

From survival to strategic use: Technology, AI, and collaboration five years after emergency remote teaching

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ABSTRACT

This research is a follow-up to a study conducted in 2022, where the researchers examined the experiences of a purposive sample of 25 elementary teachers who had never taught online and were forced into emergency remote teaching (ERT) during the 2020 pandemic. Findings from the original study conducted in 2022 indicated that teacher collaboration and technology use and knowledge increased during their time in ERT. Three years after the initial study, 19 of the original 25 teachers participated in a follow-up email survey of nine open-ended questions asking them to describe their technology practices, collaborative structures, AI integration, and support needs three years into post-pandemic teaching. Data were analyzed using open and axial coding and thematic analysis. Teachers indicated that technology use and skills have improved, and collaboration with peers has increased since ERT. Teachers also indicated that technology tools including AI improve their efficiency and ability to support students. They also indicated that they have become more selective about the tools they use, set boundaries, and use educational technology as a companion to instruction instead of a primary teaching method. Based on the findings, school leaders should provide scaffolded technology use training for teachers, time to learn and experiment with technology, and support both face-to-face and virtual opportunities for teachers to collaborate.

Keywords: artificial intelligence, technology, collaboration, K-8 teachers, emergency remote teaching

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INTRODUCTION

Elementary classrooms experienced a major change in the Spring of 2020 because COVID-19 was declared a pandemic, and schools had to cancel in-person teaching, moving to emergency remote teaching (ERT). In 2020, many teachers who had never taught online were learning new educational technology tools on the job while managing increased workloads and family obligations (Leech et al., 2022; Trust & Whalen, 2021a). The immediacy of ERT created a situation that questioned existing teacher assumptions and required new ways of teaching and learning (Daneshmand et al., 2022; Procentese et al., 2023).

Research on ERT identified many difficulties associated with online teaching. For instance, An et al. (2021) reported that 60% of participants found teaching from home stressful because of the necessity to juggle family responsibilities with ERT. Teaching online during the pandemic, it made the relational part of teaching difficult. Twenty percent of teachers in one study reported a lack of connection to their school building and colleagues (Leech et al., 2022). Despite ERT challenges, Trust and Whalen (2021b) found that 91% of K-12 educators increased their professional knowledge, skills, or perspectives on online teaching during ERT. These findings suggested that teachers are resilient and can acquire new skills

under duress, however there were many personal and professional burdens due to ERT.

As teachers transitioned back into the classroom, an opportunity surfaced to research and learn about post-pandemic classroom practices. Friedrich and Perrotta (2022) found that prolonged ERT led to declining student engagement and motivation, with teachers noting that students expected to automatically pass based on previous ERT policies. Researchers Friedrich and Perrotta (2022) found that teachers voiced relief at returning to typical classroom settings while simultaneously realizing that students had developed academic and social-emotional gaps.

ERT transformed certain aspects of daily instruction, but not all. To examine elementary teachers' experiences returning to the classroom a qualitative study was conducted in Fall 2022 (Paul & Reason, 2024). Using purposive sampling, 25 K-8 elementary teachers participated in semi-structured interviews to share their perspectives on post-pandemic teaching. Analysis with Braun et al. (2018) reflexive thematic analysis (TA) revealed a juxtaposition that complicated the transition back to the classroom. Teachers from Paul and Reason's (2024) study reported joy at returning to traditional settings; however, they also noted academic and social-emotional learning (SEL) gaps among students. Resilient teachers in the study noted transferring educational technology tools from ERT into the traditional classroom to support instructional

differentiation, while continuing to rely on face-to-face interactions for SEL instruction. This evidence implies that ERT transformed certain aspects of daily instruction, though not all.

This selective integration found in Paul and Reason's (2024) study represents an unfinished story. Currently, teachers are five years removed from entirely remote instruction and three years beyond the completion of phase 1 of the 2022 study. The field of education now faces a new disruption as artificial intelligence (AI) gains acceptance (Bakhadirov et al., 2024). Since the public release of ChatGPT in 2022, AI has gained popularity and is increasingly present in classrooms throughout the USA. Much like the rapid pedagogical shifts prompted by ERT, the use of AI is prompting change (Lampropoulos et al., 2025). As previously discussed, ERT, hybrid, and post-pandemic teaching required teachers to reflect on their practices, assess new digital tools, and think about ethical considerations for elementary students (e.g., device availability, screen time concerns, SEL, attendance, and student agency). In 2025, AI use prompted a renewed review of these issues. Just as they did during ERT and shortly after returning to the classroom, K-8 self-contained teachers have a responsibility to balance educational technology tools with skills such as literacy, numeracy, social-emotional development, problem-solving, and critical thinking (Adipat, 2025).

AI has created new demands on education similar to the impact of ERT on teaching, placing elementary teachers in a unique position. Kim's (2025) mixed-methods study found that while K-12 leaders reported a high readiness for generative AI, teachers expressed trepidation and a lack of preparedness to use it in the classroom. Kim (2025) found a disconnect between teachers and leaders regarding AI adoption. Additionally, teachers and leaders in Kim's (2025) study both reported AI positively. Still, they were also concerned about ethical considerations, lack of funding to support new online subscriptions, and the lack of school infrastructure to meet new technology demands. Even though both groups view AI positively, the findings suggest there is a need to develop infrastructures, professional learning, and increase collaboration time before implementation.

Gaps in the Literature

Although there is much research on transitioning from the traditional classroom to emergency remote and post-pandemic teaching (Daneshmand et al., 2022; Juárez-Díaz & Perales, 2021; Keldgord & Ching, 2022), little is known about educators' long-term technology practices, AI adoption rates, collaboration structures, and support needs. Only one study was identified where researchers revisited post-pandemic teaching outcomes such as teachers' persistent feelings of burnout (Ní Chinseallaigh et al., 2025). Otherwise, there are no follow-up studies about post-pandemic teaching that have engaged with the original participants to learn about long-term practices and subsequent technology changes, such as AI. In addition, no qualitative studies have been identified that have examined separately the post-pandemic experiences of elementary teachers, who prior to the 2020 pandemic had never taught online, two and five years after ERT.

When examining the literature on teacher technology integration post-ERT, a longitudinal study of ERT and post-pandemic technology integration among teachers from 2020 to 2022 noted that technological advancements would continue to impact education; thus, future research would be required (Wohlfart et al., 2021). Due to the emergence of educational technology infused with AI, extending the AI conversation in the field of education is a must. This study will provide baseline AI adoption rates for a cohort of educators who taught in an emergency remote situation and experienced post-pandemic teaching and will lay the foundation for future causal studies.

In addition, Wohlfart et al. (2021) called for additional mixed-methods research with expanded sample sizes to evaluate professional learning and district-provided support systems on technology acceptance. As such, their study provides baseline data on teacher-identified support factors for sustained technology integration. Their study specifically documented patterns of technology acceptance and tracks educational technology use from 2022 to understand its integration over time. However, this study was concluded in 2022 before the widespread emergence of generative AI tools in education. As such, the current follow up study complements Wohlfart et al. (2021)'s work, but adds teacher voice on needed supports, and includes a different geographic context, as called for by the researchers.

Gârdan et al. (2025) also suggested that future longitudinal studies described how educators' perceptions and attitudes towards AI evolve as they gain experience. Additionally, Gârdan et al. (2025) called for qualitative data to complement quantitative findings within different cultural settings. Lastly, Gârdan et al. (2025) noted that further research should identify common barriers to the adoption of AI. To address this gap, the current study includes teachers' descriptions as to how they use AI in their work.

Therefore, this research directly responds to these calls for additional research by providing qualitative baseline data. In the current study, participants reported their technology practices in the Fall of 2022 post-pandemic and again in the Fall of 2025 with the emergence of AI in education. Many studies pandemic and post-pandemic studies on teaching were conducted in countries outside of North America, particularly in Europe, and Australia (Ajjawi et al., 2022; Gârdan et al., 2025; Procentese et al., 2022; Ting et al., 2024). Therefore, this research offers insights from teachers in North America, specifically the USA on post-pandemic teaching in terms of collaboration and technology use and integration. Overall, the study's original findings in 2022 and new findings reported in 2025 provide descriptive baseline data to understand the needs teachers identify as essential for technology integration, complementing Gârdan et al.'s (2025) quantitative model of AI acceptance factors.

