Opinion Article

Reimagining Teacher Preparation: Digital Literacy in the Post-Pandemic Era

Abstract

The advent of COVID-19 exposed significant flaws in the capacity of educational institutions to deliver quality instruction to their students in a crisis. The rapid instigation of advanced digital technologies to facilitate remote learning by universities and colleges provided a pedagogical bridge to cover the time and space restrictions forced on the normal face-to-face classroom experience. Unfortunately, as the impact of the pandemic has waned, educational institutions drew down their investments in the digital technology infrastructure, hardware, and software that were indispensable to sustaining student learning over the two years the pandemic interrupted normal educational schedules. However, it is argued that it would be extremely prudent to expand rather than contract these resources. Researchindicates that manyteachers struggled with technologies in remote teaching during COVID-19. This raises the question of how teacher education programs can adequately providefuture teacherswith essential digital literacy skillsto teach in diverse technology-enriched learning environments. The proposed frameworks aim to reshape the curriculum in teacher education programs to cultivateand develop preservice teachers' digital literacy skills.

Keywords:

COVID-19; preservice teachers; digital natives, technology competencies; teacher education programs

Data availability statement

The datasets generated during and/or analyzed during the current study are available from the corresponding author upon reasonable request.

Introduction

One of the enduring truisms in any field of human endeavor is "necessity is the mother of invention". With the global impact of COVID-19 isolating countries, communities, and even families, novel ways of maintaining social infrastructure became

UNDER PEER REVIEW

critical elements in minimizing the negative consequences of the pandemic. This was especially noticeable in education where “business as usual” was clearly not an option. Schools were closed and student learning was severely disrupted. It is estimated that more than 168 million children globally were out of the classroom completely for about a year (Unicef, 2021). Higher education did not fare much better. Campuses wereshut down or courses canceled. However, most not-for-profit tertiary institutions pivoted with surprising rapidity to deal with this unprecedented challenge to the tradition of face-to-face faculty-student interaction. The “solution” was to go all-in on creating an instant remote/virtual learning model byexpandingbandwidth, installing hardware such as enhanced document and tracking cameras and augmented interactive sound systems, and providingonline training workshops. With little preparation, instructorshad to make swift changes to their teaching strategies and manage to function in two entirely new learning environments – remote and hybrid. This proved particularly problematic for laboratory-based courses.

As the world emerged from the most restrictive aspects of the pandemic, we faced some crucial questions – what have we learned as teacher educators? How can we be better prepared for the next global disruptor to education? Will teacher education be able to equip its graduates with the skills necessary to function efficiently in novel (and unimagined) learning environments?

Teachers During COVID-19

Teachers transforming their teaching styles is usually an incremental process. All this changed with COVID-19. Almost overnight, teachers were thrown into an unfamiliar environment and forced to use remote learning modes.

Many teachers struggled with this sudden transition (Alenezi et al., 2022;An & Zakaria, 2022; König et al., 2020; Shagiakhmetova et al., 2022; Winter et al., 2021) becauseonline teaching fundamentally differs from face-to-face teaching, especially due toheavy reliance on the use of technologies in remote teaching - from delivering lectures to managing student learning activities. Teachershad tomasterthe mechanics of new/unfamiliar technologies, alter teaching approaches, and interact with students

UNDER PEER REVIEW

virtually, utilizing a range of modalities such as text, audio, and video – synchronously and asynchronously. In addition, teachers needed to cope with inadequate technology infrastructure, scarce learning resources, and a lack of tech support. Many teachers felt they did not have the expertise to teach online and/or had to deal with challenges that exceeded their experiences and skills, which undermined their confidence and, consequently, their effectiveness(Aktan&Toraman, 2022; Shamburg et al., 2022). As a result, student learning suffered. Over the two pandemic years (2020-2022), there was a sizeable drop in math and reading scores of K-12 students (Kuhfeld, Soland, & Lewis, 2022), on average, five months behind in math and four months behind in reading (Dorn et al., 2021). These losses are significant and the impact may be irrevocable.

