Algopsychalia Of Out-Of-Field Teachers: A Systematic Review

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ABSTRACT:

Out-of-field teaching remains a persistent concern in STEM education, often exposing teachers to psychological stress that undermines instructional quality and student learning. This systematic review synthesizes evidence on the psychological stress experienced by out-of-field STEM teachers, the coping strategies they employ, the implications for student outcomes, and the role of mobile and digital technologies in instructional practice. Guided by PRISMA procedures, 12 peer-reviewed studies published between 2015 and 2024 were selected from Scopus, Taylor & Francis, and ScienceDirect databases and analyzed thematically. The findings identify recurring stressors, including low self-efficacy, professional isolation, and insufficient content knowledge, which consistently lead to reliance on passive teaching and avoidance of student-centered strategies. Teachers mitigated these challenges through professional development, peer collaboration, and reflective practice. Digital and mobile technologies demonstrated a dual effect, enhancing instructional confidence and engagement in well-supported contexts while intensifying stress in under-resourced settings. Overall, psychological stress emerges as a critical mechanism shaping instructional decisions, highlighting the need for integrated professional and technological support for out-of-field STEM teachers..

Keywords: out-of-field teaching; STEM education; psychological stress; coping strategies; mobile learning.

INTRODUCTION

The global demand for qualified teachers has intensified due to curriculum expansion, STEM integration, and persistent teacher shortages across many countries, including the US, UK, Australia, and Japan (Mcpherson & Lampert, 2024; Sutcher et al., 2019). A widespread consequence is out-of-field teaching, where educators teach subjects outside their specialization, observed extensively worldwide (Mcpherson et al., 2025). This practice adversely affects instructional quality, teacher confidence, well-being, and student learning outcomes (Johansson & Myrberg, 2019; Yang & Kaiser, 2022). Concurrently, increasing attention focuses on teachers' psychological stress, which compromises classroom effectiveness and retention (Mcpherson et al., 2025). At the national level, staffing practices such as subject mismatches, rural assignments, and shortages exacerbate out-of-field teaching, leading to higher workloads, diminished self-efficacy, and professional isolation for teachers (Mcpherson et al., 2025; Mcpherson & Lampert, 2024). Policy efforts emphasize teacher quality and digital integration, but uneven implementation and limited formal preparation for technology use further challenge out-of-field educators (Liu et al., 2024). These conditions illustrate the structural complexity intensifying out-of-field teaching challenges.

Out-of-field teachers face daily instructional challenges including content mastery issues, hesitation to use student-centered strategies, and stress-driven reliance on passive teaching methods, which can limit classroom engagement and effectiveness (Awad et al., 2019). Psychological stress acts as both an emotional burden and a professional constraint, negatively influencing teachers' decision-making and instructional practices (Emeljanovas et al., 2023). To manage these pressures, teachers employ coping strategies such as engaging in professional development, peer collaboration, and reflective practice, which foster resilience and support continuous improvement (Bjørndal et al., 2021; Conte et al., 2024). Mobile and digital technologies play a dual role; when teachers receive adequate training, such tools enhance instructional support, yet in under-resourced settings, they become additional sources of stress due to lack of preparation and infrastructure (Awad et al., 2019; Qiao & Fu, 2023). Existing research often treats out-of-field teaching, teacher stress, coping mechanisms, and educational technology separately, with limited integrative studies exploring their combined impact on instructional outcomes in STEM contexts. Moreover, few systematic reviews comprehensively synthesize these elements across multiple education levels, diverse geographic areas, and post-pandemic conditions. Therefore, a systematic synthesis is needed to illuminate how psychological stress shapes instructional practices, how teachers cope with out-of-field demands, and how mobile and digital technologies function as both supports and stressors in STEM education.

Research Questions

This study aimed to investigate the experience of out-of-field teaching in science subjects by focusing on four key areas: instructional challenges, coping strategies, student outcomes, and the use of technology. The following research questions guided this inquiry:

1. What are the common challenges experienced in terms of psychological stress by out-of-field STEM teachers in delivering science instruction across different educational levels and contexts?
2. What coping strategies do out-of-field STEM teachers adopt to manage psychological stress and professional demands in science teaching?
3. How does out-of-field teaching in STEM subjects affect student engagement, comprehension, and academic performance?
4. In what ways does the integration of mobile learning and other digital technologies support or hinder out-of-

field STEM teachers in addressing instructional challenges?

