Digital Capabilities of Teachers: A Comparative Case Study

Anne Pathiranage
Stockholm University
NSBM Green University

Thashmee Karunaratne
Stockholm University

Online and digital education, which was once perceived as demanding financially and academically, became the most viable option to continue teaching and learning during the COVID-19 pandemic. Despite their lack of prior experience, capabilities, or willingness, many teachers shifted their courses online in a short period to continue teaching during the pandemic. To understand the efficacy in making such a shift, the nature of digital capabilities the teachers recognize within themselves and if these capabilities correlate with their socio-cultural and geographical backgrounds are to be realized. In this study, two cases from the global North and South are compared to investigate the similarities and differences in making choices of digital tools, and, to capture their digital affordances and ability to manage technology in the teaching and learning process. A sample of 50 teachers from two higher education institutions is used to capture the perceptions. The discovered trends in the choice of tools may shed light on region-specific disparities in digital affordances in technology-enhanced learning and global digital education development.

Keywords: digital literacy, online teaching, teacher perception, visitor-resident metaphor, digital tools

INTRODUCTION

Digital literacy, often defined as the ability to use and develop technology-based content, including finding and sharing information, answering questions, and interacting with others and computer programming (Widana, 2020) is essential in the digital era. Digital literacy of academic stakeholders, specifically teachers, lays the foundation for digital education affordances and allows learners to have a holistic learning experience (Sánchez-Cruzado et al., 2021; Tomczyk, 2021). As a consequence of the COVID- 19 global pandemic, education systems shifted from traditional classrooms to online and digital platforms, which were once perceived as financially and academically demanding. Almost all academic institutions worldwide began to offer their education programs online, which opened up the possibility for all education stakeholders to experience a range of digital tools. Irrespective of their previous knowledge, capabilities, or willingness, many teachers shifted their courses to an online setting within a short period to sustain education during the pandemic (Li & Yu, 2022). Irrespective of teachers' preferences, specific digital tools are gradually becoming mandatory in the current teaching-learning process. Thus, teachers need to rethink the technology affordances associated with course delivery and explore different technology provisions best to support the pedagogy and didactics of their courses. For teachers, such a capability

demands more than simple digital skills and competencies that only focus on what and how the technology is used. Rather, teachers should be digitally literate; i.e., to be able to comprehend why a certain tool is selected; how it helps the pedagogy; how it provides adequate support; who will be affected by their choices; how the tools optimize the learning process; and many other questions related to justifying the choice of a particular tool (Bali, 2016). Digital literacy is proven to be a mandatory qualification to become a teacher in the digital era (Potyrała & Tomczyk, 2021).

Literature highlights the consequences of online education, its successes and failures, and its potential for shaping education in an era of digital by default (Li & Yu, 2022; Sánchez-Cruzado et al., 2021; Tomczyk, 2021). As contemporary studies extrapolate, the future of education would likely take a hybrid form and would differ greatly from the education of the pre-covid era (Sánchez-Cruzado et al., 2021). This change demands the future teacher play a more comprehensive role beyond the traditional task of teaching (Tomczyk, 2021). To understand the teachers' preparedness for this paradigm shift in education, it is important to assess the digital capabilities that the teachers recognize within themselves and their relationship to their socio-cultural context. If the technology and tools the universities purchase do not match the teachers' preferences and capabilities, it will inevitably lead to a failure to utilization of the purchased solutions in teaching and learning (Mucundanyi & Woodley, 2021). On the other hand, teachers who have digital practice, in general, could become early adapters for new digital affordances, where this practice can, up to a very high degree, be outside of their set of teaching (White & Cornu, 2017). In such a context, this article explores teachers' digital affordances; their intentions, and the use of various tools in professional and personal contexts. Two representative cases from two countries in the global North and the South are compared to explore the similarities and differences in digital affordances, i.e., the variations in the tools used, the teachers' preferences, and trends in higher education in the two regions. Therefore, this study attempts to answer the following research questions.

RQ1: *How different or similar are higher-education teachers' agencies in digital affordances in professional and private contexts in the global north and south?*

RQ2: *How do the selection and use of digital tools are perceived by the teachers?*

A survey-based explorative approach is followed to capture the digital affordances and teacher perceptions. A group of teachers from two universities participated in the research. The next section describes digital literacy and its effect on the quality of teaching. It also describes the metaphor to identify the teachers' agency in using digital tools. Section 3 summarises the research strategy and data collection methods used in this study, and section 4 discusses the analyses of the results. Finally, section 5 presents the study outcomes comparing the findings to previous studies and concluding remarks.

