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Investigating the Efficacy and Sustainability of Virtual Education Courses

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Abstract

As teacher educators prepare for the future of teacher education, it is important to address the sustainability of virtual education courses. This study used a pre-existing model provided by the New York State Education Department as a framework to define the types of courses that may appear in an education program. Data was collected using a convergent parallel mixed methods approach to simultaneously gather qualitative and quantitative data. A total of 640 education courses from accredited education programs across the United States were analyzed. Findings indicated the type of course did not play a role in the course effectiveness during the pandemic, suggesting all education courses can be delivered effectively in a virtual modality. The delivery method of undergraduate courses was indicated by participants to be less effective during the pandemic than graduate courses. Results suggest courses that involve fieldwork (i.e., Field Experience, Student Teaching, or Practicum) were indicated by participants to be the least sustainable as virtual courses post-pandemic. Results also suggest that although virtual education courses at the graduate level are sustainable in education programs post-pandemic, undergraduate courses may not be. Advantages to virtual course delivery clustered around logistics and access while challenges clustered around engagement and hands-on-learning. This study provides curriculum guidance to those across the globe in the position of making modality decisions.

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Introduction

Through the decades, teacher preparation and educational technology have evolved alongside each other. The two fields have become mutually dependent, with the continued evolution of education looking towards current technology and educational technology looking towards the expanding needs of learners (National Education Association [NEA], 2014). Most recently, the pandemic resulted in an amalgamation of teacher preparation and technology with a forced and abrupt shift to virtual learning. The covid-19 pandemic brought about the realization that all courses can be administered virtually. However, as Educator Preparation Programs (EPPs) and other education programs continue to transition to a post-pandemic era, many have decisions to make or reflect on regarding the most effective course modality for each of their education courses moving forward.

Given the increase in student demand for virtual courses due to potential financial and logistical benefits, many education programs have made the decision to shift education courses, and in some cases entire programs, to a virtual environment. On one hand, this shift allows for programs to integrate the ability of teacher candidates about to enter the field where they are prepared to effectively leverage technology and navigate virtual learning environments (Council for the Accreditation of Educator Preparation [CAEP], 2013; Council of Chief State School Officers [CCSSO], 2011; International Society for Technology in Education [ISTE], 2017; National Education Association [NEA], 2014; Schmidt et al., 2009). On the other hand, there is an argument to be made that not *all* education courses lend themselves to high levels of student engagement and the fulfilment of course outcomes in a shift from on-ground to virtual (Lemay et al., 2021; U.S. Department of Education, 2020).

This study seeks to address the pressing concern of shifting to online course delivery in EPPs by evaluating the effectiveness of virtual course delivery during the time of COVID-19. By examining the experiences of educators teaching within virtual education settings during the pandemic, this research aims to identify the courses that lend themselves to effective virtual delivery and those that may require alternative approaches. Situated within current literature on the benefits of virtual learning (Holmes & Gardner, 2006; Dung, 2020; Lockee, 2021) and course modality preferences within teacher preparation (Bawanea & Spector, 2009; Hachey et al., 2022), as well as current policy released from the U.S. Department of Education (2020), this study contributes valuable insights that inform decision-making processes and pedagogical practices within educator preparation programs and beyond.

Literature

History of Virtual Learning

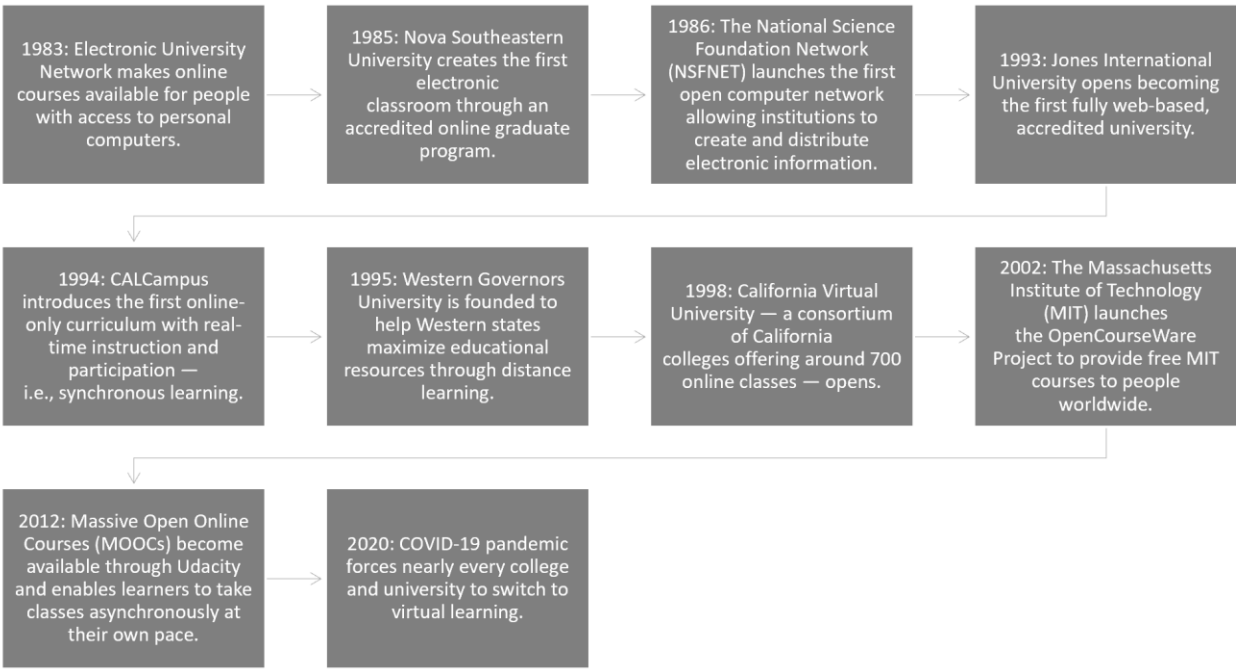
Virtual learning has roots in distance and correspondence learning, which can be traced back to the 18th century (Kentnor, 2015; Ferrari, 2020; Pregowska et al., 2021). The progression and evolution of this type of learning has advanced with innovations in technology. The first concept of distance learning was correspondence learning, which occurred mainly through the mail and was a one-way form of learning (Barbour, 2018; Britannica, 2023). When the postal service was developed, it became easier for institutions to provide education to students that were not available in physical locations. The concept of long-distance, reliable correspondence between