METHODOLOGY

This systematic review examined psychological stress and coping strategies among out-of-field STEM teachers using peer-reviewed literature published between 2015 and 2024. The initial search yielded 48 records from three academic databases: Scopus, Taylor & Francis, and ScienceDirect. Search terms targeted four thematic areas: psychological stress and out-of-field STEM teachers, educational outcomes associated with stress in this population, coping strategies reported in the literature, and the integration of technology by out-of-field STEM teachers.

After removing 13 duplicate records, 35 articles remained for the screening. During the screening stage, 12 articles were removed for not meeting the inclusion criteria. These exclusions were based on the absence of a focus on psychological stress, coping mechanisms, or STEM-specific out-of-field teaching. This left 23 articles for the full-text review.

The full-text assessment focused on determining whether each study addressed the relevant themes. Of the 23 articles reviewed, 11 were excluded due to insufficient content related to the integration of technology with out-of-field STEM teaching, even though they met the other three criteria. The remaining 12 articles contained detailed discussions on all four themes and were thematically analyzed based on the research objectives of this study. The inclusion criteria for the final synthesis were the presence of qualitative or quantitative data on psychological stress, clearly identified coping strategies, and relevance to out-of-field teaching in STEM disciplines. All included studies were written in English, peer-reviewed, and conducted in diverse educational contexts. The PRISMA flow diagram in Figure 1 outlines the review process.

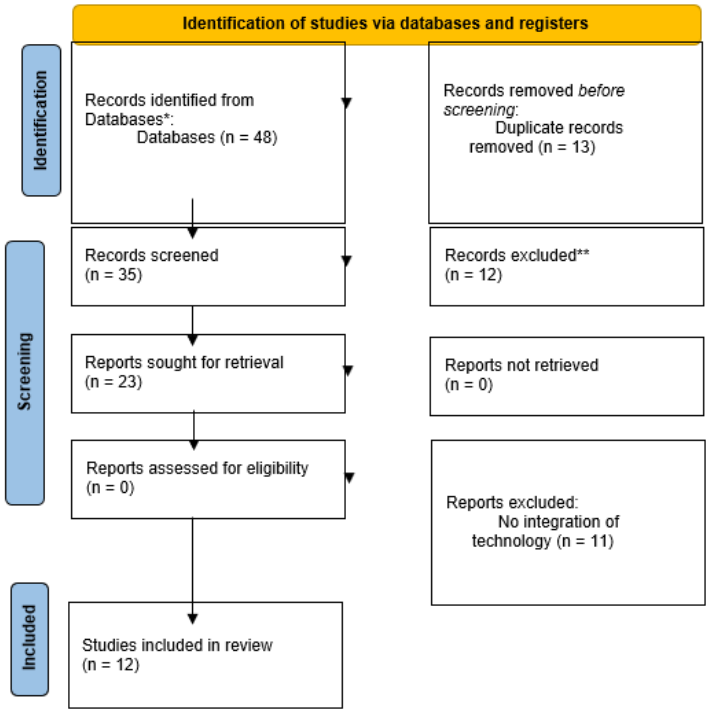

Figure 1. PRISMA Framework of the Study

Results and Discussions

Table 1 presents the key themes related to the psychological stress experienced by out-of-field STEM teachers.

Table 1. Psychological Stressors Faced by Out-of-Field STEM Teachers: Themes, Regions, Educational Levels

Theme	Regions Represented	Educational Levels	Studies / Authors
Low confidence and self-efficacy	Israel, USA, Australia, South Africa, Spain	Primary, Secondary, High School, Pre-service	Donitsa-Schmidt et al. (2021); Ogodo (2019); Du Plessis (2018); Diego-Mantecon et al. (2021); Douglass & Verma (2022)
Professional isolation and lack of support	USA, South Africa	High School	Nehmeh & Kelly (2018); Du Plessis (2018)
Insufficient content knowledge and pedagogical mismatch	Israel, USA, Australia, Spain, South Africa	Primary, Secondary, High School, Pre-service	Donitsa-Schmidt et al. (2021); Ogodo (2019); Du Plessis (2018); Fraser et al. (2019); Diego-Mantecon et al. (2021)

The most frequently reported stressor was low confidence and self-efficacy, which appeared consistently across five countries and at every educational level examined. For example, Donitsa-Schmidt et al. (2021) highlighted that science teachers in Israel without formal training experienced reduced confidence and anxiety in delivering subjects. Similar findings appeared in the U.S. context through Ogodo (2019), where out-of-field physics teachers lacked confidence before undergoing content-focused professional development. In Spain, Diego-Mantecon et al. (2021) observed how mathematics became a source of stress for project-based STEM teachers without formal subject preparation.