Objective of the Study

The objective of the study was to examine sustained post-pandemic technology tools and practices, responses to emerging AI tools, teacher collaboration, and ongoing support needs.

Research Questions

This longitudinal study was conducted in two phases, each guided by a specific research question (RQ):

1. **RQ1 (phase 1, Fall 2022).** How did K-8 elementary teachers describe their experiences transitioning from ERT back to in-person instruction?
2. **RQ2 (phase 2, Fall 2025).** How do K-8 educators describe their technology practices, collaborative structures, AI integration, and support needs three years into post-pandemic teaching?

Significance of the Study

Findings from this study provide evidence-based guidance for leaders making technology and professional learning investment decisions as elementary and secondary school emergency relief funding has expired. Collectively, school districts spent billions on educational technology and professional learning during emergency remote instruction and post-pandemic teaching. Districts must determine which pandemic-acquired platforms warrant continued licensing costs, how to support emerging AI integration without dedicated funding streams, and what professional learning investments will yield the greatest return.

Tracking the same teacher cohort over time provides the educational community evidence of which technology practices persisted or declined, and what support structures educators consistently identify as essential to enhancing their teaching practice. These findings may help superintendents and directors of finance to make informed budget decisions by identifying temporary crisis adaptations from sustainable changes warranting continued investment. It will provide empirical evidence to inform decisions about what to keep, delete, or adapt as districts transition from emergency funding to more stable general budgets. By tracking teacher experiences across multiple years, the study offers a glimpse into technology practices and support structures that merit continued investments.

Curriculum directors and instructional leaders can use this study as a guide for designing professional learning that aligns with teachers' current competency levels rather than assumed needs. The findings highlight adult learning theory and inform ways in which to preserve learner agency and honor expertise, two fundamental principles of Mezirow's (1978) work. Findings from the study offer guidance about protected collaboration time, investment in shared digital infrastructures, and the institutionalization of teacher-driven professional learning communities.

Theoretical Framework

Data collection phase 1 and phase 2 of the study were guided by Mezirow's (1991) transformative adult learning theory, which describes how adult learners experience perspective transformation and acquire new knowledge. Mezirow (1997) suggests that lived experiences create future assumptions; however, through critical reflection and dialogue, perspectives can be changed. These transformed perspectives then guide future practices in adults. Transformative learning theory served as the theoretical framework for this study and as an interpretive lens throughout the analysis of the data.

Mezirow's (1991) theory suggests that ERT and post-pandemic teaching functioned as a disorienting dilemma. K-8 teachers experienced genuine perspective transformation during ERT; therefore, their technology integration should persist beyond the immediate crisis. Through reengaging participants in the original 2022 study, this research examines whether educators have sustained their educational technology integration and their initial responses to AI.

METHODOLOGY

The study is a follow-up to a previous study conducted by the researchers in 2022 and was designed using a qualitative descriptive design. Qualitative research involves making meaning of people's lives, as they are experienced in real-life situations and conditions. A qualitative descriptive framework involves analyzing the realities of individuals or groups to represent the views and perspectives of those being studied. This approach attempts to reach generalizable conclusions about the topic under investigation (Yin, 2016). All 25 elementary teachers from the original study were invited to participate in the open-ended survey, and 19 complete responses were received. The participants work at elementary schools throughout Michigan.

Research Design

This qualitative study used a two-phase design to follow participants' experiences teaching post-pandemic (phase 1 and phase 2) and AI usage (phase 2). In Fall 2022, the study involved qualitative semi-structured interviews with 25 K-8 elementary teachers who had recently returned to in-person instruction after

ERT during the COVID-19 pandemic. Semi-structured interviews were conducted to understand 25 teachers' experiences when returning to the classroom post-pandemic. Phase 2 data collection, conducted in the Fall of 2025, built upon the original study three years earlier. A survey based on themes from the 2022 study and new AI tools was sent to the original 25 participants. Educators ($n = 19$) from the original cohort answered open-ended questions that focused on post-pandemic technology tools and practices, responses to emerging AI tools, teacher collaboration, and ongoing support needs.

Participants

Participants in the original study (Fall of 2022) were purposively selected. To be recruited into the study, individuals had to be teachers in the K-8 setting in Michigan with no prior experience teaching online. In the current study, we sent out surveys via email to all teachers who participated in the original study.

Participants in phase 1. Semi-structured interviews (Fall 2022)

The original study, conducted in 2022, implemented a qualitative research design to better understand elementary teachers' experiences with post-pandemic instruction. Twenty-five elementary teachers, who had never previously taught online prior to ERT during the 2020 pandemic, participated in the study. 68% of participants in the study were general education teachers ($n = 17$), and 32% were specialty teachers ($n = 8$), including those in art, music, multilingual education, and special education. The years of experience ranged from 4 to 38 years ($m = 16.4$ years). The geographic distribution consisted of suburban districts across Michigan. All participants had taught in a traditional classroom before the pandemic, had experience with ERT teaching in 2020, and returned to in-person instruction by the Fall of 2022.

Participants in phase 2. Follow-up survey (Fall 2025)

Nineteen out of the original 25 participants completed the follow-up survey, representing a 76% retention rate. Six teachers from the original cohort did not participate: Three had retired from the teaching profession and three emails were no longer valid. The 19 retained participants represented various experience levels, different prekindergarten through grade eight configurations, and positions. Experience ranged from seven to 40 years as of 2025, with a start in education between 1984 and 2019. Among them, 11 were general education classroom teachers, eight held specialized roles, including one special education teacher (K-5), one art teacher (young-5 through 4th grade), one multilingual learner teacher (K-8), one instructional coach, one K-6 assistant principal, and one K-8 restorative practice coordinator. Two teachers taught 4th grade, with one designated as teaching "all-star subjects." The grade distribution included one prekindergarten teacher, two 1st-grade teachers, one 2nd-grade teacher, two 3rd-grade teachers, three 4th-grade teachers, one 5th-grade teacher, two 6th-grade teachers, two 7th-grade teachers, and one 8th-grade teacher. Five participants taught multiple grade levels or were now in building-wide roles. Geographically, all participants stayed in Michigan schools and were primarily in suburban districts.

Sampling Techniques

Through purposive sampling, 25 elementary teachers participated in the 2022 study. Purposive sampling ensured all had taught in a traditional classroom pre-pandemic, experienced ERT, had never taught online prior to the pandemic, and had returned to in-person instruction by Fall 2022. Voluntary recruitment occurred through email, social media educator groups, and snowball sampling. All participants signed informed consent documents. Participants from the original 2022 study were contacted via email

Table 1. Braun et al. (2018) six-phase reflexive TA process

Six-phase reflexive TA	2022 Description	2025 Description
Phase 1. Familiarization with the data	Read through transcriptions from 25 educators, noting initial observations	Read through survey responses from 19 educators, noting initial observations
Phase 2. Generating initial codes	NVivo was used to code and identify interesting features across the entire dataset. Both semantic (explicit) and latent (underlying) codes were developed.	Researchers used open and axial coding to identify interesting features across the entire dataset.
Phase 3. Searching for theme	Codes clustered into electronic folders in NVivo by potential themes	Color-coded data were organized into potential themes
Phase 4. Reviewing themes	Themes were checked against coded extracts and the entire dataset to ensure coherence. Some themes were refined, combined, or separated.	Themes were checked against color-coded data and the entire dataset to ensure coherence.
Phase 5. Defining and naming themes	Final themes were clearly defined with names that captured their essence. The relationship between themes was clarified.	Same procedure followed
Phase 6. Producing the report	Created a table with themes, codes, representatives quotes, and a summary of insight column Each theme was introduced to the reader and compelling quotes were organized from the data followed by connections to Mezirow's (1978) research	Same procedure followed Following analysis of 2025 data, compared 2025 themes and codes to 2022 themes and codes in a comparison chart, identifying patterns of change or stability with evidence documented in a final column

in the fall of 2025 and asked to complete a voluntary follow-up survey.