Technology competency played a major role in teachers adapting to remote teaching mode during this period. Research shows that teachers who had previously used technology in daily teaching had a meaningful advantage when switching to the distance learning mode and could adapt in a fairly short time. Dincher&Wagner (2021) showed that technology competencies were positively associated with teacher use of at least one new technology during the COVID-19school shutdown, that is, technical affinity wasa major determinant inteachers' adaption to online teaching mode (Winter et al., 2021). Therefore, digital competency level is a predictor of how well teachers functioned in this period.For example, teachers with technology skills could better support student learning astheywere able to use multi-modality media to communicate and interact with students, thus sustaining social contact in their classes(König, Jäger-Biela &Glutsch, 2020).

Despite the undeniable negative outcomes of the pandemic on education, there isa silver lining.Without COVID-19, mostteachers would have stayed in their comfort zone and continued to teach in the traditional way.Thus, the pandemic has been an agent of positive change because although many teachers struggled substantially in adapting to the virtual learning environment, many used the opportunity to enhance their digital literacy. Theyinvestedsignificant time and effort in exploring new technology tools,mapping apps into their pedagogical practices, and working diligently to maintain continuity in their students' learning.As a result, teacher educators have made various

UNDER PEER REVIEW

predictions about the future of their profession – from modest changes to drastic transformation. In either case, the priority at present is to build on the legacy of COVID-19 to maximize student learning in the future with interactive technologies.Although it is a well-recognized fact thatEmergency Remote Teaching (ERT; Milman, 2020), a pedagogical consequence of COVID-19, hastenedteacher adoption of technology in remote teaching, Hodges et al. (2020) contend that when teachers were forced into remote teaching mode, they often did not fully consider thebenefits of online learning in designing and delivering their courses, but simply used online learning as a temporary option. ERT has not encouragedreimagining or constructing a “robust educational ecosystem but was simply an impetus forfaculty and students to utilize readily available access” (p.6). Ewing and Cooper (2021) cautioned: “While the pandemic has expedited emergency technology adoption in schools, this is not equivalent to the purposeful integration of technology over time” (p. 41).

Unfortunately, when most schools and universities began to return to in-person classes in the 2021-2022 academic year,the majority of instructorswere forced to revert to the previous paradigm. Hardware was precipitously removed without instructorinput and support services for remote/virtual learning were downsized or eliminated. This can be argued to be a very short-sighted response from administrators.COVID-19 showedus how poorly preparedwe are to deal with unexpected phenomenathat drastically interrupt education and the probability of a new threat to the normal order is so high that we cannot continue to prepare future teachers in the same way. Teacher education programs must transform teacher preparation, building on the foundation laid during the pandemic.The digital literacy skills instructors have gainedwill be lost if they do not have adequate opportunities to employ them. They need to continue to apply their skills in teaching and cultivate digital literacy in their students. To do otherwise is to waste talent and squander the hard-earned gains made in maintaining continuity in student learning during those years.

Universal Digital Technology Course

None of the foregoing should be construed as a call for virtual learning to replacethe traditional model. Face-to-face interaction will always be the cornerstone of

UNDER PEER REVIEW

teacher education. However, it would be very short-sighted not to acknowledge that online learning will continue to grow, as has been the trend since the mid-2010's. The ultimate value of the technology that underpins remote/virtual/online pedagogy is that it can benefit student learning, regardless of course delivery format (online, hybrid/blended, or face-to-face). To accomplish this goal, it is imperative that a required course on universal digital technologies for teacher education programsbe designed if the benefits of digital technology in education are to be fully realized.Universal digital technologies are defined as tools that can be applied effectively across various delivery modes (Figure 1).

