was the easiest thing for you to transition to a distance learning platform," and "Which skill was the most difficult for you to transition to a distance learning platform," were intended to get the participants to think deeper and reflect upon and share their experiences teaching a specific topic or skill. The third question, "What was the most difficult aspect of moving your curriculum online," was intended to get the participants to consider their biggest teaching challenge they faced during their pandemic experience. Questions four and five; "How well were your distance learning students able to adequately explain the psychomotor components of your content area without the hands-on experience," and "How do the tactile skillsets of the students who completed the course from a distance, compare to those of the students who completed the course in person," were intended to get the participants to consider the end results of their efforts during the pandemic. Question six, "What do you think should have been done to better prepare teachers for distance learning," was intended to get the participants to reflect on preparation in the event of a reoccurrence of a pandemic level event. The seventh and final question, "Is there anything else you would like to say about your teaching experiences in CATE during the COVID-19 pandemic," was intended to be a catch all question for any topics that may have been overlooked with the original questions. Based on Edmunds (2001) and Krueger (2002), the focus group interview guidelines were developed (See Appendix D).

Data Collection

The data collection procedures were as follows: First, the researcher obtained email addresses for CTAE teachers by reviewing the websites of approximately 70 public

high schools in Cobb County, DeKalb County, Fulton County and Gwinnett County. Then, the study participation solicitation email (See Appendix E) was sent to these addresses with a link to the survey instrument. Teachers were asked to respond within three days. The researcher monitored the response rate and a reminder email was sent to the participants to encourage their participation. A second reminder email was sent, and the deadline extended a week. This process was repeated until a satisfactory number of participants was obtained. Of the 543 teachers contacted, 143 responded to the survey, 115 of those respondents completed the survey and 88 of those teachers qualified to participate in the study.

The last question of the survey asked if the teacher completing the survey was willing to participate in a focus group interview with their peers to discuss their teaching experiences during COVID. Those willing to participate in the focus groups were identified by subject area and contacted by email. Once a specific date and time was selected for each of the focus groups, a group email was sent to the teachers from each subject area notifying them of the scheduling of the focus group. Email reminders were sent until a satisfactory number of focus group interview participants was secured.

A total of five focus group interviews across the five CTAE areas were conducted via Zoom. Ideally, each group would have five to eight members. However, there were a total of seven participants in the focus group interviews despite multiple reminders soliciting participation. Each interview was recorded, and Rev.com's audio transcription service was used to transcribe the interview content verbatim. Participants were thanked by email. (See Appendix F). The four interviews lasted a total of 98 minutes and 40 seconds, with the range being from 12 minutes and 52 seconds to 40 minutes and 27 seconds. The average length for an interview was 24 minutes and 40 seconds.

Table 3

Participant Demographic Information Table

Pseudonym	Gender	Age	Nationality	Current Subject Area	Focus Group	Years of Experience Teaching CATE
Anne	Female	50	Jamaican	Culinary Arts	Culinary Arts 1	27
Lisa	Female	53	African-American	Culinary Arts	Culinary Arts 2	10
Karen	Female	51	Trinidadian	Culinary Arts	Culinary Arts 2	15
Betty	Female	62	African-American	Culinary Arts	Culinary Arts 2	19
Susan	Female	52	African-American	Engineering	Engineering	9
Carl	Male	51	African-American	Air Force JROTC	JROTC	5
David	Male	47	African-American	Air Force JROTC	JROTC	7

Survey Data Analysis

After the survey data were cleaned and the interview data were transcribed, the researcher conducted a series of analyses to answer the research questions. First, the survey data as a whole were analyzed descriptively. Then, the responses were analyzed by sub-groups, based on the subjects taught.

Focus Group Interview Data Analysis

Transcripts from the focus group interviews were analyzed inductively. Selvi (2020) argued that qualitative content analysis entailed analyzing data by identifying meanings and core consistencies. For example, Culinary Arts teachers referred to students contacting them after regular school hours as students having “no boundaries,” but Air Force ROTC teachers referred to student contact after hours contact as students

just “checking in.” Once meanings were clarified, consistencies were identified. Then, the collected data was subjected to qualitative analysis to answer the research questions. The qualitative content analysis made it possible for researchers to explore human experiences (Graneheim, et al., 2017). The codes and interpretation of the content from the teachers interviewed displayed repetitions or patterns in the participant’s answers that led to the recognition of reoccurring themes.

According to the video *Qualitative Data Analysis Tips* by Delve (YEAR), inductive coding can be performed through a seven-step process. First, the researcher became familiar with the data by printing transcripts and reviewing them several times. The next step was to identify the specific ideas or concepts of the participants. The third step was to assign each of the ideas or concepts identified in step two an initial code, by color, that reflected the statements of the participants. The fourth step was to read through the data again and identify each comment in the data that applied to any of the identified codes and color-code those data. The fifth step was to adjust or redefine codes as necessary to encompass as much of those data as possible. The sixth step was to identify recurring themes. Themes were identified as the overall mood or tone behind the ideas or concepts in a group of the codes. In step six, the color-identified codes should be placed into groups based on themes. The seventh and final step was to write the narrative of the thematic analysis of the themes. This procedure was followed to develop the findings of the focus group data as discussed in Chapter 4.

Methodological Limitations

The study’s findings have to be seen in light of three possible limitations: limited participant profile, a limited survey instrument, and potential researcher bias. First, the limited participant profile. All participants live in the same geographic area, were of

African descent, and were within a 15-year age range (47 to 62). CTAE teacher outside of the Southeast United States or younger CTAE teachers or CTAE teachers not of African descent may have different opinions than those expressed in this study. Second, the limited survey instrument. The survey instrument was crafted to be extremely brief and concise. It was believed that a shorter survey would attract more participants than a longer survey. This may not have allowed participants to fully elaborate on their opinions and could have denied them the full opportunity to provide new perspectives. Lastly, the researcher was a CTAE teacher who works in the same facility as four of the seven focus group participants. Although the researcher was not aware of any conflicts, there was still a chance of unconscious bias. Future research in this area should be conducted with participants of a broader demographic in terms of age, race, and location.

Chapter IV

FINDINGS

In this chapter the data from the survey respondents will be combined with the data from the focus groups to report the results of the study structured by the research questions. These findings will then be compared to the descriptive statistics from the survey respondents. The three original research questions were: 1) What were the experiences of CTAE teachers in delivering psychomotor content pre-pandemic; 2) What were the experiences of CTAE teachers in delivering psychomotor content during the pandemic; and 3) What are the recommended strategies or techniques to teach psychomotor learning online in case another migration to online learning? The participants were from one of Metro Atlanta's four largest school districts: Cobb, DeKalb, Fulton, and Gwinnett. The DeKalb County School District's website, "About DCSD," reported employing 6,600 teachers in the 2021-2022 school year. Fulton County Schools' District website, "About Us," reported employing 6,900 teachers or administrative personnel during the 2021-2022 school year. The Cobb County School Districts' website, "About CCSD," reported employing 5,976 teachers. However, the largest school district in the state of Georgia in terms of student enrollment, Gwinnett County, did not give a total number of teachers, but the other three school districts reported a combined total of 19,476 classroom teachers. Of these teachers, 543 CTAE teachers were contacted via their public email addresses available on the school websites. One hundred and forty-three (143) teachers responded to the survey but only 115 teachers (21%) completed the survey. Not all the respondents who completed the survey qualified to participate in the study. To qualify for the study teachers needed to teach in one of the five identified areas of CTAE, Allied Health and Medicine, Audio Visual Technology and Film, Culinary Arts, Engineering

and Technology, and Junior J.R.O.T.C. (Air Force and Navy combined), have been certified in any of the five/six aforementioned areas and teaching in that area before, during and after the pandemic. Eighty-eight teachers (16%) met these criteria. The request asking for participation in focus groups to be held via Zoom was included in the survey and therefore was seen by at least 115 teachers (21%). The first round of seven focus group meetings had a low participation rate. To increase participation, a second round of focus groups was held. This second round consisted of 10 one-hour meetings held at 4 p.m. and 6 p.m. on five consecutive weekdays and open to any of the CTAE teachers who completed the surveys. The total number of focus group participants was seven, 8% of the 88 teachers who met the criteria, who were teachers of three out of five targeted CTAE areas in this study.

CTAE Teachers' Experiences Delivering Psychomotor Content Pre-Pandemic

The survey data revealed CTAE teachers' perception on the importance of psychomotor learning in their education. Most CTAE teachers (N = 77, 88%) responded that their content required primary (over 50%) psychomotor or hands-on learning. Twelve percent (N = 11) of the respondents did not believe that the psychomotor component was necessary. Their experiences of teaching psychomotor content in CTAE classrooms were elaborated with the focus group data, which included teachers from Culinary Arts, J.R.O.T.C., and Engineering. For the remaining two areas that did not have focus group participants (AV Tech, Allied Health, and Medicine), the researcher engaged in informal conversations with the teachers in his district.

