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Bridging the Pedagogical Gap Between Operational and Contextual Affordances with Social Media

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Colmare il divario pedagogico tra *affordance* operative e *affordance* contestuali nei social media

The usage of social media in education is increasing as a result of perceived pedagogical benefits. The literature emphasizes the importance of teachers continuing to build their social media capabilities, experiences, and values. Critical thinking, problem-solving, and the ability to contextualize social media require intellectual, social, and ethical talents regardless of operational proficiency. We performed a semi-structured interview with 13 high school teachers who expressed their thoughts and experiences using social media in the classroom. The interviews' recorded videos were transcribed into text and coded inductively and deductively for analysis. The study's findings agreed with a proposed conceptual framework that claims that regular interactions with social media enable teachers to better understand and teach with it. The paper presents a framework to assist education facilitators, educational technologists, teachers, and other affiliated agencies in refocusing their efforts on technology-assisted context training. It also emphasizes the significance of engaging with technology regularly.

L'utilizzo dei social media nell'istruzione è in aumento grazie ai benefici pedagogici percepiti. Studi sottolineano tuttavia l'importanza per gli insegnanti di una costruzione continua delle proprie abilità, esperienze e valori relativi ai social media. Il pensiero critico, la risoluzione dei problemi e la capacità di contestualizzare i social media richiedono attitudini intellettuali, sociali ed etiche, indipendentemente dalla competenza operativa. Abbiamo condotto un'intervista semi-strutturata con 13 insegnanti di scuola secondaria di secondo grado che hanno espresso considerazioni ed esperienze circa l'utilizzo dei social media in classe. I video registrati delle interviste sono stati trascritti in formato testo e codificati in modo induttivo e deduttivo per l'analisi. I risultati dello studio sono in linea con le prospettive teoriche che affermano che interazioni regolari con la tecnologia forniscono agli insegnanti conoscenze e strumenti per insegnare efficacemente con la tecnologia stessa. L'articolo delinea un quadro per aiutare facilitatori dell'istruzione, tecnici dell'educational, insegnanti e altre organizzazioni interessate a riorientare i propri sforzi e la formazione su contesti tecnologicamente specifici. Si sottolinea inoltre l'importanza di dare continuità all'uso didattico della tecnologia.

Keywords: Affordances; High school teachers; Contextual affordances; Operational affordances; Social media.

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1. Background

The emergence of digital technology such as social media (hereafter SM) has potentially changed the narrative of the traditional way individuals and organizations communicate (Vandeyar, 2020). In essence, individuals and organizations can now digitally access information and remotely communicate or share resources (Manca, Bocconi, & Gleason, 2021). In a similar way, teachers and students need access to internet services to communicate remotely, socialize, interact and share digital resources with culturally diverse colleagues who are thousands of miles away (Greenhow & Askari, 2017). However, the study tries to explore how teachers contextualize SM in teaching and also if there are some constraints they encounter during teaching with SM.

Indeed, it was only with the introduction of the Internet that the phrase "social media" came to have the meaning it has today, as well as the status of a buzzword (Allen, 2013; Boyd & Ellison, 2007). More specifically, it's critical to acknowledge SM's historical roots and conceptual congruence with Web 2.0. It emphasizes that the word "social media" which on the one hand, refers to the evolution of socio-technical practices that relied on "new programming languages, database systems, and architectural standards" and on the other hand, a new paradigm of interactivity (Boyd, 2015, p. 1). In this view, "social media" as a collection of socio-technical practices has embraced a vision of the Network as a "living web of humans and computers co-creating/producing/consuming a dynamic information and communicative sphere" (Fisher, 2018, p. 41).

From a technical standpoint, SM is a set of Web 2.0 computer-based technologies that allows users to seamlessly produce and consume content through the construction of virtual networks and communities (Kietzmann & Hermkens, 2011; Mpungose, 2020). SM has been defined historically by Kaplan and Haenlein (2010) as "a group of Internet-based applications that build on the ideological and technological foundations of Web 2.0, allowing the creation and exchange of user-generated content."

In the context of this study, SM is defined as a Web 2.0 application that allows users to communicate and interact by chat, video, or audio calls. SM application includes Facebook, WhatsApp, Twitter, Skype, Google Classroom, Zoom, and a host of others (Appendix A). Besides being easy to use, SM has come with many operational (technical) affordances, which are perceived to have pedagogical potentials and some constraints.

Indeed, SM has brought some innovations into the classroom. Teaching is now more interactive than it was in the past two decades (Hwang, Wang, & Lai, 2021; Jack & Higgins, 2019). Also, teachers can now use SM videos to explain previously abstract concepts and content (Otchie, Pedaste, Bardone, & Chounta, 2020). In this regard, technology has enhanced the learning experience by facilitating students' understanding. As a result, digital technology has placed many educational institutions ahead of their peers. For instance, Estonia is a technology-savvy country and as of 2018, as many as 90% of Estonian schools offered technological training under the Progetiger program (Aru-Chabilan, 2020). Even more, 98% of 16–24 year olds were online every day, and 21% of them had some programming experience (Aru-Chabilan, 2020). Subsequently, Estonian students consistently surpass most of their European peers in PISA tests in the areas of science, mathematics, and functional reading (OECD, 2018). In contrast however, another study has shown that almost 95% of UK students use SM for things that aren't related to their education, despite the fact that SM have the potential for education (Pangrazio & Selwyn, 2018).

Despite the benefits and affordances, there is a lack of consensus among the research community and educational stakeholders about integration of SM into the school curriculum. On the one hand, they claim SM comes with many benefits and affordances (Otchie, Pedaste, Bardone, & Chounta, 2021). On the other hand, they are concerned about possible abuse of the system by some students (Grau, Kleiser, & Bright, 2019; Waters, Russel, & Hensley, 2020). Moreover, SM use in education is growing due to the perceived affordances in pedagogy, but the outcomes and benefits are unclear across studies and do not reflect the acclaimed challenges and affordances associated with SM (Greenhow & Lewin, 2016; Otchie & Pedaste, 2020). This perception could be due to many reasons. Indeed, the lack of consensus among parents, teachers, and other stakeholders might be a factor. However, does the teacher really have the ability to use SM in the context of teaching? Likewise, the absence of a clear policy guideline by institutions has also put the teacher in a precarious state where he/she cannot identify the

"grey" boundaries in terms of teaching with SM (Marín, Carpenter, & Tur, 2021). These concerns put some restraints on teachers. So, to identify and address the problem, this study adopts an ethnographic approach to understand how high school teachers use SM in the context of teaching in the classroom and the constraints they encounter.

