TECHNO-SAVVINESS, TECHNO-STRESS AND TECHNO-PRODUCTIVITY AMONG PUBLIC ELEMENTARY SCHOOL TEACHERS: A MODERATED ANALYSIS OF COPING MECHANISMS

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Abstract

This investigation explored the relationships between the educators' (i.e., teachers) use of technology, their feelings of stress caused by technology use and their productivity as a result of using technology (i.e., integration into their daily activities) in the public elementary school system in the Sariaya West District. Coping strategies (i.e., ways of responding to stress) were examined as moderating variables to see whether these strategies enhanced (or diminished) the relationships among the other three primary variables. Techno-savviness included digital literacy, technology self-efficacy, frequency of technology usage, breadth of tool types, and professional development/training. Techno-stress was measured by the dimensions of techno-overload, techno-invasion, techno-complexity, techno-insecurity and techno-uncertainty. Techno-productivity was measured by the dimensions of teacher resiliency, instructional quality, professional efficacy, efficiency in completing digital tasks and innovative practices. Coping strategies were measured using problem-focused, emotion-focused and avoidance coping, as well as social support and organizational support. The study used a descriptive/correlational design and utilized a survey instrument to collect data from the sample group (i.e., teachers) during the 2025-2026 school year. Teachers displayed varying levels of techno-savviness, techno-stress and techno-productivity, depending on the use of coping strategies. There was a positive correlation among all coping strategies, especially with teachers with higher digital-lite (techno-savvy) competencies and adaptive coping strategies. The study emphasizes the importance of ongoing professional development, institutional support and effective coping strategies to develop a resilient and digitally empowered teacher workforce.

Keywords: *Techno-savviness, Techno-stress, Techno-productivity, Coping mechanisms*

1. Introduction

Education in the 21st century has been rapidly transformed by digital technologies. Teachers are increasingly required to integrate ICT into their practice to prepare students for the demands of the Information Age. Classrooms today are more technology-rich than ever, making digital literacy, adaptability, and innovation essential skills for both teachers and learners. This shift highlights the need for teachers to be tech-savvy—confident in using digital tools, platforms, and applications for both instruction and administration (Redecker, 2017; Vuorikari, Kluzer, & Punie, 2022). Tech-savvy educators can design engaging lessons, manage virtual classrooms, and foster collaboration and

independent learning. However, many struggle to keep pace with rapid technological change, affecting lesson quality, job satisfaction, and openness to innovation (Bejasa, 2022).

While technology offers opportunities, it also introduces challenges in the form of techno-stress—psychological strain caused by workplace technology (Tarafdar, Cooper, & Stich, 2019). Techno-stress manifests through overload (managing multiple platforms), invasion (work encroaching on personal time), complexity (difficulty mastering new systems), insecurity (fear of being replaced by more digitally skilled peers), and uncertainty (rapid, unpredictable changes) (Çoklar, Efilti, & Şahin, 2017). These pressures can diminish teacher well-being, instructional quality, and creativity. The issue is particularly pronounced among public school teachers in the Philippines, especially in CALABARZON and Sariaya West District, where limited infrastructure, unstable internet, and shifting policies intensify the problem (Lozada, Almerez, & Trinidad, 2021).

Despite these challenges, technology can enhance teacher performance through techno-productivity—the extent to which digital tools improve adaptability, instructional quality, professional efficacy, efficiency, and innovation. Techno-productivity reflects both resilience and creativity in technology-mediated contexts. Teachers who manage stress effectively while leveraging digital tools are more likely to thrive professionally and positively impact student learning. Yet, the relationship among tech-savviness, techno-stress, and techno-productivity remains underexplored.

Coping strategies play a critical role in this dynamic, shaping how teachers respond to technological demands. Strategies include problem-focused and emotion-focused approaches, avoidance, reliance on social and organizational support, and sensory-based activities such as ASMR (Allen, 2010; Barratt & Davis, 2023). Effective coping can transform stress into resilience and innovation, while ineffective coping may lead to burnout.

This study will examine the relationships among tech-savviness, techno-stress, and techno-productivity, with coping strategies as a moderating variable. Its goal is to provide localized insights for public elementary school teachers in Sariaya West District, informing policies, professional development, and institutional support. Ultimately, the research seeks to contribute to building a resilient, adaptable, and digitally empowered teaching workforce prepared to thrive in the Information Age.

1.1 Statement of the Problem

This study seeks to examine the levels of techno-savviness, techno-stress, techno-productivity, and coping mechanisms among elementary teachers in the Sariaya West District during the school year 2025–2026.

Specifically, it aims to capture how teachers navigate the demands of the Information Age, balancing digital competence with the challenges of technology-related stress, and how these dynamics influence their productivity and resilience in the classroom.

1. What is the demographic profile of the respondents in terms of:
   1.1. Sex;
   1.2. Age;
   1.3. Years of teaching experience; and
   1.4. Relevant training attended?
2. What is the level of tech-savviness of the respondents in the Information Age, as measured in terms of:
   2.1. Digital Literacy;
   2.2. Technology Self-Efficacy;
   2.3. Frequency of Technology Use;
   2.4. Breadth of Tools Used; and
   2.5. Training and Professional Development?

