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Teachers, Social Media, and Education for Sustainability: Challenges in Professional Learning

Fariba Mostafa¹  and Chris Eames² 

¹Otago Business School, University of Otago, Dunedin, 9010, New Zealand and ²Faculty of Education, University of Waikato, Hamilton, 3216, New Zealand

Corresponding author: Fariba Mostafa; Email: fariba.mostafa@otago.ac.nz

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Abstract

This paper aims to enhance our understanding of the challenges teachers engaged in Education for Sustainability (EfS) in New Zealand face when using social media for professional learning. An online questionnaire, including open-ended questions, was distributed to Enviroschools lead teachers nationwide to investigate these challenges. The study identifies key barriers, including time constraints, information overload, concerns about privacy and trust, and the perceived misalignment between the hands-on nature of EfS and the virtual nature of social media. Participants expressed a strong preference for face-to-face learning, emphasising its value for meaningful collaboration and practical engagement. The study highlights the need for systemic support to address these barriers. It suggests that integrating teacher professional learning through social media into teachers' working hours could significantly enhance their engagement in professional learning for EfS.

Keywords: Challenges; Education for Sustainability; social media; teacher professional learning

Introduction

In New Zealand, Education for Sustainability (EfS) is positioned as an interdisciplinary approach, placing responsibility on teachers to embed sustainability within their teaching across subjects (Bolstad, Joyce & Hipkins 2015). Integrating sustainability often relies on the initiative of individual teachers, many of whom lack access to formal professional learning or supportive learning communities, especially in remote areas or where they are the sole EfS advocate within their school (Bolstad *et al.*, 2015). Given these teachers' isolation, and the complexity and cross-disciplinary demands of EfS, professional learning is essential to equip teachers with the skills and confidence to integrate sustainability effectively (Ministry of Education, 2021). Despite this need, a notable gap exists in professional learning opportunities for New Zealand teachers engaged in EfS, limiting their capacity to implement it successfully (Eames & Barker, 2011).

The rise of social media has shown the potential to bridge such gaps in teacher professional learning (TPL) through connecting teachers and providing opportunities for collaboration and learning (López-Torres *et al.*, 2022; Nochumson, 2020; Xue *et al.*, 2019). International research has explored the possibilities and challenges of TPL through social media, often focusing on specific platforms tailored to particular educational contexts (Carpenter & Harvey, 2020; Greenhow *et al.*, 2018; Trust *et al.*, 2016). However, research on TPL through online platforms and social media, specifically focusing on teachers engaged in EfS, remains scarce.

Despite this gap, in one of the foundational studies in the field of EfS, Whitehouse (2008) provided insights into the potential of online platforms for environmental education, emphasising both the opportunities for broadening access and the challenges in maintaining experiential learning components crucial to environmental education. Similarly, Ernst *et al.*, (2020) discussed that social media offers opportunities for teacher collaboration and resource sharing but emphasised the need for alignment with pedagogical goals and teachers' ability to effectively navigate these tools.

More specifically, a decade of research on teaching and teacher learning with social media highlights a gap in understanding the challenges teachers face when using these platforms for professional learning (Greenhow *et al.*, 2020). This gap highlights the need to explore specific challenges in contexts such as EfS, where interdisciplinary demands and practical application are integral to successful teaching. To address this gap, the current study employs a qualitative approach to explore the challenges regarding professional learning in EfS through social media. This study specifically asks: What are the key challenges that New Zealand teachers face in TPL in EfS through social media? The findings of this emerging research aim to enhance understanding, inform more effective integration of social media into TPL, and support teachers in embedding sustainability into their lessons.

Following this introduction, we explore the development of EfS in New Zealand education, the need for TPL in EfS, and the role of social media in facilitating this professional learning. Next, the methodology section outlines the research design, data collection and analysis methods. The combined findings and discussion section presents the key challenges identified by participants in this study, supported by qualitative data, and analyses these findings in relation to existing literature. Finally, the conclusion provides recommendations for policy and practice, suggesting ways to better support teachers in using social media for their professional learning in EfS.