Before the pandemic, the teaching of psychomotor content in CTAE took various forms of in-person observation and coaching, after teacher or expert demonstration, as students perform real-world tasks in each area. For example, in Air Force J.R.O.T.C.,

there were teachers participating with students in physical training (PT), marching, handling weapons, using the flight simulator and flying drones. In Culinary Arts it was the teacher's constant observation and redirection of students while working in the kitchen with kitchen safety and etiquette, which meant enforcing strict standards and procedures in preparation, execution, and cleanup for assigned tasks. In Engineering it was teachers demonstrating the proper use and safety precautions for the specific equipment and tools in their Engineering lab. Engineering labs are not standardized; several teachers had access to a full woodshop with several drills, saws, and hand tools while others had only the newer technology; 3D printers, robotic equipment, and various printers. Some Engineering teachers had both old and new equipment, but the size of the lab, the layout and the placement of equipment usually varied.

For the AV Tech area, teachers would hand students the various types of cameras used in film production and demonstrate proper grip and balance for each camera to support their understanding of each camera's functionality, range, and lighting requirements. The curriculum for the area of Allied Health and Medicine required a shadowing experience for students in a medical setting which included observing medical personnel and simulation of the proper processes and techniques for various tasks (e.g., obtaining blood glucose samples, collecting urine and stool specimens, conducting capillary blood tests and venipuncture procedures, exhibiting techniques for application of sterile dressings and bandages) and documenting community service learning experiences.

Table 4 summarizes CTAE teachers' perceived classroom issues, such as time management, taking learning seriously and getting used to complex tasks, prior to transitioning to remote learning. The data suggests that the CTAE teachers "watch"

students perform tasks with equipment or tools at a physical proximity to their students for effective instruction. Furthermore, during the focus groups, participants addressed the importance of a personal connection in the teacher-student and the importance of building a rapport with the student to encourage effort and engagement with psychomotor instruction. The combination of teacher proximity to students and the relationship between them was routinely referred to as "touch" by a CTAE teacher (Carl, Air Force J.R.O.T.C.).

CTAE Teachers' Experiences Delivering Psychomotor Content During Pandemic

During the pandemic, many teachers struggled to transition their psychomotor instruction online. According to the survey data (Table 6B, Table 7B), the CTAE teachers generally believed that their students were not prepared for learning psychomotor skills remotely (M = 2.59) and struggled the most with physical manipulation of equipment (M = 2.33), followed by tools (M = 2.47), self (M = 2.87), and computer-based content (M = 3.50). Details of these two survey question responses are presented below, followed by issues related to delivering psychomotor content during the pandemic identified from focus group interviews (Table 7).

Table 4

Issues Related to Delivering Psychomotor Content Pre-Pandemic

C.T.A.E. Area	Instructional Issue(s)	Quotes
Culinary Arts	Time management	"Keeping students on task on the days we cook could be an issue. We only had 50 minutes to prep, cook, eat and clean. So, if we were not on track, the next class would start behind schedule and would not be able to finish." (Lisa, Culinary Arts)

	Taking learning seriously	"Students wasting or ruining food was what I watched for; students not following instructions closely and trying to do things their own way costs us time and money." (Anne, Culinary Arts)
J.R.O.T.C.	Different student pace	"Some students caught on to flying the MP2 (Mavic Pro 2 Drone) quickly, because it's controller is similar to a game controller. But students who were not already into gaming took a little longer to develop that feel; they needed more practice." (David, Air Force J.R.O.T.C.)
	Taking Learning seriously	"Getting used to the sensitivity of the SP3 (Stim Pilot 3 Flight Simulator) took time. We take crashing seriously. Students are not allowed to use the reset button as a crutch, so problems with take- offs and landings require extra reps." (Carl, Air Force J.R.O.T.C.)
Engineering	Attention to details	"I typically had to go over measurement and conversion more than once. The difference between a ruler and an Architectural Scale and changing fractions or decimals to metric terms makes more sense when you are actually applying it." (Susan, Engineering)
	Getting used to complex tasks	"If more than one student in a group missed a class, the entire group would get behind and would have to really push to finish their project on time. They were forced to cross train and multitask." (Susan, Engineering)

Teacher Perception of Students' Preparedness for Remote Psychomotor Learning

In the survey, teacher perception on students' preparedness for remote psychomotor learning (Question 8) was examined through five statements addressing student ability to effectively learn psychomotor learning online, ability to master CTAE content without psychomotor learning, ability to learn through trial and error online, and ability to gain, apply, and build upon cognitive knowledge and skillsets online. Frequencies and percentages of the responses are presented in Table 5A.

Student Ability to Effectively Learn Psychomotor Skills Online. As in Table 5A, no one strongly agreed that students could effectively learn psychomotor skills online. However, just over one quarter of the respondents (N = 18, 26%) agreed that the students could. Neutral was selected by a little less than a quarter of the respondents (N = 15, 22%). The majority disagreed or strongly disagreed that students could effectively learn psychomotor skills online did not believe that online students could learn psychomotor skills in a distance setting (N = 36, 52%).

The focus group interview data confirmed the teachers' negative perception on students' ability to learn psychomotor skills online effectively. When asked if the online students were remotely comparable (skill wise) to classroom students in a focus group interview, Betty (Culinary Arts) replied, "Definitely not. Because when you're doing things in the labs and hands-on activities, it's much more engaging and students enjoy it more. They get more out of it." None of the interviewees believed that students could effectively learn their CTAE course content without employing psychomotor skills.

Student Ability to Master CTAE Content Without Psychomotor Learning. As in Table 5A, only 14% of the respondents (N = 10) strongly agreed or agreed that students could effectively learn their content without psychomotor skills. A similar number of respondents (N = 11, 16%) were neutral. In contrast, 69% of the respondents (N = 48) strongly disagreed or disagreed. This 69% is the highest negative response for the five statements under this survey question.

One of the focus group interviewees, David (Air Force J.R.O.T.C.), shared his frustration with not being able to teach psychomotor skills during the pandemic, stating that in the year after the pandemic, he "basically had first year cadets again because we had to train them on how to do a lot of the things that they weren't able to do during

COVID."

Student Ability to Learn Through Trial and Error. As in Table 5A, 34% of the respondents (N = 24) strongly agreed or agreed that students could learn through trial and error and develop their own styles in online courses as they would in face-to-face settings. Forty-seven percent of the respondents (N = 33) strongly disagreed or disagreed that students could learn trial and error in online courses. Seventeen percent (N = 12) were neutral.

Student Ability to Gain Cognitive Knowledge and Skillset Online. As in Table 5A, 36% of the survey respondents (N = 25) strongly agreed or agreed that students could gain cognitive knowledge and skillsets online as they did in a face-to-face setting. About half of the respondents, however, strongly disagreed or disagreed with this statement (N = 25, 50%). Thirteen percent of the respondents (N = 9) were neutral.

Student Ability to Apply and Build on Cognitive Knowledge and Skillset Online. As in Table 5A, 34% of the respondents (N = 23) strongly agreed or agreed that students could apply and build on the cognitive knowledge and skillsets online as they did in a face-to-face setting. Forty-seven percent of the respondents (N = 33) strongly disagreed or disagreed that students could do so. Nineteen percent of the respondents (N = 13) were neutral.

According to the focus group data, the teachers seem to perceive that the more complex a task becomes the less likely their students could perform the learned skillsets online. Carl (Air Force J.R.O.T.C.) said "…some things, like basic physical fitness or a 15-count drill sequence, they (online students) could kind of figure out." He went on to say "… other things, like a 30-count drill sequence, they can't get on their own."

Moreover, it appears that teachers perceived that the online environment helped students focus on learning in the cognitive domain, while sacrificing learning in the psychomotor domain. Karen (Culinary Arts) said "Theoretically they (online students) did better (academically during the pandemic) because there were so many assignments that we could give them online...they were busy doing those, but when it came to the hands-on (skills), no, they didn't do any hands-on. Karen also commented that "(her online students would) log in, do this, just do work, do work, do work. And some children excelled in that it was self-paced enough," alluding to the possibility that the impact of individual differences in characteristics (i.e., self-directedness) may be more extensive in the remote learning setting.

Comparison Across Perceived Student Preparedness. Means and standard deviations of each statement under Question 8 are reported in Table 5B. Comparing the five statements under Question 8 based on the means, the CTAE teachers were neutral about students' ability to learn through trial and error online (M = 2.77), to gain cognitive knowledge and skillsets online (M = 2.77), to apply and build on them online (M = 2.80). The respondents were a little more negative on students' ability to effectively learn psychomotor skills online (M = 2.59) and most negative about their ability to master CTAE content without psychomotor learning (M = 2.23). Frequency distributions (Table 5A) and standard deviations (Table 5B) of the five statements support that the responses for the last three statements (trial and error, gain cognitive knowledge and skillsets, apply and build on the cognitive knowledge and skillsets) are more similar with each other than with the other two statements, which are more negative.

Comparison Across CTAE Areas. Results by each CTAE area of investigation are reported in Table 5B. Overall, Allied Health and Medicine teacher perception of student

preparedness to remote psychomotor learning was the highest (M = 3.17, SD = 0.82) of the five CTAE areas surveyed, followed by Audiovisual Technology and Film (M = 2.77, SD = 1.08), Engineering and Technology (M = 2.61, SD = 1.17), and J.R.O.T.C. (M = 2.52, SD = 1.04). Culinary Arts teachers' perception of student preparedness to remote psychomotor learning was the lowest (M = 2.48, SD = 1.01).