Notwithstanding these concerns, there is a rising interest among students, as they seamlessly access trending information and learning resources on SM. This development makes the 21st-century students more informed and curious to inquire more. This change is therefore perceived as a wake-up call for teachers to scale up their competences in technology if they still want to be relevant and be seen as change agents (Schuck, Aubusson, Burden, & Brindley, 2018).

Admittedly, the approach to learning has taken a new turn. SM has leveraged the gap between informal learning and formal learning. Many skills and competencies that teachers and students have acquired through the use of SM would not have been possible without informal learning (Greenhow & Lewin, 2016; Mpungose, 2020; Peters & Romero, 2019). Consequently, these digital knowledge and skills are brought to the classroom, thus applied in a formal learning context. This makes informal learning now crucial to digital literacy (Peters & Romero, 2019). However, effective technology use, has evolved beyond digital literacy, independent of informal learning. Digital fluency is the primary factor that contributes to a person's proficiency and confidence in using SM. Fischer (2005) argues that computer fluency requires a more fundamental understanding and command of information technology than traditional digital literacy and is a crucial condition for building a personal, deep interaction with media. The NRC (1999) report also reiterated the concept of acquiring digital fluency as a way to increase efficiency in technology use.

Meanwhile, COVID-19, a novel virus discovered in late 2019 in Wuhan, China, led to the lockdown of many economies as a consequence of its devastating spikes (Huang *et al.*, 2020). This impacted education greatly. Teachers were compelled to resort to teaching remotely using SM tools like Zoom, Google Classroom, Facebook, YouTube, etc., to connect to their students from their homes (Kara, Çubukçuoğlu, & Elçi, 2020; Williamson, Eynon, & Potter, 2020). This practice of remote teaching has become a "nightmare" especially for teachers who have no experience in online teaching (Dau, 2022; Tsegay, Ashraf, Perveen, & Zegergish, 2022). Indeed, online teaching has exposed teachers' ability to use technology but also fuelled the debate on SM adoption into our school curriculum. However, in an earlier study conducted by Rivoltella and colleagues (2012), they argue that digital technologies provide an opportunity to disrupt traditional education models by defining new conceptual and operational scenarios for teaching and learning in order to bridge the divide between passive and participatory teaching approaches.

On the basis of the aforementioned potentials of technology in education, we cannot agree more with Oliver (2016) that, SM like any other technology, is neutral until the context of use is defined by the user. Therefore, SM's effectiveness hinges on the teachers' ability to contextualize it in their instructional activities (Aagaard, 2018). Consequently, the context in which it is used is dependent upon the user (Aagaard, 2018; Lanamäki & Stendal, 2015). Therefore, we concur with Haines's (2015) claim that when a user fails to use SM affordances contextually, this can lead to misuse or underuse. Hence, many researchers believe that SM has a lot of potential as an educational tool despite its perceived shortcomings (Van Den Beemt, Thurlings, & Willems, 2020; Greenhow & Chapman, 2020).

Therefore, this study specifically focuses on teachers' ability to use SM tools in the context of teaching and learning. It reviews Gibson and Polanyi's concepts of affordances and indwelling, respectively. This is followed by presenting and describing the methods used in conducting this study. Common themes emerged from subsequent patterns in the data analysis which leads to the findings, the details of which unfold later in the narrative. Then comes the proposed conceptual framework for teaching with technology and its impact on students and teachers. The study concludes with a discussion on the outcome of the intervention and the proposed conceptual framework.

2. Conceptualizing Affordances in Social Media

Affordance is an interdisciplinary concept that first originated from Gibson in the field of ecological psychology; he defined it as "what things furnish, for good or ill" (Gibson, 1979, p. 285). According to

Gibson, "the affordances of the environment are what it offers the animal, what it provides or furnishes, either for good or ill ..." (Gibson, 1979, p. 127; Gibson, 2015, p. 119).

To Gibson, the concept is more of a relationship a person (or an animal) has with the environment. Consequently, the environment provides a range of action possibilities (called affordances) and furnishes the person (or animal) with good or ill depending on what relationship exists between them. However, in our interpretation of affordances as rooted in relationship, we agreed with Aagaard's position that affordances are reciprocal and exist irrespective of the subject.

Again, Gibson's concept further underscored the fact that all objects can afford various uses: "The fact that a stone is a missile does not imply that it cannot be other things as well. It can be a paperweight, a bookend, a hammer, or a pendulum bob" (1979, p. 134).

Norman (1988), being the first to introduce affordances in design studies and human-computer interactions (HCI) proposed an alternative definition that focuses on perception. To Norman, the term affordance refers to the perceived and actual properties of an object, mainly those essential properties that define how the object is used. For example, a chair affords ("is for") support and therefore affords sitting. A chair can also be carried (Davis & Chouinard, 2016, p. 243; Norman, 1988, p. 9). This means that affordances are the attributes of the tool (environment) which provide potential for action; the constraints are the conditions and relationships amongst attributes which provide structure and guidance for the course of actions.

Having said that, it is imperative to situate affordances of a tool (e.g. SM) in terms of operational (technical or design focus) and contextual uses. For example, SM offers a range of categories based on its design focus (See Appendix A). As a result, for example, Skype and Zoom can be classified as SM, but they clearly have a different design focus than Facebook or Instagram, which do also allow video calls. Essentially, operational affordances of any technology are design-driven, thus enabling the user to operationalize the technology as designed (Otchie, Pedaste, Bardone, & Chounta, 2021). In a related study, Zuboff (2015) argues that although technologies have their unique affordances, they are also defined by the paradigms that govern their design, implementation, and use. In essence, Zuboff is referring to the fact that technological affordances — what a particular type of technology can afford — are predicated on a certain ideology.

As a consequence, operational (technical) affordances are the same across contexts and disciplines (Raut & Patil, 2016). For example, universities, high schools, basic schools or professional institutions use the same approach to collaborate, communicate or search and disseminate information in SM. However, contextual affordances are context-specific and thus dependent on the user as well as the context. For example, contextualizing SM in teaching a lesson encompasses assessing the suitability and selection of digital resources, editing of resources, demonstration of competence and confidence in use, setting out tasks, and giving feedback. Contextual affordances also allow the teacher to focus on the lesson rather than the technology. As a result, students are more engaged and better able to comprehend. This concept makes contextual use of SM different across contexts and disciplines. Importantly, contextualizing SM for meaningful use hinges on affordance, which is rooted in the relationship and innovation.

As a result, the focus of our study is on affordances and how they influence the contextualization of technology. In light of this, we propose relationship as a crucially important concept which facilitates acquisition of experience and the formation of perception about artefacts. Relationships, by their very nature, are implicit forms of knowledge acquired through experience and can't be documented. Polanyi (1983) calls this tacit knowledge. According to him, one must "dwell in" a tool (artefact) to be able to contextualize its use purposefully and meaningfully (Polanyi, 1983, pp. 10-13). In a study, van Pelt (2011) argues that grasping an object with the intent of using it as a tool is intuitive precisely because learning to use tools and learning to indwell one's own body are both experiences that begin in childhood. Polanyi claims "the use of a probe to explore a cavern, or the way a blind man feels his way by tapping with a stick" to maintain and indwell an interior visualization of the unseen cityscape (Polanyi, 1964, p. 12). In both cases, as soon as one starts pushing and searching for something interesting, the stick is no longer felt as separate from the user.