The survey link included four screeners and nine open-ended questions. Prior to sorting the data, the researchers verified email addresses, cross-referenced year of entry into the teaching profession with the 2022 study to confirm participation in phase 1 data collection.

Procedure for Data Collection

Data was collected in two phases. Phase 1 interview data were collected in 2022, and phase 2 survey data were collected in 2025. Details on data collection procedures are noted below.

Phase 1. Procedures for data collection

The researchers collected phase 1 data using semi-structured Zoom interviews. Interviews were conducted in late September and partway through October 2022, taking on average 45 minutes for each interview. Researchers captured audio recordings of each interview, which were transcribed verbatim, and then uploaded into NVivo. As suggested by Braun et al. (2018), the researchers maintained a supplemental digital journal and engaged in reflexive journaling to address potential bias. This was accomplished before and immediately after the interviews concluded.

Phase 2. Procedures for data collection

Three years after the original study, data were collected using an open-ended survey administered online. The survey was sent out on November 3, 2025, via email and remained open for one week. The survey contained open-ended questions, taking approximately fifteen to twenty minutes to complete. Surveys were completed voluntarily.

The survey questions were designed to investigate the same core topics as the phase 1 interviews, while also incorporating questions about AI integration. Participants reflected upon peer-to-peer collaboration techniques transferred from ERT and current technology use for colleague collaboration. Participants were asked to describe changes in their technology skills and how they use it to facilitate instruction. The survey asked about digital tools integration, and their justifications, as well as how technology improved efficiency and effectiveness. Participants also commented on AI adoption. Finally, researchers inquired about ways that school leaders could better support their work.

Data Analysis

The researchers employed Braun et al.'s (2018) reflexive TA approach to analyze data from the semi-structured interviews. The TA method was selected for rigor in identifying, analyzing, and reporting themes within qualitative data. The approach is appropriate for exploring complex experiences and generating themes grounded in participants' own perspectives. Reflexive TA is a recursive approach to analyzing data collected through qualitative measures. This method encourages the researcher's subjectivity in developing themes after poring over clusters of codes. Braun et al.'s (2018) reflexive TA moves through a series of phases in which the researcher codes, organizes, interprets, and ultimately refines themes organically. The analysis process was implemented in two stages:

- (1) independent TA of each phase and
- (2) systematic longitudinal comparison.

Both datasets were analyzed following the six-phase process outlined by Braun et al. (2018). **Table 1** presents each phase and its application in this study.

RESULTS

Through open and axial coding and TA of the data, eight themes were identified that represent teachers' responses to the nine open-ended survey questions. Findings indicated that teachers' technology use, skills, and collaboration have improved and increased since ERT. Also, teachers strategically use technology to facilitate and support teaching and enhance efficiency and workflow, but still value face-to-face instruction. Findings from the current study suggest that teachers use AI to generate lessons and feedback to save time, and they want school leaders to offer greater moral support, more resources, training, trust, and autonomy.

Theme 1. Teacher Technology Skills Have Improved

Fifteen out of the 19 teachers surveyed indicated that their technology skills have improved since 2022. T9 said that "Embracing collaborative tools like Google Docs has changed how I engage students in group projects." Likewise, T4 said, "My technology skills have definitely improved since the pandemic. Pre-pandemic I had little knowledge or exposure to anything Google. Now I feel like an expert on most Google platforms. I continue to use Google Slides

daily.” T13 also said she is “... more confident and I tend to use online forms and testing more than hardcopy assessments.”

Theme 2. Teachers Have Sustained Professional Bonds with Their Colleagues and Still Use Technology to Collaborate

In the original 2022 study, teachers indicated that because of ERT they greatly increased efforts to collaborate with their colleagues, and these efforts were integral to learning how to navigate the new teaching pressures and demands. In this follow-up study all teachers indicated that they continue to regularly meet with their colleagues face-to-face and in online spaces and asynchronously share resources through the creation of digital hubs such as Google Docs (T9). For instance, T19 said they use building wide “hubs” to share/keep important information in an accessible centralized location. T2 said “Definitely more sharing of practices outside the required curriculum”, and T9 said “I continue to uphold the teamwork spirit we created online.”

Not only has collaboration among teachers in the study held steady since ERT, but all teachers in this study indicated that they continue to use technology to share and collaborate. Eleven teachers indicated they use Google tools (i.e., Docs, Drive, Meet, Slides, and Sheets) to communicate and share resources, and seven teachers said they use Zoom to meet/collaborate. For instance, T16 said “Google Doc- we can collaborate on documents in real time ... Meet Face to Face without leaving building.” T19 said “We organize all grade-level work on a shared Google Drive.” T15 indicated that she uses Google to “... develop slides with colleagues, students and parents.”

Theme 3. Technology Is Still Used as a Pedagogical Tool

Teachers indicated that they rely on platforms like Google Classroom, Clever, Kahoot, iReady, Nearpod, Class Dojo, and other apps and tools to manage learning, resources, and bolster student involvement and engagement in learning. 18 out of 19 teachers said there is value in using technology tools for supporting learning. 12 teachers also specifically indicated technology tools can assist with bolstering student engagement, collaboration, provide preparation for the workforce, and support knowledge and skill building. T17 said “I am a big tech fan and I feel as an educator knowing technology for our students and helping them navigate it, will eventually help them when there are ready to enter the workforce.” T4 said she uses “Google Slides to present most concepts. It’s great to embed timers, links and photos into lessons. Clever helps students find all apps and online platforms they use daily. Canva is also a great resource for creating interactive slides.” T2 wrote that she has “continued to use apps like screen castify to record how to videos for families.” T18 said that technology “Helps students, more independence, and higher level, reading and following.” T12 said that YouTube is useful for “getting the children to move their bodies and listen to songs- this is especially helpful for my ML students.” One teacher (T19) uses “... GoNoodle and Brain Break Academy for physical and mental breaks throughout the day.” Another teacher (T15) uses “Google Translate to translate vocabulary words and directions.” She also uses it to communicate with English language learners and their families.

Theme 4. Teachers Are More Strategic in Using Technology, but Still Value Face-To-Face Instruction

10 teachers surveyed indicated that they use technology strategically, and either as a companion to or in place of face-to-face/hands-on instruction. For instance, T11 wrote,

I never want the technology to replace me, just supplement my teaching or make my job a bit easier. During the virtual years I relied a lot on technology to reteach and keep

students engaged [engaged] when not working directly with me. Now it is mainly used to practice skills we have been working on or as a supplement to what I teach (games, Google slides to display during lesson).

T15 said she uses technology tools “in small but meaningful ways to support my teaching, especially for planning and giving feedback.”

Two teachers specifically indicated that they rarely use technology for instruction, and six teachers indicated that they use less technology to facilitate instruction than they did during ERT and indicated that it is important to set boundaries when using technology with students. For instance, T7 said “Less on technology and more hands on, small group intervention in math & reading.” T12 wrote on the survey that she doesn’t do anything online with her students and does, “pretty much everything face to face. We do collaborate [collaborate] online using Google forms, docs, etc.”

Theme 5. Technology Use Enhances Efficiency and Workflow Streamlining

Eighteen out of 19 teachers said that using technology helps them to work more efficiently and helps them customize lessons to meet student needs. Five teachers made specific references to increased “speed”, “automation”, “feedback generation”, “data analysis”, and “differentiation” when using technology tools and applications. For example, T19 said that using technology is “just so much more efficient and saves time!” T6 indicated she uses customized feedback generators such as MagicSchool.ai, and Brisk Teaching to provide students with expedited feedback. T18 said technology tools help her to “... plan and post all assignments in a timely manner and students know exactly what I expect of them and when I can return papers graded and they can monitor their progress.” T15 also said “... tools like Google Classroom and Google Drive help me keep lessons, student work, and data all in one place ... I can quickly share resources with colleagues, students and parents without losing time searching through papers or emails.”