At the statement level, Allied Health and Medicine teacher responses were the most positive in four out of the five statements asked under Question Eight. In the other statement (student ability to learn through trial and error), Audiovisual Technology and Film teacher responses ranked the highest. Culinary Arts teacher responses ranked the lowest in two of the five statements (gain cognitive knowledge and skillsets online, apply and build on the cognitive knowledge and skillsets online), while Engineering and Technology teacher responses ranked the lowest in the other two (master CTAE content without psychomotor learning, learn through trial and error). J.R.O.T.C. teacher responses had ranked the lowest in the statement for student ability to learn psychomotor skills effectively online.

Table 5A

Frequencies and Percentages of CTAE Teacher Perception of Students' Preparedness for Remote Psychomotor Learning (N = 69)

Question Eight Statement: I believe students can…		SA	A	N	D	SD
Effectively learn the psychomotor skills in a distance learning setting.	Freq.	0	18	15	26	10
	%	0	26	22	38	14
Effectively learn the CTAE course content without employing psychomotor skills.	Freq.	1	9	11	32	16
	%	1	13	16	26	23
Learn through trial and error and develop their own styles in online courses as they would in face-to-face settings.	Freq.	3	21	12	23	10
	%	4	30	17	33	14
Gain cognitive knowledge and skillset online as they would in face-to-face settings.	Freq.	4	21	9	25	10
	%	6	30	13	36	14
Apply and build upon the cognitive knowledge and skillset online as they would in face-to-face settings.	Freq.	6	17	13	23	10
	%	9	25	19	33	14

Note. SA: Strongly Agree; A: Agree; N: Neutral; D: Disagree; SD: Strongly Disagree

Table 5B

Number, Means & Standard Deviations CTAE Teacher Perception of Students' Preparedness Remote Psychomotor Learning (N = 69)

Question Eight Statement: I believe students can…	All		Eng. & Tech (N = 26)		AV T & Film (N =21)		J.R.O.T.C. (N = 12)		Culinary Arts (N = 15)		Allied Health & Medicine (N = 6)	
	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
To effectively learn psychomotor skills online	2.59	1.03	2.62	1	2.62	1.05	2.25	1.01	2.53	.88	3.50	.76
To master CTAE content without psychomotor learning	2.23	.99	2.23	1.09	2.14	.83	2.33	1.03	2.13	.96	2.83	.90
Learn through trial and error online	2.77	1.16	2.92	1.21	3.14	1.17	2.58	1.19	2.33	.94	2.67	.75
Gain cognitive knowledge and skillset online	2.77	1.19	2.62	1.24	2.90	1.23	2.75	1.01	2.73	1.06	3.33	.75
Apply and build upon the cognitive knowledge and skillset online	2.80	1.21	2.65	1.30	3.05	1.13	2.67	.94	2.67	1.19	3.50	.96
Question totals	2.63	1.12	2.61	1.17	2.77	1.08	2.52	1.04	2.48	1.01	3.17	0.82

Teacher Perception of Student Remote Psychomotor Learning

Another item on the survey captured teachers' perception on students' remote psychomotor learning (Question 10), particularly about grasping the concepts and skills related to physical manipulation of tools, equipment, computers, and self. Frequencies and percentages of the responses are presented in Table 6A.

Physical Manipulation of Tools. As in Table 6A, 56% of the teacher respondents (N = 39) strongly disagreed or disagreed that their students could learn physical manipulation of tools. Twenty-one or 30% of the respondents were neutral. Only 10 or 14% of the respondents strongly agreed or agreed that students could learn to use the tool remotely.

Physical Manipulation of Equipment. Responses to the equipment statement showed a similar frequency distribution pattern with the tool statement As in Table 6A, 66% of the teacher respondents (N = 46) strongly disagreed or disagreed that their students could learn physical manipulation of equipment. Thirteen or 19% of the respondents were neutral. The remaining 11 or 15% of the respondents strongly agreed or agreed that students could learn to use the equipment remotely.

Physical Manipulation of Computers. The teacher respondents were most positive about student learning of computer-based manipulation online. As in Table 6A, 64% of the teacher respondents (N = 45) strongly agreed or agreed that their students could learn physical manipulation of computers. Eleven or 16% of the respondents strongly disagreed or disagreed that students could learn to use the computers remotely. The remaining 14 or 20% of the respondents were neutral.

Physical Manipulation of Self. The teacher responses were most spread out for the statement on the manipulation of self. As in Table 6A, 37% of the teacher respondents (N = 26) strongly disagreed or disagreed that their students could learn physical manipulation of self. Similarly, twenty-two or 31% of the respondents strongly agreed or agreed that students could learn to use their body remotely. The remaining 20 or 29% of the respondents were neutral.

Comparison Across Types of Student Remote Psychomotor Learning. Means and standard deviations of each statement under Question 10 are reported in Table 6B. Comparing the four statements under Question 10 based on the means, the CTAE teachers were most optimistic about student learning of computer-based manipulation (M = 3.50), followed by manipulation of the self (M = 2.87), tools (M = 2.47), and equipment (M = 2.33). As noted earlier with frequency data, responses on manipulation of tools and equipment showed similar patterns. Responses on manipulation of self were most equally spread out among the four categories of physical manipulation, despite having the second highest standard deviation (SD = 1.08) after the standard deviation of the tool manipulation statement (SD = 1.09).

Comparison Across CTAE Areas. Results by each CTAE area of investigation are reported in Table 6B. Overall, Allied Health and Medicine teacher perception of student remote psychomotor learning was the highest (M = 3.50, SD = 0.65) of the five CTAE areas surveyed, followed by Engineering and Technology (M = 2.85, SD = 1.12), Culinary Arts (M = 2.79, SD = 1.08), Audiovisual Technology and Film (M = 2.69, SD =

.89), and J.R.O.T.C. teachers' perception of student preparedness to remote psychomotor learning was the lowest (M = 2.52, SD = .96).

At the statement level, Allied Health and Medicine teacher responses were the most positive in student learning of physical manipulation in all four areas asked under Question 10, ranging between 2.60 (equipment) to 4.40 (computers) as means. J.R.O.T.C. teachers were least positive with student learning to use tools (M = 2.17, SD = .80), computers (M = 3.17, SD = 1.14), and self (M = 2.42, SD = .95). Engineering and Technology teachers (M = 2.30, SD = 1.05) and Culinary Arts teachers (M = 2.30, SD = 1.00) were least positive with students learning of using equipment.

Perceived Challenges in Supporting Remote Psychomotor Learning

CTAE teachers who participated in the focus groups reported various issues related to delivering psychomotor content during the pandemic. The details of the issues varied greatly based on each course and that course's requirements, however, four reoccurring themes were prominent. These reoccurring themes can be categorized into instructional and non-instructional issues. Instructional issues are the issues that teachers have control over if prepared and or supported, and non-instructional issues are issues that teachers do not have control over. According to the data (Table 7), instructional issues of remote psychomotor learning include diverse teacher knowledge and use of online teaching tools, having no instructional alternatives for remote psychomotor learning (or not knowing them), delay in student academic progress due to missing the required psychomotor learning, difficulties of observing student actions while respecting student privacy, not being able to build rapport with students (to provide appropriate

feedback to their psychomotor learning), and promoting and sustaining student participation. Non-instructional issues were focused on their home learning environment—particularly on the technological access and the role of students' parents or guardians. Based on the conversations from the focus group members, the instructional issues were expected to an extent, but the non-instructional issues were not.

Table 6A

Frequencies and Percentages of Responses to Survey Questions

Question Ten Statement: I think my online students were able to grasp the concepts and skills related to the physical manipulation of …		N	SA	A	N	D	SD
Tools (e.g., basic tools in Automobile Maintenance, kitchen utensils in Culinary Arts, scales and protractors in Engineering).	Freq.	70	5	5	21	26	13
	%		7	7	30	37	19
Equipment (e.g., XRL cameras are Audio Visual, flight simulators in Air Force J.R.O.T.C., 3D Printers in Engineering).	Freq.	70	1	10	13	33	13
	%		1	14	19	47	19
Computers and computer-based content (e.g., online lessons)	Freq.	70	7	38	14	5	6
	%		10	54	20	7	9
Self (e.g., physical movement)	Freq.	68	3	19	20	18	8
	%		4	27	29	26	11

Note. Topic: Perception about student psychomotor learning during the pandemic.

Table 6B

Number, Mean and Standard Deviation of Responses to Survey Questions

Question 10 Statement: I think my online students were able to grasp the concepts and skills related to the physical manipulation of …	All		Eng. & Tech (N=27)		AV T & Film (N=16)		J.R.O.T.C. (N=12)		Culinary Arts (N=10)		Allied H & M (N=5)	
	GM	SD	M	SD	M	SD	M	SD	M	SD	M	SD
Tools (e.g., basic tools in Automobile Maintenance, kitchen utensils in Culinary Arts, scales and protractors in Engineering).	2.47	1.09	2.41	1.19	2.25	.75	2.17	.80	2.80	1.25	3.60	.80
Equipment (e.g., XRL cameras are Audio Visual, flight simulators in Air Force J.R.O.T.C., 3D Printers in Engineering).	2.33	.98	2.30	1.05	2.31	.98	2.33	.94	2.30	1.00	2.60	.49
Computers and computer-based content (e.g., online lessons)	3.50	1.05	3.52	1.03	3.44	.86	3.17	1.14	3.50	1.12	4.40	.80
Self (e.g., physical movement)	2.87	1.08	*3.15	*1.20	2.75	.97	2.42	.95	*2.56	*.96	3.40	.49
Question total	2.79	1.05	2.06	.82	2.69	.89	2.52	.96	2.15	.84	3.50	.65

Note. Topic: Perception about student psychomotor learning during the pandemic.