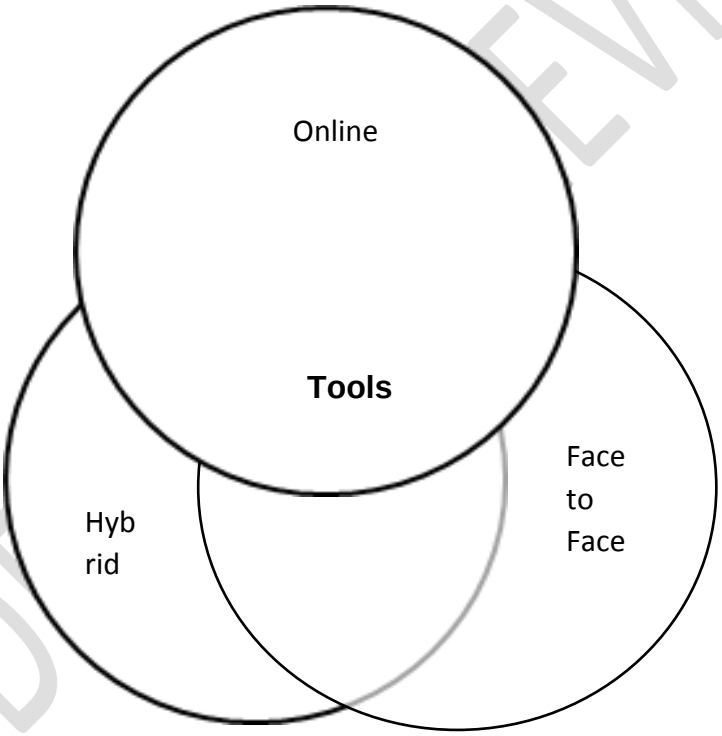

Figure 1. Universal Digital Tools

For example, although Zoom became ubiquitous for virtual teaching beginning in 2020, itcan also be used in hybrid or face-to-face courses to benefit student learningby recording lectures and then archiving themfor students to review later as often as necessary for maximum comprehension (or to identify specific information that is not well understood. This improves student capacity to connect with theirinstructorsfor

UNDER REVIEW

clarification). This use can also be an excellent accommodation for students who, for whatever reason, cannot come to class. Additionally, since Zoom allows instructors to share their computer screens, it facilitatesstep-by-step demonstrationsof how to complete a task. It is also easier to operate than some video recording apps and is an effective presentation protocol that can be used across various delivery formats.

Using technology such as Zoom also allows instructorsand students to “expand” class time. For example, student presentations in face-to-face classes, especially classes with large enrollments, are inevitably constrained by the available class time and, consequently, the audience often does not have adequate opportunity to ask questions or critique presentations. However, utilizing recording software, students can have in-depth discussions on each other’s presentations as “out of class” assignments.In an assignment on professional ethics designed by one of the authors, students were divided into groups to identify an ethicaldilemmathat may confront them as teachers. Each group was required to writea play on the theme they hadchosen and post it on an online discussion board for review by the class. When asked to reflect upon how the project could be improved in the future, some students suggested that Zoom should be used as itwould allow students to both record their actingout of their playand simultaneously present their script.The multiple protocol access is extremely beneficial in encouraging student engagement with the topic and increasingtheir depth of understanding of complex issues.

The primary principle in choosing which technology tools to employ should center on whether a particular tool increases student interaction with course material (e.g.,data mining, simulation,gaming), student interaction with each other (e.g., collaborativeapps such as Google doc, GoTo Meeting, ClickUp),or student interaction with theirinstructors (e.g.,Twitter, Metauniverse, Poll Everywhere).The key point is for future teachers to be aware of, and proficient with, digital tools, so they can make quick switches and be prepared to teach more effectively in various learning environments (online, blended, face-to-face).

Chen, Wu and Wang (2011) provide one model of pedagogical parameters that can be used to guide the development of a universal digital technology course to build

digital literacy in preservice teachers. Their new media/digital literacy framework has two continuums (Figure 2): from consumer to prosumer and from functional to critical media literacy.