BACKGROUND: TEACHER'S DIGITAL LITERACY AND THE VISITOR-RESIDENT METAPHOR

Digital literacy of teachers has been a topic of discussion since the introduction of information and communication technologies into education (Jones et al., 2016). It is the enabler for the agency in using technology (Chen, 2022). At the beginning of the digital era, pedagogy dominated teaching, and technology was of little importance. However, two decades later, skills and competencies in technology have gradually become the backbone of education (Herodotou et al., 2019). This section briefly describes teachers' digital literacy traits and their benefits as identified by contemporary research.

Digital Capabilities of Teachers and Their Effect on the Quality of Education

Any digital effort made to find, evaluate, create and communicate of information encompasses digital literacy (Fraillon et al., 2020). Adding a new dimension to pedagogical competencies, highlights the necessity for introducing more technology-based features to the teaching and learning process (Öngören, 2021). Digitally literate teachers can understand the influences of different digital media, embrace new

tools, and effectively use those tools in teaching and learning (Voogt et al., 2013). At present, teachers' digital literacy has become important due to the rapid advancement in information and communication technology and the transition of teaching from conventional methods to online teaching platforms due to the COVID- 19 pandemic (Khalid et al., 2015). Digital literacy encompasses much more than basic ICT skills (Rusydiyah et al., 2020). It requires the creative, critical, and confident use of technology to meet the digital communities' demands (Belshaw, 2012). Digital tools help the teacher to present materials more excitingly and interactively (Rusydiyah et al., 2020). It enables teachers to choose appropriate technology-enhanced teaching methods and use different tools to achieve learning outcomes (Öngören, 2021). However, teachers' digital literacy is determined by a range of personal and professional factors.

Teachers' attitude toward technology significantly impacts their choice to use digital tools in the teaching and learning process (García-Martín & Cantón-Mayo, 2019; Schiller, 2003). Additionally, it is seen that academics from different countries have different experiences in using digital tools. Thorvaldsen and Siri Madsen (2021) compare academics' digital use in Norway, New Zealand, and Jordan, clearly distinguishing between the different uses of digital tools. Even though Norway is a technologically advanced country, its teachers were less self-confident in using technology than in New Zealand, implying the teachers' professional positive attitude towards using digital tools. At the same time, academics from New Zealand are driven by professional digital competence. However, no clear findings about teachers' perception of using digital tools are recorded from Jordan (Thorvaldsen & Siri Madsen, 2021). Similar to Thorvaldsen and Siri Madsen (2021), in a study conducted in Uganda, Vandeyar (2020) emphasizes the need for determination and a positive attitude among teachers to enable technological facilitation. However, digitally fluent teachers can merge different techniques as appropriate, make learning more interesting, and keep the students engaged (McGuinness & Fulton, 2019). Teachers being digitally literate helps to create students who fit into the digital environment. Also, if teachers are not comfortable with technology, students will not receive proper direction to survive and solve problems in digital societies. Thus, teachers should transmit maximum learning benefits to students via technology (Sadaf & Johnson, 2017).

Furthermore, teachers' investment in designing the delivery of lessons (Fink, 2007) significantly improves student learning (Koslowski, 2006). By effectively integrating digital tools into their teaching (Perifanou et al., 2021), teachers not only ensure the efficient delivery of lessons but also enhance student engagement, activity, monitoring, and evaluation (Balyk et al., 2020). The success of technology integration in teaching depends on teachers' agency with technology and its continuity (Keengwe & Onchwari, 2009). In short, it depends on teachers' digital literacy.