Theme 6. Teachers Use AI Tools to Create Lessons, Generate Feedback, and to Save Time

Teachers started using predictive AI during ERT for adaptive learning through tools like iReady (44%) and NWEA (8%). This study revealed that tools, such as Class Dojo and Seesaw decreased in usage, while generative AI tool usage grew. 74% of AI adoption in this study primarily refers to generative AI tools, such as ChatGPT or MagicSchool.ai. The 2022 to 2025 shift represents moving from predictive and adaptive AI to generative AI. This represents a shift from AI that personalizes existing content to AI that creates new content.

Fourteen teachers said they are exploring and using AI tools for feedback, grading, planning lessons and creating instructional materials and indicated doing so saves them time and helps them personalize instruction. T17 wrote that using AI “... makes grading and lesson planning a lot quicker and it allows more fun and creativity with our students.” T15 said using AI saves her time and assists her in differentiating instruction for her multilingual students. T9 wrote, “AI tools have cut my prep time in half. We organize all grade-level work on a shared Google Drive.” T6 indicated that using AI allows her to instantly process “vast amounts of data, align materials to standards, and automate repetitive tasks (e.g., drafting quizzes and differentiating content).” In addition, T8 said that AI assists her in providing “feedback on student essays, giving suggestions for improvement quickly.”

Theme 7. Teachers Desire Greater Moral Support, More Resources, Training, Trust, and Autonomy

Four of the 19 teachers indicated they feel very supported and gave no suggestions for additional support from school leaders. Five

teachers said they want more training and resources that are relevant to their personal and professional needs. For instance, T5 wrote, "Continue to give us PD that WE need. Not every department has the same needs."

In addition, six teachers said they want leaders to do a better job of protecting their time, and they want more time to collaborate and reflect. For instance, T7 said better support would involve "... time to collaborate with other grade level and vertical teachers to be able to best implement the new materials purchased in math and ELA." T15 said, "School leaders can support teachers by giving time to collaborate with colleagues, providing practical resources and professional development, and listening to our feedback."

Four teachers said they want better wellness and moral support. For example, T13 said that teachers need support for mental health and self-care. T2 said leaders need to address emotional labor overload and role strain. She said that leaders need to "Understand our true challenges in the classroom in regards to class size and being the everything (nurse, counselor, parent liaison)." T19 also said that

school leaders need to better understand that workload saturation impacts teachers' sustainability and morale. T19 wrote, "I feel like we need some things taken OFF our plates, before more new things get added."

Four teachers said they want greater support for autonomy. For instance, T7 wrote that district mandates and last-minute directives limiting teacher agency, and T17 wrote "Less micromanaging of teachers!!". In addition, T5 said that professional development/training should be differentiated by department.

Table 2 provides a summary of themes. **Table 3** provides a comparison of findings from the first study (2022) and the current study (2025). We also found that teachers use a variety of technology tools to collaborate with their peers and students, and to support student learning.

More teachers (42%) in the 2025 study indicated that they use Zoom as a tool to communicate, than they did in 2022 (+22%). In 2025, more teachers indicated they use Google Translate (16% in 2025 versus 8% in 2022), Class Dojo (32% in 2025 versus 24% in

Table 2. Summary of codes and themes

Theme	Codes	Representative quotes	Summary of data
Theme 1. Teacher technology skills have improved	Definitely improved, made an effort to grow, more confident, embracing tools	"... I had strong technology skills before, but I have mad[e] an effort to grow" (T5). "I've learned to incorporate virtual field trips into my lessons, expanding students' horizons beyond the classroom walls" (T8).	15 out of 19 teachers reported growth in confidence and skills with digital tools, transforming pandemic/ERT survival skills into long-term professional competence.
Theme 2. Teachers have sustained professional bonds with their colleagues and continue to use technology to collaborate	Frequently meet, more sharing, still collaborate, weekly, organic, teamwork, connect globally, build lessons, Zoom conferences, weekly meetings, share materials, build lessons, Google Docs, Meet, MS Teams, Zoom, hubs	"My team still meets weekly" (T11). "One of the biggest lessons I still carry from the pandemic is how important it is to really communicate and collaborate with my colleagues" (T15). "We use Zoom and we have created grade level and building wide 'hubs'" (T19). "... we build lesson slide presentations. We also use Google Drive to share materials" (T5).	All teachers continue to value collaboration and regularly collaborate with colleagues post-ERT. They use it to plan lessons together, share resources, and provide a flexible format for collaborating and reflecting on their work.
Theme 3. Technology is still used as a pedagogical tool	Google, Class Dojo, iReady, Clever, Nearpod, students respond to technology, co-create, helps students, great resources	"It's great to embed timers, links and photos into lessons ..." (T4). "I prefer Google Docs for group work ..." (T9). "YouTube is great for getting the children to move their bodies..." (T12). "I use a LOT more technology in my classroom ... interactive games, ... movement videos ..." (T19).	18 out of the 19 teachers said they use some form of technology in their classroom. One indicated (T11) they don't use technology "regularly", but the other 17 indicated they integrate technology into their instruction strategically and purposefully.
Theme 4. Teachers are more strategic in using technology but still value face-to-face instruction	Companion to instruction, use less technology, more hands-on, set boundaries, more face-to-face instruction	"... set boundaries for tech use and time" (T16). "I now know kids need more face-to-face instruction ... I still continue to use AI but more strategically than before" (T17). "Technology has become a companion to teacher instruction, not the only instruction" (T7).	10 teachers said they use technology strategically, and either as a companion to or supplement for face-to-face/hands-on instruction. Two teachers indicated that they prefer face-to-face and hands-on instruction.
Theme 5. Technology use enhances efficiency and workflow streamlining	Saves time, improves organization, streamlines tasks, faster planning, simplifies grading, faster student feedback, better consistency	"I'm much more efficient in grading and providing feedback when using digital platforms" (T3). "... grade long essays more quickly with digital rubrics ..." (T5). "Google Forms automates assessment, letting me analyze student understanding efficiently" (T9).	18 out of 19 teachers said that technology helps them save time, manage tasks efficiently, and maintain coherence across lessons and materials.
Theme 6. Teachers use AI to create lessons, generate feedback, and to save time	Create lessons feedback generation, personalize learning, cut prep time, efficient	"I use AI to give student feedback and to lesson plan" (T3). "... It [AI] saves me time and helps me differentiate more effectively ..." (T15).	Fourteen teachers said they are using AI for feedback, grading, content creation, and lesson planning and said it saves them time and helps them personalize instruction.
Theme 7. Teachers desire greater moral support, more resources, training, trust and autonomy	Professional respect, protect time, relevant and quality training, resources, wellness support, more time to collaborate and reflect	"... give us more time to complete teacher tasks rather than spending our planning time in meetings" (T3). "... time to collaborate with other grade level and vertical teachers ..." (T7). "... professional development the teachers want and address teacher mental health and self care" (T13). "Feeling supported and recognized helps me stay focused on my students' learning" (T15). "Need supplies in a timely fashion ..." (T18).	Five teachers said they want more personally and professionally relevant training and resources. Seven teachers said they want more time to collaborate and reflect and want leaders to do a better job of protecting their time. Seven teachers said they want wellness and morale support, and greater support for autonomy.

