



Smartphones, Social Media, and the Role of the Teacher: Impacts on Learning, Mental Health, and the Fight Against Scientific Misinformation

Hesley Machado Silva¹

¹ State University of Minas Gerais, Ibirité, Brazil

¹ University Center of Formiga, Formiga, Brazil

Corresponding author: hesley@unifarmq.edu.br

Abstract

This article examines the impacts of excessive smartphone and social media use in the school environment, highlighting their cognitive, emotional, and social effects, as well as their role in the dissemination of scientific misinformation. It discusses the need to balance the pedagogical use of these technologies with strategies to minimize distractions and combat the spread of fake news, particularly regarding vaccines and climate change. Additionally, it underscores the essential role of teachers in mediating this scenario, emphasizing the importance of continuous teacher training to develop students' media literacy and critical thinking. The study proposes guidelines and practices for a more conscious use of digital devices in education, contributing to a more critical and productive learning environment.

Keywords: Digital Education, Media Literacy, Scientific Misinformation, Smartphone Use in Schools, Teacher Training

INTRODUCTION

The advancement of digital technology and the increasing accessibility of smartphones have radically transformed how individuals interact, work, consume information, and, most importantly, engage with knowledge. While these innovations have facilitated greater connectivity and access to information, their uncontrolled use has given rise to an alarming phenomenon: excessive dependence on social media and mobile devices. Currently, billions of people worldwide own a smartphone, and the majority of the global population uses social media daily, with an average screen time of several hours per day (BinDhim et al., 2023; Olson et al., 2022; Rogers, 2019). This phenomenon has manifested in various contexts, affecting not only individual behavior but also social and institutional dynamics, such as the school environment, where excessive use of digital devices significantly compromises teaching and learning (Martin et al., 2018; Silva, 2020a).

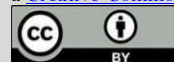
The impacts of excessive smartphone and social media use can be

History:

Received : February 25, 2025
Revised : May 10, 2025
Accepted : May 11, 2025
Published : May 13, 2025

Publisher: UIN Kiai Haji Achmad Siddiq Jember

Licensed: This work is licensed under
a [Creative Commons Attribution 4.0 International](https://creativecommons.org/licenses/by/4.0/) (CC BY 4.0)



categorized into physical, psychological, emotional, and cognitive effects. From a physiological perspective, prolonged screen exposure is associated with sleep disorders, sedentary behavior, musculoskeletal pain, and eye strain (Chen et al., [2022](#); Dyrek et al., [2024](#); Thorud et al., [2022](#)). Nighttime use of mobile devices, for instance, affects melatonin production and impairs sleep quality, interfering with academic performance and cognitive functioning throughout the day (George, [2024](#); Kestler, [2017](#)). In the psychological and emotional domain, there has been a concerning increase in cases of anxiety, depression, and social isolation, particularly among young people, due to hyperconnectivity and the constant social comparison promoted by social media (Candiottio, [2022](#); Heylighen & Beigi, [2023](#)). Additionally, research indicates that digital dependence alters brain reward mechanisms in a manner similar to chemical addictions, directly impacting emotional self-regulation and impulsivity (Alter, [2017](#); Emadi Chashmi et al., [2023](#)).

However, the cognitive effects of smartphone overuse may be the most concerning. Constant exposure to digital stimuli reduces attention span and memory capacity while compromising deep reading skills and critical reflection (Ali et al., [2024](#); Marci, [2022](#)). The phenomenon of "connectivity fatigue" has been widely documented, characterized by mental exhaustion caused by the need to be constantly connected and responsive to digital stimuli (Argyle et al., [2021](#)). Studies indicate that individuals who compulsively check their smartphones experience a significant decline in concentration ability and greater difficulty completing tasks that require sustained cognitive effort (Rosen et al., [2013](#)).

The proliferation of social media has become one of the main vectors of misinformation, generating significant impacts in crucial areas such as public health and the fight against climate change. In the field of immunization, the spread of fake news about vaccines has led to an increase in vaccine hesitancy, resulting in the resurgence of previously controlled diseases, such as measles and poliomyelitis, and hindering the global response to health crises, such as the COVID-19 pandemic (Silva, [2024c](#), [2024b](#)). Studies indicate that false information about vaccines circulates widely on platforms like Facebook and WhatsApp, employing strategies that emphasize supposed health risks and cite medical professionals to lend credibility to these claims, with some doctors even aligning themselves with this type of misinformation (Silva, [2023](#), [2024a](#)). This misinformation not only compromises individual health but also weakens public health efforts by undermining trust in vaccination campaigns and the institutions responsible for collective health.

Regarding environmental issues, social media plays a central role in spreading narratives that deny or downplay global warming, negatively influencing public policy formulation and delaying urgent actions for climate change mitigation (Silva, [2022](#); Treen et al., [2020](#)). The dissemination of false information and conspiracy theories about the causes and consequences of climate change contributes to the polarization of public debate and hinders the implementation of necessary measures to address the environmental crisis (Silva, [2021b](#); Van der Linden et al., [2017](#)). The global information crisis, characterized by the spread of misinformation,

exacerbates other interconnected crises, such as environmental, geopolitical, and health crises, forming a "polycrisis" that challenges the role of science and evidence-based decision-making (Scheufele & Krause, [2019](#)).

The school environment has been particularly affected by these digital transformations. Teachers and students face significant challenges in balancing the pedagogical use of technology with the negative impacts of hyperconnectivity (Raja et al., [2024](#)). The indiscriminate use of smartphones in the classroom compromises students' attention and academic performance, in addition to harming the pedagogical relationship between teachers and students (Junco, [2012](#)). Data from the 2022 Program for International Student Assessment (PISA) reveal that most students reported distractions caused by digital devices during math and other lessons (Almarashdi & Saleh, [2024](#); Nyberg, [2024](#)). Furthermore, the majority of students also reported feeling distracted by their peers' use of devices, negatively impacting their learning (Dontre, [2021](#)).

Misinformation spread through social media presents an additional challenge for educators, particularly science teachers, who must contend with students' resistance to scientific evidence on topics such as vaccines and climate change. The proliferation of fake news in these areas has led to a growing distrust of scientific knowledge, making it more difficult to teach fundamental concepts and undermining the formation of a critical and informed citizenry (Hopf et al., [2019](#); Park et al., [2020](#); Weingart, [2023](#)). Studies indicate that misinformation about vaccines, for instance, not only affects individual perception but also has direct consequences on public health policies by influencing adherence to immunization campaigns and contributing to the resurgence of previously controlled diseases (Lee et al., [2022](#); Silva, [2020b](#)).