educators and students led to the implementation and development of courses distributed through the postal service.

Correspondence education was first introduced in 1870s (Harting & Erthal, 2005; Betts et al., 2020). It was started by John Heyl Vincent and Lewis Miller in New York to train teachers for Sunday school in the summer. It was later expanded to include arts and general education, where supplemental studies and readings were sent home through the mail. Harting and Erthal (2005) and Betts et al. (2020) illustrated that the same model was eventually adopted by renowned universities like the University of Chicago. Correspondence education began to evolve as technologies such as radio and television emerged (Watson & Murin, 2012; Awotunde et al., 2023). The North Dakota Center for Distance Education started offering several correspondence classes in the 1930s (Watson & Murin, 2012) and the University of Houston developed televised classes in 1953 (Clark, 2013; Tritsch, 2021). This was the first public education program on television in the U.S. and ran hours of educational materials every week. Correspondence education continued to expand to other delivery methods with the emergence of the Internet. In the 1980s, the University of Nebraska High School also started to offer courses where students could submit work through email and, in 2001, offered its first full diploma online (Watson & Murin, 2012; Tritsch, 2021). Following the 1980s, the next decades brought about rapid accessibility and advancement to virtual learning in the realm of post-secondary education (see Figure 1).

Figure 1

Key Events in the Advancement of Virtual Learning for Colleges and Universities (Thompson, 2023)



By 2010, virtual learning had become mainstream rather than a trend. By 2012, almost 70% of academic leaders suggested that long-term education strategies should include virtual learning (Allen & Seaman, 2012). According to United States Department of Education (2013), 6.7 million

out of the total 20.6 million students that were enrolled in higher education were taking at least one course virtually. A lot of schools and universities also emerged in the 21st century as virtual schools. The Michigan Virtual School was a non-profit, private corporation that was funded by the Michigan Legislature in 2000 (Michigan Virtual University, 2015). The Illinois Virtual School expanded to professional development and middle school courses after initially providing only high school classes (Watson & Murin, 2012). Additionally, with the help of the state legislature, the Idaho Digital Learning Academy was founded (Watson & Murin, 2012). As noted above, distance education has been part of our education systems for two centuries, and as society continues to embrace new forms of communication, virtual learning continues to grow (Moore et al., 2011; Spector et al., 2007; Lockee, 2021).

The COVID-19 pandemic played a critical role in the expansion of virtual education (Huck & Zhang, 2021). As countries started to close and implement quarantine policies, the education system adapted to the new normal with virtual learning (Adedoyin & Soykan, 2023). It became a household activity where students started to learn virtually while teachers taught from home or the classroom. Teachers started to instruct multiple groups of students remotely, using synchronous video and audio to deliver direct and live instruction (Schwarz et al., 2022). Many teachers have used third-party service providers like YouTube, Google Meet, Zoom, and Google Classroom to engage with students (Simamora et al., 2020; Lockee, 2021; Yu et al., 2022). During COVID-19, universities took advantage of existing models of virtual learning and applications to adapt to the new need for virtual education (Lockee, 2021). With virtual learning playing such a significant role in the K-12 sector, it follows that this would be replicated in the higher education programs that prepare teachers to work in those virtual environments.

Virtual Learning and Educator Preparation

A lot of teachers give preference to face-to-face and in-person communication to teach despite the progress of virtual learning (Bawanea & Spector, 2009; Hachey et al., 2022). It is known that teaching virtually rarely makes gestures and emotions as explicit as in-person interactions do; however, it does have the ability to relay meaning, depth, and intensity (Bawanea & Spector, 2009; Hachey et al., 2022). The roles and competencies that are needed to teach in virtual environments are fundamentally similar to face-to-face environments (Spector et al., 2006; Hollister et al., & Chukoskie, 2022). For instance, listening skills are integrated in both. However, the demonstration and significance of these competencies can differ based on the roles and context that are assumed during teaching (Bawanea & Spector, 2009; Qadhi et al. 2020). Hence, individual skills and traits matter more than the teaching modality.

Educators for teachers recognize there is a gap between the application of classroom management and instruction skills and the preparedness of the teacher (Peterson-Ahmad et al., 2018). EPPs have faced challenges in sufficiently providing high-quality training for teachers to effectively raise student achievement and cater to different ability levels (Beare et al., 2012; Qadhi et al., 2020). Virtually, students appeared to master low-level skills in mathematics, reading, and science basics (Snyder, 1993; Furner & Worrell, 2017; Szczygieł & Pieronkiewicz, 2021), but not many demonstrated competency in community leadership, cultural differences, and teamwork (Sweet et al., 2022). If there is inadequate emphasis on offering pre-service training for classroom management and pedagogical practice beyond the field activities and conventional coursework,

it can cause pre-service instructors to complete EPPs without actually learning implementation knowledge, effective practices for instruction, and classroom-ready skillsets (McLeskey & Brownell, 2015; Qadhi et al., 2020).