Literature review

Since the 1960s, global environmental movements have highlighted pressing challenges such as climate change, biodiversity loss and resource depletion (Buttel, 1975; Rockström *et al.*, 2009; Ranieri, 2019). To tackle these persistent issues, UNESCO has emphasised the transformative role of education, through declarations on environmental education since the 1970s (UNESCO, 1976, 1977). The Brundtland Report (Brundtland *et al.*, 1987) further emphasised the importance of sustainable development, introducing the concept of Education for Sustainability (EfS). This framework positions education as vital for equipping individuals with the skills and values needed to achieve environmental and social resilience (Tilbury, 1995). Teachers play a pivotal role in fostering the societal transformations necessary for sustainable development (Brundtland *et al.*, 1987). In line with international frameworks and guidelines, the New Zealand government began integrating environmental education (EE) into the school curriculum in the 1990s. In 1999, the *Guidelines for Environmental Education in New Zealand Schools* were published (Ministry of Education, 1999), providing a structured yet non-mandatory framework for integrating EE into school curricula. To facilitate this integration, the Ministry of Education funded two TPL programmes from 1999 to 2002 to support the implementation of the *Guidelines* (Eames, Cowie, & Bolstad, 2008). Since 2002, however, there has been a lack of ongoing governmental support and professional learning opportunities for teachers engaged in EE (later re-focussed to EfS) (Eames & Barker, 2011), leaving non-government organisations to fill this deficit (NZAEE, n.d.). The lack of structured government-led TPL programmes highlights the need for alternative professional learning models in EfS. Social media offers flexible learning opportunities, particularly for teachers in remote New Zealand schools (Mostafa, 2021). Teacher professional learning through social media, characterised by its low barriers to collaboration, ease of content creation and sharing, facilitates continuous development and enables teachers to exchange resources and ideas (Greenhow *et al.*, 2018;

Greenhow *et al.*, 2020; Greenhow *et al.*, 2023; Ross *et al.*, 2015; Trust *et al.*, 2016). With its flexibility concerning time and place, social media enables teachers to form personal and professional learning networks (Greenhow *et al.*, 2022; Jupri *et al.*, 2022; Mostafa, 2021; Schroeder *et al.*, 2019) and share their teaching experiences and ideas (Carpenter & Harvey, 2020; Greenhow *et al.*, 2022; Nochumson, 2020; Sjoer & Meirink, 2015). Additionally, collaboration and networking on social media can help alleviate feelings of isolation among teachers and provide emotional support (Carpenter & Krutka, 2014; Greenhow *et al.*, 2023; Trust *et al.*, 2016).

Expanding on this, Greenhow *et al.*, (2023) have argued that social media has become an essential tool for TPL as it can be used for reflection, emotional support and continuous learning beyond traditional limitations. The COVID-19 pandemic especially has shown how important it is to have a borderless approach to education and lifelong professional learning (Greenhow *et al.*, 2023). Social media has created a flexible and just-in-time learning culture and offers access to a broader pool of expertise. Ross *et al.*, (2015) have defined TPL through social media as “highly engaging, dynamic, and interactive” (p. 55) and providing “anytime-anywhere learning opportunities” (p. 73). These authors note that social media has the potential to “transform the paradigm of the isolated teacher into that of a lifelong, connected learner” (p. 58). This can change professional learning from a localised, structured setting to a global, interconnected community. Social media, therefore, can aid teachers in their professional learning, enhancing their teaching practices and fostering job satisfaction (Mercado & Shin, 2023).

However, the literature has also highlighted several challenges regarding learning through social media. The vast inflow of information can become overwhelming and result in time-intensive work (Carpenter & Harvey, 2019; Davis, 2015). In addition, utilising personal social media for teaching and learning introduces tensions and exacerbates the complexity and time demands for teachers in managing posts and messages (Carpenter & Harvey, 2020). Social media’s openness and ability to connect teachers across boundaries can lead to context collapse, increasing the risk of misinterpretation (Carpenter & Harvey, 2019). Interactions and communication with a broader community of colleagues and schools can also result in receiving untrustworthy information (Carpenter & Harvey, 2020).