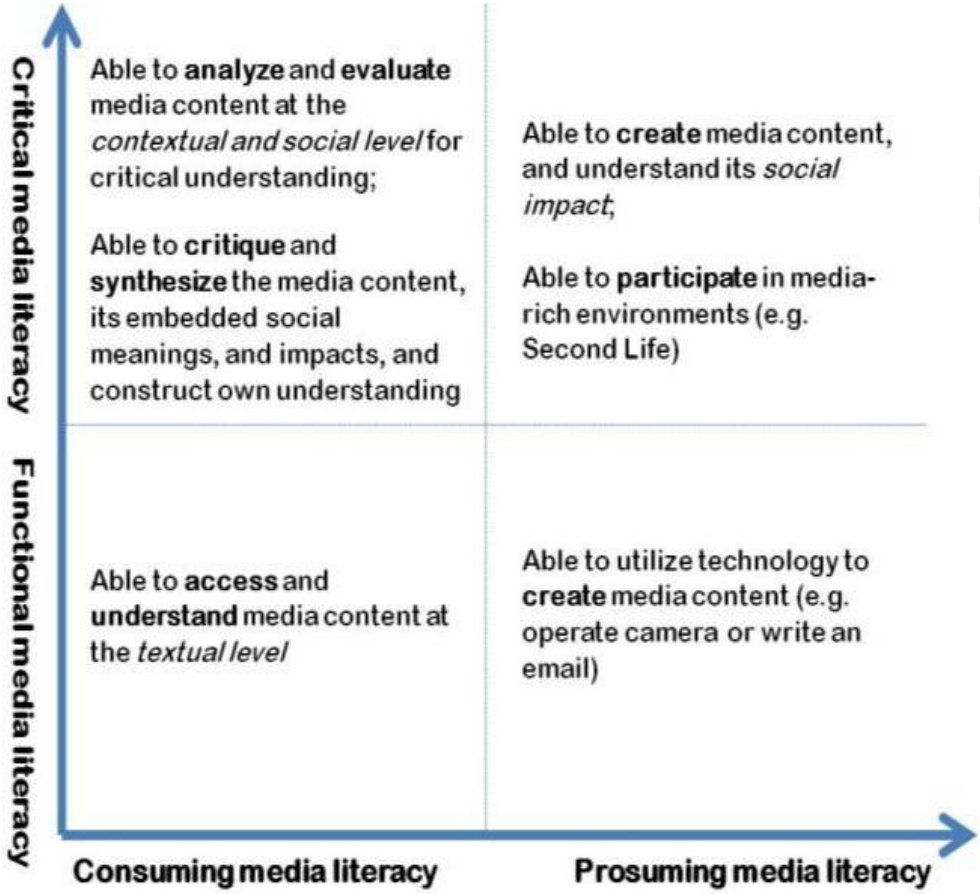

Figure 2. Framework for new media literacy(Chen, Wu, & Wang, 2011)

The framework presents four types of media literacy: (1) a functional media consumer, for example, someone who can find a YouTube video, watch it and understand its content, (2) a critical media consumer,for example, someone who after viewing a video makes attempts to understand the social and cultural values embedded in it - does it use bigoted language (e.g., gender, race)?, (3)a functional media prosumer, for example, an instructor who creates a video to illustrate a theme, a

scientific concept, or a theory, and (4) a critical prosumer, for example, someone who can weave social, cultural, and pedagogical values into a media creation and consciously monitor the message(s) conveyed in their media products.

Impacting Factors

Despite the very clear value of incorporating a universal digital technology course into teacher education programs, there are several arguments used to undermine the inclusion of such courses into existing teacher education programs, principally the myth of universal digital competence in students, cost, and increasing faculty workload.

The Myth of Universal Digital Competence

Many teacher education programs have removed required technology courses in preservice training in response to Prensky's (2001a) proclamation that younger generations today are digital natives, that is, they grow up with technology and readily adopt new devices and trending software.However, research findings do not support Prensky's claim.There is a large percentage of young people who do not have the technology proficiency prescribed in the profile of digital natives (Gros, Garcia &Escofet, 2012, Guo, Dobson, & Petrina, 2008; Kennedy et al., 2008; Margaryan& Littlejohn, 2008; Smith, Kahlke& Judd, 2020; Wallace-Spurgin, 2020). More importantly,general facility with technology does not guarantee students are capable of identifying and effectively using the technology most appropriate for specific pedagogical purposes asit has been pointed out that "the use of technology to support learning is not related to whether a student belongs to the Net generation, but that technology use is mainly influenced by the teaching model" (Gros, Garcia, &Escofet, 2012). Knowing how an oven works is not the same as being able to make a cake. The disruption caused by COVID-19showedhow poorly prepared even young teachers wereto apply online technologies to maintain the continuity of student learning. The pandemic years highlighted the folly of assuming a technology consumer is equivalent to a technology prosumer and underscored the urgent need to equip preservice teachers with a level of digital literacy necessary to function well even under the most trying circumstances.