Research shows that there is a positive link between classroom performance and subject matter knowledge for teachers (Ingersoll et al., 2012; Charity et al., 2023). There have also been positive results for teachers that gain advanced preparation for teaching strategies, fieldwork, and coursework knowledge to have a greater chance to achieve success in the long term within the classroom (Ingersoll et al., 2012). Hence, it is important to ensure that EPPs provide virtual learning and teaching to create deliberate opportunities for teachers to implement and practice teaching methods and strategies as well as receive feedback. If teachers are prepared for pedagogy and content, it can make a huge difference in the overall effectiveness within the classroom, whether virtual or in-person (Darling-Hammond, 1999; Nuangchalerm, 2012; Amador et al., 2022).

Peterson-Ahmad et al. (2018) & Chandran et al. (2021), illustrated that when effective virtual environments are created for teacher training, it can help refine specific pedagogical and behavior management methods. According to Dawson & Lignugaris-Kraft (2017), teachers who practiced positive reinforcement in virtual environments were more likely able to improve their error correction and praise techniques in conventional classrooms.

Advantages to Virtual Courses

Virtual learning offers significant benefits to teacher candidates, given that it centers around learners more than any other factor (Holmes & Gardner, 2006; Dung, 2020; Lockee, 2021) (see Table 1). Teacher candidates can access a lot of information online, which can enhance the efficacy and effectiveness of knowledge given they can access educational resources and libraries anytime without having to leave the study environment (Arkorful & Abaidoo, 2015; Mirzakhani et al., 2010; Lockee, 2021). Virtual learning provides teacher candidates convenience, accessibility, and flexibility in which students would be able to have a flexible schedule that can fit their time of availability, location, and time zones (Smedley, 2010; Dung, 2020; Hollister et al., 2022). Virtual courses also reduce tuition fees, travel expenses, and materials for students making them a cost-effective option (Mukhtar et al., 2020). Jason et al. (2001) & Hollister et al. (2022) also found that since the Internet is available 24/7, courses can be accessed at any time of the day without having to get in touch with the instructor. This allows teacher candidates to learn at their own pace, which can decrease stress, increase satisfaction, improve the exchange of perspectives, ease communication, and improve sustained learning (Singh et al., 2021). Virtual learning can also help reduce barriers that usually hinder participation, motivating teacher candidates to interact with each other (Arkorful & Abaidoo, 2015; Abramson, 2021). It encourages inclusivity, as shy students often find virtual classes to be far more conducive to participation. Teacher candidates are also able to access a variety of different programs and courses resulting in more choice for students (Yang & Arjomand, 1999; Hollister et al., 2022).

Virtual learning also offers significant benefits to teacher educators (see Table 1). Teacher educators are able to incorporate video, audio, and presentations in their delivery, which can improve retention and motivation in teacher candidates (Abdulrahaman et al., 2020). Teacher

educators can benefit from the social and intellectual partnership that is created by virtual learning technology (Husu, 2000; Abdulrahaman et al., 2020; Abramson, 2021). It can enhance additional social skills since the technology can increase mutual support and group cohesion. Husu (2000) and Singh et al. (2021) also found that the pandemic allowed new social and communication skills to overcome relative isolation by interacting with other students in similar conditions. Posey et al. (2010) and Okere (2021) illustrated that virtual learning can drastically improve teacher educator organization by creating virtual notebooks where information, class notes, assignments, and documents can be easily organized. It also pushes teacher educators to learn better and newer applications and tools to enrich the learning environment for educational activities (Dung, 2020). Teacher educators can control the medium in a much better way since both teachers and students have to speak more clearly, wait their turn, and plan what they are going to say (Husu, 2000; Yu et al., 2022).

Table 1
Potential Advantages to Virtual Courses

Teacher Candidates	**Teacher Educators**
access to information	tools to enrich learning environment
convenience	social and intellectual partnership
accessibility	mutual support and group cohesion
flexibility	improve teacher educator organization
reduce barriers to participation	save time grading
reduce cost	

The benefits of virtual learning extend to institutions as well. Virtual learning helps offer a course to huge numbers of students through videoconferences without restraints of space (Dung, 2020). It can also be a great way to address barriers of staffing scarcity since institutions can hire staff members that live in remote locations but are most qualified to teach teacher candidates (Arkorful & Abaidoo, 2015). With these teacher candidate, teacher educator, and institutional benefits, it is not surprising that in 2020 almost 60% of educational stakeholders insisted that schools should continue providing remote or virtual learning alternatives for students (Echelon Insights, 2020).

Challenges to Virtual Courses

While there are several advantages of virtual learning, there are also challenges that teacher candidates face during virtual education (see Table 2). Dung (2020) and Li & Lalani (2020) indicated that students often complain about feeling a loss of concentration, boredom, and tiredness when virtual classes are too long. Learning usually takes place over several hours, which can become tiresome for isolated teacher candidates logging in from their homes.

Additionally, although virtual learning can enhance new social skills, it cannot fully replace the interaction of in-person learning since there are low opportunities for social exchanges, especially with other teacher candidates (Dung, 2020; Young, 1997; Zhong, 2020). Technological issues also pose a challenge for teacher candidates and teacher educators. Students experienced their electrical devices heating up and shutting down due to the long hours of class (Dung, 2020; Alawamleh, 2020). Wi-Fi connection and its quality is not reliable at all times. There are also hundreds of thousands of students that might not have access to a computer for virtual education (Salman, 2020). Teacher candidates face the challenges of losing online work, learning, and assessments halfway due to a loss of connections (Dung, 2020; Yusny et al., 2021). For teacher candidates that have poor technology knowledge, this can impact their ability to take tests and access virtual education (Mahlangu, 2018; Castelli & Sarvary, 2021). Due to these elements, teacher candidates must have strong time management skills and motivation to reduce the effects of isolation, boredom, and technology issues, which is not always possible (Al-Kumaim et al., 2021).