So, by dwelling in a tool, Polanyi means there is a need for such a relationship that one's cognition appears to synchronize with the object, thus making it behave like an extension of one's hand. Crucially, a contemporary example of bodily extension is the attention given to smartphones. According to Drain

and Strong, smartphone "becomes incorporated within the assemblage of bodily appendages, environmental features, and artefacts that we encounter in everyday life, to the point where the phone can be considered as a prosthetic extension of ourselves" (2015, p. 190). Hence, Polanyi's concept came alive and resonates more, especially in many studies on physical and emotional attachment people have on technology such as smart TV, smartphones, smart homes, smart classrooms, etc., which has potentially embodied their capabilities as an extension of human cognition (Gant & Kiesler, 2002; Miller, 2014; Miller, 2015). This relationship is manifested through experiential encounter with these tools because of regular dialogue. Ultimately, stronger relationships develop, which potentially build confidence, control and competence, which constitute a range of tacit dimensions of knowledge needed to contextually use technology. The consequence of this regular dialogue and the perceived affordances give teachers the leverage to articulate SM or any technology pedagogically. Thus, dwelling in the tool allows teachers to gain control, confidence and expertise to contextualize SM in the teaching and learning process.

2.1. Rationale of the Study

The current study examines teachers' perspectives in terms of their relationships with SM use and their ability to articulate it in the teaching process. Essentially, teachers' relationships with SM will be contextualized in explicit and implicit (tacit) knowledge dimensions. The following research questions were devised:

1. How do teachers contextualize SM in teaching?
2. What are the constraints teachers encounter during teaching with SM?

3. Methodology

The study employs ethnography as the methodological approach to describe and understand the use of SM in education from the teachers' perspective (Cohen, Manion, & Morrison, 2013). Hence, this approach helps the researcher develop an understanding to integrate his/her theoretical knowledge, conceptual knowledge and perspectives and those of the participating teachers (Hammersley & Atkinson, 2007). Although ethnography research is based on fieldwork, which demonstrates traditional face-to-face approach to data collection, it also gives consideration to remote data collection that is conducted in an online environment (Walker *et al.*, 2020).

3.1. Data Collection

The study employed purposeful and convenience sampling and, in a few cases, the snowball approach as the sampling procedure. First, emails were sent to selected secondary schools in Estonia as well as the Estonian Biology Teachers' Association. The study aimed at finding teachers who would be interested in sharing their experiences about teaching with SM. Subsequently, interested teachers responded to the emails and a follow-up was organized to provide them with the guidelines in addition to the letter of consent. A semi-structured interview consisting of open-ended questionnaires (Appendix B) was used to interview 13 participants remotely through Zoom, where they were also asked to show samples of the lessons and videos they used to teach. Also, regardless of the consent protocol, participants were again assured of the purpose of the study and the confidentiality of the data. They were again asked if they agreed to be video recorded before the interview began. This process began in early September 2020 after a pilot interview was conducted to validate the instrument (Creswell, 2014). The data collection lasted from September 2020 to December 2020. All participating teachers with ID numbers had 3-35 years and 3-26 years' experience in teaching and teaching with technology, respectively (see Appendix C). Also, all participants were professional teachers with a minimum of a master's degree in education, a few having two master's degrees in education and science, and one participant had a doctoral degree in physics. In terms of gender distribution, four were males (31%) and nine were females (69%). The interview was remotely conducted in English via Zoom environment, where participants were asked to share their experiences and challenges during teaching with SM. Although 11 of the teachers were not

native English speakers, they spoke the English language fluently. The interviews lasted approximately 30–55 min. Some analytic memos were written during the interviews, particularly to summarize the researcher's impression about the interview and to write down points for reflection and those that need further clarification. The teachers' initial response to participate in the study was pretty fast and encouraging. However, it later took a slower pace and quite a few appointments were later cancelled. No reasons were given, though. Also, regardless of the relatively small sample size, the objectives of the interview were duly accomplished. Eventually, the data that comprised the recorded video, written memo and interview transcripts were all kept in a folder with a password to maintain their confidential status, allowing only the researcher to access the folder. The data produced will be stored in the cloud under a password for a few years and later deleted. Also, data in the form of a hard copy will be shredded and those on the researcher's laptop permanently deleted after the publication of the article.

3.2. Data Analysis

This study relies on each participant's responses to the interview questions to answer the research questions outlined in the narrative. As previously noted, the researcher conducted a remote interview through Zoom environment, where semi-structured open-ended questionnaires were used in addition to analytical memos. All videos recorded from the interview were duly transcribed into text format.

Incidentally, all the transcripts and the analytic memos were read more than once to get some clarity in terms of participants' responses in the data. The analytical memos, on the other hand, gave an overview of the impression to address the content of each interview. Preliminary analysis of the transcripts revealed diverse data related to experience, insights, and constraints. Before coding, we operationalized affordances in terms of benefits and constraints or *good or ill* as contended by Gibson. The study used thematic analysis (deductive reasoning) as an approach to search for themes that emerge as important to describing their occurrence. (Creswell & Poth, 2017; Braun & Clarke, 2006). These were openly and directly coded. First coding was done inductively by careful reading and re-reading of data to identify the themes and some patterns within the data. The codes were deductively mapped into a set of categories based on the literature and the theoretical framework to from the themes based on the affordance concepts emerging from the transcripts. On one hand, affordances were coded in terms of text that implies potentials, capabilities, possibilities, benefits, and advantages and on the other hand, as constraints, restrictions, limitations, and disadvantages. Thus, the evolving patterns became the themes for the analysis. (Rice & Ezzy, 1999, p. 258). All these helped organize and refine these categories to form two themes: (1) potentials and (2) constraints/drawbacks of teaching with SM.

4. Findings

Many affordances emerged in using SM in the context of teaching. During the interview, teachers reported several kinds of potential and experiences SM afforded them in their teaching activities. Besides the opportunity to remotely connect with their students, they could also select their students and group them based on their abilities and competencies to collaboratively perform tasks while they remotely supervised them. As one teacher noted,

> This technology makes us more motivated as we perform many traditional tasks in a virtual environment. Well ... I am currently in quarantine but teaching my students from home. Zoom provides me the opportunity to connect with my students currently in the classroom with their iPads ... with the help of my wonderful colleague teachers who stepped in to connect me to my class. So, even though I am in quarantine, I have been able to connect remotely with my school and class ... and everything works fine. The whole lesson was also recorded for students to watch it over again in the comfort of their homes to facilitate understanding of the lesson. It also affords students who were absent from school the opportunity to watch the recorded lesson to enable them to catch up with the activities in class.