UNDER PEER REVIEW

Cost

Arguably the greatest obstacle to expanding technology in teacher education programs is cost.Infrastructure, hardware, and software are expensive and can put a significant strain on the budget of any institution. Many colleges and universities were forced to “buy big” by COVID-19 or close down completely so this wasa decision driven by necessity, not pedagogical values. As such, once the crisis had passed, many, if not all, of the technological resources made available to instructors during this time were removed.However, this is a very short-sighted approach, and investing in technology, especially for teacher education programs, needs to be viewed by university administrations as a necessary cost to prepare future teachers to be effective in an uncertain world.From a budgetary perspective, gradual investment makes better sense than desperate spending in a crisis.

Faculty Workload

To cultivate digital literacy in future teachers, teacher education faculty must model how to apply digital technologies in their teaching. Of course, this can be very time-consuming. For example, to choose an appropriate digital tool, facultyare likely to have to test and evaluate multiple options.Moreover, once an appropriate tool has been identified, incorporating it to maximum effect in the classroom can also take a significant investment of time (e.g., creating a video). Unfortunately, this can be a lot of trial-and-error and application projects that do not land as designed can result in lost teachable moments and poor student evaluations.

Enhanced technological training for teacher education students through a required universal digital technology course could minimize the potential for “failed” technological pedagogy and faculty time lost. However, even successful projects can be timeintensive, and faculty need motivation and deserve incentives for committing to improving their expertise in this way. One option is for the university administration to recognize the value of this work by awarding faculty members credit for applying innovative technology in their teaching. In the institution of one of the authors, a new rubric for evaluating teaching performance has student evaluation scores

UNDER PEER REVIEW

contributing30%,with 70% allocatedfor innovative technologies integration, faculty professional development, and course revisions. Risk-reward models such as thismay be necessary to motivate more faculty members to apply digital technologies to benefit student learning.

Professional Development

There is no doubt that technology does not stand still, and it is imperative that faculty have meaningful professional developmentopportunities to keep abreastof emerging trends. Unfortunately, technology training for faculty in higher education has had limited impact in improving their digital literacy. Often, training consists of short workshops, where only a limited amount of the content may be relevant to any particular faculty member. Alternatively, some institutions offer individualized training, but this is frequently on a limited scale due to a lack of trained personnel.

To alleviate the gap in the current modes of technological training for faculty professional development, YouTube may be a “customizable” solution. It hosts training videos on a wide range of topicswhichvary in time and scope. Compared to formal training workshops, YouTube video training is focused, targeted, and individualized, and faculty members are in complete control of their training (e.g., how long they want to stay on in a specific session, and how often they want to review). The takeaway here is that given the shortcomings of most institution-provided “professional development” in technology, faculty must be adept at self-improvement to enhance their digital literacy.

Conclusion

There are lessons to be learned from even the most difficult challenges. One of the legacies of COVID-19 is the broadened realization of the value of digital technologies in facilitating education. In recognizing both the inevitability of another global disruption of normal educational practices and the expansion ofself-selected remote living and learning options, teacher education programs have the opportunityto enhance digital technology pedagogy through deliberate action rather than out of desperation. If the travails in education 2020-2022 are to be avoided, this is a step that

needs to be taken now or the cost will be another round of significant loss of student learning.

References

Aktan, O., &Toraman, Ç. (2022). The relationship between Technostress levels and job satisfaction of Teachers within the COVID-19 period. *Education and Information Technologies*, 1-25.