The second theme, professional isolation and lack of support, was evident in high school environments, especially in urban or under-resourced settings. Nehmeh and Kelly (2018) reported that U.S. physics teachers working in isolation and with limited administrative support developed stress-related symptoms that affected their teaching performance. Du Plessis (2018) further documented emotional exhaustion and anxiety among teachers in South Africa and Australia, which was intensified by being disconnected from support structures.

The third theme, insufficient content knowledge and pedagogical mismatch, was present in nearly every study that spanned the primary to high school spectrum. Fraser et al. (2019) detailed how teachers in rural Australia lacked subject expertise and struggled to adapt instruction effectively. These challenges were not only technical but also influenced how teachers made decisions in the classroom, often lowering the level of task complexity to cope with their insecurities.

These stressors highlight significant obstacles that impact teachers' identities and instructional quality. Teachers without subject area training must navigate multiple demands without the preparation that in-field peers receive. The pattern of stress related to confidence and content knowledge is not isolated to one type of school or region but appears across contexts. This consistency suggests that the problem is embedded in systemic staffing practices and professional preparation policies. When teachers are placed out of field, especially without sustained support or upskilling opportunities, the outcome often includes emotional stress and a reduction in instructional quality.

The issue of isolation, particularly in urban and under-resourced areas, reflects an additional layer of psychological stress that is less about content and more about the environment. Teachers who lack mentorship or peer networks are more likely to report disengagement and burnout than those

who do. This situation may be compounded when teachers are out of field and do not feel part of the subject-specific community in their schools.

Overall, the data in Table 1 reveal how out-of-field teaching results in psychological stress that undermines both teacher performance and student learning. Three distinct yet interconnected stressors emerged: lack of confidence, isolation, and inadequate content knowledge. These challenges are not confined to a single region or school level in the country. They appear consistently across diverse contexts, suggesting that out-of-field teaching must be addressed not only through individual teacher effort but also through systemic changes in teacher assignment, training, and ongoing professional support.

The influence of psychological stressors on educational outcomes among out-of-field STEM teachers is summarized in Table 2.

Table 2. Influence of Psychological Stressors on Educational Outcomes

Theme	Types of Psychological Stressors	Studies / Authors
Decline in instructional quality and student engagement	Low confidence, anxiety, lack of content knowledge, emotional exhaustion	Du Plessis (2018); Ogodo (2019); Nehmeh & Kelly (2018); Fraser et al. (2019)
Impact on teacher decision-making and classroom effectiveness	Perceived inadequacy in subject matter, misalignment between beliefs and teaching practices	Donitsa-Schmidt et al. (2021); Fraser et al. (2019); Vale et al. (2020); Diego-Mantecon et al. (2021)
Hesitation in implementing innovative or student-centered methods	Re-novicing in tech, lack of computing readiness, discomfort with unfamiliar pedagogies	Lane et al. (2023); Douglass & Verma (2022); Ogodo (2019); Diego-Mantecon et al. (2021)

The first theme, *decline in instructional quality and student engagement*, emerged consistently across studies that described how emotional strain, limited knowledge, and low self-efficacy reduced teachers' capacity to deliver meaningful STEM lessons. Du Plessis (2018) found that out-of-field teachers in South Africa and Australia often delivered simplified or inaccurate content due to emotional exhaustion and lack of qualifications. Similarly, Ogodo (2019) reported that many U.S. physics teachers defaulted to lecture-based teaching because they felt unprepared before receiving professional development. Nehmeh and Kelly (2018) added that isolation and lack of institutional support led teachers to withdraw and avoid experimental or engaging teaching methods. This pattern directly affects student interest and reduces active learning in science classrooms.

The second theme, *impact on teacher decision-making and classroom effectiveness*, is rooted in the perceived mismatch between teachers' personal beliefs about learning and their limited subject matter knowledge. Donitsa-Schmidt et al. (2021) noted that although teachers were committed to improving their practice, they hesitated when making instructional decisions in science due to their own doubts. Fraser et al. (2019) and Vale et al. (2020) explained that teachers lacked the content depth to confidently adapt tasks or facilitate higher-order thinking. Diego-Mantecon et al. (2021) observed that this uncertainty led teachers to deliver low-cognitive demand tasks, avoiding student-centered approaches altogether.