This affords teachers the opportunity to teach their lessons from any location without necessarily having to be in the classroom. This is what another teacher said:

> The future is already in some schools ... Partially, learning is going to be online. Some schools have created a system where students can be in school for a few weeks and spend the rest online. I think the future is combining both methodologies of teaching and learning ... blended learning.

This would afford teachers and students diverse teaching and learning opportunities and flexibility.

The consequence of the COVID-19 pandemic has hastened the frequency and intensified the need to use SM, particularly for remote teaching and learning. Also, the market shares of IT companies surged as online commercial activities heightened. Regardless, COVID-19 has undoubtedly brought severe hardships and disruptions to individuals, institutions, and economies. Schools were closed across countries which made traditional teaching and learning impossible. SM has become what could be described as a lifeline for many institutions, including schools, to remotely connect and continue with their activities online. Although COVID-19 has caused untold hardships, it could have been worse in the absence of digital tools such as Zoom, Facebook, Twitter, WhatsApp, YouTube, and a host of other SM platforms. This has amounted to high spikes in SM usage in recent times (Greenhow & Chapman, 2020). Essentially, the present study was not about what teachers did during the COVID-19 pandemic; however, because we conducted the interviews during the pandemic, it was obvious and inevitable that teachers made reference to that. This is how one participant described it:

> I think the pandemic has made teachers more proactive by preparing and storing more digital materials ... for example, these videos I have created will not be possible if not for COVID-19. Eventually, COVID-19 has made me use digital resources in my teaching more frequently.

Another teacher shared her thoughts:

> COVID-19 has changed my perspectives ... now I think everything is possible ... A year ago, my principal could not accept that I travel and be away for some time during school session. Now because of COVID-19, I can travel and still connect with my class remotely.

Here is how similar sentiment was expressed by another teacher:

> I would say COVID-19 situation has made me improve my technique in terms of how I can deliver synchronous lessons in an online environment. Also, it made me to pay more attention to time management, kind of prepare everything in advance that I do not go over time. I think I also gain more skills in using of YouTube video to give different examples and perspectives of my topic. It's been a good practice.

Concerning the future of SM in education, here is another teacher's response:

> I think these SM and other digital platforms can help us a lot in the classroom as well. So we can use it to monitor and track student learning and make it more efficient to see who is struggling and to help those students faster. Also, if they are struggling, I can pay more attention to them. In addition, it is also easier to see which topics students are still struggling with. It also gives me instant feedback on the lesson.

As for meeting any milestone in terms of teaching during the COVID-19 pandemic, here is what one teacher said:

> I think they are both like negative and positive ... For example, the positive side is that Estonian teaching system is innovative. So even though the pandemic has caused several troubles, we survived it well. So it means that even though we had a hard time and some did not imagine teaching and learning will be possible, then we proved it.

Although the COVID-19 pandemic has hastened and heightened teachers' relationships with SM pedagogically, regular dialogue with SM is the reason for discovering new affordances. This came up during our interaction with participants. Essentially, we discovered that participants had unrestricted access to using digital devices, both on the personal and on the institutional level. During our conversation, teachers disclosed how they were using these digital tools regularly in performing many tasks, including teaching and learning before the COVID-19 spike. This practice contributed to forming a bond with the tools and ultimately perceiving and discovering new affordances. For instance, one participant disclosed how he used these tools regularly in his teaching activities: "Notwithstanding the training we had to use GoFormative environment (LMS) and Zoom apps... we were also allowed to freely choose and use any relevant digital environment to teach our lessons." One teacher explained how regular use of SM influenced her teaching:

> Teaching with digital tools or SM is not difficult for me. For me, teaching remotely was pretty much easier than for most older teachers. So in school, I use digital tools during class lessons and my students are familiar with these tools ... I do give them iPads in class, they are pretty comfortable because they knew how to use them.

Multiple participants described how their previous experiences with SM tools contributed to their teaching. A physics teacher reflected on how his experience largely influenced and motivated him to use SM and other digital tools in his lessons:

> Yeah, my previous experience with technology helped me a lot! I would say I teach with YouTube videos because it helps me to use different perspectives to explain the topic. Before selecting any video, I always watch it first to review the topic and then I share it with the students as well ... the good thing about video is that it makes the lesson real and the interactive visual provides different perspectives to the lesson which facilitates students' reflection and understanding. Also students can watch it even at home. Beside YouTube, I use Zoom to teach online lessons.

One teacher explained why she preferred using Zoom to other tools:

> I chose Zoom because it has excellent features. Microsoft Teams and Google Meet do not give me chance to put students into breakout room. I really love that feature. It gives me the leverage to pair the weaker students with the brilliant students using Zoom ... This affords the weak students to be guided by their brilliant peers.

Here, this teacher relied on peer and collaborative learning within the Zoom environment. Thus, brilliant students could scaffold their weaker colleagues. Another teacher remarked, smiling:

> For me, teaching with technology is easy because I use these resources to teach my lessons all the time. For example, YouTube videos help me to interactively show visual and spatial orientation of the structures and reactions in atoms, molecules and compounds in my chemistry lessons. These are abstract concepts which hitherto were difficult for students to visualize in my traditional lessons. Now with YouTube videos students are motivated to learn chemistry because they can visualize abstract concepts.

As one teacher noted, she gained confidence by regularly teaching with technology:

> I became more confident as I regularly teach in the Zoom environment ... and this makes it possible, especially for online teaching using the breakout rooms which provides me the opportunity to group my students remotely and assign them to work on a class task ... and of course I do go round to inspect their work and give feedback remotely just like in a traditional class ... interesting.