*Self (N=68) / *Eng & Tech (N=26) / * Culinary Arts (N=9)

Table 7

Issues Related to Delivering Psychomotor Content During Pandemic

Category	Theme	Quotes
Instructional issues	Diverse teacher knowledge and use of online teaching tools	"There were large disparities in technological skills among educators which affected instruction." (Susan, Engineering) "We say we have this district platform, but we still have teachers that are using whatever they like. And so, the challenge becomes, I use one thing in my class, another teacher uses something in their classroom." (Susan, Engineering)
	Having no instructional alternatives for remote psychomotor learning (or not knowing them)	"Teaching a 30-count drill sequence is mandatory, so without that portion of the curriculum, it made it a lot harder for us to actually prepare our students." (David, J.R.O.T.C.) "I would say being able, giving my students the experience of using the tools, the hands-on tools, the saws, the 3D printer, the Y format printers, all of those things that they're excited about using when they're in the classroom [I could not do it remotely]." (Susan, Engineering)
	Delay in the student academic progress due to missing the required psychomotor learning	"…the next year, when those same students came in to the classroom, we were so behind on certain routines that would've been developed had they been in the classroom the year before." (Karen, Culinary Arts) "The next year, we basically had first year cadets again." (David, J.R.O.T.C.)

	Difficulties of observing student actions while respecting student privacy	"It was very difficult to explain chicken fabrication if you're [students are] not watching (me) fabricate a chicken." (Karen, Culinary Arts) "They didn't have to be on camera, so sometimes I would have them show their faces, but it wasn't mandatory so they could be doing anything." (Betty, Culinary Arts) "They'd reach out to me and tell me that they can't turn their cameras on because of their living situation. They were embarrassed of what was happening at home." (Anne, Culinary Arts)

Category	Theme	Quotes
	Not being able to build rapport with students (for appropriate feedback on psychomotor learning)	"… it just comes down to that relationship... I really didn't have a relationship with the cadets online, where here I have that relationship. I can read their expressions, I could see their faces, I could talk to them if need be, where I could not do that really via remote learning. All instructors need to build that relationship." (David, Air Force J.R.O.T.C.)
	Promoting and sustaining student participation	"For me, it was like, yeah, those kids were happy to just show up, let you know that they saw the work that you posted on the platform and they were gone. So, they didn't want to engage." (Karen, Culinary Arts) "…the difference is that online they didn't really pay attention as much because the attention span is only for so long; watch(ing) looking at a screen only so long. And then also I heard someone say it was like high tech, high tech, low touch." (Carl, J.R.O.T.C.) "…out of my three classes, I think I had one that really liked to engage in conversations if everybody showed up." (Lisa, Culinary Arts)

Non-instructional Issues	Difficulties with parents or guardians at home	"I had parents coming to interrupt, when are they going to be doing labs? Isn't this the cooking class?" (Anne, Culinary Arts) "Some students would be laying in their beds and watching TV and doing whatever they wanted to do. So, it was difficult." (Betty, Culinary Arts)
	Access to technology at home (device, software, internet, etc.)	"Some of them [students] said they didn't have Chromebooks. Some of them lived in areas where they didn't even have internet connection." (Anne, Culinary Arts) "…sometimes connectivity is the biggest one, and so it got to the point where we had to turn off cameras. The students have different levels of WIFI…" (Susan, Engineering)

Recommendations for Teaching Psychomotor Content Online

As the teachers reflected upon their teaching experiences during the pandemic, they were able to make recommendations for teaching psychomotor content in the future. Teacher perception about school district support for remote learning is presented below based on the survey results, leading to recommendations CTAE teachers had regarding external support they would need in case of another transition to remote teaching and learning.

Teacher Perception of District Support for Remote Learning

According to the survey, 59% of the teacher respondents (N = 41) strongly disagreed or disagreed that they were prepared for online teaching. Nineteen or 27% were neutral. The remaining 10 or 14% of the respondents strongly agreed or agreed that they are prepared. Only one of these respondents strongly agreed that they were prepared. Interestingly, most respondents strongly agreed or agreed that their school district was prepared for another transition to online (N = 28, 40%). Twenty-three or 30% of them were neutral, and the remaining 19 or 27% strongly disagreed or disagreed to the statement.

Compared to the general perception about school district's preparedness (N = 28, 40%), the teachers' perceptions on the following specific areas of district support were mostly negative: Clear goal setting and communication, instructional guide, teacher preparation, technical support. Frequencies and percentages of the responses are presented in Table 8A.

*Clear Goal Setting and Communication***.** As in Table 8A, 48% of the teacher respondents (N = 33) strongly disagreed or disagreed that their school district had clearly set goals for transition to online and communicated them with the teachers. Twenty-three or 33% of the respondents strongly agreed or agreed that they did. The remaining 14 or 20% were neutral.

Instructional Guide. As in Table 8A, 42% of the teacher respondents (N = 29) strongly disagreed or disagreed that their school district had provided instructional guide suitable for CTAE teachers. Twenty-five or 36% of the respondents strongly agreed or agreed that they did. The remaining 23% or 16 were neutral.

Teacher Preparation. As in Table 8A, 44% of the teacher respondents (N = 31) strongly disagreed or disagreed that their school district had provided instructional guide suitable for CTAE teachers. Twenty-one or 30% of the respondents strongly agreed or agreed that they did. The remaining 26% or 18 were neutral.

Technical Support. As in Table 8A, 55% of the teacher respondents (N = 38) strongly disagreed or disagreed that their school district had provided enough technical support during the transition. Twenty or 29% of the respondents were neutral. The remaining 17% or 12 strongly agreed or agreed that they did.

Comparison Across Areas of School Support. Means and standard deviations of each statement under Question 9 are reported in Table 8B. Similar to the frequency analysis results, the CTAE teachers had generally neutral to negative perceptions about different areas of district supports. Of the four areas asked, the most negative perception was found in the area of technical support (M = 2.50, SD = 1.01), followed by clear goal setting and communication (M = 2.80, SD = 1.05), teacher preparation (M = 2.84, SD =

1.05), and instructional guide appropriate for CTAE teachers (M = 2.96, SD = 1.07).

Comparison Across CTAE Areas. Results by each CTAE area of investigation are reported in Table 9B. Overall, J.R.O.T.C. teacher perception of student remote psychomotor learning (M = 3.19, SD = .94) was the highest of the five CTAE areas surveyed, followed by Allied Health and Medicine (M = 2.88, SD = 0.73), Audiovisual Technology and Film (M = 2.87, SD = .84), Culinary Arts (M = 2.65, SD = .89) and Engineering and Technology teachers' perception of student preparedness to remote psychomotor learning was the lowest (M = 2.61, SD = 1.16).

At the statement level, Allied Health and Medicine teacher responses were the most positive in student learning of physical manipulation in all four areas asked under Question 10, ranging between 2.60 (equipment) to 4.40 (computers) as means. J.R.O.T.C. teachers were least positive with students learning to use tools (M = 2.17, SD = .80), computers (M = 3.17, SD = 1.14), and self (M = 2.42, SD = .95). Engineering and Technology teachers (M = 2.30, SD = 1.05) and Culinary Arts teachers (M = 2.30, SD = 1.00) were least positive with students learning of using equipment.

CTAE Teacher Recommendations

Recommendations from the focus group participants were placed into three categories: Policy and Guideline, Teacher Training and Support, and Systemic Changes.

Policy and guideline recommendations are changing the teacher's belief the school districts should make to improve online instruction. These changes include uniform teaching practices by subject area and implementation of a standard use of technology across CATE.

Teacher training and support are changing the teacher's belief the school districts should make to better prepare and support teachers to become and remain technology savvy as school districts implement and integrate new and current technologies into the classrooms.

Systemic changes are large scale changes that go beyond a school district and speak to making changes in the educational industry that better address the current needs of academic adaptability and flexibility of today's students.

Table 8A

Frequencies and Percentages of Responses to Survey Question Nine

Question Nine Statement: I think that my school district…		N	SA	A	N	D	SD
clearly set goals for transitioning to online, virtual instruction and communicated them with CTAE teachers.	Freq.	70	2	21	14	27	6
	%		3	30	20	39	9
*did not provide instructional guidance for online teaching suitable for CTAE teachers.	Freq.	70	5	20	16	25	4
	%		7	29	23	36	6
adequately prepared me for the move to distance learning.	Freq.	70	4	17	18	26	5
	%		6	24	26	37	7
*should have provided more technical support for teachers and students during the move to distance learning.	Freq.	70	2	10	20	27	11
	%		3	14	29	39	16

Note. *Recoded. Topic: Perception about school district's support for distant learning.