The Visitor Resident (V-R) Metaphor for Literacy Quantification

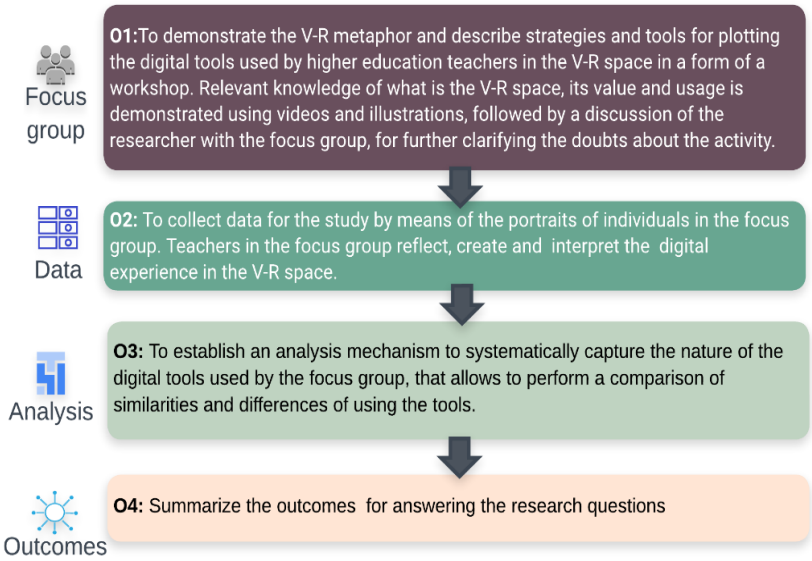
Digital (information and communication) tools enhance the quality of education. They mediate learning, support engagement and communication, and allow access to education anywhere, anytime (Tomczyk, 2021). As mentioned above, teachers' digital affordances significantly impact how teachers incorporate different tools in teaching. White and Cornu (2017) argue that engagement with digital technologies, in principle, has two conceptual dimensions; the visitor and the resident. Accordingly, a visitor of a certain digital tool may consider the tool simply use for a specific task; similar to a mechanical tool in a toolbox. Hence, the digital visitor "sees the digital space as a collection of disparate tools that are used for achieving specific tasks; they leave little evidence of having entered the digital space" (Jones, 2016) A digital resident on the other hand, appreciates navigating the digital space and recognizes the "value in inhabiting [it]" (Jones, 2016). Therefore, the digital resident comfortably maneuvers the digital space with no worry of leaving their digital footprint. The digital visitor-resident metaphor quantifies how comfortable an individual is in using a digital tool (White & Cornu, 2011). Although the V-R metaphor is rigid, in reality, the two categories may not necessarily be mutually exclusive (White & Cornu, 2017). An individual could be both a visitor and a resident depending on the tools they use. Furthermore, one's purpose for using the digital space may change often. For example, a teacher may use YouTube to create educational videos, but during their leisure time, they might watch a film on YouTube. Hence, the purpose of using the digital space is determined by the personal/professional aspect of the task done online (Caroline, 2017).

Literature shows the advantages of quantifying teachers' digital affordances in the V-R space (White & Cornu, 2017) since it could, not only help teachers to self-assess their digital practices, but also allow them to communicate their preferences systematically and illustratively. On the one hand, it allows teachers to reflect on how they afford different tools, and how versatile they are in using technologies in both personal and professional aspects. On the other hand, it indicates the modality and frequency of the use of tools. In summary, the individual V-R portrait of digital tools can be analogous to their digital tools' persona, which reflects the teachers' unique behaviors in their personal - professional contexts. In this study, the V-R metaphor is used for the same purpose as previous studies to capture the overview of teachers' digital affordances to understand how and to what extent technology is used to enhance their teaching.

METHODOLOGICAL APPROACH

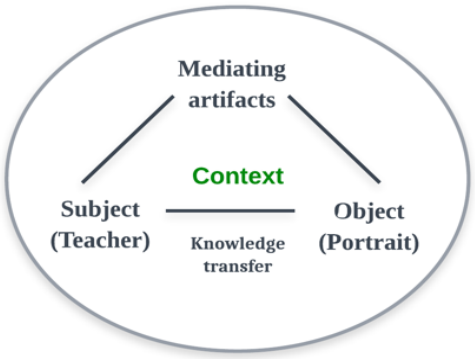
This research is grounded in the socio-cultural activity theory and the corresponding framework that depicts how technology is adopted and used by individuals in a complex societal context (DeVane & Squire, 2012). Activity theory fundamentally reflects human activity associated with mediated artifacts created under pre-defined situations (Popov, 2008). As the research questions of this study focus on analyses of how and in what context the participants (teachers) use digital tools, it requires a methodological base within an "interpretive and socially constructed paradigm" (Stuart, 2014). As Stuart (2014) states, such a paradigm enables teachers to reflect on, create, and interpret their experiences of using digital tools and situate them in the V-R structure. The socio-cultural dimension of the activity theory explores the relationship between technology and its cultural context. It explores, for example, how Swedish teachers may use tools such as Spotify that are limited to their region. Being a form of empirical research (Bligh & Flood, 2017), the sociocultural context of the activity theory allows to development a suitable methodological base to capture the demographic aspects and the other situational variations that are naturally biased in this study. Hence, according to this theoretical framework, the research questions would be answered systematically. In the process, the objectives illustrated in figure 1, which were based on contemporary literature (Bligh & Flood, 2017; DeVane & Squire, 2012; Hung & Wong, 2000; Popov, 2008; Stuart, 2014;) would be achieved.