After observing remote demonstration of teaching with digital tools, we discovered that teachers integrated different digital multimedia tools such as text, videos, pictures, etc., during the teaching activities. According to participants, this approach of integrating different multimedia tools motivates students and makes teaching and learning more effective, a finding also reported in many studies (Mayer, 1997; Ni, 2017). During our conversation, we asked teachers to show us the kind of digital tools they used, how they prepared the lessons, and most importantly, how they taught with these tools. Screenshots from videos, presented below, demonstrate how a teacher prepares and delivers his chemistry lessons with a YouTube video in class or remotely via Zoom digital environment. Figure 1 shows a screenshot of a YouTube video on the bonding of a water molecule. According to the chemistry teacher, he selected this video because it gives a 3-D visualization, which is more interactive and interesting, thus motivating students to easily see how molecular bonds are formed and also visualize the angles of the rotation in bonds. In the traditional class, 2-D images are used to explain this abstract concept, and this makes it difficult for students to understand. Also, according to another teacher, the LMS he uses comes with some learning resources, particularly in the form of text, pictures, videos, etc. However, he reported regularly searching for supplementary materials on YouTube to make the lesson more visual and interactive, which helps to explain abstract concepts. He does this search using his pedagogical, content and technological knowledge and skills (Mishra & Koehler, 2006). Here, the teacher tried to contextualize these resources in the teaching process. This was his response when asked about how he used the videos in his lesson:

> Yes, I use YouTube videos in my lesson, and sometimes I share the link to my students to watch at home and reflect as a requirement to participate in my next lesson. In the video on bonding, for instance, I asked my students to watch how chemical bonds are formed in chemistry that is also related to our physics topic. The video affords them to see 3-D images that are interactive and graphically demonstrating why bonds do not have energy. This contributed to making an abstract concept real and practical to my students ... Then, I ask them to form small groups so they can collaborate to work on a task. This task is sometimes an open-ended questionnaire for reflection on the lesson.

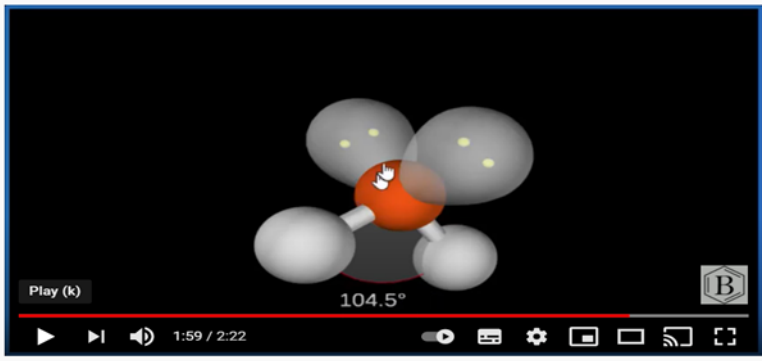

Figure 1 – Water Molecular Geometry and Bond Angles

Another teacher demonstrated how she collectively used YouTube videos and resources from GoFormative LMS to teach a plant cell topic in biology and give feedback (see Figs. 2 and 3). According to her, the GoFormative environment had some resources. However, teaching with YouTube reportedly made her lessons more interactive, interesting, and comprehensive. Also, she emphasized that it saved time and resources, unlike having the same practical lesson in a traditional class. Here was her remark on Figure 2.

> The video of a plant cell looks more graphic and spatial and comes with an interactive window to help students perform activities to master the functions of the parts of the plant

cell. Certainly, the interactive video saves time and inconvenience to mount such an experiment, such as, for instance, preparing slides of plant cells, or cutting slides of a plant part and applying iodine, then mounting it and fine-tuning the microscope until the image is well magnified. What is more, students are able to watch these practical lessons at home. This is not possible in a traditional class.

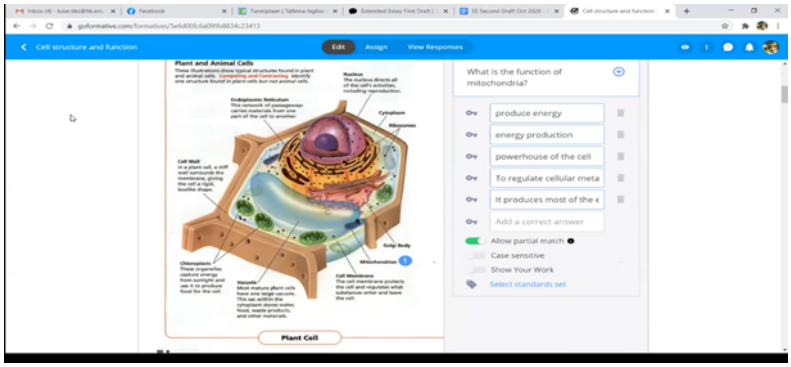

Figure 2 – A Plant Cell

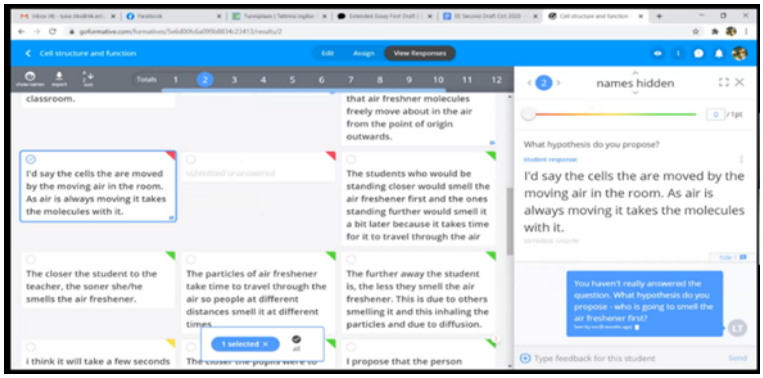

Figure 3 – GoFormative Environment for Feedback

During the conversation with teachers, many concerns came up, some of which directly impact teaching with digital tools such as SM and especially in virtual learning environments. For instance, when teachers were asked if they ever faced any challenges during their teaching with digital tools such as SM, here is what one teacher said:

> I think some of my students were living in rural areas where they did not have good internet. Some 2 or 3 students also did not have computers, but we eventually solved it because our municipality gave them computers to use.

Here is what another teacher shared with us in terms of challenges he encountered in teaching online:

> It's possible that some students only had the names but not present. It's also a possibility that the students were not listening. This attitude exposes the negative side of technology. Maybe to stem this practice, students should be randomly called to answer questions or perform some tasks more frequently.

Another teacher looks at concerns from a different perspective. Here is her take:

> Most students are excellent at using these digital tools. However, there are a few who do not. Also, some technical problems, perhaps some homes having low internet connectivity ... and some students have difficulty connecting. So, they can't access Zoom. I also know that many students will like to ask more questions and to have a direct discussion with the teacher during the lesson.

Here is what one teacher said concerning "camera fatigue", that is, continuous sitting in front of the camera and its impact on students:

> I think one of the important things I learned during the distance learning is that it is difficult to tell over the camera if the students are working or just there ... I saw several people trying to make sure students are in front of their camera seemingly following the lesson. I think one of the concerns we talk about is that the camera exhausts students and they feel self-conscious if they are in front of the camera. This camera fatigue will be reduced if we use tools that can allow us to follow what they are doing without trying to always show their faces.

5. Discussion

Previous literature describes affordances and how these impact our SM use, particularly in the context of teaching and learning (Otchie, Pedaste, Bardone, & Chounta, 2021). The findings from our study are an additional contribution to the studies on teaching with SM, particularly in high schools (Galvin & Greenhow, 2020; Greenhow & Askari, 2017; Manca, Bocconi & Gleason, 2021; Stewart, 2015).