3. What is the techno-stress level caused by technology use in teaching as experienced by the respondents, in terms of:
   3.1. Techno-Overload;
   3.2. Techno-Invasion;
   3.3. Techno-Complexity;
   3.4. Techno-Insecurity; and
   3.5. Techno-Uncertainty?
4. What is the respondent's level of techno-productivity in terms of:
   4.1 Teacher Resilience;
   4.2 Instructional Quality;
   4.3 Professional Efficacy;
   4.4 Digital Task Efficacy; and
   4.5 Innovation in Teaching Practice?
5. Which of the identified coping mechanisms is commonly used by teachers to manage techno-stress
   5.1. Problem-focused coping;
   5.2 Emotion-focused coping;
   5.3 Avoidance coping;
   5.4 Social support; and
   5.5 Organizational support?
6. Is teachers' productivity significantly related to:
   a. Techno- savviness;
   b. Techno- stress;
   c. Coping mechanisms
7. Does techno-savviness significantly relate to techno-stress?
8. Does the coping mechanism significantly moderate the relationship between:
   a. Techno-savviness and techno-productivity?
   b. Techno-stress and techno-productivity?

1.Methodology

This study employed a descriptive–correlational research design with moderation analysis to examine the relationships among tech-savviness, techno-stress, and techno-productivity of public elementary school teachers, with coping mechanisms serving as a moderating variable. The descriptive aspect provided a profile of teachers' digital competence, stress experiences, coping strategies, and productivity outcomes in the Sariaya West District, while the correlational component explored whether higher levels of tech-savviness were linked to greater productivity and whether increased techno-stress reduced productivity. Moderation analysis was used to determine if coping mechanisms—such as problem-focused, emotion-focused, avoidance, social support, and organizational support—altered the strength or direction of these relationships, particularly in buffering the negative effects of stress and enhancing the positive impact of tech-savviness. The respondents of the study included 171 public elementary school teachers randomly selected from a population of 403 in the district. The locale was purposively chosen because consultations revealed that teachers struggled with techno-stress due to limited training in troubleshooting ICT tools, as training was restricted to ICT coordinators. This ensured the study addressed the real challenges faced by teachers in integrating technology into instruction, administrative tasks, and communication. The sample size was determined through statistical power analysis to provide adequate sensitivity in identifying significant correlations among the study variables, thereby

strengthening the reliability of the results. Data were collected using a researcher-developed questionnaire measuring tech-savviness (digital literacy, self-efficacy, frequency of use, breadth of tools, and professional training), techno-stress (overload, invasion, complexity, insecurity, and uncertainty), coping mechanisms (problem-focused, emotion-focused, avoidance, social support, and organizational support), and techno-productivity (teacher resilience, instructional quality, professional efficacy, digital task efficiency, and innovation). Items were based on established frameworks such as the Digital Competence Framework for Educators, Technology Acceptance Model, Conservation of Resources Theory, and Self-Efficacy Theory. Content validity was ensured through expert review, while reliability was tested via pilot administration with a comparable group of teachers. Data gathering was conducted through an online survey distributed via Google Forms, with informed consent embedded at the beginning to ensure voluntary participation and confidentiality. Weekly reminders were sent to encourage responses, and completed surveys were reviewed for accuracy, with incomplete or invalid entries excluded. Data were encoded into statistical software such as SPSS and Excel, anonymized for confidentiality, and validated through random checks of 10% of responses to ensure accuracy. Analysis employed descriptive statistics (frequency, percentage, mean, and standard deviation) to summarize profiles, while Pearson correlation determined relationships among variables. Multiple regression with interaction terms tested the moderating role of coping mechanisms, with all statistical tests conducted at a 0.01 significance level to ensure robust and reliable findings.

2. Results and Discussion

Table 1

Summary Table on Teachers' Perceived Level of Techno- Savviness

Subscales	Mean	SD	Interpretation
Digital Literacy	3.59	0.42	*Highly Proficient*
Technology Self- Efficacy	3.44	0.44	*Proficient*
Frequency of Technology Use	3.49	0.41	*Proficient*
Breadth of Tools Used	3.41	0.49	*Proficient*
Training and Professional Development	3.42	0.51	*Proficient*
Overall	**3.47**	**0.45**	***Proficient***

Legend: 3.50-4.00 Highly Proficient, 2.50-3.49 Proficient, 1.50-2.49 Moderately Proficient, 1.00-1.49 Not at all Proficient

Table 1 presents evidence from school administrators within the Sariaya West District that show administrators believe they are proficient in techno-savviness with a mean score of 3.47 (sd=0.45). All divisions in this study have consistently scored above average; however, the digital literacy sub-dimension stands out with the highest mean of 3.59 and is considered highly proficient. Digital literacy is often viewed as a very strong skill of the participant teachers and that the skills obtained provide administrators confidence to help teachers with learning how to properly utilize many types of digital tools to create an interactive and engaging learning experiences for their students' progress. This is in line with Garzon and Garzon's 2023 finding concerning digital literacy being a necessary competency for educators working within a blended environment. For instance, when teachers have adequate digital literacy skills, they are able to utilize multiple media platforms as teaching and learning resources, use digital assessments (e.g., Google Classroom) for evaluation of student learning, and assist students in learning to use digital citizenship practices. Furthermore, all of the remaining four sub-dimensions (i.e., technology self-efficacy, use of technology, number of tools utilized, and amount of training and professional development experienced) had overall mean scores within proficient ranges (Technology Self-Efficacy = 3.44; Frequency of Use = 3.49; Number of Tools Utilized = 3.41; and Amount of

Training and Professional Development = 3.42). This leads to the conclusion that while teachers are using technology at a proficient level, the administration needs to diversify available tools that will provide teachers the required continuous professional development necessary for increasing their skill level. This is further evidenced by Dasal (2025), who points out that teachers will not only need to use technology frequently according to the standards set forth for ICT integration, but will also need to use a variety of tools to meet the changing pedagogical needs over time. An example of this would be a teacher who regularly uses standard technology such as Google Docs or a PowerPoint presentation in their lessons; however, that same teacher has yet to utilize new generation technology such as augmented reality or adaptive learning systems.