Given this scenario, it is imperative that educational institutions adopt effective strategies to mitigate the negative effects of excessive smartphone use and combat the spread of misinformation. This includes implementing policies that regulate the use of digital devices in the classroom, fostering critical thinking, and promoting media literacy among students and educators. Only through an integrated and conscious approach will it be possible to harness the benefits of digital technologies in education while minimizing their adverse impacts on the teaching-learning process and society.

Considering this, it becomes essential to establish strategies that regulate smartphone use in classrooms, balancing their pedagogical potential with the need to prevent distractions and counter misinformation. This article presents a review of the challenges and benefits associated with smartphone use in educational settings, emphasizing the importance of policies that restrict recreational social media use during lessons, strategies to mitigate digital addiction, and the necessity of training both teachers and students for a more conscious and critical engagement with technology.

LITERATURE REVIEW

This literature review was conducted to understand the impact of smartphone use in educational environments, as well as to identify

strategies to mitigate its negative effects and maximize its pedagogical applications. To achieve this, academic databases were consulted, including articles, theses, and publications in specialized journals, covering the period from 2010 to 2025. The selection of materials considered studies addressing the use of mobile devices in education, digital dependence among students and teachers, and the spread of scientific misinformation through social media.

The results of the review indicate that smartphone use in the classroom is a widely debated topic, with studies highlighting both its benefits and challenges. While some researchers emphasize the potential of mobile devices to enrich the teaching-learning process, others warn of the risks of distraction and dependence associated with their unregulated use. Research demonstrates that excessive smartphone use can lead to a decline in academic performance and negatively affect students' mental well-being (Cao et al., [2018](#); Kim et al., [2019](#); Yang et al., [2019](#); Zhou et al., [2022](#)). On the other hand, studies also indicate that when used in a planned and guided manner, smartphones can serve as effective tools for promoting student engagement and active participation in educational activities (Gikas & Grant, [2013](#); Schindler et al., [2017](#); Serrano et al., [2019](#); Yu et al., [2022](#)).

Smartphone Use in the Classroom: Challenges and Opportunities

The presence of smartphones in the school environment presents a dilemma for educators and administrators. On one hand, these devices provide quick access to information, interactive educational resources, and personalized learning opportunities (Al-Kindi & Al-Suqri, [2017](#); Caballé et al., [2010](#); Grant & Basye, [2014](#)). On the other hand, their inappropriate use can lead to distractions, decreased academic performance, and even the development of addictive behaviors (Dobler, [2015](#); Dontre, [2021](#); Lin & Chiang, [2017](#)). Studies indicate that excessive smartphone use is associated with a reduction in attention and academic performance (Amez & Baert, [2020](#); Lin et al., [2021](#); Qayyum et al., [2024](#)), as well as negative impacts on students' mental health (Pereira et al., [2020](#); Sohn et al., [2019](#); Wacks & Weinstein, [2021](#)).

In response to these challenges, several countries have implemented restrictions on cellphone use in schools (Böttger & Zierer, [2024](#); Gath et al., [2024](#)). For instance, France banned the use of smartphones for students aged 3 to 15 in 2018, aiming to improve concentration and academic performance (Gath et al., [2024](#); Montag & Elhai, [2023](#); Spiratos & Ratanasiripong, [2023](#)). More recently, in 2025, Brazil enacted a law restricting smartphone use in elementary and high schools, allowing it only in emergencies, for educational purposes, or for students with disabilities.

However, a total ban on smartphone use in the classroom may not be the most effective solution (Campbell et al., [2024](#); Grigic et al., [2023](#); Vahedi et al., [2021](#)). Some studies suggest that banning cellphones during lessons does not necessarily improve students' academic performance, behavior, or mental well-being (Böttger & Zierer, [2024](#); Smale et al., [2021](#)). In fact, students tend to compensate for the restriction by using their devices more frequently outside school hours, which does not effectively reduce overall screen time exposure.

Given this complex scenario, it is essential to adopt a balanced approach that acknowledges both the challenges and opportunities associated with smartphone use in education (Böttger & Zierer, [2024](#); Iqbal & Bhatti, [2020](#); Latif et al., [2019](#)). Instead of enforcing a blanket ban, effective educational policies should establish clear guidelines on the use of these devices, prioritizing their pedagogical potential while mitigating their negative impacts (Gao et al., [2014](#); Kates et al., [2018](#); Randhawa et al., [2024](#)). Implementing strategies such as the use of educational apps, mobile learning platforms, and active learning methodologies can transform smartphones into valuable educational tools—provided their use is properly monitored (Al-Hunaiyyan et al., [2017](#); Berge & Muilenburg, [2013](#); Brown & Mbati, [2015](#)). Research has shown that well-integrated digital tools, such as gamification systems, learning reinforcement apps, and augmented reality, can significantly enhance student engagement and improve academic performance (Al-Hunaiyyan et al., [2017](#); Bai et al., [2020](#); Lampropoulos et al., [2022](#); Pechenkina et al., [2017](#)).

However, one of the main challenges of this integration is ensuring that devices are used exclusively for educational purposes (Kadry & Roufayel, [2017](#); Norris et al., [2011](#)). Studies indicate that, without proper control, many students divert their attention to social media and digital entertainment during lessons, compromising their academic performance (Duncan et al., [2012](#); McCoy, [2020](#); Park et al., [2025](#)). To mitigate this issue, some schools worldwide have implemented access blockers for non-educational apps during school hours, as well as device usage monitoring through educational management platforms (Armstrong, [2020](#); Fuchs, [2012](#); Talan, [2020](#)). Additionally, strategies such as creating designated times for technology use and promoting digital self-discipline among students are fundamental to ensuring a more conscious use of smartphones in the school environment (Muksin & Makhsin, [2021](#); Pérez-Juárez et al., [2023](#); Roffarello & De Russis, [2023](#)).

Another essential aspect for the successful integration of smartphones in education is the ongoing training and professional development of teachers (Dahri et al., [2022](#), [2023](#)). Many educators still struggle to balance the use of these tools, either due to a lack of technological familiarity or resistance to adopting new methodologies (Firdaus & Isfandiari, [2024](#); Fishman et al., [2016](#); Johnson et al., [2016](#)). Teacher training programs focused on the pedagogical use of digital technologies are crucial to equipping educators with effective strategies that enhance learning while minimizing distractions (Aithal & Aithal, [2023](#); Kumbo et al., [2023](#); Nabung, [2024](#)). Schools that invest in continuous training on responsible technology use, alongside clear digital governance policies, tend to achieve better results in integrating mobile devices into education (Collins & Halverson, [2018](#); Ng, [2015](#); West, [2012](#)).