The third theme, *hesitation in implementing innovative or student-centered methods*, is especially visible when digital tools or interdisciplinary methods are involved. Lane et al. (2023) described teachers in a computational thinking program who felt like

novices despite being experienced educators. Their stress stemmed from working with coding platforms such as Python and Jupyter Notebooks, which were unfamiliar and perceived as difficult to integrate. Douglass and Verma (2022) found that pre-service teachers working in informal makerspaces experienced fear and uncertainty about their ability to teach science using unfamiliar tools. Diego-Mantecon et al. (2021) also noted that while teachers attempted to use platforms like GeoGebra, they required additional support to integrate them effectively.

The presence of psychological stress appears to influence not only how teachers feel, but also how they act in the classroom. Teachers who experience low confidence or feel disconnected from the subject content are more likely to default to passive teaching methods. This limits the learning experience for students, especially in subjects in which active participation and practical application are essential. Stress does not occur in isolation; it feeds into pedagogical decisions and classroom behaviors. This creates a feedback loop in which weak instruction leads to poor student engagement, further undermining teacher confidence.

Hesitation to implement newer, more effective instructional strategies, especially those involving technology, also emerges as a common outcome. While digital tools have the potential to enhance learning, they can become barriers when teachers are not properly trained or supported. These findings suggest that stress is not only an emotional issue but also a professional one, shaping decisions that directly impact student outcomes.

The evidence in Table 2 indicates that psychological stress significantly disrupts classroom dynamics. Whether through reduced quality of instruction, ineffective decision-making, or reluctance to try innovative strategies, stress among out-of-field STEM teachers has measurable consequences for student learning. These outcomes are not confined to any specific context or region. Instead, they reflect a recurring pattern across international studies: teachers who feel underprepared often retreat from active teaching practices, which reduces both instructional effectiveness and student achievement in STEM education.

Table 3 presents the coping strategies used by out-of-field STEM teachers to manage the psychological stress associated with teaching outside their area of expertise.

Table 3. Coping Strategies for Managing Psychological Stress Among Out-of-Field STEM Teachers

Theme	Types of Coping Strategies	Studies / Authors
Professional development and structured learning	Participation in targeted PD programs, use of workshops, skills-based training	Donitsa-Schmidt et al. (2021); Ogodo (2019); Cosby et al. (2024); Du Plessis (2018)
Peer collaboration and community support	Informal peer networks, mentoring, team planning, collaboration with in-field colleagues	Fraser et al. (2019); Vale et al. (2020); Nehmeh & Kelly (2018); Lane et al. (2023)
Reflective and adaptive practices	Self-study, reflective journaling, adapting instructional strategies, revisiting past struggles	Douglass & Verma (2022); Du Plessis (2018); Fraser et al. (2019); Lane et al. (2023)

The first theme, professional development and structured learning, appeared in studies where targeted training was used to equip out-of-field teachers with the necessary content knowledge

and teaching strategies. Donitsa-Schmidt et al. (2021) found that a two-year program improved teacher confidence and content mastery in Israeli science classrooms. Similarly, Ogodo (2019) described how U.S. teachers benefited from physics-specific professional development, which helped them transition from passive to interactive teaching. Cosby et al. (2024) added that workshops like the GPS Cows module helped Australian teachers with little agricultural background gain confidence. These findings show that focused and content-rich training offers a practical response to stress.

The second theme, peer collaboration and community support, reflects how teachers draw strength from their colleagues and communities to cope with stress. Fraser et al. (2019) emphasized mentoring and collaborative reflection as effective tools for out-of-field teachers in rural Australia. Vale et al. (2020) and Nehmeh and Kelly (2018) highlighted that collaboration—whether formal or informal—helped teachers feel less isolated and more confident. Lane et al. (2023) reported that physics teachers struggling with computational integration improved when supported through a network of peers and facilitators. These findings suggest that human connections play a major role in reducing stress.

The third theme, reflective and adaptive practices, points to the internal strategies teachers use to manage emotional and instructional pressures. Du Plessis (2018) described how self-study and extra preparation helped teachers rebuild their knowledge base. Douglass and Verma (2022) found that pre-service teachers wrote reflective journals that helped them process their insecurities and build self-awareness. Lane et al. (2023) showed that teachers revisited prior learning failures as a way to move forward. These coping methods suggest that reflection helps teachers to regulate their emotions and recover from setbacks.