There are also challenges that teacher educators face during virtual education (see Table 2). Teacher educators struggle with supervision of assessments in virtual environments, as it is typically held by proxy which can make it hard, if not impossible, to regulate academic integrity (Al-Qahtani & Higgins, 2012; Greenhow et al., 2022). It can result in an increase in piracy, inappropriate use of copy and paste, and plagiarism (Arkorful & Abaidoo, 2015; Greenhow et al., 2022). Teacher educators also face plenty of challenges when it comes to managing virtual learning since students might leave during the lesson or are late. Many teacher candidates, especially underrepresented minorities, also do not want to turn the camera on during class due to personal appearance, weak internet connections, or physical location which can make communication harder (Castelli & Sarvary, 2021; Dung, 2020). While virtual learning can save teacher educators time in a myriad of ways, it can also increase time spent learning new technology, finding new ways to structure material, and adjusting curriculum so students can access learning through the virtual platform (Piccoli et al., 2001; Posey et al., 2010; Li & Lalani, 2020). Additionally, teacher educators have to be on-call at all times since students expect prompt feedback and responses (Posey et al., 2010).

Table 2
Potential Challenges to Virtual Courses

Teacher Candidates	**Teacher Educators**
isolation/boredom	technological issues
low opportunities for social exchanges	supervision of assessments
technological issues/access	plagiarism
	classroom management
	adjusting curriculum

prompt feedback

Another huge issue is that not all disciplines can be taught effectively in virtual environments (Arkorful & Abaidoo, 2015). Elhaty et al. (2020) illustrated that scientific fields need practical, hands-on experience that is different from doing during virtual learning. Virtual learning is more suitable for humanities, social sciences, English, and other such subjects, while sciences need more in-person practical experimentation to fully understand. Virtual learning can emulate the hands-on experiences that lab classes often offer (Brown, 2001).

Pre-Pandemic Education Courses

The outbreak of the pandemic resulted in widespread devastation around the world. As governments attempted to halt the spread of the epidemic, the education sector was severely impacted. Globally, social distance signaled the closure of institutions, transforming the face of education (Dhawan, 2020). Before the pandemic, many courses in EPPs were taught in person as part of formal instruction of schooling experiences (Tang et al., 2020). This involved the use of curricular documents, texts, films, and other teaching materials that were specifically chosen to support a school's intentional instructional agenda. Specifically, content courses providing a knowledge base in core subject areas, pedagogy courses providing a knowledge base in education, and field experiences were primarily face-to-face. Content courses included physical encounters between lecturers and students, as well as group discussions to increase the learning experience and social interaction of students (Ferdig et al., 2020). Pedagogy courses involved emotions, facial expressions, and ethics, which were practical face-to-face courses as they required physical encounters for students to learn how to successfully teach life-preparatory information, such as social skills and cultural standards (New York State Education Department [NYSED], 2023b). Field experiences occurred outside of the classroom and were intended to give supervised and controlled encounters with professionals to pre-service candidates (NYSED, 2023b). As the post-pandemic era continues, and the pandemic requirement for virtual education courses is no longer present, EPPs have time to reflect on decisions regarding the most effective course modality for each of their education courses/programs.

Conceptual Framework

Lemay et al. (2021) argues that just because a course/program is effective on-ground does not mean it is effective in a virtual environment. The U.S. Department of Education (2020) released a Distance Education and Innovation regulation which outlined that “while many will see the benefits of distance education after the pandemic is over… some programs would not be appropriate to conduct fully online…” (p. 54744) and research is needed to evaluate efficacy. Additionally, it is evident through various state policies that a change in delivery modality should not be the only difference between an on-ground and a virtual course (California Department of Education, 2022; New York State Education Department [NYSED], 2023a; South Carolina Commission on Higher Education; n.d.; Texas Higher Education Coordinating Board, n.d.). These policies suggest that there is a great deal of planning and thought that must go into transitioning an on-ground course to become a virtual course. With a clear understanding of *which* type of

education courses can be effectively administered virtually programs can strive to reach a balance between the need to protect student interests (i.e., offer virtual courses) while providing faculty with the tools they need to deliver high-quality, distance education for students in the 21st century (Bloom, 1956; Prensky, 2001; U.S. Department of Education, 2020).

The pre-existing model provided by the New York State Education Department (NYSED, 2023b) was used as a framework to define the types of courses that may appear in an education program. These included:

- General Education Core – prepares candidates with knowledge, understanding, and skills in the liberal arts and sciences.
- Pedagogical Core – provides a knowledge base for education, including human developmental processes, learning processes, motivation, communication, and classroom management, the needs of students with disabilities, language acquisition and literacy development, curriculum development, instructional planning, instructional strategies, uses of technology, assessment, school law, etc.
- Content Core – provides a knowledge base for meeting the State learning standards in core subject areas.
- Field Experience, Student Teaching, or Practicum

With an understanding of these types of courses, one can better determine what "type" of course, if any, lends itself to effective virtual delivery.