Table 3. Comparison chart of 2022 interviews vs. 2025 survey

2022 themes & representative quotes	2025 themes & representative quotes	Pattern classification	Supporting evidence
Theme 1. Skill acquisition: Educators developed technological knowledge and proficiency during ERT. "I've probably increased my technology knowledge 110%" (P19). "I think my biggest success has been like feeling very confident with using technology" (P4).	Technology skills improved and sustained post-ERT. "My technology skills have definitely improved since the pandemic" (T4). "I am more confident" (T13).	Persisted	n = 15/19 (79%). Confidence sustained; skills became "long-term professional competence", shift from "survival skills" (2022) to "long-term competence" (2025)
Theme 2. Collaborative support systems: Educators depended on trusted peers; tight-knit groups for dialogue and mutual support. "We're a tight-knit building" (P5). "It takes a village" (P20).	Collaboration sustained with digital tools. "One of the biggest lessons I still carry from the pandemic is how important it is to really communicate and collaborate" (T15).	Persisted	n = 19/19 (100%). All teachers mentioned ongoing collaboration, technology-enabled collaboration became permanent: Google Docs, Zoom, Google Drive, MS Teams central to workflow
Theme 3a. Technology for instructional differentiation: Used technology for instructional differentiation, classroom management, parent communication. Tools: Google Classroom, Class Dojo, SeeSaw, iReady, GoNoodle. "I'm able to differentiate practice a lot more" (P1).	Technology as strategic pedagogical tool. Tools: Google Slides, Clever, Nearpod, Class Dojo, iReady, Canva, YouTube. "Students respond to technology well" (T13).	Refined & strategic	n = 18/19 (95%). Tool portfolio evolved strategically, Google Workspace: 88% in 2022 to 79% in 2025, SeeSaw: 36% in 2022 to 16% in 2025, iReady: 44% in 2022 to 26% in 2025
Theme 3b. Hands-on learning emphasis: Proactively adopted tactile approaches with an emphasis on manipulatives, fine motor skills, physical materials. "They need paper, pencil. They need cutting and gluing" (P11).	Strategic balance; intentional boundaries for technology use. "Technology has become a companion to teacher instruction, not the only instruction" (T7).	Persisted & matured	n = 6/19 (32%) explicitly stated strategic use. Balance between digital and hands-on maintained with more intentional boundaries, technology as "companion" not primary instruction
Theme 3c. Efficiency enhancement Technology: Made teachers "more efficient," "paperless," easier differentiation tracking. "That makes me more efficient" (P12).	Technology enhances efficiency and workflow. "Much of the teacher manuals, lessons are online now. It is easier to find" (T13).	Persisted	n = 18/19 (95%). Efficiency mindset deepened; timesaving remains key value, new emphasis: AI for timesaving
Theme 3d. Student learning support Addressed: Skill gaps addressed through instructional differentiation and teacher-created interventions. "Helps with differentiated learning" (P20).	Technology supports student learning and workforce preparation. "Knowing technology will help them when ready to enter the workforce" (T17).	Persisted & expanded	n = 18/19 (95%). Differentiation use sustained, added uses: multilingual support (Google Translate), workforce preparation emphasis
Theme 4. AI integration. Not present in 2022. Zero substantive mentions of AI tools or artificial intelligence in qualitative data	Teachers use AI for lesson planning, feedback, and differentiation. Tools: ChatGPT, Google Gemini, MagicSchool.ai. "AI tools have cut my prep time in half" (T9). "I use AI to scaffold passages at the appropriate reading level for my multilingual learners" (T7).	New emergence	n = 14/19 (74%). Major technology adoption between 2022-2025, primary uses: lesson planning, differentiation, feedback generation, content creation, 6 teachers (32%) explicitly noted time-saving benefits
Theme 5. Professional support needs: Stress student skill, knowledge and social-emotional gaps, need for support, teamwork essential. "It's a big, huge burden on us as teachers" (P22).	Desire for greater morale support, relevant resources, training, autonomy. "Continue to give us PD that WE need" (T5). "Less micromanaging!!" (T17).	Consistent	Same core needs across 3 years: 7 teachers want relevant PD/resources, 7 teachers want protected collaboration time, 7 teachers want wellness/morale support, suggests persistent unmet needs or enduring professional requirements

2022), Clever (16% in 2025 versus 8% in 2022), and Nearpod (16% in 2025 versus 4% in 2022).

Fewer teachers use Google Workspace (79% in 2025 versus 88% in 2022), Seesaw (16% in 2025 versus 36% in 2022), and iReady (26% in 2025 versus 44% in 2022). Teachers also indicated that they now use AI tools such as ChatGPT/Google Gemini (37%), MagicSchool.ai (11%), and general use of AI is up from 0% to 26%. **Table 4** conveys the differences in specific tool use from 2022 to 2025.

Limitations

It is important to note some of the limitations of the present study. While the response rate was 76% (19 out of 25 educators), not all teachers who were interviewed in the original 2022 study responded to the current 2025 study. This poses a limitation in that the researchers did not capture the current experiences and perspectives of all original study participants. In addition, the study relies entirely on self-reported data, which may result in social desirability bias, specifically on the topics of collaboration, technology competence and AI adoption, where there may be professional pressure to appear current. Another limitation is that the sample is geographically and contextually limited to suburban K-8 elementary school teachers in Michigan.

Table 4. Analysis of tool persistence and change

Tool name	% used 2022 (n = 25)	% used 2025 (n = 19)	% change in use
Google Workspace	88%	79%	-9%
Google Translate	8%	16%	+8%
Zoom	20%	42%	+22%
Class Dojo	24%	32%	+8%
SeeSaw	36%	16%	-20%
iReady	44%	26%	-18%
Blooket	8%	16%	+8%
Kahoot!	8%	16%	+8%
GoNoodle	16%	11%	-5%
Online Videos/YouTube	52%	37%	-15%
NWEA	8%	5%	-3%
Clever	8%	16%	+8%
Nearpod	4%	16%	+12%
Canva	4%	11%	+7%
ChatGPT/Google Gemini	0%	37%	+37%
MagicSchool.ai	0%	11%	+11%
General AI use	0%	26%	+26%

Note. Percentages represent the proportion of teachers who reported using each tool in the respective study year (2022, n = 25; 2025, n = 19); teachers could report using multiple tools; therefore, percentages do not total 100%; "% change in use" reflects the percentage-point difference between reported use in 2022 and 2025; & tools listed

Therefore, findings may not be transferable to other settings such as urban or rural schools or districts, high schools, or school systems outside of the USA. Also, while the researchers obtained rich, deep, and complete responses to all open-ended questions on the survey from all participants who responded, conducting semi-structured interviews as done in 2022 may have resulted in even more descriptive and detailed explanations of those responses.

DISCUSSION

Findings from the current study indicated that 79% of teachers' technology skills have transitioned from emergency survival strategies during ERT to sustained professional competence. This indicates a shift from the study conducted in 2022 (Paul & Reason, 2024) in professional development priorities from introductory-level tool-based technology use training to the need for more advanced practical and pedagogical applications, refinement, and reflective use of these tools to further enhance efficiency and impact in their classroom instruction. This is aligned with others' findings that ERT during the pandemic pushed many teachers to become more innovative and learn how to use technology to support instruction and to enhance connections with students and parents (Santagata et al., 2024). Therefore, researchers from this study recommend that school leaders use technology integration models such as technological pedagogical and content knowledge, substitution, augmentation, modification, redefinition, and teacher-AI collaboration to support teacher growth and innovation of technology use in the classroom (Boonmoh & Kulavichian, 2023; Cabbeke et al., 2025; Ibragimov et al., 2025). In addition, school leaders should consider adopting Internet of Things-based classrooms, and systematic AIED curriculum (a structured, coherent, and scaffolded curriculum that integrates AI concepts and tools into educational practices), as well as ongoing school-based training and research-to-action/policy partnerships (Arantes, 2022; Crompton & Burke, 2020; Kim, 2024a).

In addition, all teachers reported they continue to highly value both face-to-face and digital collaboration and regularly collaborate informally and formally using both modalities. All teachers also indicated that they engage with colleagues using digital platforms such as Google Docs, Sheets, Forms, as well as Zoom, and digital hubs to share lessons, ideas, and resources. In fact, technology-enabled collaboration has become embedded in teachers' professional routines and is no longer just an emergency workaround. Santagata et al. (2024) found that variables that predict teachers' ability to see opportunities to innovate and use technology include an overall satisfaction with the level of support they are provided by their school or district, degree to which they collaborate with their peers, and their level of confidence in using technology to teach specific subject matter and curriculum.

However, despite technological competence gains, 16 teachers expressed unmet needs related to morale, wellness, autonomy, protected time, and relevant professional development across multiple years of data collection. The persistence of these concerns suggests structural issues rather than transitional challenges. These findings are aligned with the work of Nordgren et al. (2021), who found that a supportive collegial structure has a tremendous impact on how teachers describe their working conditions. However, the infrastructure of most school organizations does not provide support for efficient and systematic formative instruction and assessment. Therefore, researchers in this study recommend that educational leaders formalize collaborative digital practices by protecting teachers scheduled collaboration time and use their budgets to provide teachers with shared digital workspaces and embed them in the school's infrastructure (Li et al., 2023). In addition, leaders are

well advised to recognize the importance of collaborative planning, reflection, and teacher mental wellbeing as integral to institutional growth and evolution, and support teacher-driven professional learning agendas. In so doing, it is suggested that school leaders create and support training, space and time for teacher-driven, and adaptable professional learning communities, as well as time, training and support for teacher mental health and wellbeing (Khosla et al., 2025; Tołwińska, 2021).