The use of professional learning, peer networks, and personal reflection forms a pattern of coping that spans geographic and educational contexts. These strategies vary in form but share a common outcome: they reduce teacher stress and help educators navigate out-of-field responsibilities with greater clarity and resilience. Teachers turn to both institutional programs and personal efforts to manage the disconnect between their training and their assignments to address this issue. Peer support and reflection serve not only as emotional relief but also as catalysts for instructional improvements.

One key insight is that none of these strategies act independently. Many teachers combine professional development with collaboration and reflection. For example, a teacher attending a workshop also leaned on colleagues to apply what they learned and used personal reflections to evaluate their progress. This combination enhances teacher confidence and counters the emotional exhaustion associated with out-of-field teaching.

The evidence in Table 3 shows that out-of-field STEM teachers rely on multiple strategies to manage stress and improve teaching outcomes. These include external resources such as professional development and interpersonal support through peer collaboration, and internal coping tools such as reflection and adaptation. Together, these strategies help teachers maintain instructional effectiveness despite initial training deficiencies. The ability to access professional learning, build supportive networks, and critically reflect on practice is essential for teachers working under out-of-field conditions. These practices form the foundation for coping in contexts where formal subject expertise is lacking.

Table 4 examines how mobile learning and digital technologies support or hinder out-of-field STEM teachers' instructional practices.

Table 4. Integration of Mobile Learning and Digital Technologies in Supporting or Hindering Out-of-Field STEM Teachers

Theme	Types of Mobile Learning/Digital Integration	Studies / Authors
Enhancing instructional confidence and engagement	Use of simulations, collaborative platforms, digital inquiry tools, Jupyter Notebooks, Python, 3D modeling	Ogodo (2019); Lane et al. (2023); Douglass & Verma (2022)
Contextual barriers and technological limitations	Limited access in rural/isolated schools, low confidence in using digital tools, need for offline alternatives	Du Plessis (2018); Fraser et al. (2019); Nehmeh & Kelly (2018)
Expanding STEM relevance and student interest	Use of GIS, geospatial tech, GPS tracking in agriculture, GeoGebra for math visualization	Prahalad et al. (2024); Cosby et al. (2024); Diego-Mantecon et al. (2021)

The first theme, enhancing instructional confidence and engagement, shows how digital tools help out-of-field STEM teachers improve lesson quality and classroom-participation. Ogodo (2019) described how U.S. physics teachers began using simulations and collaborative software after attending focused training. Lane et al. (2023) noted that digital platforms like Jupyter Notebooks allowed teachers to explore computational thinking, although some felt inexperienced at first. Douglass and Verma (2022) observed that pre-service teachers in informal STEM settings gained confidence through hands-on interaction with 3D modeling software. These technologies increase teacher engagement and support more interactive, inquiry-based teaching, especially when accompanied by adequate preparation.

The second theme, contextual barriers and technological limitations, focuses on how digital tools sometimes fall short because of external conditions or teacher capacity. Du Plessis (2018) documented that in South Africa and Australia, teachers lacked consistent access to technology, which limited their ability to use digital resources. Fraser et al. (2019) added that rural teachers struggled with using offline-compatible tools, and felt unprepared to integrate technology without reliable support. Nehmeh and Kelly (2018) found that teachers in isolated U.S. schools attempted to build online support communities but still reported low technology integration in classrooms. These cases show that technological solutions are not equally available or effective in different school contexts.

The third theme, expanding STEM relevance and student interest, reflects how mobile tools help connect science and mathematics education with real-world applications. Prahalad et al. (2024) suggested that geospatial technology could raise student engagement in geography, especially when it is reframed as a STEM discipline. Cosby et al. (2024) reported that Australian agriculture teachers began using GPS-based tools to help students understand the relevance of technology in farming. Diego-Mantecon et al. (2021) showed that GeoGebra helped visualize math concepts in STEAM instruction, although teachers still needed support to use it effectively. These examples highlight how the right technology can increase both subject relevance and student motivation in the learning process.

Mobile learning and digital tools present opportunities and constraints for out-of-field teachers. When accessible and well-matched to teachers' skill levels, they serve as entry points to improve instruction and reduce dependence on traditional methods. Teachers gain confidence when they use simulations and modeling tools that simplify complex content. This helps them

move away from passive instructional methods toward active student engagement.

However, these benefits depend heavily on the context. In schools where infrastructure is lacking or professional training is limited, digital tools do not bridge the gap. Instead, they become sources of pressure. Teachers feel unprepared, and a lack of institutional support leads to the underuse or misuse of available technology. This tension is particularly evident in rural and isolated school systems in Brazil.