Method

This study used a convergent parallel mixed methods approach to simultaneously gather qualitative and quantitative data through a web-based survey. The study involved participant consent to complete a survey designed to address the following research questions:

1. What type of education courses, if any, lent themselves to effective virtual course delivery during to the covid-19 pandemic?
2. To what extent, if any, are virtual courses sustainable in education programs after the covid-19 pandemic?
3. What were the challenges and advantages to delivering education courses virtually during to the covid-19 pandemic?

After indicating how many education courses were taught during the covid-19 pandemic, participants were asked to identify characteristics of each course, including: course code and title, course level (i.e., undergraduate or graduate), type of course (per NYSED framework), and course delivery method prior and during pandemic. Participants were then asked to indicate, using a Likert scale, the effectiveness of delivery method during pandemic, as well as share any challenges and/or advantages with the delivery method. Effectiveness was defined as the degree to which a course was successful in students achieving the desired student learning outcomes. Finally, as an experienced individual who has taught the course, participants were asked to indicate if they believed the course would lend itself to effective virtual course delivery in the future.

Demographics were also collected for analysis related to faculty perspectives of effective virtual courses and their gender, age, ethnicity, level of education, title(s), and years of experience.

Additionally, institutional location (i.e., state) data was collected in an effort to gauge the state of virtual education courses across the country.

Participants

Purposive sampling was used to identify a pool of individuals from across the nation who taught education courses during the pandemic. To identify potential participants, faculty listed on the webpages of colleges and universities with accredited educator preparation programs were identified using CAEPs Accredited Provider & Recognized Program Search (Council for the Accreditation of Educator Preparation [CAEP], 2015). Participants were contacted in a state-by-state method with faculty from accredited educator preparation programs receiving and invitation to participate (this is an on-going process to reach all 50 states). Snowball sampling was used to increase the sample size; participants were asked to forward the survey to individuals (e.g., adjunct faculty) within their college/department that have taught education courses. To date, a total of 2858 potential participants have been contacted with 193 participating in the survey. After cleaning the data to eliminate incomplete surveys and participants who taught outside of the US or did not teach any/appropriate courses in an education program, a sample of 183 participants was analyzed.

Data Analysis

Descriptive statistics were analyzed using Likert scale responses from the survey and reported out in a visual manner. Specifically, the average effectiveness of virtual delivery during the pandemic was calculated across course types and levels. An ANOVA was conducted to compare the effectiveness of course delivery during the pandemic across the types of courses, while an independent sample t-test was conducted comparing effectiveness of course delivery during the pandemic across the level of the course. The qualitative data gathered though the open-ended questions soliciting thoughts or comments pertaining to advantages and challenges of course delivery during the pandemic were analyzed using in vivo coding (Saldaña, 2013). Specifically, this involved the development of themes in the form of short phrases or words from participants' own language.

Results

Participants included primarily white females, which mirrors the national trend in the field of education (see Table 3). There was a variety of ages represented in the sample, with participants over 50 years old making up the majority (59%) of the sample. As expected with a population stemming from the field of higher education, over 90% of participants indicated they had obtained a doctorate degree.

Table 3
Personal Demographics

	n	%		n	%

Gender			**Ethnicity**		
Male	51	27.87	White	140	76.50
Female	130	71.04	Black or African American	11	6.01
Non-binary/other gender	1	0.55	Asian	7	3.83
Prefer not to answer	1	0.55	Latino	3	1.64
Age			Multiple Ethnicity or Other	11	6.01
20-29	1	0.55	Prefer not to answer	11	6.01
30-39	19	10.38	**Highest Degree**		
40-49	47	25.68	Master's Degree	14	7.65
50-59	47	25.68	Professional Degree	2	1.09
60-69	39	21.31	Doctorate Degree	166	90.71
70 or Older	22	12.02	Prefer not to answer	1	0.55
Prefer not to answer	8	4.37			

Participants included a diverse and representative sample of faculty from accredited education programs across the nation (see Table 4). Thirty four of the fifty states were represented within the sample, with 58.47% of participants working within one of four states; Florida, Virginia, California, or New York. It follows that each of these states have multiple EPPs that are CAEP accredited. Participants included primary full-time faculty, with several indicating they worked part-time or in administration, separately or in addition to their full-time faculty roles. All participants were experienced in the field of education, with no participants having less than one year of experience, and the majority (67.76%) holding their position for over 10 years.

Table 4
Professional Demographics

	n	%		n	%
Years Held Position			**Institution Location (cont.)**		

Less than 1 year	0	0	Idaho	2	1.09
1-5 years	24	13.11	Missouri	2	1.09
6-10 years	35	19.13	South Carolina	2	1.09
11-15 years	31	16.94	Indiana	2	1.09
16-20 years	31	16.94	North Carolina	2	1.09
More than 20 years	62	33.88	Ohio	2	1.09
Position(s)			Maryland	2	1.09
Administrator	21	11.48	Massachusetts	1	0.55
Full-time Instructor	153	83.61	Arkansas	1	0.55
Part-time Instructor	21	11.48	New Mexico	1	0.55
Institution Location			Georgia	1	0.55
Florida	29	15.85	New Jersey	1	0.55
Virginia	27	14.75	Oregon	1	0.55
California	26	14.21	Connecticut	1	0.55
New York	25	13.66	Nevada	1	0.55
Alabama	10	5.46	Nebraska	1	0.55
District of Columbia	9	4.92	Hawaii	1	0.55
Utah	6	3.28	Michigan	1	0.55
Texas	5	2.73	Colorado	1	0.55
Louisiana	5	2.73	Vermont	1	0.55
Kansas	4	2.19	Arizona	1	0.55
Illinois	4	2.19	West Virginia	1	0.55
Pennsylvania	4	2.19			