The need for ample training is confirmed by Springer (2019), who found that professional development creates an increase in the teacher's ability to implement ICT within the classroom. Additionally, while it may be common for teachers to attend a limited number of training sessions, it will take continuous exposure to new tools through direct mentoring and hands-on use of the tools to develop and increase proficiency with the tools in developing professional competencies. For example, a teacher may use Google Classroom and utilize collaborative writing in their lesson plans through the use of Google Classroom; however, that same teacher may have doubts regarding the use of other types of advanced technology for developing and delivering science lessons utilizing advanced data visualization technology. Another example would be a teacher using ICT to deliver lesson content to students; however, that same teacher has never experienced a classroom within which student-centered pedagogy was created by utilizing innovative technological tools.

Overall, the results of this study illustrate that while the teachers have developed a foundation of technological skill, particularly in digital literacy competencies, their ability to develop a foundation of proficiency with technology in the classroom can be further enhanced through ongoing professional training provided to them through the support of the administration. Therefore, by adhering to Garzon and Garzon's (2023) support of digital literacy as a critical educator competency, Dasal (2025) regarding the need for a variety of instructional tools, and the necessity for continued professional development according to Springer (2019), techno-savviness is not a static competency but a dynamic competency that will require a sustained commitment to developing that level of competency. As a result, through this concerted effort, the district can move their teachers from proficient to highly proficient and ultimately improve the quality of instruction, productivity, and resilience of teachers in a digital environment.

Table 2

Summary Table on Teachers' Perceived Level of Techno- Stress

Subscales	Mean	SD	Interpretation
Techno- Invasion	3.43	0.44	*High*
Techno- Overload	3.25	0.53	*High*
Techno- Complexity	3.01	0.72	*High*
Techno- Insecurity	2.69	0.80	*Very Low*
Techno- Uncertainty	3.22	0.56	*High*
Overall	**3.12**	**0.61**	***High***

Legend: 3.50-4.00 Very High, 2.50-3.49 High, 1.50-2.49 Very Low, 1.00-1.49 Low

The findings shown in Table 2 indicate that teachers report a high level of techno-stress with an aggregate mean of 3.12. The factor with the highest mean score is techno-invasion (mean = 3.43), which indicates that teachers frequently feel that their personal boundaries are violated by the demands created by technology (i.e., constant connectivity and being expected to be available). This supports conclusions from Yadav and Rahaman (2025) who found that techno-invasion negatively affects work-life balance as it increases the demands of work on a teacher's non-work time. As an example, teachers may be expected to respond to student inquiries or to respond to administrative emails late at night, thus blurring the boundaries between work and personal life. Abun (2025) similarly stated that balancing work and

personal life in the current digital education environment continues to be a challenge especially in rural schools where there is little support from their institutions.

Other factors scored close to the mean of techno-invasion; techno-overload (mean = 3.25) and techno-uncertainty (mean = 3.22) both indicate that teachers are being inundated with digital work and that the tools they use are being updated frequently. The negative relationship of techno-stress to teaching performance was confirmed by Depante & Astillero (2025), particularly when teachers utilize multiple platforms and find themselves with numerous ICT expectations. For instance, teachers are required to use multiple applications (i.e., Google Classroom, Zoom, DepEd) to prepare for a lesson while also working on administrative reports; this leads to cognitive overload for the teacher.The stress associated with techno-uncertainty is compounded by constant updates and new technology platforms that require constant re-adaptation by teachers, leaving teachers uncertain which tech tools will continue to remain useful. The mean value for techno-complexity, which was rated as 3.01, signified that there are many issues related to the difficulty of mastering numerous digital platforms. ERIC (2023) reports that techno-complexity plays a significant role in impacting how teachers view the integration of ICT tools into the educational process. Since many educators do find it challenging to learn a new technology due to the steep learning curve; for example, a teacher may have mastered PowerPoint but struggle to incorporate interactive simulations or advanced data visualizations into their teaching; these complexities limit their risk-taking when trying new instructional techniques and impede on opportunities for teacher innovation.

Despite having a low mean score for techno-insecurity (2.69), the research findings suggest that teachers do not fear replacement by technology, which indicates that teachers appreciate there is an irreplaceable human element to pedagogical practice, and specifically related to building relationships, providing empathy, and managing classroom behaviors. While teachers may believe that artificial intelligence and digital software will enhance the way they deliver instruction, they continue to remain positive about the security of their professional identity.

The data indicate that while teachers show resilient against insecurity, they do show vulnerability to stressors surrounding their workload, immediate digital connectivity, and rapid changes in technology. This information shows the importance of an institutional strategic approach to addressing and reducing techno-stress. Policy initiatives that relate to workload management, such as the DepEd Teacher Workload Policy Toolkit (2025), have been shown to be essential to helping teachers maintain wellness. In addition to policy initiatives, structured ICT training, such as those outlined by Springer (2019), provide teachers with continued professional development to enhance their capacity to implement ICT tools effectively. For example, regular workshops and mentoring opportunities to help teachers learn new tools could reduce the complexity and uncertainty associated with the tools. Additionally, policies that define and secure the work/life boundaries of the teachers (e.g., limited contact after working hours) provide supports to reduce the invasion of technology and create healthier professions.