Additionally, teachers are concerned about the credibility of experts on social media and the quality and accuracy of shared content (Carpenter & Harvey, 2020; Carpenter *et al.*, 2019; Hertel & Wessman-Enzinger, 2017). This may be particularly concerning in EfS professional learning, where topics often involve complex, multifaceted issues requiring a deep understanding of diverse perspectives (Parry & Metzger, 2023). While concern for credibility allows learners to be critical of the content, it can also lead to a general lack of trust, which may reduce learners’ participation and willingness to share knowledge in collaborative activity (Carpenter & Harvey, 2020).

Furthermore, teachers may end up losing time; they may be distracted and waste their time by being involved in superficial social media exchanges. In a study on social studies teachers’ perceptions regarding the usefulness of social media for TPL, López-Torres *et al.*, (2022) found that social media was associated with entertainment, making it inappropriate for professional use. With the absence of gatekeepers on social media, low-quality information and unreliable resources can be shared. As a result, some teachers saw learning through social media as a waste of time, superficial and tedious and yielding untrustworthy information (Davis, 2015).

In addition, the extensive possibilities of learning through social media often extend beyond working hours, meaning that teachers may invest more of their personal time on the professional use of social media (Greenhow *et al.*, 2018; Selwyn *et al.*, 2017). In a study on teachers’ perceptions of Twitter for professional learning, Davis (2015) found that professional engagement through social media consumed teachers’ personal time because of their busy schedules and limited time

for learning during school hours. This might limit teachers' engagement with social media for learning and make managing boundaries between personal and professional life challenging (Carpenter & Harvey, 2019, 2020).

Studies on using social media have also addressed privacy as another challenge which could hinder learners' engagement (Marín *et al.*, 2022). The risk of personal data exposure may cause teachers to participate less and engage in self-censorship, thereby limiting their professional discourse and collaboration. Throughout their review of the literature, Greenhow *et al.*, (2018) noted that teachers' technological capabilities, interest in social media and willingness to use it for professional learning impeded effective learning and communication through such means.

In the context of EfS, where multisensory methods are essential for deepening students' understanding and fostering transformative learning by enabling them to "sense" sustainability issues (Heinrichs, 2021), utilising social media presents unique challenges. As an emerging area of research, the limited literature on teaching interdisciplinary but sensory topics such as EfS in online environments suggests that while digital platforms can facilitate engaging and sensory-rich learning experiences, significant challenges persist in replicating the hands-on, experiential learning (Aguayo & Eames, 2023). Therefore, this study aims to understand the challenges and barriers teachers face in their professional learning in EfS through social media.

The following section details the research design, data collection methods and analytical approach employed to investigate these challenges.

Research design

This study is grounded in an interpretivist paradigm (Crotty, 1998) which assumes that reality is socially constructed and that knowledge emerges from individuals' subjective experiences within their specific contexts (Denzin & Lincoln, 2011). Through this paradigm, the study focuses on understanding how teachers construct meaning and interpret their experiences of learning through social media in EfS (Guba, 1990). Interpretivism allows this study to explore participants' experiences and perspectives as they engage with learning through social media. Given this theoretical position, a qualitative approach was deemed most appropriate for exploring the research question. This approach emphasises an inductive process, enabling themes to emerge from participants' narratives and fostering a contextualised understanding of how teachers perceive professional learning through social media (Merriam & Tisdell, 2009). This helps to understand teachers' challenges and concerns in using social media for professional learning in EfS.

An online questionnaire, encompassing both open-ended and closed-ended questions was disseminated among EnviroSchools lead teachers. The EnviroSchools Programme is a holistic educational initiative in New Zealand that aims to integrate sustainability through a combination of educational initiatives, commitment to sustainable practices, and proactive environmental actions (Eames, 2010). The questionnaire garnered a 20% response rate: 90% identified as female, 77% above the age of 40, and 45% over 50 years of age. Demographically, the respondent profile reflects New Zealand national teaching staff statistics (Ministry of Education, 2018).