First, our study focused on finding how teachers articulate SM in the context of teaching and learning through the lenses of operational and contextual affordances. In doing so, we analysed the results based on emerging affordances in teaching with SM as the main theme and the respective sub-themes such as SM in education, affordances through regular use, consequences of COVID-19 on SM in education, and observing the digital learning environment.

Results of the interview revealed that the teachers demonstrated profound knowledge and skills in technology use but did not have any idea about the operational and contextual affordances concepts we outlined. However, their description of the processes and protocols in using SM in the context of teaching and learning was situated in the aforementioned concepts. Most often, their use of technology for teaching was mainly operational, such as giving an assignment, homework, feedback, and providing links to resources. Sometimes, they unknowingly contextualized SM, especially during the lesson preparation, presentation, and in the organization of class activities around a subject lesson.

Regular use, for example, was credited by all participants as the source of their fluency and competency in using technology in the classroom. In other ways, this practice allowed them to perceive or even find new possibilities for using technology to teach. As a result, technology allows teachers to achieve things that were previously impossible in traditional classroom contexts. The ability to employ SM to teach 3-D visual orientation of abstract concepts in Chemistry lessons, for example, cannot be underestimated. These findings are consistent with Gibson's (1979) relational and perception-based definition of affordance. The study's findings also put Polanyi's (1965) concept of *indwelling* into context. On the one hand, participants use the Zoom environment and its capabilities to pair weak students with outstanding colleagues remotely. This allows talented students to scaffold their weaker classmates remotely, while also encouraging teamwork and collaboration. Teachers, on the other hand, who have unrestricted access to technology at both a personal and institutional level, now have abilities and competencies to monitor and provide feedback on issues in which students appear to be having difficulty. As a result, the capacity of teachers to use technology in these innovative ways was related to their fluency in their use, which stemmed from regular interaction with technology. In effect, users become so accustomed to these tools that they begin to act as if they are an integral part of their cognition. A concept Polanyi refers to as *indwelling*. Essentially, this research supports Polanyi's assertion that efficient technology use is dependent not only on knowledge of the technology, but also on a user's personal encounter with it.

In terms of emerging affordances, this relates to teachers' relationships with technology once again. For instance, our data indicate that the majority of teachers are more at ease with the virtual learning experience as a result of their daily use of these technologies in school and at home. According to them, technology enables learning to occur anywhere and at any time, and most crucially, it enables students, particularly those who are absent from school, to quickly access all learning materials. Additionally, interactive videos enable the visualization of 3-D images within a lesson, making some abstract concepts more real.

As a consequence, the level of dialogue with SM determines the quality of the relationship, which directly impacts teachers' ability to articulate this tool in their teaching. In general, explicit and practical knowledge gained from the tool only equips users with operational or technical benefits. In spite of the fact that this knowledge is critical and fundamental, it only allows the user to understand how the technology works, which in turn permits him/her to use this tool as intended: to share, post, communicate, view movies, chat, etc. Nevertheless, technology can be useful when used in a specific context, but one requires more than technical expertise. In addition to pedagogy, content and technology knowledge (Graziano, Foulger, Schmidt-Crawford, & Slykhuis, 2017), teachers will be highly effective with technology if they regularly interact with it. Through this encounter, they acquire experiential knowledge, which Polanyi refers to as tacit knowledge. That said, the onus then rests on all stakeholders in education to make technology become available, accessible and functional both at home and in school. By interacting with these tools regularly, users become familiar with them and are able to "interrogate" them, which in turn enhances their skills and confidence. Polanyi argues that this behaviour makes the user feel as if he/she is part of the tool, thereby *dwelling* within the tool, and the tool becomes like an extension of the user's arm.

Also, learning with SM provides the learner with many learning choices and preferences and allows learning to occur remotely across different locations. For example, besides learning at any place and time, it gives learners the opportunity for lifelong learning, professional development, self-regulated learning, informal learning, and formal learning (Otchie, Pedaste, Bardone, & Chounta, 2021; Peters & Romero, 2019). SM also allows learners to remotely connect and study collaboratively in the virtual environment (Galvin & Greenhow, 2020; Greenhow & Askari, 2017; Greenhow & Chapman, 2020; Manca & Ranieri, 2016; Otchie, Pedaste, Bardone, & Chounta, 2020).

To learn about the digital teaching environment, we asked participating teachers to demonstrate the tools they used, how they prepared their lessons, and how they taught. We discovered that although teachers utilized their schools' LMSs, they also depend on carefully selected YouTube videos to make their teaching more interactive and enjoyable. In terms of virtual learning, teachers utilized Zoom, Teams, etc. However, the most preferred option for online teaching according to participants, was Zoom because it has more features allowing teachers to remotely group students in breakout rooms and supervise them remotely just like in a face-to-face setting. In general, this might not be the case in other contexts.

Secondly, our analysis revealed some constraints when it comes to using SM for teaching and learning. During our interview, we got to a point where teachers shared some challenges they encountered directly or remotely with SM. Here is what one teacher speculated:

> It's possible that some students had only the names but were not present. It's also a possibility that the students were not listening. This attitude exposes the negative side of technology. Maybe to stem this practice, students should be randomly called to answer questions or perform some tasks more frequently.

This supports Gibson's assertion that the "affordances of the environment are what it offers the animal, what it provides or furnishes, either for good or ill" (Gibson, 1979, p. 127). These affordances leave the context of the use of the technology in the hands of the user and not the tool. Thus, the tool remains neutral until the user determines the context of its use. Here, it was the student who determined to either use it purposefully or not. This is also consistent with the literature that has established potential abuse of SM by students, which has resulted in social and psychological ramifications (Coyne, Padilla-Walker, Holmgren, & Stockdale, 2019).

When asked if the curriculum provides any requirements and guidelines, especially concerning specific digital resources, a teacher replied, "I do not think the curriculum requires us to use a specific digital app. However, I know the curriculum requires us to use technology to develop digital skills and competencies in the student."

Although the curriculum did not specify which technology application teachers should use in the classroom, it highlighted the importance of digital technology and the need for teachers and students to develop digital literacy skills relevant to contemporary societies (Mihailidis, 2018).

Eventually, as a result of the theoretical consideration, the analysis and subsequent discussion, we propose a framework for teaching with SM (see Fig. 4). As part of this framework, we take into account the theories and concepts as well as the findings from the interviews to examine how teachers teach with SM and how this tool could be effectively utilized in the classroom context. Grounded on Gibson's affordance and Polanyi's indwelling concepts, it comprises 3 competency phases of using SM in any context including teaching: the understanding phase, interaction phase, and contextualization phase.