Table 8B

Number, Mean and Standard Deviation of Responses to Survey Question Nine

Question Nine Statement: I think that my school district…			Eng. & Tech (N=27)		AV T & Film (N=21)		J.R.O.T.C. (N=12)		Culinary Arts (N=15)		Allied H & M (N=6)	
	GM	SD	M	SD	M	SD	M	SD	M	SD	M	SD
Clearly set goals for transitioning to online, virtual instruction and communicated them with CTAE teachers.	2.80	1.05	2.56	1.10	2.90	.87	3.08	1.11	2.80	.91	3	.82
*did not provide instructional guidance for online teaching suitable for CTAE teachers.	2.96	1.07	2.78	1.20	3.0	.76	3.67	.94	2.53	.96	3.17	.69
Adequately prepared me for the move to distance learning.	2.84	1.05	2.63	1.16	3.0	.87	3.42	.86	2.60	.88	2.67	.47
*should have provided more technical support for teachers and students during the move to distance learning.	2.50	1.01	2.48	1.17	2.57	.85	2.58	.86	2.67	.79	2.67	.94
Question total	2.78	1.05	2.61	1.16	2.87	.84	3.19	.94	2.65	.89	2.88	.73

Note. *Recoded. Topic: Perception about school district's support for distant learning.

Table 9

CTAE Teacher Recommendations for Another Transition to Remote Teaching

Category	Theme	Collected Data (Quotes)
Systemic change	Rebuild the system for flexible teaching	"education as a whole missed an opportunity to really be innovative. Covid was time. If you were going to destroy and rebuild systems, that would've been the perfect time to do it. … our babies (are) flipped. They worked during the day, but no educational services were offered for them in the evening for them to be successful. … Access was not provided for our young moms and dads because they were working and parents by day, but they were available at night." (Lisa, Culinary Arts)
Policy and guidelines	Guidelines to manage situations at home	"They were embarrassed of what was happening at home. I had parents coming to interrupt …" (Anne, Culinary Arts)
	Uniform software use	"I think what should have been done is teachers should have been required to use whatever the district learning platform was. And I think we still have this challenge now." (Susan, Engineering)
Teacher training and support	Teacher training on instructional technology tools	(The school districts should) "prep the school environment and then make it safe so that teachers could be in the building and safe. If I (would have been) able to have my classes with the smartboard where the students could interact with me from there while I'm doing the labs, that would've worked out so much better." (Anne, Culinary Arts)
	On-going support	"maybe not preparation, but maybe the maintenance of it. So yes, they (school districts) couldn't prepare us, but maybe there might've been some things like maybe checking in. And then also too, for those people that were falling behind, just ask them why they were falling behind." (Carl, J.R.O.T.C.)

Summary of Findings

This study captured CTAE teachers' perceptions and experiences of teaching psychomotor content prior to, during, and after the pandemic through a survey and focus group interviews.

Prior to the pandemic, teachers in several of the various areas of CTAE taught in less standardized learning environments which allowed for varying levels of instructional customization in the classroom that fit that particular teacher and were effective with specific subject matter. This customization proved to be traditionally effective for the transference of psychomotor skills in face-to-face setting as it created a personal connection between teacher and student which led to rapport building which facilitated student effort and engagement. Over time, CTAE teachers built an instructional dependency on relationship and proximity to their students for effective instruction. This combination was used to address the wide variety of psychomotor issues in CTAE classrooms. The combination of teacher proximity and teacher-student relationship was routinely referred to as "Touch" by CTAE teachers and proved to be very effective in the captive environment of a classroom. When CTAE teachers moved to online learning, their students were no longer in a captive environment and "Touch" was no longer available, the delivery of psychomotor content suffered.

Table 10 below reports the notable statistical data gathered from the respondents to the three main survey questions. The responses from the survey were consistently supported by the responses from the focus group which further confirms the findings.

Table 10

Summary of Survey Findings

Question Eight	
I believe students can… effectively learn the psychomotor skills in a distance learning setting.	• 52% Of the respondents either Disagree or Strongly Disagreed • 38% Disagree selection rate 5th highest negative response rate of the survey • Of the remaining 48% of respondents, 22% of them answered Neutral
I believe students can… effectively learn the CTAE course content *without* employing psychomotor skills.	• 69% Of the respondents either Disagree or Strongly Disagree • 69% The highest combined negative response rate of the survey • 46% Disagree selection rate was the 2nd highest Disagree selection rate • 23% Strongly Disagree rate was highest of the survey • 14% Of respondents Agreed or Strongly Agreed with this statement • 14% Combined positive response rate is tied for the lowest of the survey
I believe students can… gain cognitive knowledge and skillset online as they would in face-to-face settings.	• 50% Combined negative response rate
Question Nine	
I think that my school district… should have provided more technical support for teachers and students during the move to distance learning	• 55% Of the respondents either Agreed or Strongly Agreed with this statement. • 55% is the 2nd highest combined positive response rate • 39% Agree selection is the 2nd highest positive selection rate • 16% Strongly Agree is the highest of the survey
I think that my school district… was prepared for the move to distance learning	• 29% Neutral selection rate is tied for 3rd highest of survey • 59% Combined negative response rate is the 3rd highest of the survey • 40% Disagree selection rate was the 3rd highest of the survey • 19% Strongly Disagree rate was tied for 2nd highest of the survey • 14% Combined positive response rate is tied for the lowest of the survey
I think that my school district… is prepared for another migration to distance learning.	• 33% Of respondents selected Neutral as the answer to this question

Question Ten	
I think my online CTAE students were able to grasp the concepts and skills related to the physical manipulation of… tools	• 56% Combined negative response rate is the 4th highest of the survey • 19% Strongly Disagree rate was tied for 2nd highest of the survey • 14% Combined positive response rate is tied for the lowest of the survey • 30% Neutral selection rate is tied for 2nd highest of survey
I think my online CTAE students were able to grasp the concepts and skills related to the physical manipulation of… equipment	• 66% Combined negative response rate is the 2nd highest of the survey • 47% Disagree selection rate was the highest of the survey • 19% Strongly Disagree rate was tied for 2nd highest of the survey
I think my online CTAE students were able to grasp the concepts and skills related to the physical manipulation of… computers and computer-based content	• 64% Combined positive response rate is highest of the survey • 54% Agree selection is the highest of the survey • 16% Lowest combined negative response rate of the survey
I think my online CTAE students were able to grasp the concepts and skills related to the physical manipulation of… self	• 29% Neutral selection rate is tied for 3rd highest of survey

Question Eight inquired as to the respondent's belief in online student's abilities. The majority of CTAE teachers who responded to the study, did not believe it was possible to teach psychomotor skills in a distance learning format, did not believe that online students could learn CTAE content without psychomotor skills, and did not believe that online students would gain the knowledge and skillset equal to face-to-face setting. Cumulatively, these responses reflect that the CTAE teachers did not believe that what they were asked to do could be done.

Question Nine inquired as to the respondent's opinions about their school districts' preparedness and performance in terms of support for students and teachers during the pandemic. The majority of CTAE teachers who responded to the study did not believe that they were prepared for the move to distance learning and felt that their school district should have provided more technical support for teachers and students. One of the most interesting things about the responses to this question in particular is the number "Neutral" or noncommittal responses to the questions. Each of the six statements made in Question Nine had Neutral or noncommittal response rate of between 20% and 33%, meaning that effectively 1/5 to 1/3 of the respondents chose not to speak about their school districts. Even so, almost half of the respondents, 33 out of 70, had a negative opinion about the job their school district did setting goals clearly for transitioning to online, virtual instruction and almost half, and 31 out of 70 did not feel that their school districts adequately prepared them for the move to distance learning. Cumulatively, these responses do not reflect positively on the CTAE teacher's opinions about their school districts. Considering that 110 of the 420 (26%) responses to this group of questions were neutral or noncommittal, and that typically an employee would not withhold a positive

comment about their employer, one has to wonder what the results for this question would be if neutral was not an option.

Question 10 inquired as to the respondent's beliefs as to the concepts and skills of physical manipulation that online students were able grasp. The majority of CTAE teachers did not believe that their students were able to grasp the use of tools or equipment online. However, the majority did believe that online students grasped the concepts and skills of physical manipulation of computers and computer-based content. When considered together, it appears that CTAE teachers have considerable doubts about the ability to effectively teacher some of the CTAE courses online, but they do believe that other course, some of the computer based CTAE course and related content can be taught effectively online.

Based on the data, three recommendations addressing the online teaching and learning of psychomotor skills on the secondary level were extracted. First, educators must recognize the significance of personal connections. Establishing a rapport contributes to effective psychomotor learning, as well as student engagement. Second, educators emphasized a need for the school districts to establish and enforce universal instructional guidelines for CTAE subjects, remote or otherwise. Lastly, school districts must require educators to fully engage in instructional technology, proactively embracing it while highlighting the importance of continued training and a universal approach to learning platforms.

The survey finding identified several issues with the experiences of CTAE teachers moving to online learning and focus group findings amplified those findings and provided the depth and details needed to reach the conclusions of the study. Focus group

participants expounded on several of the difficulties they faced; getting the students to activity participate online, the repeated technology issues the students faced, the less than ideal learning environments of some student's homes, the expectations of CTAE teachers online and technical proficiency, the lack of an influential relationship between student and teacher, and the incomplete skillsets of the students whom successfully completed an online course but were not prepared for the next level course in a face-to-face setting.

Chapter V

INTERPRETATION, CONCLUSIONS, AND RECOMMENDATIONS

This chapter will present a discussion of the results from the study, conclusions drawn from the study, recommendations for further research, and finally recommendations for future policy and practices.