Four open-ended questions were included in the questionnaire (Table 1). The questionnaire generated both qualitative and quantitative data. The latter were analysed using descriptive statistics to identify participants' demographic features and social media usage (Pallant, 2010). The former were analysed using inductive thematic analysis (Boyatzis, 1998; Burnard *et al.*, 2008; Punch, 2014) to determine the patterns of data and to structure the findings and themes. In line with the study's theoretical approach and for the purposes of this paper, our focus is solely on the qualitative data obtained from four open-ended questions in the questionnaire.

Table 1. Open ended questions

Question
1. Rate how useful social media is for professional learning in EfS on a scale of 1 (not useful) to 10 (extremely useful) and explain your rating.
2. What could a new EfS social media learning network provide for you?
3. What are your concerns, if any, about professional learning through social media in EfS?
4. Please add any final thoughts about TPL in EfS through social media.

We received a total of 135 responses to one or more questions of these four. These responses were carefully examined, and any responses that did not specifically address the research question were excluded from the dataset. This process involved iterative and recursive analysis, allowing themes and patterns to emerge naturally from the data. Subsequently, we compiled a dataset of 101 responses directly or indirectly addressing the research question as the main source for our analysis.

As Table 2 indicates, the participants who provided answers related to challenges and barriers of TPL through social media belonged to different age groups, with most respondents falling in the age range of 40–59. Notably, the dominant demographic profile aligns with the statistical data on New Zealand national teaching staff (Ministry of Education, 2018), indicating consistency between the respondent demographics and the characteristics reflected in the questionnaire responses. The demographic composition of respondents and EfS teachers provides context for the key challenges identified in this study. These characteristics may have influenced participants' engagement with social media professional learning.

Table 2. Demographic characteristics of respondents who provided answers concerning challenges and barriers

Gender (<i>n</i> = 101)	Frequency
Female	89
Male	11
Not stated	1
Age (<i>n</i> = 101)	
20–29	2
30–39	13
40–49	34
50–59	36
60 and above	16

Data were transferred into NVivo 12 pro (a computer software package for qualitative data analysis). Using NVivo, answers with similar meanings, whether a single word or a paragraph, were grouped into categories to develop themes within the answers (Bazeley & Jackson, 2013). NVivo's coding capabilities enabled us to categorise these responses efficiently, ensuring that similar responses were grouped. This process not only streamlined the analysis but also provided a clear framework for identifying and interpreting the common, recurring themes reflecting the challenges faced by the participants. Coding and categorising the data allowed for an in-depth understanding of the challenges participants perceived and described.

To ensure clarity and organisation in the analysis, direct quotes from participants are specified using the initial 'T' for 'teacher', followed by the respondent number from 1 to 101. This

respondent number corresponds to a unique identifier assigned to each respondent's questionnaire, ensuring precise tracking and referencing of responses.

For the ethical aspects of research, ethical approval was granted by the University of Waikato Human Research Ethics Committee prior to beginning the research. Informed consent was obtained from all participants, and their privacy was protected throughout the research process. Ethical issues were considered at every stage, and confidentiality issues concerning the data collected and report writing were addressed (Lune & Berg, 2016).

The study identified several challenges participants faced regarding EfS professional learning through social media. The following section presents these challenges and concerns and discusses the findings.

Challenges in EfS professional learning through social media

Time

Findings from this study indicate that, “the overriding barrier to social media’s potential for professional learning in EfS is time” (T49). Describing their challenges and concerns, participants commented that “it will always be a matter of time constraint” (T14), emphasising difficulties such as “finding the time to connect and contribute” (T20) or having “no time to fully engage” (T49) in professional learning through social media. This is in line with the literature, which consistently recognises time constraints as a challenge for TPL (Lovett & Gilmore, 2003; Timperley *et al.*, 2007) particularly through social media (Chen & Bryer, 2012; Davis, 2015; Greenhow *et al.*, 2018, 2023; Sobaih *et al.*, 2016; Zhang *et al.*, 2017).