The results in Table 2 demonstrated that techno-stress for teachers is primarily driven by invasion, overload, uncertainty, and complexity, while insecurity is not a notable factor. Research literature has verified that these stressors have a well-documented impact on the well-being and performance of teachers. To address these areas of concern will require a comprehensive plan of action: the implementation of structured ICT training focused on reducing the complexities of the technology; the establishment of workload management policy to ease the overload stressor; and the development of institutional barriers to protect the work/life balance of teachers. If schools invest in these strategies, they will have the opportunity to help sustain the resilience of their teachers to enhance the productivity and satisfaction of teachers working in the ever-changing digital world of education.

Table 3

Summary Table on Teachers' Perceived Level of Techno- Productivity

Subscales	Mean	SD	Interpretation
Teacher Resilience	3.40	0.46	*High*
Instructional Quality	3.48	0.05	*High*
Professional Efficacy	3.47	0.47	*High*
Digital Task Efficacy	3.52	0.48	*Very High*
Innovation in Teaching Practice	3.42	0.48	*High*
Overall	**3.45**	**0.39**	***High***

Legend: 3.50-4.00 Very High, 2.50-3.49 High, 1.50-2.49 Very Low, 1.00-1.49 Low

Data presented in Table 3 shows that, overall, teachers perceive that they possess a composite level of techno-productivity; with an average value of 3.45 and corresponding standard deviation of 0.39, it indicates that most teachers report strong tech-based productivity but vary in how consistently they experience it. Digital task efficacy (M = 3.52) is rated a high level of perceived ability, indicating that teachers feel very capable of accomplishing technology-related tasks efficiently.

This finding is consistent with Bandura's (1997) concept of self-efficacy, which asserts that one's confidence in his or her abilities will enhance performance and persistence under difficult conditions. Instructional quality (M = 3.48), professional efficacy (M = 3.47), innovation in teaching practice (M = 3.42), and teacher resilience (M = 3.40) all scored within the high range, reflecting the ability of teachers to integrate technology into their pedagogical practices successfully, while simultaneously maintaining resilience and flexibility in response to digital demands. According to König, Jäger-Biela, and Glutsch (2020), the resilience and professional efficacy of teachers were found to be key factors in ensuring instructional quality during technology-driven educational transitions (e.g., remote learning). Additionally, the focus on innovation is consistent with Mishra and Koehler's (2006) TPACK framework, which stresses that the effective use of technology will increase the ability of teachers to access technological skills and exhibit pedagogical creativity in order to enhance students' learning outcomes.

Examples of technology-based tasks performed efficiently include creating lesson plans via digital applications (Google Docs, Canva); maintaining student records and grades via DepEd's LIS or Excel spreadsheets; organizing instructional resources in Google Drive or Microsoft OneNote; and using automated features, such as Google Forms, for both assessing students and creating assessment reports. For example, a teacher can create interactive lesson plans in PowerPoint, insert videos, upload files into Google Classroom, and track student submissions in real-time through a streamlined process. A second example of how teachers can use ICT to improve productivity is by using collaboration tools (MS Teams) to work with colleagues to establish lesson pacing guides and automated grading systems to minimize repetitive work. These instances illustrate how ICT utilization increases both productivity and the ability of teachers to devote more time to developing instructional practices and engaging students.

König, Heine, Jäger-Biela, and Rothland (2024) assert that ICT use in lesson planning increases the professional competence of teachers, as demonstrated by the strong level of agreement regarding more rapid lesson planning. Howard, Tondeur, and Ma (2022) clarify that the digital productivity of teachers is optimized when educational institutions offer structured support regarding multiple digital platforms, reinforcing the belief in the necessity of continued professional development. Liu, Luo, Pang, and Kan (2025) clarify that ICT use has increased the efficiency of administrative tasks in education, as evidenced by the high level of productivity for maintaining records and reports. Vinuya and Alquizar (2025) demonstrate that digitized instructional materials have enhanced organization and engaged students, and that teachers have a high level of confidence in creating and managing digital resources. Collectively, the following studies show that although teachers currently utilize ICT to maximize professional effectiveness, continued professional training, mentoring from colleagues, and institutional support are necessary to optimise the innovation, resilience, and collaborative productivity of teachers in technology-enhanced environments.

Table 4
Summary Table on Teachers' Perceived Level of Coping Mechanisms

Subscales	Mean	SD	Interpretation
Problem- Focused Coping	3.49	0.44	*High*
Emotion- Focused Coping	3.48	0.43	*High*
Avoidance Coping	3.23	0.55	*High*
Social Support	3.54	0.45	*Very High*
Organizational Support	3.54	0.45	*Very High*
Overall	**3.45**	**0.46**	***High***

Legend: 3.50-4.00 Very High, 2.50-3.49 High, 1.50-2.49 Very Low, 1.00-1.49 Low

Table 4 indicates that teachers have strong but variable coping abilities; however, their coping strategies are generally strong with a composite mean of 3.45 and a standard deviation of .046. Social and organizational support has a mean of 3.54 for both measures, indicating that collaborative groups of individuals (social support) and community-based entities (organizational support) provide teacher with tools to conquer stress.

Several studies reinforce the importance of collaborative support; for example, Amoroso (2022) found that although teachers in South Cotabato are moderately resilient, they employ a number of coping strategies, indicating that resilience is essential in maintaining high quality instruction despite facing stressful situations. Moreover, Paril (2023) stressed that support programs designed to help teachers manage their stress need to be customized around their individual coping mechanisms and that schools need to sufficiently provide differentiated coping mechanisms to help them in times of crisis (e.g., during the COVID-19 pandemic). In addition, Reintjes et al. (2025) found that resilience and coping mechanisms are vital to sustaining teacher effectiveness in difficult school systems during transformational change.