Discussion of Results of the Study

Validity of the Data

The results of the study appear to be accurate. Of the 543 teachers contacted for the study, 143 teachers responded. From this group, 115 teachers completed the survey. Of those completing the survey, 88 teachers qualified for the study which means this study was able to reach 16.20% of its target audience. From this target audience, all 88 of the teachers completed the first component of the study, the survey. The second component of the study, the focus groups, were held in two rounds for the 88 teachers that qualified for the study. There was a total of 17 focus group opportunities held via Zoom between September 5 and October 13, 2023. Participation in the focus groups was low; seven of the teachers who qualified attended. When taken in combination, the two components of the study, the responses from the survey and the transcript from the focus group are in alignment. This verifies each individual component and makes a definitive statement about the opinions of the CTAE teachers who participated in the study.

The respondents, current CTAE teachers, formed a more than adequate sample of the population for this study. All the respondents had taught in their current CTAE areas before and through the pandemic and were still teaching in that area at the time of the study. The demographic profile shows a very diverse group of veteran teachers. The key

descriptors for our respondents were: 70% were 41 years old or older, 64% had at least a master's degree, 50% had taught at least seven years, and the gender split was 51% male and 49% Female. It is believed this group of teachers answered the questions as openly and honestly as they felt they could and it may be inferred that these same results could be applied to other Atlanta metro CTAE teachers.

Theoretical Framework

The theoretical framework for this study was constructivism, which states that the acquisition of new ideas and concepts requires the learner to add them on top of their existing ideas and concepts. This framework holds true for some of the areas in CTAE. For example, success and advancement in some of the psychomotor-heavy courses such as Culinary Arts (knife skills and creating product consistence) AV Technology (organizing film shoots and capturing footage) and J.R.O.T.C. (physical fitness and marching) is based on the learner continuing to grow or advance the tactile or psychomotor skillsets they learned previously. However, the constructivism framework does not hold true for CTAE courses such as Business, Finance, and Marketing which do not require the learner to have a specific knowledge base on which to attach and apply newly acquired information.

Conclusions of the Study

The major conclusions of the study are:

1) Expecting teachers to effectively devise a way to teach their psychomotor content online was not realistic.

2) Both the school districts and the teachers were at a loss for exactly what needed to be done and therefore shared in the responsibly for the academic inadequacies.
3) CTAE may need to consider either modifying the curriculum of their psychomotor-heavy courses to focus more on theory and make them more suitable for online learning or switch to offering CTAE courses that are more suitable for online learning.
4) Online CTAE students can gain cognitive knowledge and skillset as they would in face-to-face settings taking the majority of CTAE classes; and
5) School districts were generally ill-prepared and struggled to provide support to CTAE teachers in their efforts to teach the psychomotor skills related to their programs.

First Conclusion

1) Expecting teachers to effectively devise a way to teach their psychomotor content online was not realistic.

Based on a combination of the responses from Question Seven, asking respondents if they believed the content of their CTAE class required primarily (over 50%) psychomotor or hands-on learning and the collection of sub-questions of Question Nine, which asked about the respondents' perception of student psychomotor learning during the pandemic, the consensus is that CTAE teachers do not believe students can effectively learn psychomotor skills online**.** Uniform policies and procedures by content area were not made available by the school districts which gives the impression that

school district leadership may have had the expectation of each CTAE teacher finding a way to teach the psychomotor skill component of their course online.

Second Conclusion

2) *Both the school districts and the teachers were at a loss for exactly what needed to be done and therefore shared in the responsibly for the academic inadequacies.*

Based on responses from the group of sub-questions from Question Ten, most CTAE teachers were not satisfied with the support provided by their school districts during the pandemic in terms of setting of goals for online instruction, providing sufficient instructional guidance, teacher preparation for the move to online learning, and providing sufficient technical support for teachers and students. One of the most interesting things about this conclusion is that the negative ratios that indicate respondent's dissatisfaction with their school districts were reached with over a quarter of the respondents (on average) selecting "Neutral" as the answer for each sub-question. This *perception* gives the impression that while over 25% of the respondents were hesitant to speak critically of their employer, the respondents who were not hesitant were clearly dissatisfied with their school districts. Also, of note is the ratio between personal responsibility and employer responsibly for teacher preparation for the move to online learning was never clearly defined but both were acknowledged by the respondents during the study as reflected in responses to focus group questions. This gives the impression that both the school districts and the teachers were at a loss for exactly what needed to be done and therefore shared in the responsibly for the academic inadequacies.

Third Conclusion

3) *CTAE may need to consider either modifying the curriculum of their psychomotor-heavy courses to focus more on theory and make them more suitable for online learning or switch to offering CTAE courses that are more suitable for online learning.*

Based on responses from Question Ten, which asked the respondent's opinion about their online student's ability to grasp the concepts and skills related to physical manipulation of tools, equipment, computers and self, the respondents clearly believe that online students cannot learn how to effectively use tools or equipment online. However, they are just as clearly convinced that online students can effectively learn computer and computer-based content online. Their opinion of the online student's ability to effectively learn to manipulate themselves was inconclusive. There was some indecision by a notable percentage (25%) of respondents who selected neutral as the answer for this portion of the question. This information, combined with the information from the first conclusion in reference to teacher motivation, gives the impression that administrators should attempt to identify which of the 17 CTAE programs lend themselves to online or blended learning. The curricula of those programs that do not lend themselves to blended or online learning should be redesigned to become more compatible with online learning. The theorical and practical application components of each course could be separated and the structure used to teach the theorical component should be fitted to a computer-based curriculum. If this is not possible, maybe the CTAE courses that do not fit an online platform may need to be replaced by more suitable CTAE courses that better lend themselves to online learning. For example, Finance as opposed to Engineering and

Table 11

CTAE Career Clusters and Pathway Courses in Georgia

• Agriculture, Food, and Natural Resources	• Energy	• Information Technology
• Architecture and Construction	• Finance	• Law, Public Safety, Corrections, and Security
• Arts, AV/Technology, and Communications	• Government and Public Administration	• Manufacturing
• Business, Management, and Administration	• Health Science	• Marketing
• Culinary Arts	• Human Services	• Science, Technology, Engineering, Mathematics
• Education and Training	• Hospitality and Tourism	• Transportation, Distribution, and Logistics

Government and Public Administration instead of J.R.O.T.C. The subject areas available in CTAE are listed on Table 11.

Fourth Conclusion

4) *Online CTAE students can gain cognitive knowledge and skillset as they would in face-to-face settings taking the majority of CTAE classes.*

This conclusion was determined from the findings of the responses to the last two statements given to the sub-questions in Question Nine, "I believe students can gain cognitive knowledge and skillsets online as they would in face-to-face settings" and "I believe students can apply and build upon the cognitive knowledge and skillset online as they would in face-to-face settings."

The data reflects that the over 1/3 of the CTAE teachers did feel students could accomplish cognitive learning, so the teaching of the theoretical component of CTAE courses was perceived as doable by most of the respondents.

Fifth Conclusion

5) *School districts were generally ill-prepared and struggled to provide support to CTAE teachers in their efforts to teach the psychomotor skills related to their programs.*

This conclusion is determined from the findings of the responses to the first four statements given in response to Question Ten. In those four statements, respondents were asked if they thought their school district clearly set goals for transitioning to online/virtual instruction and communicated them with CTAE teachers, if they thought they were provided suitable instructional guidance for online teaching, if they felt like their school district prepared them for the move to online learning and if they received adequate technical support during the move to online learning. The majority of responses for all four statements were negative. Collectively these responses reflect that CTAE teacher were not pleased with their school districts during the move to online learning. The school districts' failure to provide sufficient guidance (in terms of instruction), communication (in terms of goals for the transition), and technical support (for teachers and students) lead to most teachers feeling unprepared for the move online. What is more concerning, less than half of the respondents reported that they believe their school district is prepared for another move to online learning in the event of a second pandemic.

Recommendations for Further Research

There are six areas recommended for further research:

1) *More information is needed to examine the experiences of CTAE teachers in the 12 areas of CTAE that were not included in this study.*
2) *More information is needed to examine how online learning impacted the learning of psychomotor skills in the 12 areas of CTAE that were not included in this study.*
3) *More information is needed to determine the type and level of psychomotor skills inherent in CTAE courses that are appropriate or inappropriate for online learning.*
4) *More information is needed to determine if there are any new and emerging CTAE subject areas to expand and/or determine their compatibility with online learning.*
5) *More information is needed to identify the best online practices for the teaching of psychomotor skills related to each specific area of CTAE and become part of that course's standard operation procedures.*
6) *The instructional technology industry should incorporate the use of virtual reality in CTAE courses.*

First Research Recommendation

1) *More information is needed to examine the experiences of CTAE teachers in the 12 areas of CTAE that were not included in this study.*

More information is needed to examine the experiences of CTAE teachers in the CTAE areas that were not included in this study. Areas such as Agriculture, Manufacturing, Transportation, and others may have different psychomotor content or requirements but respondents from those areas were not available and therefore were not

included in this study. Those areas should be researched to identify the instructional commonalities, psychomotor or otherwise, that apply to all areas and those that differ from other areas of CTAE before changes that could affect all of CTAE are suggested.

Second Research Recommendation

2) *More information is needed to examine how online learning impacted the learning of psychomotor skills in the 12 areas of CTAE that were not included in this study.*

More information is needed to examine how online learning impacted the learning of psychomotor skills in the areas of CTAE that were not included in this study. Areas of CTAE such as Agriculture, Manufacturing, Transportation and others are believed to have different instructional psychomotor requirements and components. Respondents from those areas were not available and therefore were not included in this study. Those areas should be researched and evaluated for psychomotor learning and requirements before changes that could affect all of CTAE are suggested.