Our study found that participants’ concerns were not only related to the lack of time to engage in learning through social media, but respondents also pointed out that they have to devote their personal time to professional learning because “social media time is usually extra time outside work hours” (T68). For teachers “to be involved with social media, [they] would need uninterrupted time, and that is in the evening round” (T7). Time to engage in learning through social media “is outside of school hours” (T53), would “take up teachers’ personal time” (T74), and “would impact on work-life balance” (T7). This finding was consistent with a study that indicates that teachers can struggle to balance professional and personal boundaries when using social media for teaching or learning (Carpenter & Harvey, 2020).

In addition, teachers “can get side-tracked easily and waste a lot of time” (T57) because they are bombarded with “many posts” (T81) or “trivial” (T92) information. As the quality of information shared on social media can vary widely, it can be difficult and time-consuming (T91) to find useful information in an avalanche of posts, “inappropriate posts” (T79), and “unprofessional posts” (T45), and to verify the accuracy and credibility of the content. These findings are confirmed by those of Carpenter and Harvey (2020), which illustrate that finding and engaging with valuable professional content on social media can be time-consuming, as teachers have to sift through a lot of information to find quality interactions (Davis, 2015). This point has been emphasised as a weakness of social media in a study that discussed the findings of 132 papers on social media use for various purposes (Kapoor *et al.*, 2018).

The perception that teachers lack time for professional learning in EfS may be closely tied to the non-mandatory status of EfS within the curriculum. This may explain why participants described TPL in EfS through social media as “another add-on” (T46) and “an extra” (T38), as teachers “have enough to do already” (T30). Consequently, teachers would be reluctant to engage in learning through social media, “as it is an extra thing to keep up with” (T94), which often “gets shelved” (T51) due to teachers’ priorities.

This finding aligns with previous research, which suggests that time scarcity and the non-mandatory status of EfS contribute to its sidelining in professional learning (Evans *et al.*, 2017; Hill & Dymont, 2016). Teachers and students are less motivated to invest time in EfS teaching and learning,

as it is not seen to be a core part of the curriculum (Parry & Metzger, 2023). Previous research in New Zealand similarly highlights that many teachers perceive EfS as an additional burden rather than an integral part of their core responsibilities (Eames *et al.*, 2008). Our research findings echo the non-compulsory nature of EfS further complicating opportunities for professional learning through social media.

Volume and accuracy of information

Our research has shown that learning through social media can be time-consuming (T90), overwhelming (T52) and distracting (T80) — symptoms of social media information overload. One participant felt that teachers were inundated with a flood of information and posts on social media (T52). Others pointed out that on social media, teachers are overwhelmed with large amounts of information, which is often “not very focused” (T18). For example, a teacher commented: “NZ Teachers (primary) [New Zealand primary teachers Facebook page] has so many postings, and comments and time wasters that I had to block it from my Facebook feed” (T81). These findings align with Carpenter and Harvey (2019), who highlighted that the vast inflow of information on social media can become overwhelming and time-intensive for teachers to manage.

Teachers in our study were concerned about the reliability and validity of information shared on social media. One teacher, explaining her hesitation in joining social media for learning, remarked that “I’m not sure how reliable the information on social media would be” (T3). To highlight her concerns about learning through social media, another teacher wrote that “social media can be full of crap” (“e.g. teachers’ page on Facebook”), and this “makes it hard to sift through to get to the good stuff” (T50). Our findings are in line with the literature highlighting the spread of inaccurate information and posting of inappropriate, low-quality or unprofessional content as constraints on learning through social media (Carpenter & Harvey, 2020; Ranieri, 2019).

Participants in our study noted that irrelevant or “trivial” information distracted them from meaningful learning (T92). This reinforces concerns raised by Davis (2015) about the proliferation of low-quality information and unreliable resources, leading some teachers to view social media as a waste of time. These shared frustrations highlight how information overload, coupled with the perceived superficiality of social media, undermines its potential as a tool for professional learning in EfS.

Trust and privacy

Some participants were concerned about the “privacy” (T77) “of children and teachers” (T33) and “people not following digital protocols” (T40), leading to “poor online behaviour and not observing codes of conduct” (T34). One teacher commented, “I personally feel that on social media, there are always negative people” (T75). Another teacher expressed a similar concern, noting that some individuals “should not be [on social media]” (T71).