Teachers in this study also indicated they use technology as a "companion", or "supplement" to face-to-face instruction rather than a replacement. This explicit setting of boundaries illustrates intentional instructional decision-making and responsiveness to students' social, emotional, and developmental needs, and interests. Therefore, it is important that training be offered to teachers to explore and develop the acumen to make choices regarding the modality for instructional delivery that offers the most instructional impact and allows them to differentiate instruction to meet the needs of learners. Professional training could include an array of both hands-on and technology-based tools and activities, and scenarios that ask them to decide the best type of instruction that will meet students' needs (Zagouras et al., 2022). In fact, Li et al. (2023) found that face-to-face and online modalities are equally effective in supporting learning. Therefore, having access to tools and resources, and practicing making those decisions using hypothetical scenarios will help them develop expertise in choosing which instructional modality and activity will work best in real-world situations (Lee & Lee, 2025).

The emergence of AI use among 74% of teachers indicates a large shift in instructional planning and in providing students with feedback, particularly for differentiation of instruction and time-saving purposes. This aligns with past research that suggests teachers value using AI to support, not replace, instruction (Kaplan-Rakowski et al., 2023). However, teachers emphasized personalization and efficiency rather than automation of teaching itself in their answers. These findings align with research that suggests using AI can reduce teacher workload (Fassbender, 2024; Li et al., 2025), and because AI-generated feedback can offer relevant and immediate feedback, it is appreciated by teachers and students, but it is recommended that teachers review feedback generated from AI because it may not always be completely accurate or clear (Burner et al., 2025).

Therefore, it is recommended that schools invest in technology tools that will assist teachers in lesson planning and constructing student feedback to free up time for collaboration, reflection, and instructional improvement (Uwosomah & Dooly, 2025; Lee & Lee, 2025; Tołwińska, 2021). In addition, training for teachers should offer guided exploration of AI tools grounded in ethical, pedagogical and contextual considerations. In addition, training and support should be teacher-driven with emphasis on determining appropriate applications for AI use for supporting instruction (Kim, 2024a, 2024b, 2025). **Table 5** conveys connections between findings and past research and provides implications and recommendations for future professional practice.

Finally, future research could include analyzing the effects of teacher-driven professional development on student academic performance and engagement. In addition, research on differences between schools that fully embody collaborative cultures (i.e., protected time for collaboration, support professional learning communities, etc.) and those that do not in terms of student academic performance, teacher job satisfaction and retention, and stakeholder perception of school culture and climate should be examined. Future studies could also explore how teacher-driven professional development and training impact teacher motivation, job satisfaction, and mental and physical well-being.

Table 5. Connections between findings and recommendations for professional practice

Theme	Evidence from the data	Implications of findings on professional practice	Recommendations for future practice
Teacher technology skills have improved (theme 1)	15 of 19 teachers reported increased confidence and long-term competence with technology, shifting from ERT survival skills to sustained professional use	Technology competence is no longer a novice concern; teachers are operating at a level requiring refinement, reflection, and pedagogical discernment (Runge et al., 2023; Tang & Jin, 2024)	Redesign professional development to move beyond basic tool training toward advanced pedagogical integration, discipline-specific applications, and reflective decision-making about technology use (Arantes, 2022; Crompton & Burke, 2020; Kim, 2024a).
Teachers have sustained professional bonds with their colleagues and continue to use technology to collaborate (theme 2)	100% of teachers reported ongoing collaboration using digital platforms such as Google Docs, Sheets, Zoom, Meet, and shared hubs	Collaboration supported by technology has become a permanent feature of professional learning rather than a temporary response to a crisis (Beleulmi & Boudibi, 2026; Herrera-Pavo & Ornellas, 2024)	Build teacher collaboration into routines and infrastructure by protecting time, maintaining shared digital workspaces, and recognizing collaboration as essential professional labor (Lee & Lee, 2025; Tołwińska, 2021)
Technology is still used as a pedagogical tool (theme 3)	18 of 19 teachers reported purposeful instructional technology use to support engagement, differentiation, and learning	Teachers demonstrate pedagogical agency in selecting tools aligned with instructional goals (Cabbek et al., 2025)	Support professional learning that underscores pedagogical intent, instructional alignment, and reflective evaluation of digital tools rather than tool adoption mandates (Kim, 2024a)
Teachers are more strategic in using technology but still value face-to-face instruction (theme 4)	Teachers described technology as a “companion” or “supplement” and stressed the importance of hands-on, face-to-face instruction	Intentional selection of technology illustrates sound professional judgement and responsiveness to student interests, as well as cognitive, developmental and social needs (Haroud & Saqri, 2025).	Support balanced and strategic technology use in professional learning models, framing boundary-setting as a marker of instructional expertise (Lee & Lee, 2025; Li et al., 2023; Zagouras et al., 2022)
Technology use enhances efficiency and workflow streamlining (theme 5)	18 out of 19 teachers reported time savings, streamlined grading, and improved organization when using digital tools	Efficiency in menial tasks frees up time and cognitive capacity for higher-order instructional planning and reflection (Tołwińska, 2021)	Encourage technology use that prioritizes workflow efficiency while reinvesting saved time into collaboration, reflection, and instructional improvement (Li et al., 2023)
Teachers use AI to create lessons, generate feedback, and to save time (theme 6)	14 teachers reported using AI for lesson planning, constructing and delivering student feedback, differentiation, and content creation	AI serves as a professional support tool rather than a replacement for instructional judgement (Haroud & Saqri, 2025).	Provide guided, ethical, and pedagogically grounded professional learning around AI that preserves teacher autonomy and instructional agency (Fassbender, 2024; Kim, 2024a, 2024b, 2025)
Teachers desire greater moral support, more resources, training, trust, and autonomy (theme 7)	Teachers consistently requested protected time, wellness support, trust, and relevant PD across multiple years (2022, 2025)	Professional growth is constrained when systemic conditions do not support teacher well-being and autonomy (Hsieh et al., 2024; Procentese et al., 2023; Troubouni et al., 2026)	Address professional development as a systemic responsibility by protecting teacher time, honoring professional voice, and embedding wellness and autonomy into leadership practices (Khosla et al., 2025; Tołwińska, 2021)

CONCLUSIONS

Findings from this longitudinal study offer an important message for educational leaders. The burden of change should not fall on individual educators to be resilient. Instead, organizations must recognize that professional agency drives positive change, and that professional agency is cultivated when leaders nurture educators as adult learners, provide supportive environments, and foster collaboration. The following belief statements synthesize the study's themes and findings into principles for future professional practice.

Belief Statement 1. Nurture Educators as Adult Learners

Researchers from this study believe in nurturing teachers as adult learners through well-designed, personalized professional learning. Themes 1, 3, and 4 together tell a coherent story. Fifteen of 19 teachers successfully transitioned technology skills from ERT into sustained classroom practice, and those same teachers demonstrated professional judgment in determining how, when, and how often to use technology, using it as a supplement to instruction rather than a replacement. These teachers have advanced well past introductory tool training and are making complex pedagogical decisions; therefore, their professional learning should reflect that sophistication. Leaders must shift the focus of professional development from platform familiarity to pedagogical judgment, particularly around ethical AI use, bias recognition, and determining when human expertise is irreplaceable (Ng et al., 2023). Professional learning that positions educators to

grapple with real instructional dilemmas, rather than learning new tools in isolation, honors where these teachers are and supports the kind of growth that sustains transformation.