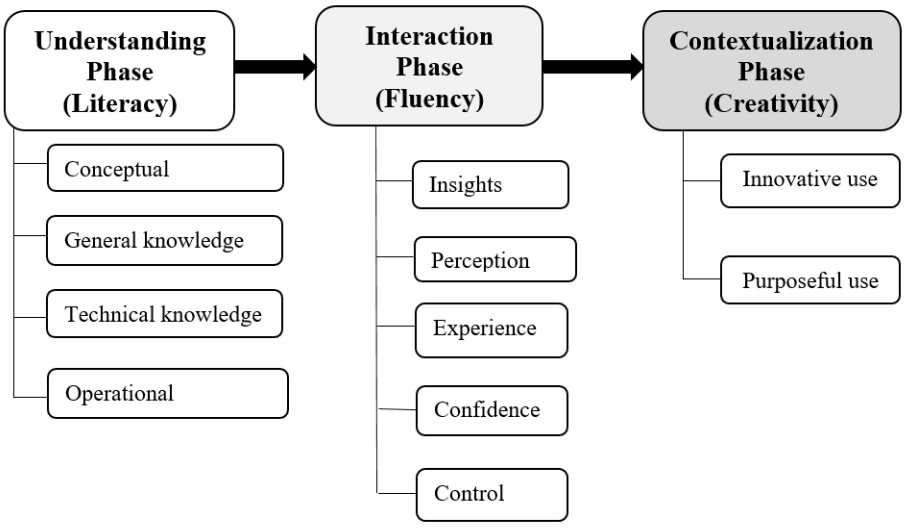

Figure 4 – Framework for Social Media Use

The understanding phase is also known as the literacy phase, is characterized by explicit, pragmatic and externalized knowledge that can be documented or transferred (Polanyi, 1965). It comprises four (4) knowledge dimensions: conceptual knowledge, general knowledge, technical knowledge, and operational knowledge. Conceptual knowledge deals with ideological and pragmatic perspectives about the technology. Essentially, this dimension of knowledge mostly serves as a lens to have a world view about digital technology. This was, in fact, one of the most basic conditions for using technology, and all participants met it. (see Appendix C). As a result, they exhibited sufficient technological knowledge in this situation. The interaction phase (fluency phase) is characterized by a knowledge dimension that is implicit or tacit. Here, the focus is on competence and experience which are tacit. In other words, tacit knowledge is mostly internalized and cannot be documented or passed down from one person to another. The characteristics of this phase make it a vital knowledge dimension, however it appears that when it comes to adopting technology, it is overlooked, disregarded, or ignored. Five elements of tacit knowledge are described here: insights, competence, experience, confidence, and control. Personal experience is the only way to obtain these knowledge dimensions. As a result, this knowledge can be obtained by regular practice and persistent dialogue with the technology. This explains Polanyi's concept of *indwelling*, where one literally dwells in the tool such that his/her cognition synchronizes with the tool. In other words, regular interactions literally move the tool onto the side of the user, hence no separation thereof (Heidegger, 1927). As a result, it's critical to recognize that participants' fluency and effectiveness in teaching with technology, including SM, is based on their experience with these tools as a result

of regular discourse. Hence, making a tool a part of one's cognition allows teachers to focus more on the teaching process rather than the instrument, which was previously the norm in many contexts. Again, as a result of the regular dialogue, the users develop confidence, competence, experience, and eventually gain control of using the technology as again exemplified by the respondents. This finding is consistent with the argument by Drain and Strong that, smartphone "becomes incorporated within the assemblage of bodily appendages, environmental features, and artefacts that we encounter in everyday life, to the point where the phone can be considered as a prosthetic extension of ourselves" (2015, p. 190).

The contextualization phase, however, involves a purposeful and value-added use of technology. Here, the focus is essentially on innovation and creativity. This phase illustrates the perceived and actual interplay of explicit and tacit knowledge dimensions. At this point, users synchronize both practical and experiential knowledge acquired from the technology (literacy and fluency), thus maximizing its potentials and minimizing any risks. Ultimately, the framework shows that teaching with SM or any digital technology can only be effective if consideration is given to both explicit and tacit knowledge dimensions.

6. Conclusions and Implications

This research was an ethnographic study that aimed at exploring high school teachers' ability to contextualize SM in the context of their teaching. In essence, it allowed teachers to share their perspectives and insights concerning virtual and face-to-face teaching with SM. The fact that SM facilitates active learning that is more student-driven and thus supports a constructivist learning paradigm cannot be underestimated (Greenhow & Chapman, 2020; Rap & Blonder, 2017; Vartiainen, Leinonen, & Nissinen, 2019). After inductively and deductively coding the transcribed texts from the conversations with teachers, two themes emerged which formed the basis for our analysis. Thus, potentials and constraints.

First, we set out to find the skills that would enhance effective teaching with SM. From our conversations with teachers, it became clear that regular use of technology by these teachers gave them the competence, control and confidence to use technology in the context of their teaching. This result demonstrated the importance of a relationship with tools that helps users not only to discover more affordances but to overcome the tacit knowledge gap that exists between operational and contextual use of a tool.

Second, most teachers were optimistic that SM is the new learning paradigm, as it facilitates active and interactive learning as well as provides opportunities for diverse forms of learning. However, just as there are two sides to every narrative, teachers were quick to specify some constraints they encountered during their lessons with SM. Eventually, the study establishes that relationships with technology can help to bridge the affordances gap and facilitates our purposeful and contextual use of technology.

Meanwhile, the study provides some implications for stakeholders in education. In terms of contextualizing SM for teaching, the study proposes a framework that can help education facilitators, educational technologists, teachers and allied agencies to re-direct their focus to context-training with technology. Also, any clear or actual restrictions in schools, homes, etc., in terms of using SM should be lifted to allow both teachers and students to regularly interact with these applications to gain skills, control, and confidence. It is important that stakeholders in education fast-track the policies and regulations that promote and motivate positive and purposeful use of SM to regulate its possible abuses among students. Again, the issue of camera fatigue needs further study. Finally, teachers should be motivated to take advantage of learning options and opportunities of SM to develop a professional network of learning communities with many schools globally.

In terms of relevance and context to other studies, this study features many limitations. Firstly, it took us four months (September 2020 - January 2021) for a relatively small number of teachers to eventually accept participating in the study. This was because the study was in English, which was also a limitation to many teachers who speak Estonian. Secondly, the study was conducted on a virtual platform and was self-reported. Perhaps we could have found more information if we had been physically present in the classroom, but for the COVID-19 lockdown. Thirdly, COVID-19 will undoubtedly have had far-reaching implications for society at large, particularly for teachers, students, and parents. On the one hand, it increased teacher involvement with technology, and students developed certain

competencies in technology as well. However, prolonged sitting and staring at a computer screen may produce boredom and exhaustion in teachers, impairing their psychological health and possibly affecting the study indirectly. Lastly, the sampling was convenient and purposive, and a snowball approach was used in some cases. This approach allowed us to get the teachers with the requisite expertise. However, we cannot generalize our findings, as this sample is not a representation of the population of the Estonian high school teachers. Regardless of the small sample, language, etc., the study was able to meet its objectives.