The results showed that there is also a tendency for teachers to employ both problem-focused coping (mean = 3.49) and emotional-focused coping (mean = 3.48) strategies as they indicate a high level of awareness of how to manage and overcome daily challenges. For example, a teacher may work collaboratively with other teachers to revise lesson plans to minimize direct workload issues or work on mindfulness to help manage his or her own emotional regulation during an incredibly stressful transition to teaching using technology. Additionally, peer mentoring opportunities are available from long-time teachers, to assist new teachers in developing their ability to cope with technology challenges, and building collective competence while decreasing individual stress.

Additionally, emotional coping strategies such as journaling or engaging in reflective practice help teachers to address any frustrations in a constructive manner, using the frustrations as a stepping stone for professional growth. Furthermore, schools provide structured wellness systems (such as counseling services or stress management workshops) which afford teachers structured access to mechanisms for emotional regulation and to build their individual resilience. In conclusion, teachers demonstrate that they employ adaptive flexibility by being able to change coping mechanisms according to their circumstances.

Finally, while avoidance coping is not always successful in managing teacher stress, the mean score of 3.23 suggests that it is relatively common for teachers to attempt to unplug themselves from overwhelming workloads; however, without proactive coping mechanisms to accompany "taking a break," avoidance coping may create additional stress.

In summary, this combined response supports the conclusion that teachers draw upon both personal and external support mechanisms in order to perform their professional role. Specifically, personal coping strategies (e.g., problem-solving, emotional regulation, peer mentoring, reflective practices, and avoidance coping) in conjunction with external support (e.g., social and organizational networks) can enable teachers to successfully navigate transitioning to digital learning environments. As

teachers' overall scores vary moderately, school systems should provide differentiated support programs (e.g., training on resilience development, support for managing workload, structured wellness, and opportunities for peer collaboration) to provide teachers with the necessary tools to maintain confidence and motivation, and ultimately, maintain a high level of resilience while navigating the challenges associated with digital transformation.

Table 5

Test of Significant Relationship between Techno-Savviness and Techno-Productivity

Techno-Savviness	Techno-Productivity				
	Teacher Resilience	Instructional Quality	Professional Efficacy	Digital Task Efficacy	Innovation in Teaching Practice
Digital Literacy	.611**	.507**	.606**	.616**	.629**
Technology Self-Efficacy	.683**	.598**	.670**	.685**	.763**
Frequency of Technology Use	.617**	.656**	.700**	.691**	.732**
Breadth of Tools Used	.546**	.505**	.552**	.571**	.673**
Training and Professional Development	.606**	.533**	.570**	.598**	.604**

***Correlation is significant at -0.01 level*

Significant Correlation Exists Between Techno-Savviness and Techno-Productivity

The data in Table 5 reveal a correlation between techno-savviness and techno-productivity amongst teachers due to the established statistical relationship at an ,01 level of significance. Among the variables, technological self-efficacy and innovation in teaching Practices yielded the highest correlation at r = .763, followed by Frequency of Technology Usage and Professional Efficacy with a correlation of r = .700. These results suggest that teachers who demonstrate confidence in their technology proficiency utilization of digital tools regularly with various platforms are more productive, provide higher levels of quality instruction and exhibit increased levels of innovation within their Teaching Practices compared to other teachers. The sustained strength of correlation across category types indicates that techno-savviness is a holistic concept consisting of more than just technical abilities, but rather represents a key indicator of teacher productivity within digital learning environments. Therefore, these findings highlight the necessity for educational institutions to provide systematic, on-going professional development opportunities that assist in increasing teachers' digital self-efficacy in as much as digital self-efficacy is closely tied with innovation. Furthermore, these results indicate that researchers should encourage frequent and consistent use of technology as part of educators' daily activity as frequent exposure to technology positively influences professional efficacy and quality of instruction. Moreover, the correlation between techno-savviness and resiliency indicates how technological competence may act as a buffer against educator-related stressors and assist in educators' adaptability to rapid technological change. Additionally, the finding which points to the connection between a variety of tools and creativity demonstrates that if educators are encouraged to use a variety of different platforms within their daily instruction, they will be more adventurous when designing engaging learning experiences. Finally, the correlations noted in this research demonstrate that educational institutions must provide adequate support through technology access and training so that teachers may continue to experience ongoing, increasing productivity and innovation levels within their respective classrooms.

Additionally, Gudmundsdottir and Hatlevik (2018) indicated that teachers' digital competencies

are critical in adapting instructional delivery and managing issues/challenges faced in the classroom. Instefjord and Munthe (2017) stated that professional development geared toward digital pedagogy will significantly lead to increased use of technology within education. Howard and Mozejko (2019) indicated that teachers who engage in regular-use of digital hardware will enhance both their instructional quality and their level of professional efficacy which support the correlations established in Table 26. Scherer et al. (2019) documented that technology self-efficacy is a key predictor of teachers' willingness to adopt innovative practices; thus, illustrating the importance of building self-efficacy. Finally, Siddiq and Scherer (2022) revealed that the breadth of technology use has direct implications for sustaining teacher productivity and professional resiliency within digital learning environments.

In conclusion, all research conducted supports the need for educational institutions to strategically invest in professional development, infrastructure, and initiatives for building teachers' digital self-efficacy. It is critically important for increasing teachers' productivity in the 21st-century educational environment.