This concern is echoed in the literature, which has identified privacy (Bexheti *et al.*, Bexheti *et al.*, 2014; Chen & Bryer, 2012; Sobaih *et al.*, 2016), lack of trust (Carpenter & Harvey, 2020) and the reliability of so-called experts on social media (Carpenter & Harvey, 2020; Carpenter *et al.*, 2019; Hertel *et al.*, 2017) as barriers to using social media for teaching and learning. Participants’ concerns about the credibility of online content and the behaviour of individuals on social media platforms highlight the significance of digital literacy in improving online conduct and the critical evaluation of content. Making the most of social media affordances for professional learning requires digital literacy (Ranieri, 2019).

In addition, some participants indicated that they have not used social media in general (T6, T11) or have no skills or experience using social media for their learning (T10, T97). One participant expressed the view that using social media for learning places additional strain on teachers because it requires skills which they are “expected to have with no training or time” (T51).

Consequently, some participants declared that they would be inclined to use social media for their professional learning if it were easy to use (T26, T69, T54).

The teachers in this study did not specify how their inexperience with social media might lead to difficulties. The concerns may be related to privacy and online professional behaviour. The literature supports the notion that effectively incorporating social media into professional learning can be fraught with challenges, such as sharing inappropriate or private content in professional communities (Carpenter *et al.*, 2019). Learning through social media requires self-regulation, proactive strategies and a balance between professional and personal use, while maintaining professional conduct (Muljana & Luo, 2023). The ever-changing popularity of social media platforms also means that teachers must continuously adapt to new platforms, features and privacy policies.

While age and gender differences in using social media were not the primary focus of this study, the demographic profile of participants may have influenced the findings. A significant portion of the respondents may not be digitally savvy, making it challenging for them to adapt to new learning methods and platforms. This aligns with research indicating that older teachers, often struggle to integrate digital tools into their learning and teaching due to insufficient training and support (Carpenter & Harvey, 2020). Additionally, female teachers, who made up the majority of respondents, may have heightened concerns about online privacy and data security, further limiting their willingness to engage with digital professional learning environments (Marín *et al.*, 2022).

Preference for face-to-face learning

Participants in the study expressed a clear preference for face-to-face learning over learning through social media, citing various reasons for their choice. A key reason highlighted was the belief that meaningful collaboration happens more effectively in face-to-face settings through social interactions whereas “a virtual relationship is nowhere near as good as a real one” (T43). A teacher explained that “with social media it is highly possible for people to talk the talk. Personal interaction shows those who can walk the walk” (T97). These findings align with recent studies emphasising the value of direct interpersonal interactions. For instance, a study by Onyeaka *et al.*, (2024) compared online and face-to-face teaching during the COVID-19 pandemic, finding that the lack of real-life interaction in online settings raised concerns about teaching quality and effectiveness.

In the current study, teachers were concerned about the trade-offs between spending time on social media (in the virtual world) and spending time in “real life” (T86). For these teachers, it is “important to maintain human contact” (T17) because “teaching is about knowing people and relationships; using social media doesn’t promote either” (T27). A teacher commented, “I am not particularly interested in social media. Too disconnected for how I like to interact or develop a relationship with people” (T93). This finding concurs with Ernst *et al.*, (2020), who insist on the effectiveness of face-to-face collaboration in facilitating relationships, collaboration, dialogue and participatory learning for EfS professional learning.

In addition, teachers often find face-to-face interactions more conducive to meaningful collaboration and engagement (Mineia-Pic, 2020). These findings are consistent with earlier research by Arkorful and Abaidoo (2015), which investigated the effectiveness of e-learning in tertiary education. In a review of the literature, they remarked on the absence of personal interaction as a disadvantage for e-learning, due to a lack of “clarifications, explanations, and interpretations” (p. 35). Collectively, this body of literature underscores the importance of personal interaction in effective professional learning, suggesting that while social media offers flexibility, it may not fully replicate the benefits of face-to-face engagement.