After cleaning the data to eliminate incomplete responses and errors, a sample of 640 education courses taught at accredited education programs across the nation were recorded from the 183 participants (see Table 5). Each participant outlined an average of between 3 to 4 separate courses taught during the covid-19 pandemic (courses taught more than once only counted one time). The courses were primarily taught at both the undergraduate and graduate levels (96.18%), with a small percentage (3.75%) defined as “other” (e.g., training, combined UG/GR, etc.). The sample included each type of course that may appear in an education program, as outlined by NYSED (2023b) (i.e., General Education Core, Pedagogical Core, Content Core, and Field Experience, Student Teaching, or Practicum). With that said, the majority of courses were indicated to be Pedagogical Core; those that provide a knowledge base for education, including human developmental processes, learning processes, motivation, communication, and classroom management, the needs of students with disabilities, language acquisition and literacy development, curriculum development, instructional planning, instructional strategies, uses of technology, assessment, school law, etc. (NYSED, 2023b). As expected, one can see that the courses shifted drastically from being delivered primarily on ground before the pandemic (64.53%), to delivered primarily virtually during the pandemic (83.13%). This suggests that most education courses, regardless of the way in which they were delivered prior to the pandemic and the “ideal” delivery method is believed to be, have the *ability* to be taught virtually.

Table 5
Education Course Specifics

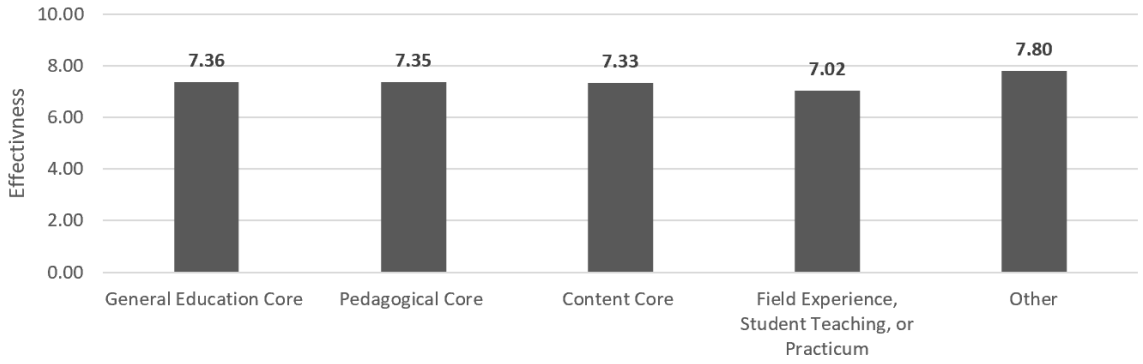
	n	%		n	%
Level			**Modality(s) (before pandemic)**		
Graduate	381	59.53	Virtual	195	30.47
Undergraduate	232	36.25	Hybrid	106	16.56
Other	24	3.75	On Ground	413	64.53
Not indicated	3	0.47			
Type			**Modality(s) (during pandemic)**		
General Education Core	33	5.16	Virtual	532	83.13
Pedagogical Core	279	43.59	Hybrid	61	9.53
Content Core	133	20.78	On Ground	43	6.72
Field Experience, Student Teaching, or Practicum	90	14.06			

Other	105	16.41

Results indicated General Education Core, Pedagogical Core, and Content Core courses to be around the same level of effectiveness in delivery method during to the pandemic, all between 7.33 and 7.36 on a Likert scale from one (Very Ineffective) to ten (Very Effective) (see Figure 2). Field Experience, Student Teaching or Practicum courses were indicated to be slightly less effective as virtual courses (7.02). Although, “other” courses do not fit into the outlined NYSED framework (e.g., research methods, special topics, electives, etc.), they were found to be slightly more effective as virtual courses than the others aligned with the NYSED framework. This suggests that the courses more aligned with education were less effective. With that said, a one-way ANOVA was conducted comparing the effectiveness of each type of course when offered virtually. No significant difference was found ($F(4,635) = 1.40$, $p > .05$). When offered virtually, other types of courses ($m = 7.8$, $sd = 2.28$) did not differ significantly from General Education Core courses ($m = 7.36$, $sd = 2.01$), Pedagogical Core ($m = 7.35$, $sd = 2.2$), Content Core ($m = 7.33$, $sd = 2.47$), or Field Experience, Student Teaching or Practicum courses ($m = 7.02$, $sd = 2.71$) in terms of effectiveness. Findings imply the type of course did not play a role in the course effectiveness during the pandemic, suggesting all education courses *can* be delivered effectively in a virtual modality.

Figure 2

Level of Effectiveness During Pandemic Based on Course Type



A greater deviation was found related to the level of effectiveness in delivery method during to the pandemic when it came to course level (see Figure 3). Specifically, the delivery method of undergraduate courses was indicated by participants to be less effective during the pandemic than graduate courses. As outlined by Table 6 an independent sample t-test was conducted comparing the effectiveness of graduate courses delivered during the pandemic to undergraduate courses. A significant difference was found ($t(611) = 10.393$, $p < .001$). The average effectiveness of virtual graduate courses was significantly higher ($m = 8.08$, $sd = 2.54$) than the average effectiveness of undergraduate courses ($m = 6.19$, $sd = 1.93$). It follows that those who have been in school longer and possibly have been participating in virtual courses more pre-pandemic (i.e., graduate students) may have been able to better adapt to the learning conditions that were presented during the pandemic.