Finally, adopting a balanced educational policy regarding smartphone use requires a collective effort among school administrators, teachers, students, and guardians (Burleigh & Wilson, [2022](#); McQuiggan et al., [2015](#); Wishart, [2017](#)). The development of clear institutional guidelines, combined with an educational approach that fosters digital literacy and critical

thinking, is essential to transforming smartphones from a source of distraction into a powerful learning tool (McHaney, [2023](#); Murray et al., [2020](#); Nabung, [2024](#); West, [2012](#)).

Combating Scientific Misinformation

The spread of scientific misinformation on social media poses a significant challenge to the contemporary educational environment. False information about topics such as vaccines, climate change, and pseudoscientific theories can distort students' understanding and compromise their learning process (Achiam et al., [2024](#); Grant, [2011](#); Lawrence, [2024](#)). For example, the proliferation of fake news has been identified as a contributing factor to vaccine hesitancy, leading to the resurgence of previously controlled diseases such as measles (Lee et al., [2022](#); Loomba et al., [2021](#); Silva, [2020b](#)). Additionally, climate change denial, amplified by online misinformation, negatively influences public perception and hampers the implementation of effective environmental policies (Benegal & Scruggs, [2018](#); Johansen, [2023](#); Nation & Feldman, [2021](#); Treen et al., [2020](#)).

Another concerning aspect is the dissemination of conspiracy theories and pseudoscience, which can lead students to question well-established scientific foundations, undermining critical thinking and scientific literacy (Lack & Rousseau, [2016](#); McIntyre, [2019](#)). Health-related misinformation, such as the promotion of miracle cures without scientific evidence, can result in behaviors harmful to both individual and public health (Perlis et al., [2023](#); Silva, [2021a](#), [2024d](#)). These phenomena not only threaten the integrity of scientific knowledge but also directly impact the school environment, where teachers face the challenge of correcting misconceptions and fostering an education based on evidence (Lack & Rousseau, [2016](#); McIntyre, [2019](#); Souza & Oliveira, [2024](#)).

To mitigate these impacts, it is essential for educators to adopt pedagogical strategies that foster critical thinking and digital literacy among students, equipping them with the ability to assess the credibility of information and identify reliable sources (Alsaleh, [2020](#); Mokhtari, [2023](#); Thelma et al., [2024](#)). Moreover, integrating discussions on the nature of science and the process of scientific knowledge construction can strengthen students' understanding of the importance of evidence and scientific consensus (Duncan et al., [2018](#); Linn & Eylon, [2011](#)). Collaboration between schools, families, and communities is fundamental to creating an environment that values science and promotes resistance to misinformation (Mayorga et al., [2020](#)).

Promoting these competencies not only enhances academic performance but also prepares students to engage in society in an informed and active manner, addressing the challenges imposed by the era of misinformation (Pérez-Escolar et al., [2021](#); Smith & Parker, [2021](#); West, [2012](#)). Therefore, educators and policymakers must prioritize the inclusion of practices that cultivate critical thinking and digital literacy, ensuring that students are equipped to navigate today's complex informational ecosystem safely and consciously.

Teacher Training for the Conscious Use of Technologies

The effective integration of smartphones and other digital technologies in education requires comprehensive teacher preparation that goes beyond mere technical proficiency (Fishman et al., [2016](#); Haleem et al., [2022](#)). Educators must develop pedagogical skills that enable them to use these technologies to foster an active and critical learning environment (Hamilton, [2022](#); West, [2012](#)). This includes the ability to select and apply digital resources that enrich curricular content, facilitate student collaboration, and encourage problem-solving in creative ways (Churchill, [2017](#); Kong, [2016](#); Van den Berg, [2018](#)). Therefore, teacher training should encompass not only technical knowledge but also pedagogical strategies that meaningfully integrate digital technologies into the teaching-learning process.

Initial and continuous training programs are essential to prepare teachers for the challenges associated with using digital technologies in education (Abedi, [2024](#); Rodrigues, [2020](#)). These programs should address aspects such as managing device usage in the classroom, preventing digital dependence, and combating scientific misinformation (Haleem et al., [2022](#); Valverde-Berrocoso et al., [2021](#)). For instance, educators must learn to establish clear guidelines for smartphone use during lessons, ensuring that these devices serve as learning tools rather than sources of distraction (Shurygin et al., [2022](#); Twining et al., [2013](#)). Additionally, training programs should include modules that teach educators how to identify and correct false or misleading information that students may encounter online, thereby fostering critical thinking and digital literacy (Gudmundsdottir & Hatlevik, [2018](#); Santos, [2020](#)).

Teacher training policies must consider both the social and professional well-being of educators, providing continuous support to help them adapt to constant technological innovations and evolving educational contexts. This includes fostering communities of practice, where teachers can exchange experiences and resources, as well as creating ongoing professional development opportunities that encourage peer collaboration. For instance, the establishment of study groups or workshops focused on the integration of new technologies can help educators stay updated and develop innovative pedagogical approaches. Furthermore, it is essential that educational institutions provide both technical and pedagogical support, ensuring that teachers have access to the necessary resources to effectively implement digital technologies in their teaching practices.

Proposals for Training Activities

For the initial and ongoing training of teachers, the following activities are recommended.

- **Workshops on Digital Literacy:** Practical sessions that train teachers to use digital tools pedagogically, including the creation and curation of educational digital content.
- **Seminars on Scientific Misinformation:** Events addressing the origins, mechanisms of dissemination, and strategies to combat misinformation, with a focus on topics relevant to the school curriculum.

- Discussion Groups on Digital Dependence: Spaces where educators can share experiences and develop strategies to identify and mitigate digital dependence behaviors among students and colleagues.

For classroom implementation, teachers can develop activities such as:

- Critical Source Analysis: Exercises that encourage students to evaluate the credibility of different sources of information, particularly those found online.
- Collaborative Research Projects: Activities that use smartphones for group research, promoting responsible technology use and peer collaboration.
- Debates on Contemporary Issues: Structured discussions on current topics, such as climate change and public health, using data and scientific evidence to support arguments.

CONCLUSIONS AND SUGGESTIONS

The increasing integration of smartphones and social media into daily life has had profound impacts on various spheres of society, particularly in education. While these technologies provide new opportunities for teaching and learning, their unregulated use compromises students' attention, cognition, and the quality of social interaction. Moreover, the spread of scientific misinformation on social media represents one of the greatest contemporary challenges, negatively affecting essential areas such as public health and climate change mitigation. In the school environment, this phenomenon translates into the growing difficulty teachers face in dealing with students' resistance to scientific evidence, undermining the formation of a critical and informed citizenry. Addressing this reality requires the implementation of strategies that balance the pedagogical potential of digital technologies with the need to promote critical thinking and media literacy.