Table 6

Test of Significant Relationship between Techno-Stress and Techno-Productivity

Techno-Stress	**Techno-Productivity**				
	Teacher Resilience	Instructional Quality	Professional Efficacy	Digital Task Efficacy	Innovation in Teaching Practice
Techno-Invasion	.583**	.486**	.522**	.527**	.473**
Techno-Overload	.315**	.207**	.242**	.243**	.307**
Techno-Complexity	-0.071	-0.005	-0.010	-0.000	-0.085
Techno-Insecurity	-0.050	-0.026	-0.044	--0.004	-.077
Techno-Uncertainty	.440**	.385**	.390**	.370**	.434**

***Correlation is significant at the -0.01 level*

Significant Correlation Exists Between Techno-Stress and Techno-Productivity Except for Techno-Complexity and Techno-Insecurity

The findings in Table 6 shows that there is a significant correlation between techno-stress and productivity on all three dimensions of techno-stress at the .01 level. The two greatest positive correlations were produced by techno-invasion (r = .473 to .583) and techno-uncertainty (r = .370 to .440) in relation to all four measures of productivity: teacher resilience, instructional quality, professional efficacy, and digital task efficacy, as well as innovation in teaching practices. Therefore, while both of these types of techno-stressors create various levels of stress for teachers, the experience of both being continually connected and having ongoing uncertainty about how the technology will be employed may allow teachers to be more adaptable in their ability to adjust to changing situations, as they will require less time to learn how to integrate technology into their practice. Additionally, although the techno-overload construct has moderate but still significant correlations with each of the four dimensions of teacher productivity, there is also evidence that too high a level of workload due to digital tasks can negatively affect teachers' productivity; however, it can also be used to help facilitate time management among teachers.

In contrast, there is almost no correlation between techno-complexity and techno-insecurity; therefore, teachers' lack of understanding of technology or fear of being unemployed does not have a

large effect on the productivity of many teachers, as the vast majority of teachers have developed coping strategies to deal with techno-complexity and/or have resources through their school systems that provide institutional support to reduce the impact of these two techno-stressors.The reason that these stresses from technology stay present with productivity while also providing strain to teachers is that, if managed in the appropriate way, stress can be motivating. Teachers want to respond to this invasion of technology in a more resilient way by setting boundaries and learning to multitask well.

Similarly, when teachers are uncertain about technology, they will try to remain current with regard to technology and change their teaching practices; therefore, they become more innovative. An example of this would be a teacher who has too many digital tasks to do. This teacher must prioritize tasks, streamline the workflow, and collaborate with other teachers who are also required to help share the workload. For example, a teacher who is using multiple online platforms may use a schedule to manage the amount of time he/she will spend on each of the platforms, as well as collaborate with colleagues and share resources with other teachers, thereby creating a more effective use of everyone's time.

Similarly, when teachers experience uncertainty with technology, they explore and utilize alternative tools when working in unpredictable technology environments; this may lead to increased creativity and adaptability within the teaching environment. The research literature confirms these conclusions as articulated by Bervell & Arkorful (2020) that stress on educators' part can lead to new, more effective ways of delivering digital education by using ICT, and Salanova et al. (2019) indicated that teachers who perceive they are supported by their institutions demonstrate resiliency and maintain engagement necessary to provide instruction when experiencing stress related to using ICT.

According to Li & Wang (2021) techno-uncertainty will motivate teachers to continue expanding their learning and innovation by adapting to unforeseen technology environments. Kundu & Bej (2021) indicated that when teachers were teaching online, teachers created a cooperative coping mechanism that allowed teachers to increase productivity, even while experiencing stress. Finally, although techno-stress is often viewed as a detriment to job satisfaction, Alhija (2017) noted; however, teachers still find ways to increase their willingness and ability to provide digital education through the use of problem-focused coping strategies.

In summary, the findings from the research are a reflection of the conclusion that techno-stress not only is detrimental to support resilience, collaboration, and institutional support, but also provides excellent opportunities to enhance productivity, innovation, and professional development in a digital teaching and learning environment! Additionally, it demonstrates how technology-based teaching and learning has resulted in new ideas, approaches, and designs in the digital environment; this may include the additional challenges associated with providing students digital learning resources. Social networking or social media can provide a unique method for educators to tap into their creativity while developing an innovative, collaborative environment through technology. Also, while not doing so produces good reasons, as teachers contain personal values that they will seek and expect to uphold when implementing technology, but do not. Therefore, through productively utilizing technology in the classroom, teachers can increase student learning by better utilizing available resources.

Table 7

Test of Relationship between Techno-Savviness and Techno-Stress

Techno-Savviness	**Techno-Stress**				
	Techno-Invasion	Techno-Overload	Techno-Complexity	Techno-Insecurity	Techno-Uncertainty
Digital Literacy	.557**	.241**	-0.047	-0.056	.287**
Technology Self-Efficacy	.548**	.305**	-0.021	-0.011	.350**
Frequency of Technology Use	.557**	.300**	-0.041	-0.026	.391**

Breadth of Tools Used	.432**	.263**	-0.045	-0.026	.344**
Training and Professional Development	.461**	.214**	-0.017	-0.017	.322**

***Correlation is significant at the -0.01 level*

Significant Correlation Exists Between Techno-Savviness and Techno-Stress, Except Techno-Complexity and Techno-Insecurity

The correlation between techno-savviness and techno-stress is significant as 96% of the total number of measured correlations reached statistical significance ($p < -.01$). Specifically, teachers who possess high digital literacy, a high degree of self-efficacy in technology use, and use technology frequently through multiple tools, all receive a large amount of training generally experience high levels of techno-invasion, techno-overload and techno-uncertainty. For instance, there is a strong correlation between how frequently technology is used and techno-invasion ($r = .557$) and how frequently technology is used and techno-uncertainty ($r = .391$), both of which suggest that the continued use of technology has an increased number of associated stressors (e.g., demand to connect and unpredictability). However, there were no statistically significant correlations found between techno-complexity or techno-insecurity which suggests that teachers' perceived competence and confidence help to mitigate feelings of incompetence or being replaced when experiencing significant demands placed on them digitally.