Figure 3

Level of Effectiveness During Pandemic Based on Course Level

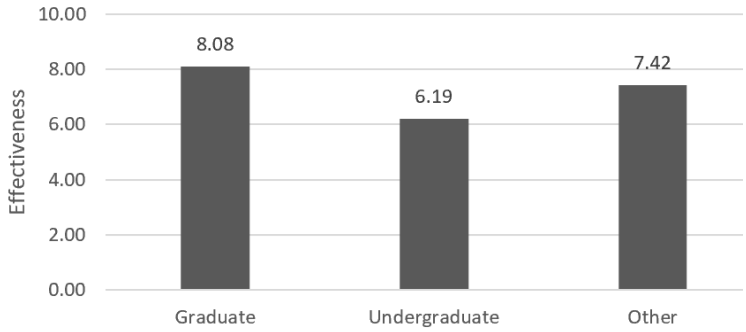


Table 6

Independent Sample t-test for Effectiveness Based on Course Level

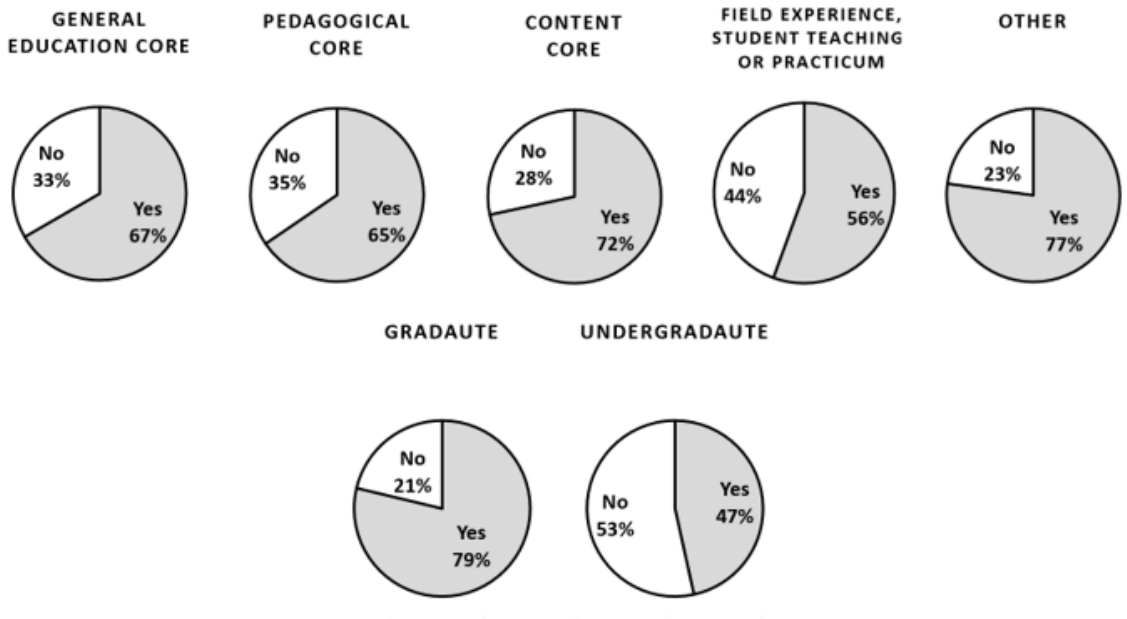
Course Level	n	Mean (m)	Standard Deviation (sd)	t-values	df	p
Undergraduate	381	6.19	193	10.393	611	**
Graduate	232	8.08	2.54			

** $p < .001$

Results suggest that virtual courses are sustainable in education programs post-pandemic, regardless of the type of course. Over half of participants indicated that each type of course lends itself to effective virtual course delivery in the future. With that said, courses that involve fieldwork (i.e., Field Experience, Student Teaching, or Practicum) were indicated by participants to be the least sustainable as virtual courses (see Figure 4). This follows the result from Figure 2, indicating this type of course to be the least effective during the pandemic. Results also suggest that although virtual education courses at the graduate level are sustainable in education programs post-pandemic, undergraduate courses may not be. Less than half of participants indicated that undergraduate courses lend themselves to effective virtual course delivery in the future. This follows the results from Table 6, indicating that undergraduate courses were significantly less effective during the pandemic.

Figure 3

Perceived Virtual Course Sustainability in Future



Finally, results suggest the following themes related to advantages and challenges to delivering education courses virtually during to the covid-19 pandemic (see Table 7). Following the literature, advantages clustered around logistics and access, with the majority of participants indicating the convenience for both students and instructors as a large benefit. It follows that graduate courses, often taken by students who are often navigating multiple roles and balancing many responsibilities, would be indicated as sustainable as virtual courses (see Figure 3). When it came to challenges, participants focused on both engagement and hands-on-learning. Difficulty keeping students engaged in the virtual courses was mentioned repeatedly, but often with the caveat that given the proper time a preparation, a luxury not afforded during the pandemic, courses could be designed in a more engaging way. Additionally, lack of hands-on learning was mentioned. It follows that more hands-on courses (i.e., field experience, students teaching or practicum) would be indicated as the least effective as virtual courses (see Figure 2).

Table 7
Advantages and Challenges During Pandemic

Advantages	Challenges
• Flexibility • Convenience/Time • Comfortable learning environment • Financial • Adaptability • Instructor access	• Academic integrity • Adapting/transitioning teaching materials • Technical issues • Lack of in-person interactions (personal) • Lack of hands-on learning (academic) • Student engagement and motivation

Discussion

In an effort to prepare for the future of teacher education, this study sought to evaluate the effectiveness of virtual course delivery during the time of covid-19. The purpose was to determine which education courses, if any, should continue to be administered virtually by analyzing 640 education courses from accredited institutions across the nation. Although the overall response rate (6.4%) was a limitation to finding generalizations, the results yielded implications the provide guidance to higher education instructors and administrators across the globe making modality decisions.