The role of teachers in this context is crucial, as they act not only as knowledge mediators but also as role models in shaping healthy digital habits and promoting evidence-based science. However, for them to effectively fulfill this role, their initial and ongoing training must include preparation for the pedagogical use of technology and the fight against misinformation. Additionally, educational policies should establish clear guidelines for the use of mobile devices in classrooms, limiting unrestricted access to social media and encouraging practices that support active learning. Adopting a balanced approach that combines regulation, and training is essential to transform smartphones into allies in the educational process rather than mere sources of distraction and misinformation. Only through a collective effort among educators, administrators, and policymakers will it be possible to tackle the challenges posed by the digital age, ensuring a more productive, critical, and socially responsible school environment.

ACKNOWLEDGMENTS

The author thanks UNIFORMG and the Research Productivity Scholarship Program (PQ) State University of Minas Gerais (UEMG) for the scholarships and the opportunity to encourage research.

REFERENCE

- Abedi, E. A. (2024). "We [teachers] first require basic technical [skills] training": Investigating formal professional development pathways and knowledge needs of teachers for technology integration. *Education and Information Technologies*, 29(10), 11793–11814. <https://doi.org/10.1007/s10639-023-11938-1>
- Achiam, M., Jontes, D., & Skapin, A. (2024). *The ecosystem of science communication in the post-truth era: Perspectives, contexts, dynamics*. Založba ZRC.
- Aithal, P. S., & Aithal, S. (2023). How to empower educators through digital pedagogies and faculty development strategies. *International Journal of Applied Engineering and Management Letters*, 7(4), 139–183. <https://doi.org/10.47992/IJAEML.2581.7000.0174>
- Al-Hunaiyyan, A., Al-Sharhan, S., & Alhajri, R. (2017). A new mobile learning model in the context of smart classroom environment: A holistic approach. *International Journal of Interactive Mobile Technologies*, 11(3), 39–56. <https://doi.org/10.3991/ijim.v11i3.6813>
- Al-Kindi, S. S., & Al-Suqri, M. N. (2017). Mobilizing learning: Using Moodle and online tools via smartphones. *International Journal of Knowledge Content Development & Technology*, 7(3), 67–86. <https://doi.org/10.5865/IJKCT.2017.7.3.067>
- Ali, Z., Janarthanan, J., & Mohan, P. (2024). Understanding digital dementia and cognitive impact in the current era of the internet: A review. *Cureus*, 16(9), e45321. <https://doi.org/10.7759/cureus.45321>
- Almarashdi, H. S., & Saleh, H. (2024). Digital devices in mathematics classes: A negative distraction or a key to success? In *2024 Global Digital Health Knowledge Exchange & Empowerment Conference (GDigiHealth. KEE)* (pp. 1–5). IEEE. <https://doi.org/10.1109/GDigiHealthKEE57890.2024.1234567>
- Alsaleh, N. J. (2020). Teaching critical thinking skills: Literature review. *Turkish Online Journal of Educational Technology*, 19(1), 21–39. <https://files.eric.ed.gov/fulltext/EJ1241715.pdf>
- Alter, A. (2017). *Irresistible: The rise of addictive technology and the business of keeping us hooked*. Penguin Press.
- Amez, S., & Baert, S. (2020). Smartphone use and academic performance: A literature review. *International Journal of Educational Research*, 103, 101618. <https://doi.org/10.1016/j.ijer.2020.101618>
- Argyle, E. M., Marinescu, A., Wilson, M. L., Lawson, G., & Sharples, S. (2021). Physiological indicators of task demand, fatigue, and cognition in future digital manufacturing environments. *International Journal of Human-Computer Studies*, 145, 102522. <https://doi.org/10.1016/j.ijhcs.2020.102522>

- Armstrong, P. (2020). Digital management systems in the classroom with a focus on tablets. *Flinders University, College of Science and Engineering*. <https://doi.org/10.25957/5f6b7c8e8b7e3>
- Bai, S., Hew, K. F., & Huang, B. (2020). Does gamification improve student learning outcome? Evidence from a meta-analysis and synthesis of qualitative data in educational contexts. *Educational Research Review*, 30, 100322. <https://doi.org/10.1016/j.edurev.2020.100322>
- Benegal, S. D., & Scruggs, L. A. (2018). Correcting misinformation about climate change: The impact of partisanship in an experimental setting. *Climatic Change*, 148(1–2), 61–80. <https://doi.org/10.1007/s10584-018-2192-4>
- Berge, Z. L., & Muilenburg, L. Y. (Eds.). (2013). *Handbook of mobile learning*. Routledge.
- BinDhim, N. F., Althumiri, N. A., Al-Duraihem, R. A., Alasmay, S., Alkhamaali, Z., & Alhabeeb, A. A. (2023). Association between daily use of social media and behavioral lifestyles in the Saudi community: A cross-sectional study. *Frontiers in Public Health*, 11, 1254603. <https://doi.org/10.3389/fpubh.2023.1254603>
- Böttger, T., & Zierer, K. (2024). To ban or not to ban? A rapid review on the impact of smartphone bans in schools on social well-being and academic performance. *Education Sciences*, 14(8), 906. <https://doi.org/10.3390/educsci14080906>
- Brown, T. H., & Mbatia, L. S. (2015). Mobile learning: Moving past the myths and embracing the opportunities. *International Review of Research in Open and Distributed Learning*, 16(2), 115–135. <https://doi.org/10.19173/irrodl.v16i2.2071>
- Burleigh, C., & Wilson, A. M. (2022). Mobile technology acceptable use policies and teaching in high school classrooms: Do boundaries exist? *International Journal of Multidisciplinary and Current Educational Research*, 4(1), 71–86. <https://doi.org/10.5281/zenodo.1234567>
- Caballé, S., Xhafa, F., & Barolli, L. (2010). Using mobile devices to support online collaborative learning. *Mobile Information Systems*, 6(1), 27–47. <https://doi.org/10.3233/MIS-2010-0105>
- Campbell, M., Edwards, E. J., Pennell, D., Poed, S., Lister, V., Gillett-Swan, J., Kelly, A., Zec, D., & Nguyen, T.-A. (2024). Evidence for and against banning mobile phones in schools: A scoping review. *Journal of Psychologists and Counsellors in Schools*, 34(3), 242–265. <https://doi.org/10.1017/jgc.2024.15>
- Candiotta, L. (2022). Extended loneliness: When hyperconnectivity makes us feel alone. *Ethics and Information Technology*, 24(4), 47. <https://doi.org/10.1007/s10676-022-09635-5>
- Cao, X., Masood, A., Luqman, A., & Ali, A. (2018). Excessive use of mobile social networking sites and poor academic performance: Antecedents and consequences from stressor-strain-outcome perspective. *Computers in Human Behavior*, 85, 163–174. <https://doi.org/10.1016/j.chb.2018.03.023>
- Chen, A.-H., Rosli, S. A., Basri, R., & Hoe, C. Y. W. (2022). Investigation of screen time inclination and the accompanying visual and