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Appendix

Appendix A. *List of some social media applications (Statista, 2020)*

No	SM/SNS/SMS	COUNTRY OF ORIGIN	YEAR	MU(B)	DESIGN FOCUS	FUNCTIONS
1	Facebook	USA	2004	2.700	Social network	TPVV
2	YouTube	USA	2005	2.000	Video sharing	TPVV
3	TikTok	China	2016	2.000	Short Video sharing	TPVV
4	WhatsApp	USA	2009	1.500	Messaging	TPVV
5	Messenger	USA	2008	1.300	Messaging	TPVV
6	WeChat	China	2011	1.100	Messaging	TPVV
7	Instagram	USA	2010	1.000	Photo sharing	TPVV
8	Viber	Japan	2010	1.000	Messaging	TPVV
9	QQ	China	1999	0.899	Messaging	TPVV
10	LinkedIn	USA	2003	0.706	Professional networking	TPVV
11	Tumblr	USA	2007	0.642	Messaging	TPVV
12	QZone	China	2005	0.640	Social network	TPVV
13	VKontakte(VK)	Russia	2006	0.593	Social network	TPVV
14	Pinterest	USA	2009	0.400	Image sharing	TPVV
15	Twitter	USA	2006	0.330	Messaging	TPVV
16	Zoom	USA	2012	0.300	Video telephony	TPVV
17	Skype	Estonia	2003	0.300	Video telephony	TPVV
18	Snapchat	USA	2011	0.200	Image sharing	TPVV
19	Google Classroom	USA	2014	0.100	Educational LMS	TPVV
20	Telegram	Russia	2013	0.100	Messaging	TPVV

T = write text/ edit text; P = post/share information or resources; V = voice/video calls or interactive videos;
MU = monthly users; SM = social media; SNS = social networking sites; SMS = social media sites; B = billion

Appendix B. *Semi-structured interview protocol*

Part I: Pre-interview briefing

Exchange of pleasantries, introduction, expression of appreciation, brief about the interview, etc.

- *Thanks for willing to participate in the interview.*
- *As I have mentioned before, the study seeks to understand how high school teachers use social media in their teaching activities especially during the COVID-19 pandemic.*
- *The aim of the research is to document the possible concepts of effectively teaching with social media and how teachers could apply it in their teaching activities.*
- *Our interview today will last approximately 45 minutes during which I will be asking you to show me what you did in terms of teaching with social media during the COVID-19 lockdown. Also, I will like you to tell me how you used this tool specially to teach in class, assess your students, and give homework.*
- *Indeed, you completed a consent form indicating that I have your permission (or not) to record our conversation.*
- *Are you still ok with me recording (or not) our conversation today? ___ Yes ___ No*
- If yes: *Thank you! Please let me know if at any point you want me to turn off the recorder or keep something you said off the record.*
- If no: *Thank you for letting me know. I will only take notes of our conversation.*
- *Before we start the interview, have you any questions?* [Discuss questions]
- *If any questions (or other questions) arise at any point in this interview, you can feel free to ask them at any time. I would be more than happy to answer your questions.*

Part II: Interviewee data

1. Sex .....
2. Age .....
3. Educational level.....
4. Years of teaching.....
5. Subject(s) .....
6. Classes/Grades .....
7. Years of teaching with digital technology.....
8. Years of teaching with social media.....

Part III: Actual interview questions

1. Can you **show to me** (share a screen) the digital T&L resources you used during the COVID-19 lockdown to teach?

   (a) Class activities/ lessons (b) Homework (c) Assessments?

2. Please **explain** how you **prepared and used** these resources for

(a) Class activities/lessons. Probe: Any examples?
(b) Homework. Probe: Can you elaborate with an example?
(c) Assessments. Probe: Can you show me some examples?

3. How did you come up with this ideas? I mean selecting these resources, etc.?
4. What new possibilities or potentials have you discovered in social media (**after regular use**). Probe: Can you elaborate with some examples?
5. Can these possibilities or potentials make it a good pedagogical tool? Probe: How? Please elaborate
6. Did you encounter any challenges or uncertainties during teaching? How did you overcome it?
7. In which way has the curriculum design supported the technology you use? Probe: Can you elaborate?

Part IV: Conclusion and reflection

8. *With your perspectives about social media use in teaching, what can you say about its future in teaching?*
9. *In which way has the COVID-19 pandemic impact your perspectives about online teaching especially with social media?*
10. *Before we conclude this interview, is there something about your experience with social media that you think influences how you engage with your teaching we have not yet had a chance to discuss?*

Part V: Debriefing

- The main goal of interview is to allow teachers to show the exploits of social media in teaching
- Thus, sharing with me what you teachers (experts) do with social media in your teaching
- This is not evaluating you! I was just conducting an ethnographic study for research purposes and participant's anonymity will be kept.
- Generally, finding out how you cope with the lockdown and also if you'll like to continue using these tools after the pandemic
- Finally, I want to thank you for your contribution to this study.

Appendix C. *Demographics of participants*

ID	Gender	Age	Highest Qualification	Years of Teaching	Subject	Class	Teaching with Technology (Yrs.)
ST01	F	31	MA Ed	10	G, NSc, B	6-12	10
ST02	F	31	MA Ed	5	B, C	10-12	5
ST03	M	41	PhD Physics	3	P	9-12	3
ST04	F	30	MA(Sc. Ed)	7	B, C	5-12	6
ST05	F	44	MA(Comp Sc)	4	IT, R	4-9	4
ST06	M	59	MA(Sc.Ed) MA(Ed Tech)	35	P, M, R	8-9	15
ST07	M	51	MSc(Ecology, MA(Sc.Ed)	26	B, BT, Bot	10-12	26
ST08	F	40	MA Ed	8	M	7-10	8
ST09	F	42	MA(Sc.Ed)	10	B, C, NSc.	7-9	10
ST10	F	45	MA Ed	20	E, ELit	8-10	14
ST11	F	31	MA Ed	9	A	8-10	9
ST12	M	42	MA(Sc.Ed)	14	B	8-10	14
ST13	F	30	MA Ed	4	E	7-9	4

Key: A = Art, B = Biology, Bot = Botany, BT = Biotechnology, C = Chemistry, E = English, Elit = English literature, G = Geography, M = Mathematics, P = Physics, IT = Information technology, NSc. = Natural science, R = Robotics

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