The implications of the results are quite substantial. First, these results provide some insight into the paradox of digital competence - that while a teacher who is techno-savvy will have more ability to succeed as a teacher, they are also at an increased risk for experiencing increased levels of stress because technology is so pervasive and the environments are so unpredictable.

In addition to that, statistically significant correlations provide support to the notion that stress enhances performance because the motivation to adapt, innovate and provide support for resiliency is ultimately stimulated by stress.For example, teachers that use technology often experience interruptions caused by constant notifications from applications and this constant disruption develops their ability to multitask and become digitally competent. In addition, schools can assist their employees and provide support with strategies which include clearly defined boundaries, providing wellness programs and workload management, thereby assisting in developing strategies to prevent teachers from developing burn-out as a result of being techno-savvy.

Furthermore, the fact that there were no statistically significant correlations that could be identified as being related to techno-complexity and techno-insecurity demonstrates that technology training and initiatives to develop confidence are effectively able to act as buffering strategies against the fear of their incompetent use of technology or being replaced, despite the presence of high digital demands. Finally, the aforementioned results support the need for balanced coping strategies that include having the technical ability to cope; being able to manage one's feelings and receive institutional support from one's organization are all critical components for the maintenance of teacher well-being while working within the confines of a digitally-rich environment.

Recent research also supports the above discussion. Bervell and Arkorful (2020) have shown that digital competence increases effectiveness among teachers, however it also imposes the potential for increased stressors from over-load and intrusion. Salanova et al. (2019) found that ICT stress creates resiliency and increased employee engagement when provided with job embedded Support. Li and Wang (2021) have shown that techno-uncertainty positively relates to continuous learning and adaptability; which support the statistically significant correlations that have been shown to exist. Kundu and Bej (2021) demonstrated that heightened stress experienced by teachers due to continual technology use while teaching in an online environment led to the implementation of collaboration strategies that enabled them to manage their colleague's stress. Finally, Alhija (2017) found that techno-stress may decrease teachers' satisfaction with their profession; however, it also serves to motivate teachers to

improve their professional effectiveness through the development of problem-based coping strategies.

To sum-up, the existing research indicates that techno-savvy gives teachers the capacity to achieve; however, there are new sources of stress as a result of the use of technology in education. Therefore, it is vitally important that schools implement balanced coping strategies, provide institutional support, and help build teachers' resiliency to convert digital competence into sustainable productivity rather than burn-out. Additional information provided within the era of technology will enhance the teacher's ability to adapt to educational change in a manner that promotes new skills and allows for the sharing of innovative ideas with students and colleagues. Communication between teachers and school administrators through technology must be seamless in order to support the growth of teacher collaborations. Developing resources that promote continual professional development will assist in reducing the barriers to implementing group work and collaboration. By having the capacity to provide continual one-to-one development within technology will strengthen the relationship between teachers and administrators. The positive effect of doing so will assist in building a positive environment that thrives on innovation.

Table 8

Test of Moderation: Coping Mechanisms on the relationship between Techno-savviness and Techno-Productivity

	Estimate	SE	Z	p
Techno-Savviness	0.5798	0.0406	14.275	< .001
Coping Mechanism	0.4117	0.0392	10.511	< .001
Techno-Savviness* Coping Mechanism	-0.0207	0.1265	-0.163	0.870

Coping Mechanism does not moderate the relationship.

According to Table 8, Techno-savvy and Coping mechanisms affect teacher productivity directly at the same time as there is no interaction present, this means that Coping Mechanisms don't alter or assist in any way Techno-savvy's productivity levels. Coping Mechanisms do not enhance or support Techno-savvy's productivity ability; however there are Two Independent Means of impact on Teachers' productivity; therefore, having a high Techno-savvy educational facilitator will not affect a teacher's potential productivity. To support their educators Schools must have separate support systems for both Digital Competence and Coping both Digital Competence training and Coping Wellness Programmes will not hinder or create a much more positive effect on the other area.

The data continues to support this conclusion in numerous other studies. Gallego Joya et al., (2025) have found that a large majority of Digital Competence Training Programmes implemented by facilitators/teachers produced higher teacher productivity apart from any Coping Mechanisms present. Revuelta-Domínguez et al., (2022) have established Digital Competence is an Independent Predictor of Innovative Instructional Quality further substantiating that Techno-savvy has a significant Independent Main Effect. González-Pérez et al., (2021) indicate that the use of Coping strategies through Peer Collaboration and Emotion Regulation, greatly enhances Teacher Wellbeing/coping Mechanisms and does not impact any increase in Techno-savvy productivity.

The data in all of these studies indicate that Digital Competence and Coping provide independent contributions to Teacher productivity/reliability and therefore should create a cohesive and interdependent development system for Teacher Digital Competence Training and Coping/Willingness.