- musculoskeletal discomfort in young smartphone users. *Trends in Sciences*, 19(2), 1753. <https://doi.org/10.48048/tis.2022.1753>
- Churchill, D. (2017). *Digital resources for learning*. Springer. <https://doi.org/10.1007/978-981-10-3776-4>
- Collins, A., & Halverson, R. (2018). *Rethinking education in the age of technology: The digital revolution and schooling in America* (2nd ed.). Teachers College Press.
- Dahri, N. A., Al-Rahmi, W. M., Almogren, A. S., Yahaya, N., Vighio, M. S., & Al-Maatuok, Q. (2023). Mobile-based training and certification framework for teachers' professional development. *Sustainability*, 15(7), 5839. <https://doi.org/10.3390/su15075839>
- Dahri, N. A., Vighio, M. S., Alismaiel, O. A., & Al-Rahmi, W. M. (2022). Assessing the impact of mobile-based training on teachers' achievement and usage attitude. *International Journal of Interactive Mobile Technologies*, 16(9), 4–20. <https://doi.org/10.3991/ijim.v16i09.29817>
- Dobler, E. (2015). E-textbooks: A personalized learning experience or a digital distraction? *Journal of Adolescent & Adult Literacy*, 58(6), 482–491. <https://doi.org/10.1002/jaal.391>
- Dontre, A. J. (2021). The influence of technology on academic distraction: A review. *Human Behavior and Emerging Technologies*, 3(3), 379–390. <https://doi.org/10.1002/hbe2.237>
- Duncan, D. K., Hoekstra, A. R., & Wilcox, B. R. (2012). Digital devices, distraction, and student performance: Does in-class cell phone use reduce learning? *Astronomy Education Review*, 11(1), 010108. <https://doi.org/10.3847/AER2012011>
- Duncan, R. G., Chinn, C. A., & Barzilai, S. (2018). Grasp of evidence: Problematizing and expanding the next generation science standards' conceptualization of evidence. *Journal of Research in Science Teaching*, 55(7), 907–937. <https://doi.org/10.1002/tea.21464>
- Dyrek, M., Sikorska, E., Partyka, A., Sikorski, P., Dusza, E., & Kopacz, D. (2024). Prolonged screen-time as the cause of ocular disorders: What can we do with the problem?—A review. *European Journal of Clinical & Experimental Medicine*, 22(1), 1–5. <https://doi.org/10.15584/ejcem.2024.1.1>
- Emadi Chashmi, S. J., Shahrajabian, F., Hasani, J., Potenza, M. N., Kuss, D. J., & Hakima, F. (2023). The effects of emotional working memory training on internet use, impulsivity, risky decision-making, and cognitive emotion regulation strategies in young adults with problematic use of the internet: A preliminary randomized controlled trial study. *Journal of Behavioral Addictions*, 12(3), 786–802. <https://doi.org/10.1556/2006.2023.00063>
- Firdaus, M., & Isfandiari, F. (2024). Integrating technology in English language teaching: Innovations in computing and effective education management. *Journal of English Teaching and Linguistics*, 1(2), 86–100. <https://doi.org/10.55640/jetl.v1i02.145>
- Fishman, B., Dede, C., & Means, B. (2016). Teaching and technology: New tools for new times. In D. H. Gitomer & C. A. Bell (Eds.), *Handbook of*

- research on teaching* (5th ed., pp. 1269–1334). American Educational Research Association.
- Fuchs, L. H. (2012). The impact of filtered Internet access on student learning in public schools (Doctoral dissertation). Walden University.
- Gao, Q., Yan, Z., Zhao, C., Pan, Y., & Mo, L. (2014). To ban or not to ban: Differences in mobile phone policies at elementary, middle, and high schools. *Computers in Human Behavior*, 38, 25–32. <https://doi.org/10.1016/j.chb.2014.05.011>
- Gath, M. E., Monk, L., Scott, A., & Gillon, G. T. (2024). Smartphones at school: A mixed-methods analysis of educators' and students' perspectives on mobile phone use at school. *Education Sciences*, 14(4), 351. <https://doi.org/10.3390/educsci14040351>
- George, A. S. (2024). Sleep disrupted: The evolving challenge of technology on human sleep patterns over two centuries. *Partners Universal Multidisciplinary Research Journal*, 1(1), 83–108.
- Gikas, J., & Grant, M. M. (2013). Mobile computing devices in higher education: Student perspectives on learning with cellphones, smartphones & social media. *The Internet and Higher Education*, 19, 18–26. <https://doi.org/10.1016/j.iheduc.2013.06.002>
- Grant, J. (2011). *Denying science: Conspiracy theories, media distortions, and the war against reality*. Prometheus Books.
- Grant, P., & Basye, D. (2014). *Personalized learning: A guide for engaging students with technology*. International Society for Technology in Education.
- Grigic Magnusson, A., Ott, T., Hård af Segerstad, Y., & Sofkova Hashemi, S. (2023). Complexities of managing a mobile phone ban in the digitalized schools' classroom. *Computers in the Schools*, 40(3), 303–323. <https://doi.org/10.1080/07380569.2023.2244372>
- Gudmundsdottir, G. B., & Hatlevik, O. E. (2018). Newly qualified teachers' professional digital competence: Implications for teacher education. *European Journal of Teacher Education*, 41(2), 214–231. <https://doi.org/10.1080/02619768.2017.1416085>
- Haleem, A., Javaid, M., Qadri, M. A., & Suman, R. (2022). Understanding the role of digital technologies in education: A review. *Sustainable Operations and Computers*, 3, 275–285. <https://doi.org/10.1016/j.susoc.2022.03.001>
- Hamilton, B. (2022). *Integrating technology in the classroom: Tools to meet the needs of every student*. International Society for Technology in Education.
- Heylighen, F., & Beigi, S. (2023). Anxiety, depression and despair in the information age: The techno-social dilemma. *Anxiety, Depression and Despair in the Information Age*.
- Hopf, H., Krief, A., Mehta, G., & Matlin, S. A. (2019). Fake science and the knowledge crisis: Ignorance can be fatal. *Royal Society Open Science*, 6(5), 190161. <https://doi.org/10.1098/rsos.190161>
- Iqbal, S., & Bhatti, Z. A. (2020). A qualitative exploration of teachers' perspective on smartphones usage in higher education in developing countries. *International Journal of Educational Technology in Higher Education*, 17(1), 29. <https://doi.org/10.1186/s41239-020-00205-6>