Ultimately, the data in Table 4 reveal that mobile learning and digital technologies serve as both assets and obstacles for out-of-field STEM teachers. In well-supported settings, tools such as simulations, coding platforms, and spatial technology help teachers deliver better instruction and connect content to real-world applications. In underserved contexts, the lack of access and confidence limits the usefulness of these resources. While digital integration offers a path to improved instruction, its success depends on both teacher readiness and the conditions under which they work. These findings show how technology both empowers and challenges teachers working outside their areas of expertise.

SYNTHESIS

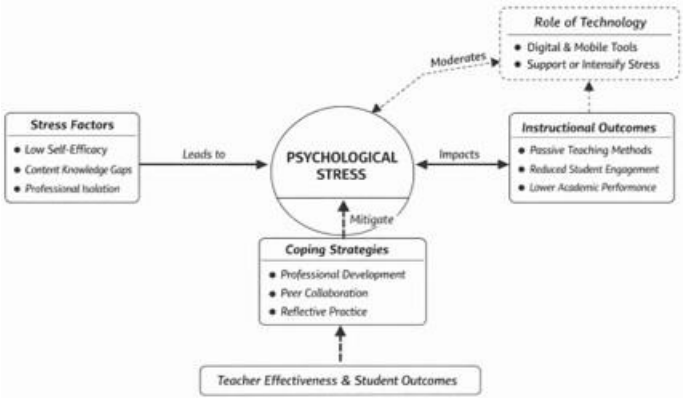

Figure 1. Conceptual Framework of Psychological Stress, Coping Mechanisms, and Instructional Outcomes in Out-of-Field STEM Teaching

Figure 1 illustrates the conceptual relationships identified in this systematic review regarding out-of-field STEM teaching. The framework positions psychological stress as the central mechanism influencing instructional practice. Stress emerges from three primary sources: low self-efficacy, insufficient content knowledge, and professional isolation. These stressors contribute to instructional consequences such as passive teaching methods, reduced student engagement, and lower academic performance. The model further shows that coping strategies—professional development, peer collaboration, and reflective practice—function as mitigating mechanisms that reduce the negative impact of psychological stress. When effectively implemented, these strategies enhance teacher confidence and instructional effectiveness.

Additionally, the framework highlights the moderating role of mobile learning and digital technologies. Technology can either alleviate stress by supporting instructional delivery or intensify stress when teachers lack training or institutional support. Overall, the figure synthesizes how stress, coping, and technology interact to shape teacher effectiveness and student outcomes in out-of-field STEM contexts.

Conclusions and Recommendations

This systematic review examined psychological stress, coping strategies, educational outcomes, and the use of mobile and digital technologies by out-of-field STEM teachers. Four key findings emerged from the analysis of 12 peer-reviewed studies conducted between 2015 and 2024.

First, out-of-field STEM teachers commonly experience psychological stress due to their low

confidence, limited subject knowledge, and professional isolation. These stressors have been consistently reported across different regions and educational levels. The experience of being assigned outside one's subject area reduces teacher self-efficacy and adds emotional strain, especially when institutional support is weak.

Second, stress influences educational outcomes in several ways. Teachers under stress often shift toward passive teaching strategies, avoid innovative methods, and lower the cognitive demand for instruction. Consequently, student engagement and achievement are affected. Stress also impacts instructional decision-making and contributes to hesitation in using student-centered or interdisciplinary practices, particularly in contexts involving new technology.

Third, teachers use various coping strategies to manage stress. These include professional development programs, peer collaboration and personal reflection. While professional learning builds competence, peer networks help to reduce isolation. Reflective practices allow teachers to reframe their experiences and regain confidence. Teachers often use these strategies in combination, depending on the nature of the challenges they face.

Fourth, digital technologies have mixed effects on instructional quality. In supportive environments, mobile tools such as simulations, coding platforms, and geospatial applications improve students' confidence and make STEM more engaging. In contrast, teachers in under-resourced contexts report limited access, insufficient training, and uncertainty regarding the use of these tools. When digital tools are not well-matched to a teacher's readiness or working conditions, they contribute to increased stress.

Future studies should explore the impact of mobile learning tools on long-term teaching practices among out-of-field educators. There is also space to examine how digital integration varies between rural and urban schools and between pre-service and in-service teachers. Research that connects mobile technology use with coping mechanisms could help identify which tools support resilience and which tools add pressure. These directions can contribute to practical models for supporting teachers in out-of-field assignments using effective digital resources.

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