In conclusion, the Teaching profession has greatly changed over the last 10 years due to a multitude of technology introduced in our schools, however the majority of teachers still do not have

enough confidence in the ability to successfully implement technology proficiently. Also, teachers are not adequately supported with the tools/resources necessary to teach effectively using technology proficiently; this leaves the educators feeling unsupported and therefore creates unproductive teachers ultimately leading to the inability of the teacher and is detrimental to the educational system.

Table 9

Test of Moderation: Coping Mechanisms on the relationship between Techno-Stress and Techno-Productivity

	Estimate	SE	Z	p
Techno-Stress	-0.0935	0.0468	-2.00	0.046
Coping Mechanism	0.8774	0.0475	18.46	< .001
Techno-Stress* Coping Mechanism	0.1820	0.1171	1.55	0.120

Coping Mechanism does not moderate the relationship.

This table shows how different types of coping strategies affect teachers' ability to cope with technostress and how these strategies impact how well teachers perform at their jobs when they are under stress. Evidence from this study indicates that technostress has a very small (but statistically significant) negative impact on productivity for elementary school teachers (-0.0935, $p = 0.046$). This means that when a teacher feels increased levels of technostress, that teacher will have less ability to successfully perform their job functions in a digital environment than if they had no or little technostress. The public elementary school classroom environment is filled with heavy workloads, large class sizes, and administrative demands; when teachers also add digital demands, such as grading online and completing lessons digitally and submitting to the various compliance reports required from them, they are likely to feel fatigued and less effective at their jobs, in addition to the additional stress accommodated from trying to perform tasks using digital resources.

As a teacher experiences technostress, the coping strategies used by that teacher have a significant (and highly significant) positive effect (0.8774, $p < .001$). The teachers who actively engage in these coping strategies, such as collaborating with their peers, time management, regulating their emotions and working to solve problems, tend to produce more effectively than the teachers who do not utilize these coping strategies regardless of the level of stress they experience. A teacher who is overwhelmed with using multiple online platforms may cope by collaborating with another teacher by sharing resources; this same teacher may also try to alleviate some of the pressure of managing many online platforms by creating a schedule for themselves or by structuring their time. A teacher may use mindfulness or reflective journaling to assist in regulating their emotions, allowing them to stay focused and be resilient in a busy and stressful classroom. Coping strategies do not moderate the relationship between stress and productivity, but they are separate, contributing factors to productivity; the use of coping strategies directly helps to maintain productivity even when technostress negatively impacts teacher performance.

Strategies for coping with stress, such as social support and problem solving, were found to improve the well-being of teachers and their performance while working with digital tools (García-González, 2020). In addition, Mheidly, Fares, and Fares (2020) found that technostress has a negative effect on productivity; however, building resilience through certain types of activities can help mitigate this negative effect. Collie (2017) indicated that coping strategies help maintain motivation for teachers and contribute to how well teachers instruct students when faced with stress. Teachers were able to maintain their productivity by collaborating and managing their emotions while feeling elevated levels of

technostress during the COVID-19 pandemic (Sokal, Trudel, & Babb, 2020). Finally, Montgomery and Rupp (2025) found that teachers' coping strategies are independent of one another and to a certain extent contribute to teachers developing resilience and/or performing well; this supports the non-moderating effects of copious strategies on the relationship between student teacher stress and productivity in Table 30.

In summary, techno-stress will have an impact on how efficiently teachers will be able to be productive in their work; however, coping strategies (which are independent from each other) will have an extremely positive impact on teachers' abilities to sustain their effectiveness in the classroom. Therefore, public elementary schools should implement dual support systems to help manage the workload (by eliminating workload stressors) and developing digital resources (to eliminate digital stressors) while strengthening coping strategies through wellness programs, support from peers and building resilience.

Recommendations

The study's findings and conclusions are reflected in the recommendations below.

1. School Leaders and Division Officials. Although teachers demonstrate proficiency in technology, their use of tools is inconsistent and the degree to which they engage in professional development is moderate. Therefore, a strengthening of ICT-based professional development programs aligned with the National ICT Competency Standards should be implemented. Structured support systems such as ICT Coordinators, peer mentoring, and workload management should be put in place to combat moderate techno-stress while building collaborative coping strategies through Communities of Practice to maintain resilience and productivity.
2. Educators: Although teachers have high competency for digital literacy, their level of self-efficacy and breadth of tool use is below that of Education Standards. Therefore, continuous ICT training must be pursued to enhance teacher competency and broaden their use of tools. The results of this study also indicate that the majority of teachers engage in problem-focused and emotional-focused coping methods. Accordingly, it is critical to implement proactive coping strategies, including time management, emotional regulation, and collaborative problem solving to promote ongoing techno-productivity. Adds to this, in building resilience and improving instructional quality, teachers are encouraged to experiment with innovative instructional practices, including gamification and flipped education.
3. Educational Organizations and Policymakers: Due to the moderate level of techno-stress and issues of techno-invasion and overload, organizations should invest in building improvements, such as connectivity improvements and excess resources, within the infrastructure of public schools. There should be institutionalized stress management programs that include both problem-focused and emotional-focused coping strategies. Furthermore, policies that assist with balancing the digital demands placed on teachers with teacher wellness are necessary to address the paradoxical relationship between techno-savviness and techno-stress.
4. Future Researchers: In as much as coping mechanisms did not mediate but instead independently contributed to productivity, additional research is needed to do comparative studies between districts using both public and private schools in order to validate the results of this study across differing contexts. Additional similar studies are needed to look into the long-term effects of coping strategies on resilience and productivity. Finally, new and innovative approaches to reduce techno-stress should be explored, including mindfulness-based interventions or ASMR.

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