- Johansen, B. E. (2023). Science: Why so urgent? Saving ourselves from ourselves. In *Global warming and the climate crisis: Science, spirit, and solutions* (pp. 17–96). Springer.
- Johnson, A. M., Jacovina, M. E., Russell, D. G., & Soto, C. M. (2016). Challenges and solutions when using technologies in the classroom. ERIC Clearinghouse.
- Junco, R. (2012). The relationship between frequency of Facebook use, participation in Facebook activities, and student engagement. *Computers & Education*, 58(1), 162–171. <https://doi.org/10.1016/j.compedu.2011.08.004>
- Kadry, S., & Roufayel, R. (2017). How to use effectively smartphone in the classroom. In *2017 IEEE Global Engineering Education Conference (EDUCON)* (pp. 441–447). IEEE. <https://doi.org/10.1109/EDUCON.2017.7942887>
- Kates, A. W., Wu, H., & Coryn, C. L. S. (2018). The effects of mobile phone use on academic performance: A meta-analysis. *Computers & Education*, 127, 107–112. <https://doi.org/10.1016/j.compedu.2018.08.017>
- Kestler, J. (2017). How does pre-sleep usage of LED screen technology affect sleeping behavior and academic achievement? University of Cincinnati.
- Kim, M.-H., Min, S., Ahn, J.-S., An, C., & Lee, J. (2019). Association between high adolescent smartphone use and academic impairment, conflicts with family members or friends, and suicide attempts. *PLOS ONE*, 14(7), e0219831. <https://doi.org/10.1371/journal.pone.0219831>
- Kong, S.-C. (2016). A framework of curriculum design for computational thinking development in K-12 education. *Journal of Computers in Education*, 3, 377–394. <https://doi.org/10.1007/s40692-016-0077-7>
- Kumbo, L. I., Mero, R. F., & Hayuma, B. J. (2023). Navigating the digital frontier: Innovative pedagogies for effective technology integration in education. *The Journal of Informatics*, 3(1), 14–33.
- Lack, C. W., & Rousseau, J. (2016). *Critical thinking, science, and pseudoscience: Why we can't trust our brains*. Springer Publishing Company.
- Lampropoulos, G., Keramopoulos, E., Diamantaras, K., & Evangelidis, G. (2022). Augmented reality and gamification in education: A systematic literature review of research, applications, and empirical studies. *Applied Sciences*, 12(13), 6809. <https://doi.org/10.3390/app12136809>
- Latif, M. Z., Hussain, I., Saeed, R., Qureshi, M. A., & Maqsood, U. (2019). Use of smartphones and social media in medical education: Trends, advantages, challenges and barriers. *Acta Informatica Medica*, 27(2), 133. <https://doi.org/10.5455/aim.2019.27.133-138>
- Lawrence, G. (2024). *Societal deception: Global social issues in post-truth times*. Springer Nature.
- Lee, S. K., Sun, J., Jang, S., & Connelly, S. (2022). Misinformation of COVID-19 vaccines and vaccine hesitancy. *Scientific Reports*, 12(1), 13681. <https://doi.org/10.1038/s41598-022-17958-1>

- Lin, T. T. C., & Chiang, Y.-H. (2017). Investigating predictors of smartphone dependency symptoms and effects on academic performance, improper phone use and perceived sociability. *International Journal of Mobile Communications*, 15(6), 655–676. <https://doi.org/10.1504/IJMC.2017.087694>
- Lin, Y., Liu, Y., Fan, W., Tuunainen, V. K., & Deng, S. (2021). Revisiting the relationship between smartphone use and academic performance: A large-scale study. *Computers in Human Behavior*, 122, 106835. <https://doi.org/10.1016/j.chb.2021.106835>
- Linn, M. C., & Eylon, B.-S. (2011). *Science learning and instruction: Taking advantage of technology to promote knowledge integration*. Routledge.
- Loomba, S., De Figueiredo, A., Piatek, S. J., De Graaf, K., & Larson, H. J. (2021). Measuring the impact of COVID-19 vaccine misinformation on vaccination intent in the UK and USA. *Nature Human Behaviour*, 5(3), 337–348. <https://doi.org/10.1038/s41562-021-01056-1>
- Marci, C. D. (2022). *Rewired: Protecting your brain in the digital age*. Harvard University Press.
- Martin, F., Wang, C., Petty, T., Wang, W., & Wilkins, P. (2018). Middle school students' social media use. *Journal of Educational Technology & Society*, 21(1), 213–224.
- Mayorga, M. W., Hester, E. B., Helsel, E., Ivanov, B., Sellnow, T. L., Slovic, P., Burns, W. J., & Frakes, D. (2020). Enhancing public resistance to “fake news”: A review of the problem and strategic solutions. In *The Handbook of Applied Communication Research* (pp. 197–212). Wiley. <https://doi.org/10.1002/9781119399926.ch10>
- McCoy, B. R. (2020). Gen Z and digital distractions in the classroom: Student classroom use of digital devices for non-class related purposes. *Gen*.
- McHaney, R. (2023). *The new digital shoreline: How Web 2.0 and millennials are revolutionizing higher education*. Taylor & Francis.
- McIntyre, L. (2019). *The scientific attitude: Defending science from denial, fraud, and pseudoscience*. MIT Press.
- McQuiggan, S., McQuiggan, J., Sabourin, J., & Kosturko, L. (2015). *Mobile learning: A handbook for developers, educators, and learners*. John Wiley & Sons.
- Mokhtari, F. (2023). Fostering digital literacy in higher education: Benefits, challenges and implications. *International Journal of Linguistics, Literature and Translation*, 6(10), 160–167.
- Montag, C., & Elhai, J. D. (2023). Do we need a digital school uniform? Arguments for and against a smartphone ban in schools. *Societal Impacts*, 1(1–2), 100002. <https://doi.org/10.1016/j.socimp.2023.100002>
- Muksin, S. N. B., & Makhsin, M. B. (2021). A level of student self-discipline in e-learning during pandemic COVID-19. *Procedia of Social Sciences and Humanities*, 1, 278–283.
- Murray, L., Giralt, M., & Benini, S. (2020). Extending digital literacies: Proposing an agentive literacy to tackle the problems of distractive technologies in language learning. *ReCALL*, 32(3), 250–271. <https://doi.org/10.1017/S095834402000014X>