Alenezi, E., Alfadley, A. A., Alenezi, D. F., &Alenezi, Y. H. (2022). The Sudden Shift to Distance Learning: Challenges Facing Teachers. *Journal of Education and Learning*, *11*(3).

An, B. G., & Zakaria, A. R. (2022). A Scoping Review of Teacher Training during COVID-19 Pandemic. *International Education Studies*, *15*(2), 102-112.

Chen, D. V., Wu, J., & Wang, Y.M. (2011). Unpacking new media literacy. *Systemics, Cybernetics and Informatics, 9*(2), 84-88.

Dorn, E., Hancock, B., Sarakatsannis, J., &Viruleg, E. (2020). New evidence shows that the shutdowns caused by COVID-19 could exacerbate existing achievement gaps. *McKinsey and Company*.

Dincher, M., & Wagner, V. (2021). Teaching in times of COVID-19: determinants of teachers' educational technology use. *Education Economics*, *29*(5), 461-470.

Dorn, E., Hancock, B., Sarakatsannis, J., &Viruleg, E. (2021). COVID-19 and education: The lingering effects of unfinished learning. *McKinsey & Company*, *27*.

Ewing, L. A., & Cooper, H. B. (2021). Technology-enabled remote learning during COVID-19: perspectives of Australian teachers, students and parents. *Technology, Pedagogy and Education*, *30*(1), 41-57.

Gros, B., Garcia, I., &Escofet, A. (2012). Beyond the net generation debate: A comparison of digital learners in face-to-face and virtual universities. *International Review of Research in Open and Distributed Learning*, *13*(4), 190-210.

Guo, R. X., Dobson, T., & Petrina, S. (2008). Digital natives, digital immigrants: An analysis of age and ICT competency in teacher education. *Journal of Educational Computing Research*, *38*(3), 235-254.

Hodges, C. B., Moore, S., Lockee, B. B., Trust, T., & Bond, M. A. (2020). The difference between emergency remote teaching and online learning.

Kennedy, G. E., Judd, T. S., Churchward, A., Gray, K., & Krause, K. L. (2008). First year students' experiences with technology: Are they really digital natives? *Australasian journal of educational technology*, *24*(1).

König, J., Jäger-Biela, D. J., &Glutsch, N. (2020). Adapting to online teaching during COVID-19 school closure: teacher education and teacher competence effects among early career teachers in Germany. *European Journal of Teacher Education*, *43*(4), 608-622.

Kuhfeld, M., Soland, J., & Lewis, K. (2022). Test score patterns across three COVID-19-impacted school years. *Educational Researcher*, *51*(7), 500-506.

Margaryan, A., Littlejohn, A., &Vojt, G. (2011). Are digital natives a myth or reality? University students' use of digital technologies. *Computers &Education*, *56*(2), 429-440.

Milman, N.B. (2020). Pandemic pedagogy. KAPPAN: Connecting education research, policy, and practice. https://kappanonline.org/pandemic-pedagogy-covid-19-online-milman/

Prensky, M. (2001a). Digital natives, digital immigrants, Part 1: On the Horizon, 9(5), 1-6. doi10.1108/10748120110424816

Shamburg, C., Amerman, T., Zieger, L., & Bahna, S. (2022). When school bells last rung: New Jersey schools and the reaction to COVID-19. *Education and Information Technologies*, *27*(1), 23-44.

Smith, E. E., Kahlke, R., & Judd, T. (2020). Not just digital natives: Integrating technologies in professional education contexts. *Australasian Journal of Educational Technology*, *36*(3), 1-14.

Unicef. (2021). COVID-19: Schools for more than 168 million children globally have been completely closed for almost a full year, says UNICEF.

Wallace-Spurgin, M. (2020). Implementing Technology: Measuring Student Cognitive Engagement. *International Journal of Technology in Education*, *3*(1), 24-38.

Winter, E., Costello, A., O'Brien, M., & Hickey, G. (2021). Teachers' use of technology and the impact of Covid-19. *Irish Educational Studies*, *40*(2), 235-246.

UNDER PEER REVIEW