Taking this further, teachers in our study regarded EfS as a sensory-rich and practical subject, emphasising the importance of hands-on, experiential learning. Some participants highlighted the limitations of social media in creating meaningful educational experiences with regards to “EfS as

a practical subject and for the hands-on type of learner” (T7). Teachers “use practical ways to explain sustainability” (T86). On social media, in contrast, “all senses are not engaged, and teachers do not get outside and get their hands dirty” (T43). Another teacher wrote that “there is a place for social media. However, I believe that hands-on and face-to-face are more effective learning tools because you are using more of your senses, you are able to question, which in turn makes the experience more memorable and more likely to effect change (learning)” (T27). One teacher even mentioned, “I would hate to see engagement in nature become engagement with technology out in nature” (T35). Learning for teachers is more meaningful and effective when it is face-to-face and offers a promising pathway to fostering a deeper, more resonant connection with EFS.

It can be argued that characterising Efs as primarily “practical” (T90), providing “active curriculum” (T61) and “hands-on activities” (T24) can lead teachers to a singular focus on its ecological aspects, in activities such as recycling, replanting or making “a worm farm” (T86). This conception is consistent with research by Bolstad *et al.*, (2015), reporting that the *action-oriented* aspect of Efs (in the form of hands-on activities) has been the most widely accepted and promoted characteristic of Efs in New Zealand schools.

To further unpack this, the concept of EfS is complex and can be interpreted differently, resulting in an emphasis on its pro-environmental behaviour aspect (Taylor *et al.*, 2009), possibly at the expense of other elements which can be fostered through learning through social media. This finding underlines the necessity for comprehensive TPL, enabling teachers to fully explore and integrate all aspects of sustainability into curriculum and pedagogy. Such professional learning recognises the part that social media can play in developing a comprehensive understanding of sustainability, including economic, social and environmental aspects, empowering teachers with a holistic view of sustainability practices and principles.

Collectively, the study findings indicate that many factors described by participants ultimately led them to express a preference for “face-to-face” learning. In a word cloud created using NVivo, the word “face” appeared to have the highest frequency (Figure 1). This is because the software counted each instance of “face” in the phrase “face-to-face” separately, effectively doubling its occurrence. While this technical aspect of word counting contributes to the high frequency, it also aligns with participants’ consistently expressed preference for face-to-face learning, reinforcing the importance of such interactions in EfS professional learning.



Figure 1. The predominant themes and concepts identified in our study.

Discussion

Teachers face multiple barriers and challenges when using social media for professional learning in EfS. These challenges are shaped by each teacher's personal and professional preferences and skills, social media characteristics and the position of EfS in the New Zealand educational framework.

A teacher with strong digital skills may use social media effectively to find information and resources or connect with other teachers, while another teacher who has progressed less in digital literacy needs more time to sift through online resources and may find it too time-consuming. Likewise with privacy concerns, teachers with a strong command of digital technologies are better equipped to implement effective privacy protection measures. Conversely, those with less proficiency in technological skills often have greater concern regarding privacy issues.

Social media's openness, accessibility and flexibility offer teachers broad resources, professional networks and opportunities for collaboration. However, these benefits are counterbalanced by concerns over the accuracy of information, the overwhelming amount of content, privacy issues and the distinct nature of virtual interactions compared to traditional, in-person learning. The overwhelming volume of material and information presents a specific challenge for users, who must filter through vast amounts of content to find useful and relevant material. The lack of clear, focused and up-to-date EfS teacher guidelines exacerbates this issue. Additionally, while social media provides a platform for sharing ideas, it often falls short in offering practical, hands-on experiences essential for EfS professional learning.

Education for sustainability in New Zealand is characterised by its broad, interdisciplinary nature. However, it is not the primary focus of the curriculum, making it a lesser priority for teachers. As a result, many teachers feel they do not have enough time to engage in EfS learning through social media. Furthermore, EfS is approached as a hands-on practical subject demanding more time, social interaction and resources for experiential activities. Teachers noted the conflict between the practical or real-life aspects of EfS and the theoretical virtual nature of learning on social media. Consequently, this misalignment makes discussion-based social media unfit for TPL in EfS.