- Nabung, A. (2024). The impact of multitasking with digital devices on classroom learning: A critical review on the future of digital distraction in education. *US-China Education Review*, 14(6), 369–383.
- Nation, M. T., & Feldman, A. (2021). Environmental education in the secondary science classroom: How teachers' beliefs influence their instruction of climate change. *Journal of Science Teacher Education*, 32(5), 481–499. <https://doi.org/10.1080/1046560X.2021.1889950>
- Ng, W. (2015). *New digital technology in education*. Springer. <https://doi.org/10.1007/978-3-319-05825-2>
- Norris, C., Hossain, A., & Soloway, E. (2011). Using smartphones as essential tools for learning: A call to place schools on the right side of the 21st century. *Educational Technology*, 51(3), 18–25.
- Nyberg, L. (2024). The impact of digital device usage on educational achievement: Evidence from PISA data. Universidade Católica Portuguesa.
- Olson, J. A., Sandra, D. A., Colucci, É. S., Al Bikaii, A., Chmoulevitch, D., Nahas, J., Raz, A., & Veissière, S. P. L. (2022). Smartphone addiction is increasing across the world: A meta-analysis of 24 countries. *Computers in Human Behavior*, 129, 107138. <https://doi.org/10.1016/j.chb.2021.107138>
- Park, J., Paxtle-Granjeno, J., Ok, M. W., Shin, M., & Wilson, E. (2025). Preventing digital distraction in secondary classrooms: A quasi-experimental study. *Computers & Education*, 227, 105223. <https://doi.org/10.1016/j.compedu.2024.105223>
- Park, S., Fisher, C., Flew, T., & Dulleck, U. (2020). Global mistrust in news: The impact of social media on trust. *International Journal on Media Management*, 22(2), 83–96. <https://doi.org/10.1080/14241277.2020.1780452>
- Pechenkina, E., Laurence, D., Oates, G., Eldridge, D., & Hunter, D. (2017). Using a gamified mobile app to increase student engagement, retention and academic achievement. *International Journal of Educational Technology in Higher Education*, 14(1), 1–12. <https://doi.org/10.1186/s41239-017-0069-7>
- Pereira, F. S., Bevilacqua, G. G., Coimbra, D. R., & Andrade, A. (2020). Impact of problematic smartphone use on mental health of adolescent students: Association with mood, symptoms of depression, and physical activity. *Cyberpsychology, Behavior, and Social Networking*, 23(9), 619–626. <https://doi.org/10.1089/cyber.2019.0605>
- Pérez-Escolar, M., Ordóñez-Olmedo, E., & Alcaide-Pulido, P. (2021). Fact-checking skills and project-based learning about infodemic and disinformation. *Thinking Skills and Creativity*, 41, 100887. <https://doi.org/10.1016/j.tsc.2021.100887>
- Pérez-Juárez, M. Á., González-Ortega, D., & Aguiar-Pérez, J. M. (2023). Digital distractions from the point of view of higher education students. *Sustainability*, 15(7), 6044. <https://doi.org/10.3390/su15076044>
- Perlis, R. H., Trujillo, K. L., Green, J., Safarpour, A., Druckman, J. N., Santillana, M., Ognyanova, K., & Lazer, D. (2023). Misinformation, trust, and use of ivermectin and hydroxychloroquine for COVID-19.

- JAMA Health Forum*, 4(9), e233257. <https://doi.org/10.1001/jamahealthforum.2023.3257>
- Qayyum, A., Kashif, M. F., & Shahid, R. (2024). The effect of excessive smartphone use on child cognitive development and academic achievement: A mixed method analysis. *Annals of Human and Social Sciences*, 5(3), 166–181.
- Raja, W. A., Ahmad, S., & Qureshi, A. M. (2024). Effect of smartphone addiction on the life satisfaction and interpersonal relationships of prospective teachers. *International Research Journal of Management and Social Sciences*, 5(3), 207–223.
- Randhawa, A., Pallan, M., Twardochleb, R., Adab, P., Al-Janabi, H., Fenton, S., Jones, K., Michail, M., Patterson, P., & Sitch, A. (2024). Secondary school smartphone policies in England: A descriptive analysis of how schools rationalize, design, and implement restrictive and permissive phone policies. *Journal of Research on Technology in Education*, 1–20. <https://doi.org/10.1080/15391523.2024.2293456>
- Rodrigues, A. L. (2020). Digital technologies integration in teacher education: The active teacher training model. *Journal of E-Learning and Knowledge Society*, 16(3), 24–33. <https://doi.org/10.20368/1971-8829/1135275>
- Roffarello, A. M., & De Russis, L. (2023). Achieving digital wellbeing through digital self-control tools: A systematic review and meta-analysis. *ACM Transactions on Computer-Human Interaction*, 30(4), 1–66. <https://doi.org/10.1145/3580283>
- Rogers, K. (2019, October 29). US teens use screens more than seven hours a day on average—and that’s not including school work. CNN. <https://www.cnn.com/2019/10/29/health/screen-time-teens-wellness/index.html>
- Rosen, L. D., Carrier, L. M., & Cheever, N. A. (2013). Facebook and texting made me do it: Media-induced task-switching while studying. *Computers in Human Behavior*, 29(3), 948–958. <https://doi.org/10.1016/j.chb.2012.12.001>
- Santos Guimarães Carvalho, I. (2020). The construction of digital teaching skills: A challenge for teacher training. In *Proceedings of the Eighth International Conference on Technological Ecosystems for Enhancing Multiculturality* (pp. 892–895). ACM. <https://doi.org/10.1145/3434780.3436635>
- Scheufele, D. A., & Krause, N. M. (2019). Science audiences, misinformation, and fake news. *Proceedings of the National Academy of Sciences*, 116(16), 7662–7669. <https://doi.org/10.1073/pnas.1805871115>
- Schindler, L. A., Burkholder, G. J., Morad, O. A., & Marsh, C. (2017). Computer-based technology and student engagement: A critical review of the literature. *International Journal of Educational Technology in Higher Education*, 14(1), 1–22. <https://doi.org/10.1186/s41239-017-0063-0>
- Serrano, D. R., Dea-Ayuela, M. A., Gonzalez-Burgos, E., Serrano-Gil, A., & Lalatsa, A. (2019). Technology-enhanced learning in higher education: How to enhance student engagement through blended learning.