Prior to the pandemic, literature indicated that many higher education instructors were biased toward face-to-face learning; however, once the pandemic began the avoidance of virtual learning was no longer an option (Walker et al., 2022). The results of this study indicate that education courses were not an exception to this dramatic shift, with 64.53% of courses being delivered primarily on ground before the pandemic to 83.13% being delivered virtually during the pandemic. Given that all types of courses (content, pedagogy, fieldwork, and general education) were found to be sustainable as virtual courses in education programs post-pandemic, it is important that colleges/schools of education ensure their instructors are prepared for the necessary use of educational technology and tools to be effective in the virtual realm. With that said, the findings indicated that more participants indicated undergraduate courses as less sustainable than graduate courses should suggest that potential supports may be required at the undergraduate level to ensure student success in virtual courses/programs (e.g., academic supports, advisement, counseling, etc.). Results also indicated that fieldwork courses were the least effective type of course delivered virtually. According to Elhaty et al. (2020), courses that involve working in the field require practical, hands-on experience that cannot be achieved in virtual modalities. This suggests that education programs should consider residency models that require a portion of the virtual program to include in-person fieldwork, and/or supplement virtual courses with existing simulations (e.g., simSchool) that work to provide students with authentic clinical experiences that work to prepare them for the field.

This study corroborates the literature indicating that the favorable logistics of virtual courses play a large role in their perceived advantage over on-ground courses (Dung, 2020). This suggests that virtual courses will continue to be in-demand by both students and faculty for their flexibility, convenience, adaptability, accessibility, etc. These advantages, now ever-present after the pandemic, second what many proponents of virtual learning have insisted; that if on-ground faculty had the opportunity to join the virtual world, they would see the benefits (Walker, etc., 2022). Although logistics played a role in a favorable learning environment for many, they also posed pedagogical challenges. With instructors and students working on asynchronous courses at different times, or with barriers to access of activity materials in the virtual realm, instructors and administration may want to consider innovative approaches to navigating hands-on-learning, such as investing in interactive learning technologies (e.g., Pear Deck, Padlet, etc.), virtual manipulatives, or even mailing students physical activity materials in advance. These initiatives can work to ensure courses have the means to be administered effectively in a virtual modality. Findings also indicated that the most challenging aspect of virtual learning was the difficulty of keeping students engaged and focused. This is not surprising, as student motivation often decreases in the absence of on-ground interactions (Portuguez & Gómez, 2020; Torres-Martín et

al., 2021). Instructors may want to implement virtual learning policies related to having cameras on, participating in the chat, using emoji reactions, etc. to limit virtual barriers that often result in a lack of participation (Liang et al., 2020).

Considering the evolving landscape of education and the continued integration of virtual modalities, future research should delve into refining and expanding upon the findings of this study. Specifically, researchers may investigate the long-term impacts of virtual course delivery on student outcomes, exploring whether the formats identified in this study as effective in a virtual modality are due more distinct features such as specific content, instructor, tools used, etc. Future studies might explore innovative approaches to enhance virtual learning environments, considering the effectiveness of emerging technologies and interactive tools in addressing identified challenges in the literature. Furthermore, there is a need to explore the potential variations in the effectiveness of virtual education across diverse student populations and disciplines within the field of education. Comparative analyses between undergraduate and graduate levels, as well as variations across content, pedagogy, fieldwork, and general education courses, could provide valuable insights into tailoring virtual education strategies for specific educational contexts. As the educational landscape continues to evolve, ongoing research efforts will be essential to inform evidence-based practices and policies, ensuring the continued improvement and optimization of virtual course/program delivery.

Scholarly Significance

While it is unclear what the shift to virtual learning will mean for higher education's global future, it is evident that virtual courses are not going away. It is also evident that more is involved in transitioning courses effectively to a virtual modality than what occurred in the transition during the pandemic. Decisions regarding course modality should be made with great consideration and fidelity; if solely made around logistical aspects and not around efficacy, there is the possibility for the course to be *accessible*, but not *effective*. Thus, higher education instructors and administrators should be introspective on their current virtual courses to develop a sophisticated combination of face-to-face and virtual learning that maximizes the potential of the technological tools while meeting students' needs and improving the learning experience.

Although there are many opinions regarding the efficacy of virtual education courses, the “truth” behind what is effective will inevitably be known as educators who received their training virtually during the pandemic enter the field. In an effort to position education programs to be proactive in developing courses that meet the virtual needs of 21st century learners, instead of maintaining a status quo that may be inequitable, the results of this study provide instructors and administrators in the field of education with information needed to make informed decisions regarding what courses, if any, should remain in an virtual delivery format post pandemic.

Conclusion

As we prepare for the future of teacher education, it is important to address the sustainability of virtual education courses. As programs continue to transition to a post-pandemic era, many have made the decision to switch to virtual delivery. This study demonstrated that while all courses may be able to be delivered online, deliberate thought should be given to which courses lend themselves to a be administered effectively in a virtual environment, and which do not. It is

important to note that there are many institutional and personnel factors that make any course effective in a specific modality, and that a US based framework was used to classify courses which may not apply to the structure of international courses. The results of this study yield suggestions to stakeholders as to which education courses may lend themselves to be administered effectively in a virtual setting. Given the large national sample size of 640 education courses reviewed by the 183 participants, this study provides higher education faculty and administration from across the globe research to refer to when making modality decisions.

Conflict of Interest

The author(s) disclose that they have no actual or perceived conflicts of interest. The authors disclose that they have not received any funding for this manuscript beyond resourcing for academic time at their respective university.

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