Conclusion and recommendations

For many teachers in New Zealand, particularly those in remote areas or serving as the sole EfS teacher in their schools, the lack of formal professional learning and a supportive learning community highlights the need for alternative learning. Social media offers opportunities for collaboration, resource-sharing and peer support. However, its use is not without challenges, stemming from the inherent features of social media, individual teachers' personal and professional preferences and skills, and the positioning of EfS within the New Zealand educational framework.

Overcoming challenges and barriers in TPL is essential to bridging gaps in EfS professional learning. While attempting to alter factors such as teachers' interests or the characteristics of social media may be unrealistic, modifications in other areas are more achievable. A promising strategy involves establishing specialised professional learning networks specifically tailored to the needs of teachers engaged in EfS. Such networks offer targeted opportunities for collaboration, access to reliable resources, and dedicated professional support (Carpenter & Krutka, 2014; Jupri *et al.*, 2022; Trust *et al.*, 2016). By fostering these exclusive networks, teachers can address issues such as information overload and privacy concerns while improving the relevance and quality of content, ultimately saving time (Carpenter & Harvey, 2020; López-Torres *et al.*, 2022). Additionally, providing teachers with time management strategies for social media use, such as the creation of focused communities or hashtags that aggregate EfS-related content, could be highly beneficial (Davis, 2015; Greenhow *et al.*, 2023; Muljana & Luo, 2023; Veletsianos, 2016).

For teachers to develop focused and targeted professional learning networks or to engage effectively with relevant hashtags and online communities, they require dedicated time. Studies highlight the potential of collaborative networks and social media in enhancing professional learning when supported with adequate time and structure during school hours (Jupri *et al.*, 2022; López-Torres *et al.*, 2022). This integration ensures that professional learning is not an additional burden but a core component of their professional responsibilities (Avalos, 2011; Darling-Hammond *et al.*, 2017). Therefore, integrating professional learning into teachers' working hours is another promising approach that eliminates the need to allocate their personal time (Bredeson, 2000). This is particularly relevant in New Zealand, where the non-mandatory status of EfS reduces teachers' motivation to pursue professional learning outside school hours.

When teachers have the opportunity to engage in professional learning during work hours, they are more likely to apply new technologies in their teaching practices effectively and feel less overwhelmed by the demands of time management (Darling-Hammond *et al.*, 2017). For New Zealand teachers, who are often solely engaged in EfS in their school or area, learning during school hours provides opportunities for collaboration with teachers across subjects. Given the interdisciplinary nature of EfS, this collaboration not only supports EfS teachers in sharing strategies, troubleshooting challenges and accessing immediate support but also enables them to engage and inspire other teachers to integrate sustainability concepts into their own teaching.

Future research could explore the effectiveness of allocating time within the workday to support teachers in navigating and critically engaging with EfS professional learning through social media. Investigating how these adjustments influence teachers' long-term engagement with EfS professional learning would provide valuable evidence to inform policy changes. Additionally, longitudinal studies on integrating professional learning into teachers' work routines could offer crucial insights into its role in enhancing the implementation of EfS.

In conclusion, as we continue to face global environmental crises, re-envisioning TPL in EfS is not a recommendation; it is a necessity. To this end, the elevation of TPL in EfS as a critical and legitimate aspect of professional work will be a key driver in fostering a sustainable future. In this re-envisioning process, social media can be used to connect teachers with experts, and resources, promoting collaborative learning and enabling them to engage in EfS teaching and learning. In light of this, Barth's (1990) vision of schools evolving into environments where TPL and teaching coexist under one roof is worth considering for EfS.

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Author Biographies

Fariba Mostafa teaches at the Otago Business School, University of Otago, where she designs workshops and learning activities that embed sustainability into business education. Her research explores teacher professional learning across school and tertiary contexts, with a particular focus on education for sustainability.

Chris Eames is an Associate Professor in environmental and sustainability education at the University of Waikato's School of Education. He is contributing to the OECD's 2025 PISA as a member of the Environmental Science Expert Group, and served on the Subject Expert Group for the Review of Achievement Standards for Environment and Societies in Aotearoa New Zealand from 2022 to 2024. His research and evaluation projects for the Ministry of Education and the Teaching and Learning Research Initiative have also focused on enhancing Education for Sustainability.