- European Journal of Education*, 54(2), 273–286.
<https://doi.org/10.1111/ejed.12330>
- Shurygin, V., Ryskaliyeva, R., Dolzhich, E., Dmitrichenkova, S., & Ilyin, A. (2022). Transformation of teacher training in a rapidly evolving digital environment. *Education and Information Technologies*, 1–20.
<https://doi.org/10.1007/s10639-022-10885-2>
- Silva, H. M. (2020a). A new and serious disease arises in schools. *Journal of Education and Health Promotion*, 9(1), 1.
- Silva, H. M. (2020b). The historic success of vaccination and the global challenge posed by inaccurate knowledge in social networks. *Patient Education and Counseling*, 104(1), 213–214.
- Silva, H. M. (2021a). The Brazilian scientific denialism through *The American Journal of Medicine*. *The American Journal of Medicine*, 134(4), 415–416.
- Silva, H. M. (2021b). Wildfires and Brazilian irrationality on social networks. *Ethics in Science and Environmental Politics*, 21, 11–15.
- Silva, H. M. (2022). Information and misinformation about climate change: Lessons from Brazil. *Ethics in Science and Environmental Politics*, 22, 51–56.
- Silva, H. M. (2023). Risks of scientific misinformation through press and pre-print articles. *Irish Journal of Medical Science*, 192(1), 1–2.
- Silva, H. M. (2024a). Challenges and reflections on pandemic disinformation: The case of hydroxychloroquine and the implications for global public health. *Value in Health Regional Issues*, 43, 101005.
- Silva, H. M. (2024b). Deceptive tactics: Misappropriation of scientific literature by ‘Gazeta do Povo’ in undermining COVID-19 vaccination efforts. *Human Vaccines & Immunotherapeutics*, 20(1), 2350113.
- Silva, H. M. (2024c). Return of poliomyelitis: A real risk in a country afflicted by scientific denialism. *Vaccine*, 42(5), 126449.
- Silva, H. M. (2024d). Vaccine detox in Brazil: Myths and risks of a pseudoscientific therapy. *The American Journal of the Medical Sciences*, 367(2), 142–143.
- Smale, W. T., Hutcheson, R., & Russo, C. J. (2021). Cell phones, student rights, and school safety: Finding the right balance. *Canadian Journal of Educational Administration and Policy*, (195), 49–64.
- Smith, K., & Parker, L. (2021). Reconfiguring literacies in the age of misinformation and disinformation. *Journal of Language and Literacy Education*, 17(2), n2.
- Sohn, S. Y., Rees, P., Wildridge, B., Kalk, N. J., & Carter, B. (2019). Prevalence of problematic smartphone usage and associated mental health outcomes amongst children and young people: A systematic review, meta-analysis and GRADE of the evidence. *BMC Psychiatry*, 19, 356. <https://doi.org/10.1186/s12888-019-2350-x>
- Souza, D. V. L. de, & Oliveira, I. M. de. (2024). Pseudosciences and the current challenges imposed on science teaching. *Educação & Realidade*, 49, e121157.
- Spiratos, K., & Ratanasiripong, P. (2023). Problematic smartphone use among high school students. *Journal of School Administration Research and Development*, 8(2), 76–86.

- Talan, T. (2020). The effect of mobile learning on learning performance: A meta-analysis study. *Educational Sciences: Theory and Practice*, 20(1), 79–103. <https://doi.org/10.12738/jestp.2020.1.006>
- Thelma, C. C., Sain, Z. H., Shogbesan, Y. O., Phiri, E. V., & Akpan, W. M. (2024). Digital literacy in education: Preparing students for the future workforce. *International Journal of Research (IJIR)*, 11(8), 327–344.
- Thorud, H.-M. S., Mork, R., Bjørset, C. O., Gilson, S. J., Hagen, L. A., Langaas, T., Pedersen, H. R., Svarverud, E., Vikesdal, G. H., & Baraas, R. C. (2022). Labouring reading and musculoskeletal pain in school children—the role of lifestyle behaviour and eye wear: A cross-sectional study. *BMC Pediatrics*, 22(1), 416. <https://doi.org/10.1186/s12887-022-03466-6>
- Treen, K. M. d'I., Williams, H. T. P., & O'Neill, S. J. (2020). Online misinformation about climate change. *Wiley Interdisciplinary Reviews: Climate Change*, 11(5), e665. <https://doi.org/10.1002/wcc.665>
- Twining, P., Raffaghelli, J., Albion, P., & Knezek, D. (2013). Moving education into the digital age: The contribution of teachers' professional development. *Journal of Computer Assisted Learning*, 29(5), 426–437. <https://doi.org/10.1111/jcal.12031>
- Vahedi, Z., Zannella, L., & Want, S. C. (2021). Students' use of information and communication technologies in the classroom: Uses, restriction, and integration. *Active Learning in Higher Education*, 22(3), 215–228. <https://doi.org/10.1177/1469787419864430>
- Valverde-Berrocoso, J., Fernández-Sánchez, M. R., Revuelta Dominguez, F. I., & Sosa-Díaz, M. J. (2021). The educational integration of digital technologies pre-COVID-19: Lessons for teacher education. *PLOS ONE*, 16(8), e0256283. <https://doi.org/10.1371/journal.pone.0256283>
- Van den Berg, C. L. (2018). Enriching the information systems curriculum to enable digital innovation capacity. *South African Journal of Higher Education*, 32(6), 215–233. <https://doi.org/10.20853/32-6-2653>
- Van der Linden, S., Leiserowitz, A., Rosenthal, S., & Maibach, E. (2017). Inoculating the public against misinformation about climate change. *Global Challenges*, 1(2), 1600008. <https://doi.org/10.1002/gch2.201600008>
- Wacks, Y., & Weinstein, A. M. (2021). Excessive smartphone use is associated with health problems in adolescents and young adults. *Frontiers in Psychiatry*, 12, 669042. <https://doi.org/10.3389/fpsy.2021.669042>
- Weingart, P. (2023). Trust and distrust of scientific experts and the challenges of the democratization of science. In S. R. Turner (Ed.), *The Oxford Handbook of Expertise and Democratic Politics* (pp. 29–51). Oxford University Press. <https://doi.org/10.1093/oxfordhb/9780190671870.013.3>
- West, D. M. (2012). *Digital schools: How technology can transform education*. Brookings Institution Press.
- Wishart, J. (2017). *Mobile learning in schools: Key issues, opportunities and ideas for practice*. Routledge.
- Yang, Z., Asbury, K., & Griffiths, M. D. (2019). An exploration of problematic smartphone use among Chinese university students: Associations with

- academic anxiety, academic procrastination, self-regulation and subjective wellbeing. *International Journal of Mental Health and Addiction*, 17, 596–614. <https://doi.org/10.1007/s11469-018-9961-1>
- Yu, Z., Yu, L., Xu, Q., Xu, W., & Wu, P. (2022). Effects of mobile learning technologies and social media tools on student engagement and learning outcomes of English learning. *Technology, Pedagogy and Education*, 31(3), 381–398. <https://doi.org/10.1080/1475939X.2021.1932687>
- Zhou, D., Liu, J., Ye, G., Wang, T., Xia, X., & Liu, J. (2022). Relationships among problematic smartphone use, mathematics achievement, teacher–student relationships, and subjective well-being: Results from a large-scale survey in China. *Behavioral Sciences*, 12(11), 454. <https://doi.org/10.3390/bs12110454>