Third Research Recommendation

3) *More information is needed to determine the type and level of psychomotor skills inherent in CTAE courses that are appropriate or inappropriate for online learning.*

Information is needed to determine what makes a psychomotor-heavy or tactile based course, such as the CTAE courses of Agriculture, Manufacturing, Transportation and others appropriate or inappropriate for online learning. Those areas should be researched and evaluated for psychomotor learning and requirements before changes that could affect all of CTAE are suggested.

Fourth Research Recommendation

4) *More information is needed to determine if there are any new and emerging CTAE subject areas to expand and/or determine their compatibility with online learning.*

More information may be needed to determine if there are any new potential subject areas in which CTAE needs to expand or to determine if there are any current areas that no longer need to be offered because of its incompatibility with online learning. The feasibility of online transference of courses Agriculture, Manufacturing, Transportation and others should be researched and evaluated for psychomotor learning and requirements before changes that could affect all of CTAE are suggested.

Fifth Research Recommendation

5) *More information is needed to identify online best practices for the teaching of psychomotor skills related to each specific area of CTAE and become part of that course's standard operation procedures.*

Best practices for online learning in each specific area of CTAE should be researched and established and become part of that course's standard operation procedures. Focus group interviews revealed a large disparity in the instructional proficiency and practices of teachers teaching the same subjects in the same school districts. Standardizing instruction and instructional practices should help alleviate these disparities. This research should also provide information on recommended best practices for online classroom management to ensure proper facilitation of recommendations.

Sixth Research Recommendation

6) *The instructional technology industry should incorporate the use of virtual reality in CTAE courses.*

The instructional technology industry should conduct further research to explore the viability of virtual reality technology as a teaching tool for CTAE online psychomotor learning.

Recommendations for Future Policies

The following six district level, or higher, policies are recommended to facilitate future online psychomotor learning.

1) School districts should designate, require, and enforce the use of a single particular online learning platform throughout the district's online classes. 2) Once a particular online learning platform has been identified, school districts need to establish and enforce online instructional guidelines for each CTAE subject offered.

3) School districts should mandate increased professional development training opportunities for CTAE educators to gain skills on the most recent "District Approved" instructional online classroom technologies.
4) School districts' technology policy should require signed acknowledgment of specific student and parent acceptable online behavior and class environment practices.
5) Local school district CTAE administration should institute a policy of periodically reviewing their CTAE curricula to determine the compatibility of each existing course with district online learning technology and practices to

determine the degree to which the psychomotor learning in the current and future courses may be suitable for online learning.

6) School districts and state educational agencies should fund the development of new *instructional* technology for psychomotor learning and skill *development for CTAE online instruction.*

First Recommendation for Future Polices

1) School districts should designate, require, and enforce the use of a single particular online learning platform throughout the district's online classes.

Based on the focus group interviews, some school districts allowed the use of multiple online learning platforms and did not necessarily offer ongoing training or support for the platforms being used. According to the respondents, this was an issue because it forced some students to learn multiple learning platforms and did not help the less tech savvy teachers adapt to online learning.

Second Recommendation for Future Polices

2) Once a particular online learning platform has been identified, school districts need to establish and enforce online instructional guidelines for each CTAE subject offered.

Based on the focus group interviews, the plethora of subject areas offered in CTAE create a need for uniformed online instructional guidelines for each subject area. Many of the courses utilize unique equipment and technology that require additional training for proficiency. An attempt at standardization to regulate the delivery and flow of content would be very beneficial.

Third Recommendation for Future Polices

3) *School districts should mandate increased professional development training opportunities for CTAE educators to gain skills on the most recent "District Approved" instructional online classroom technologies.*

School districts need to provide more training opportunities for educators to become "current" in instructional technology. School districts should also emphasize and strongly encourage the academic benefits of the integration of other instructional technologies for classroom success.

Fourth Recommendation for Future Polices

4) *School districts' technology policy should require signed acknowledgment of specific student and parent acceptable online behavior and class environment practices.*

Based on the focus group interviews, one of the more challenging obstacles to online learning on the secondary level was the lack of structure of the learning environment. Focus group respondents reported various family members regularly interrupting classes. Hopefully rising parental awareness of the requirements for a proper learning environment will help decrease the frequency of interruptions.

Fifth Recommendation for Future Polices

5) *Local school district CTAE administration should institute a policy of periodically reviewing their CTAE curricula to determine the compatibility of each existing course with district online learning technology and practices to determine the degree to which the psychomotor learning in the current and future courses may be suitable for online learning.*

Many courses taught traditionally in CTAE such as Agriculture, Food, and Natural Resources or Manufacturing may need periodic updating to the psychomotor component of its instruction. These updates would include modifications of the teaching methods and revaluation of its suitability for online learning. In addition, advances in technology are creating new methods and areas of academic interest that may fall under the CTAE category and could be more suitable for online learning.

Sixth Recommendation for Future Polices

6) *School districts and state educational agencies should fund the development of new instructional technology for psychomotor learning and skill development for CTAE online instruction.*

Today's students are tomorrow's labor force and as the use of online learning increases, the need for educational institutions to have the ability to effectively provide adequate training will be vital for both the future of learning and society itself.

Recommendations for Future Practices

The following six practices for future CTAE online learning of psychomotor skills should be engaged at the district level or higher:

1) *School district's technology policy for class attendance online should require use of specific features to ensure attentiveness.*
2) *CTAE teachers should be strongly encouraged to fully engage and incorporate the most recent online instructional classroom technology available into their teaching practices; and*

3) *CTAE teachers should be provided with professional development on how to build relationships with online students to simulate the "instructional touch" component of CTAE face-to-face courses.*
4) *School districts should develop take home instructional kits for online CTAE students to learn basic psychomotor skills for the use of tools and self-manipulation.*
5) *School districts should offer professional development that teach instructors how to use psychomotor technology online.*
6) *Teacher certification programs for CTAE should include training on how to teach psychomotor skills online.*

First Recommendation for Future Practices

1) *School district's technology policy for class attendance online should require use of specific features to ensure attentiveness.*

School district's technology policy for class attendance online should require use of specific features to ensure attentiveness. This recommendation comes from the focus group data in reference to student's reluctance to use their cameras or microphones because of their living situations at home. The latitude granted in active participation allowed for students who were less than attentive to take advantage and leave class once they had answer role. The school district's technology policy for class attendance online should require use of the camera along with use of the "Blur Background" feature and active use of the "Mute" feature when not speaking in all online classes.

Second Recommendation for Future Practices

2) CTAE teachers should be strongly encouraged to fully engage and incorporate the most recent online instructional classroom technology available into their teaching practices.

CTAE teachers must be strongly encouraged to attempt to fully engage the most recent instructional classroom technology available into their teaching practices. As mentioned with the third recommendation for future policy, the district must encourage teachers to become as "tech-savvy" as possible and engage as much instructional technology into their teaching as possible. The third recommendation for future policy offers teachers training, the accompanying practice should offer teachers some type of incentive to incorporate as much technology of the technology as they have learned into their teaching practices. This recommendation also comes from the focus group interviews reports of a large disparity in the instructional proficiency and practices of teachers teaching the same subjects in the same school districts.

Third Recommendation for Future Practices

) CTAE teachers should be provided with professional development on how to build relationships with online students to simulate the "instructional touch" component of CTAE face-to-face courses.

The last on most challenging recommended practice is for CTAE teachers make more of an effort to build relationships with online students to simulate the "instructional touch" component of CTAE face-to-face courses. As revealed from the focus group, effective psychomotor learning on the secondary level in a face-to-face setting has an element of relationship or socialization between teacher and student that facilitates and encourages student effort and attention. While relationships cannot be mandated, teachers

making themselves available for students putting forth more than the perfunctory effort and / or showing sincere interest should be encouraged.

Fourth Recommendation for Future Practices

4) *School districts should develop take home instructional kits for online CTAE students to learn basic psychomotor skills for the use of tools and self-manipulation.* By providing each online CTAE student a take home instructional kit, tailored to the course in which they are enrolled, students will be able to engage the psychomotor component of their course and possibly develop transferable tactile skills**.**

Fifth Recommendation for Future Practices

5) *School districts should offer professional development that teach instructors how to use psychomotor technology online.*

Incorporating the pedagogy of online psychomotor learning is vital for CTAE but with the ever-developing technologies and practices used in the various courses, it cannot be done effectively as a one-time event. School districts should offer ongoing professional development designed to keep their teachers technically savvy in terms of online learning and psychomotor learning, and the integration of the two.

Sixth Recommendation for Future Practices

6) *Teacher certification programs for CTAE should include training on how to teach psychomotor skills online.*

To ensure teacher quality in the online environment, CTAE certification programs should make sure that incoming teachers receive training on how to effectively convey psychomotor skills to online learners.