Belief Statement 2. Provide Supportive Environments

Researchers from this study believe that leaders create supportive environments by making intentional structural and purchasing decisions that protect the conditions teachers need to do meaningful work. Theme 5 found that 95% of teachers reported that technology tools enhanced their efficiency and streamlined their workflow. Theme 6 revealed that 74% of teachers have adopted generative AI specifically to reclaim time, which is direct evidence that when teachers are given access to tools aligned with their needs, they use them purposefully. However, theme 7 complicates this picture. Across both the 2022 and 2025 data collection cycles, 16 teachers consistently reported unmet needs for moral support, autonomy, protected time, and relevant professional development. The persistence of these concerns across three years points to structural conditions, not individual shortcomings, as the primary barrier to teacher effectiveness. Therefore, leaders are encouraged to ask not only what tools to purchase, but whether those tools genuinely free up time for reflection, collaboration, and deep instructional work (Uwosomah & Dooly, 2025; Kim, 2024a).

Belief Statement 3. Foster Collaboration

Researchers from this study believe that fostering collaboration is among the most essential and actionable leadership practices supported by this research. Theme 2 found that all 19 teachers sustained professional collaboration across both formal and

informal settings, embedding digital platforms such as Google Docs, Zoom, and shared hubs into their everyday professional routines. Collaboration was not a pandemic workaround; it became an embedded way of working. Theme 7 further reinforces that while collaboration is already a self-sustaining practice among these educators, institutional structures have not yet caught up to support it. Teachers consistently requested protected time to collaborate and reflect, signaling that leadership's role is not to introduce collaboration but to remove the barriers that impede it. Leaders who trust educators to direct their own professional learning, without burdensome documentation or leader-driven protocols, honor both the capacity and the commitment these teachers have already demonstrated (Gavin & Stacey, 2023; Muylaert et al., 2025).

Taken together, these three belief statements represent a call for systems-level change. Education has moved well beyond one-size-fits-all professional learning, and the teachers in this study are evidence of that. They adapted, sustained, and continued to grow, often without the structural support they deserved. The work ahead belongs not to individual teachers alone, but to the organizations responsible for creating the conditions in which great teaching can thrive.

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REFERENCES

- Adipat, S. (2025). Challenging conventions: ChatGPT's controversial impacts on educational and English language teaching practices. *Education Process: International Journal*, 14(1), Article e2025066. <https://doi.org/10.22521/edupij.2025.14.66>
- Ajjawi, R., Fischer, J., Tai, J., Bearman, M., & Jorre de St Jorre, T. (2023). 'Attending lectures in your pajamas': Student agency in constrained circumstances. *Higher Education*, 86, 1363-1376. <https://doi.org/10.1007/s10734-022-00976-9>
- An, Y., Kaplan-Rakowski, R., Yang, J., Conan, J., Kinard, W., & Daugherty, L. (2021). Examining K-12 teachers' feelings, experiences, and perspectives regarding online teaching during the early stage of the COVID-19 pandemic. *Educational Technology Research and Development*, 69, 2589-2613. <https://doi.org/10.1007/s11423-021-10008-5>
- Arantes, J. (2022). The SAMR model as a framework for scaffolding online chat: A theoretical discussion of the SAMR model as a research method during these 'interesting' times. *Qualitative Research Journal*, 22(3), 294-306. <https://doi.org/10.1108/QRJ-08-2021-0088>
- Bakhadirov, M., Alasgarova, R., & Rzayev, J. (2024). Factors influencing teachers' use of artificial intelligence for instructional purposes. *IAFOR Journal of Education*, 12(2), 9-32. <https://doi.org/10.22492/ije.12.2.01>
- Beleulmi, S., & Boudibi, N. (2026). Fostering teacher collaboration through online communities of practice in teacher education. *The Journal of Studies in Language, Culture and Society*, 8(4), 123-140. <https://asjp.cerist.dz/en/article/286504>
- Boonmoh, A., & Kulavichian, I. (2023). Exploring Thai EFL pre-service teachers' technology integration based on SAMR model. *Contemporary Educational Technology*, 15(4), Article ep457. <https://doi.org/10.30935/cedtech/13567>
- Cabbeke, B., Adams, B., Rotsaert, T., & Schellens, T. (2025). Collaborative design through authentic design challenges: Preservice teachers' perceptions of digital competence development and SQD-aligned supports. *Education Sciences*, 15(10), Article 1331. <https://doi.org/10.3390/educsci15101331>
- Braun, V., Clarke, V., Hayfield, N., & Terry, G. (2018). Thematic analysis. In P. Liamputtong, (Eds.) *Handbook of research methods in health social sciences*. Springer, Singapore. https://doi.org/10.1007/978-981-10-2779-6_103-1
- Burner, T., Lindvig, Y., & Wærness, J. I. (2025). 'We should not be like a dinosaur'—Using AI technologies to provide formative feedback to students. *Education Sciences*, 15(1), Article 58. <https://doi.org/10.3390/educsci15010058>
- Crompton, H., & Burke, D. (2020). Mobile learning and pedagogical opportunities: A configurative systematic review of PreK-12 research using the SAMR framework. *Computers and Education*, 156, Article 103945. <https://doi.org/10.1016/j.compedu.2020.103945>
- Daneshmand, A., Harris, M., & Viviani, D. A. (2022). Roadmap to emergency remote teaching. *New Directions for Community Colleges*, 2022(199), 49-62. <https://doi.org/10.1002/cc.20523>
- Fassbender, W. J. (2024). 'I can almost recognize its voice': AI and its impact on ethical teacher-centaur labor. *English Teaching: Practice and Critique*, 23(1), 104-117. <https://doi.org/10.1108/ETPC-08-2023-0101>
- Friedrich, J.C., Perrotta, K.A. (2022). Head above water: A study of K-12 teachers' perspectives on emergency remote learning during the COVID-19 Pandemic. In C. Haeussler Bohan, J. L. Pecore, & F. S. Allair (Eds.), *Curriculum and teaching dialogue* (pp. 191-312). <https://doi.org/10.1108/979-8-88730-050-420251017>
- Gârdan, I. P., Manu, M. B., Gârdan, D. A., Negoită, L. D. L., Paștiu, C. A., Ghiță, E., & Zaharia, A. (2025). Adopting AI in education: Optimizing human resource management considering teacher perceptions. *Frontiers in Education*, 10, Article 1488147. <https://doi.org/10.3389/educ.2025.1488147>
- Gavin, M., & Stacey, M. (2023). Enacting autonomy reform in schools: The re-shaping of roles and relationships under local schools, local decisions. *Journal of Educational Change*, 24(3), 501-523. <https://doi.org/10.1007/s10833-022-09455-5>
- Haroud, S., & Saqri, N. (2025). Generative AI in higher education: Teachers' and students' perspectives on support, replacement, and digital literacy. *Education Sciences*, 15(4), Article 396. <https://doi.org/10.3390/educsci15040396>
- Herrera-Pavo, M., & Ornellas, A. (2024). From emergency remote teaching to an online educational ecosystem: An Ecuadorian University case study. *Electronic Journal of E-Learning*, 22(9), 15-27. <https://doi.org/10.34190/ejel.22.9.3461>
- Hsieh, C., Gunawan, I., Li, H., & Liang, J. (2024). Teachers' voice behavior—Principal leadership-driven or teacher self-driven? evidence from Taiwan. *Psychology in the Schools*, 61(5), 2077-2099. <https://doi.org/10.1002/pits.23152>
- Ibragimov, G. I., Kolomoets, E. N., Filippova, A. A., Khairullina, E. R., Garnova, N. Y., & Torkunova, J. V. (2025). An analysis of science teachers' use of artificial intelligence in education from a technological pedagogical content knowledge perspective. *Online Journal of Communication and Media Technologies*, 15(3), Article e202523. <https://doi.org/10.30935/ojcm/16594>

- Juárez-Díaz, C., & Perales, M. (2021). Language teachers' emergency remote teaching experiences during the COVID-19 confinement. *Profile: Issues in Teachers' Professional Development*, 23(2), 121-135. <https://doi.org/10.15446/profile.v23n2.90195>
- Kaplan-Rakowski, R., Grotewold, K., Hartwick, P., & Papin, K. (2023). Generative AI and teachers' perspectives on its implementation in education. *Journal of Interactive Learning Research*, 34(2), 313-338. <https://doi.org/10.70725/815246mfssgp>
- Keldgord, F., & Ching, Y.-H. (2022). Teachers' experiences with and perceptions of virtual manipulatives following the COVID-19 pandemic. *TechTrends*, 66(6), 957-967. <https://doi.org/10.1007/s11528-022-00796-9>
- Khosla, A., Sharma, P., Sethi, M., & Yadav, D. (2025). Teachers' well-being and lifestyle at G. D. Goenka Public School, Dwarka. *Indian Journal of Health and Wellbeing*, 16(21), 249-255.
- Kim, J. (2024a). Leading teachers' perspective on teacher-AI collaboration in education. *Education and Information Technologies*, 29(7), 8693-8724. <https://doi.org/10.1007/s10639-023-12109-5>
- Kim, J. (2024b). Types of teacher-AI collaboration in K-12 classroom instruction: Chinese teachers' perspective. *Education and Information Technologies*, 29(13), 17433-17465. <https://doi.org/10.1007/s10639-024-12523-3>
- Kim, J. (2025). Perceptions and preparedness of K-12 educators in adopting generative AI. *Research in Learning Technology*, 33, 1-17. <https://doi.org/10.25304/rlt.v33.3448>
- Lampropoulos, G., Ferdig, R., & Kaplan-Rakowski, R. (2025). A social media data analysis of general and educational use of ChatGPT: Understanding emotional educators through Twitter data. *Educational Technology & Society*, 28(3), 51-65. [https://doi.org/10.30191/ETS.202507_28\(3\).SPO5](https://doi.org/10.30191/ETS.202507_28(3).SPO5)
- Lee, J., & Lee, J. (2025). Generative AI chatbot for teachers' data-informed decision-making: Effects and insights. *Educational Technology & Society*, 28(3), 298-317. [https://doi.org/10.30191/ETS.202507_28\(3\).TP06](https://doi.org/10.30191/ETS.202507_28(3).TP06)
- Leech, N. L., Gullett, S., Cummings, M. H., & Haug, C. A. (2022). The challenges of remote K-12 education during the COVID-19 pandemic: Differences by grade level. *Online Learning*, 26(1), 245-267. <https://doi.org/10.24059/olj.v26i1.2609>
- Li, Z., Hassan, N. C., & Jalil, H. A. (2023). The effectiveness of face-to-face versus online delivery of continuing professional development for science teachers: A systematic review. *Education Sciences*, 13(12), Article 1251. <https://doi.org/10.3390/educsci13121251>
- Li, X., Li, B., Li, J., & Cho, S. (2025). Technology review of magic school AI: An intelligent way for education inclusivity and teacher workload reduction. *Education Sciences*, 15(8), Article 963. <https://doi.org/10.3390/educsci15080963>
- Mezirow, J. (1978). Perspective transformation. *Adult Education Quarterly*, 28(2), 100-110. <https://doi.org/10.1177/074171367802800202>
- Mezirow, J. (1991). *Transformative dimensions of adult learning*. Jossey-Bass.
- Mezirow, J. (1997). Transformative learning: Theory to practice. *New Directions for Adult and Continuing Education*, 1997(74), 5-12. <https://doi.org/10.1002/ace.7401>
- Muylaert, J., Decramer, A., Van der Heijden, Beatrice I. J. M., & Audenaert, M. (2025). The effect of red tape on employability competences of teachers. *Public Personnel Management*, 54(2), 209-242. <https://doi.org/10.1177/00910260241294152>
- Ng, D. T. K., Leung, J. K. L., Su, J., Ng, R. C. W., & Chu, S. K. W. (2023). Teachers' AI digital competencies and twenty-first century skills in the post-pandemic world. *Educational Technology Research and Development*, 71(1), 137-161. <https://doi.org/10.1007/s11423-023-10203-6>
- Ní Chínseallaigh, E., Shipsey, M., Minihan, E., Gavin, B., & McNicholas, F. (2025). Burnout persists in teachers in Ireland post-COVID-19: A qualitative follow up comparative study. *International Journal of Environmental Research and Public Health*, 22(4), Article 641. <https://doi.org/10.3390/ijerph22040641>
- Nordgren, K., Kristiansson, M., Liljekvist, Y., & Bergh, D. (2021). Collegial collaboration when planning and preparing lessons: A large-scale study exploring the conditions and infrastructure for teachers' professional development. *Teaching and Teacher Education*, 108, Article 103513. <https://doi.org/10.1016/j.tate.2021.103513>
- Paul, C., & Reason, L. (2024). Safeguarding learning before, during, and after emergency remote learning. *Michigan Reading Journal*, 56(3), 37-47.
- Procentese, F., Gatti, F., & Ceglie, E. (2023). Protective and risk social dimensions of emergency remote teaching during COVID-19 pandemic: A multiple mediation study. *Journal of Community Psychology*, 51(1), 67-83. <https://doi.org/10.1002/jcop.22879>
- Runge, I., Lazarides, R., Rubach, C., Richter, D., & Scheiter, K. (2023). Teacher-reported instructional quality in the context of technology-enhanced teaching: The role of teachers' digital competence-related beliefs in empowering learners. *Computers and Education*, 198, Article 104761. <https://doi.org/10.1016/j.compedu.2023.104761>
- Santagata, R., Villavicencio, A., Wegemer, C. M., Cawelti, L., & Gatlin-Nash, B. (2024). 'I have been pushed outside of my comfort zone and have grown as a result': Teacher professional learning and innovation during the pandemic. *Journal of Educational Change*, 25(4), 699-726. <https://doi.org/10.1007/s10833-023-09491-9>
- Tang, X., & Jin, M. (2024). Deep learning PCA correlation analysis of teacher's educational technology quality and teacher's professional competence. *Journal of Electrical Systems*, 20(5s), 212-226. <https://doi.org/10.52783/jes.1941>
- Ting, A., Manaig, K., & Yazon, A. (2024). Online teaching during COVID-19: A tale of two cities. *International Journal of Web-Based Learning and Teaching Technologies*, 19(1), 1-15. <https://doi.org/10.4018/IJWLTT.336545>
- Totwińska, B. (2021). The role of principals in learning schools to support teachers' use of digital technologies. *Technology, Knowledge and Learning*, 26(4), 917-930. <https://doi.org/10.1007/s10758-021-09496-4>
- Troubouni, E., Antonopoulou, H., Kourtidou, S., Gkintoni, E., & Halkiopoulou, C. (2026). Cognitive-emotional teacher burnout syndrome: A comprehensive behavioral data analysis of risk factors and resilience patterns during educational crisis. *Psychiatry International*, 7(1), Article 26. <https://doi.org/10.3390/psychiatryint7010026>
- Trust, T., & Whalen, J. (2021a). Emergency remote teaching with technology during the COVID-19 pandemic: Using the whole teacher lens to examine educator's experiences and insights. *Educational Media International*, 58(2), 145-160. <https://doi.org/10.1080/09523987.2021.1930479>
- Trust, T., & Whalen, J. (2021b). K-12 teachers' experiences and challenges with using technology for emergency remote teaching during the COVID-19 pandemic. *Italian Journal of Educational Technology*, 29(2), 10-25. <https://doi.org/10.17471/2499-4324/1192>

- Uwosomah, E. E., & Dooly, M. (2025). It is not the huge enemy: Preservice teachers' evolving perspectives on AI. *Education Sciences*, 15(2), Article 152. <https://doi.org/10.3390/educsci15020152>
- Wohlfart, O., Trumler, T., & Wagner, I. (2021). The unique effects of covid-19 – A qualitative study of the factors that influence teachers' acceptance and usage of digital tools. *Education and Information Technologies*, 26(6), 7359-7379. <https://doi.org/10.1007/s10639-021-10574-4>
- Yin, R. K. (2016). *Qualitative research from start to finish* (2nd ed.). The Guilford Press.
- Zagouras, C., Egarchou, D., Skiniotis, P., & Fountana, M. (2022). Face to face or blended learning? A case study: Teacher training in the pedagogical use of ICT. *Education and Information Technologies*, 27(9), 12939-12967. <https://doi.org/10.1007/s10639-022-11144-y>