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APPENDIX A:

Institutional Review Board Approval

Institutional Review Board (IRB)

for the Protection of Human Research Participants

Protocol Number: 04404-2023

Responsible Researcher: Ira Andrews

Supervising Faculty: Dr. Reynaldo Martinez

Co-Investigators: Dr. Keith Waugh, Dr. Kenny Ott, and Dr. Jiyoon Jung

Project Title: *Hands off, Hands-on Learning: CTAE in Secondary Schools during COVID-19.*

INSTITUTIONAL REVIEW BOARD DETERMINATION:

This research protocol is **exempt** from Institutional Review Board (IRB) oversight under 45 CFR 46.101(b) of the federal regulations, **category 2**. If the nature of the research changes such that exemption criteria no longer apply, please consult with the IRB Administrator (irb@valdosta.edu) before continuing your research study.

ADDITIONAL COMMENTS:

- *Upon completion of the research study, collected data must be securely maintained and accessible only by the researcher(s) for a minimum of 3 years. At the end of the required time, collected data must be permanently destroyed.*
- *Exempt guidelines prohibit the collection, storage, and/or sharing of recordings. Exempt protocol guidelines permit the recording of interviews/focus group sessions provided recordings are made to create an accurate transcript. Upon creation of the transcript, the recorded interview and/or focus group session must be deleted immediately from recording and storage devices.*
- *As part of the informed consent process, recordings and transcripts must include the researcher reading aloud the consent statement, confirming participant's understanding, and establishing the participants willingness to take part. Participants must be offered a copy of the research statement.*
- *To ensure confidentiality, pseudonym lists must be kept in a separate secure file from corresponding name lists., email addresses, etc.*

☒ ***Please submit any documents you revise to the IRB Administrator at tmwright@valdosta.edu to ensure an updated record of your exemption.***

Elizabeth W. Olphie *04.18.2023* ***Thank you for submitting an IRB application.***

Elizabeth W. Olphie, IRB Administrator Date ***Please direct questions to irb@valdosta.edu or 229-259-5045.***

Revised: 06.02.16

APPENDIX B:

Survey Instrument

Participant Demographics

1. What is your gender?

Male	Female	Non-binary / third gender	Prefer not to answer
O	O	O	O

2. What is your current age?

21 to 25	26 to 30	31 to 35	36 to 40	41 to 45	46 to 50	51 or more
O	O	O	O	O	O	O

3. What is the highest degree you have obtained?

Bachelor's Degree	Master's Degree	Specialist's Degree	Doctoral / Terminal Degree
O	O	O	O

4. Which of the listed CTAE areas were you teaching in March 2020 when the pandemic hit?

O	Air Force JROTC	O	Culinary Arts
O	Allied Health and Medicine	O	Engineering and Technology
O	Audio Visual Technology & Film	O	Navy JROTC

5. Were you certified to teach in the area selected in the previous question in March 2020?

Yes	No
O	O

6. How many total years of have you taught in the area selected in the previous questions before the pandemic?

1 to 3	4 to 6	7 to 9	10 to 15	16 to 20	21 to 25	26 or more
O	O	O	O	O	O	O

7. In your opinion, did the content of the CTAE class you were teaching require primarily (over 50%) psychomotor or hands-on learning (e.g., physical manipulation of tools, equipment, computer-based content, or self)?

Yes	No
O	O

Please respond to the following statements based on your experience of teaching the CTAE class during the pandemic.

8. I believe students can…	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
effectively learn psychomotor skills in a distance learning course	O	O	O	O	O

effectively learn course content ***without*** the ability to employing psychomotor skills	O	O	O	O	O
learn through trial and error and develop their own styles in online	O	O	O	O	O
courses as they would in face-to-face settings	O	O	O	O	O
gain cognitive knowledge and skillset online as they would in face-to-face settings	O	O	O	O	O
apply and build upon the cognitive knowledge and skillset online as they would in face-to-face settings.	O	O	O	O	O

9. I think that my school district…	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Clearly set goals for transitioning to online/virtual instruction and communicated them with CTAE teachers	O	O	O	O	O
did ***not*** provide instructional guidance for online teaching suitable for CTAE teachers	O	O	O	O	O

10. I think my online CTAE students were able to grasp the concepts and skills related to the physical manipulation of…

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
tools (e.g. basic tools in kitchen utensils in Culinary Arts, scales and protractors in Engineering)	O	O	O	O	O
equipment (e.g., XRL camera in Audio Visual, flight simulators in Air Force JROTC, 3D printers in Engineering)	O	O	O	O	O
computers and computer-based content. (e.g. online lessons)	O	O	O	O	O
Self. (e.g. physical movement)	O	O	O	O	O

11. Thank you for responding to this survey. However, we understand that this survey alone is not the best way to collect information about your experience as CTAE teachers. We would love to invite you to a virtual focus group meeting to share your experiences on the topic. Are you interested?

Yes	No
O	O

APPENDIX C:

Focus Group Questions

1. How much of your content were you able to demonstrate via distance learning?
2. What was the easiest thing for you to transition to a distance learning platform?
3. Which skill was the most difficult for you to transition to a distance learning platform?
4. What was the most difficult aspect of moving your curriculum online?
5. How well were your distance learning students able to adequately explain the psychomotor components of your content area without the hands-on experience?
6. How do the tactile skillsets of the students who completed the course from a distance compare to the those of the students whom completed the course in person?
7. What do you think should have been done to better prepare teachers for distance learning?
8. Is there anything else you would like to say about your teaching experiences in CATE during the COVID-19 pandemic?

APPENDIX D:

Focus Group Guidelines

The focus groups were conducted in the following seven-step process:

Step one was to begin with, a welcome, thanking each participant for agreeing to be part of the focus group.

Step Two was the introduction of the moderator.

Step Three explained the purpose of the focus groups and why each participant's honest and open input was essential.

Step Four explained the five ground rules of this focus group.

Rule One, the participants were supposed to do the talking and everyone should participate.

Rule Two, the moderator may call on a participant if the participant has not spoken in a while.

Rule Three, there were no right or wrong answers; every person's experiences and opinions were essential, speak up whether you agree or disagree; we want to hear a wide range of opinions.

Rule Four, what was said in this room stayed here.

Rule Five, the session was recorded, but participants would not be identified by name.

Step Five: Each participant was then asked to introduce her/himself.

Step Six: The Moderator answered any questions the participants had and verified they all had the moderator’s contact information and thanked all participants for participating.

Step Seven: The Moderator began asking questions to the group.

APPENDIX E:

Solicitation Letter to Teachers

Greetings Teachers,

My name is Ira Andrews. I am a CTAE teacher at Lakeside High school in the Dekalb County School District and a doctoral student at Valdosta State University. I am completing my dissertation on Career, Technical, and Agricultural Education (CTAE) teachers' experiences of supporting students' psychomotor learning prior to and during the pandemic, in hopes of creating a guide to best practices.

You have been identified as a CTAE teacher in the area of Air Force JROTC, Allied Health and Medicine, Audio Visual Technology & Film, Culinary Arts, Engineering and Technology, Navy JROTC, or Automobile Maintenance. As such, you are being asked to participate in a research study entitled, "Hands off, Hands-on Learning: CTAE in Secondary Schools during COVID-19." This study is being conducted by Ira Andrews, a DeKalb County School District employee and student at Valdosta State University. The study will include completion of a 25-question online survey and participation in one of five online focus group meetings. These meetings will be divided into subject areas. The purpose of the study is to explore the experiences of high school CTAE teachers during the shift to remote learning during the COVID-19 pandemic and to document the best practices or the most effective techniques discovered for learning hands-on skills online. You will receive no direct benefits from participating in this research study. However, your responses may help us learn more about teaching students hands-on skills online. There are no foreseeable risks involved in participating in this study other than those encountered in day-to-day life. Participation should take approximately one hour. The online group discussion will be recorded in order to accurately capture concerns, opinions, and ideas that are offered by the group. Once the recordings have been transcribed, the recordings will be destroyed. No one, including the researcher, will be able to associate your responses with your identity. Your participation is voluntary. You can choose to participate in both the survey and the focus group, the survey alone, or the focus group alone. You may choose not to participate, to stop responding at any time, or to skip any questions that you do not want to answer. You must be at least 18 years of age to participate in this study. Your participation in the online group discussion will serve as your voluntary agreement to participate in this research study and your certification that you are 18 years of age or older.

Questions regarding the purpose or procedures of the research should be directed to Ira Andrews at idandrews@valdosta.edu. This study has been exempted from Institutional Review Board (IRB) review in accordance with federal regulations. The IRB, a university committee established by federal law, is responsible for protecting the rights and welfare of research participants. If you have concerns or questions about your rights as a research participant, you may contact the IRB Administrator at 229-253-2947 or irb@valdosta.edu.

If you are willing to participate, please clicking the link the **Survey Instrument** (Appendix F).

Thank you very much for your time and consideration.

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APPENDIX F:

Participation Thank You Letter

CTAE Teachers,

Thank you for your participation in this study through your completion of the Likert scales and focus group. The information you provided will assist future generations of teachers, students and administrators in the event of another pandemic. You have been a great help to understanding the conditions that arose during and after the COVID-19 pandemic in 2020-2021, and hopefully this research will be of benefit for all parties involved.

Questions regarding the purpose or procedures of the research should be directed to Ira Andrews at idandrews@valdosta.edu. This study has been approved by the Valdosta State University Institutional Review Board (IRB) for the Protection of Human Research Participants. The IRB, a university committee established by Federal law, is responsible for protecting the rights and welfare of research participants. If you have concerns or questions about your rights as a research participant, you may contact the IRB Administrator at 229-253-2947 or irb@valdosta.edu.

Thank you for your support and cooperation.

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