FIGURE 1
OBJECTIVES OF THE STUDY



Accordingly, the research takes into consideration the actors for the *activity* and subsequently designs a collaborative interaction space to explore the relationships between the *subject* (human) and its *object* (outcome) (Bligh & Flood, 2017). Specifically, this theoretical base and its impact on the research process can be encapsulated as shown in Figure 2.

FIGURE 2
THE CONTEXTUALISATION OF THE SOCIO-CULTURAL ACTIVITY THEORY



Popov, 2008

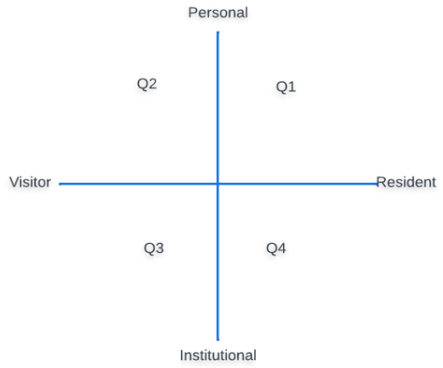
In this study, the teachers reflect on their use of digital tools, and present it in terms of the V-R structure, data is collected from a focus group. Data collection attempts to capture and summarise individuals' portraits.

Methods and Instruments of Data Collection

The two cases considered in this study consist of the academics from two universities in two countries; The NSBM Green University in Sri Lanka and Stockholm University in Sweden. The researchers conducted a workshop for a selected group of academics, introducing them to the V-R metaphor and the meaning and implications of its different quadrants. This step was essential to ensure the accuracy of the data collected. Next, the academics were asked to plot the digital tools they use within the V-R metaphor. In the process of portraying, they considered how they envision the use of different tools (as a visitor or resident) and their purpose of using the tools (for personal or professional purposes) (White & Cornu, 2011). Following this stage of mapping the tools into the metaphor, short interviews of randomly selected teachers were executed for acquiring deeper reasoning of the mapped portraits. The interview mainly consisted of two questions 1) why the tools are placed in the V-R portrait 2) if there are other reasons why the tool is not mapped elsewhere.

The focus groups were selected using convenience sampling. Furthermore, no additional aids or prompts were provided to stimulate the teachers' responses and no brainstorming was done during the workshop. The intention of such a focus was to minimize any group or interviewer bias. Randomly selected academics from both of the focus groups were then interviewed to investigate their reasoning for positioning the digital tools in the respective quadrants. Researchers gathered fifty portraits (plotted diagrams); 21 from Swedish lecturers and 29 from Sri Lankan lecturers. The data were prepared for analysis by codes of the four quadrants as shown in Figure 3.

FIGURE 3
THE V-R METAPHOR TEMPLATE USED FOR DATA COLLECTION



White & Cornu, 2011

Data Analysis Methods

Data visualization methods were used as the main data analysis instrument due to their ability to overview diverse types of tools the teachers presented in their V-R portraits and analyze the context of using the tools. Visualizing methods are used to derive insights about the data, comparing the outcomes in different aspects as it gives more information about the data and areas of interest of the respondents (Elmqvist & Fekete, 2010). Visualization techniques also enable accomplishing this study's aims of comparing the two countries and identifying the academics' preferences and any regional differences. The interview data is used only to identify teachers' motives for choosing and placing the digital tools in the VR structure. The data from the interviews and the visualizations are triangulated in analyzing the teacher's perceptions on using different digital tools.

Ethical Implications

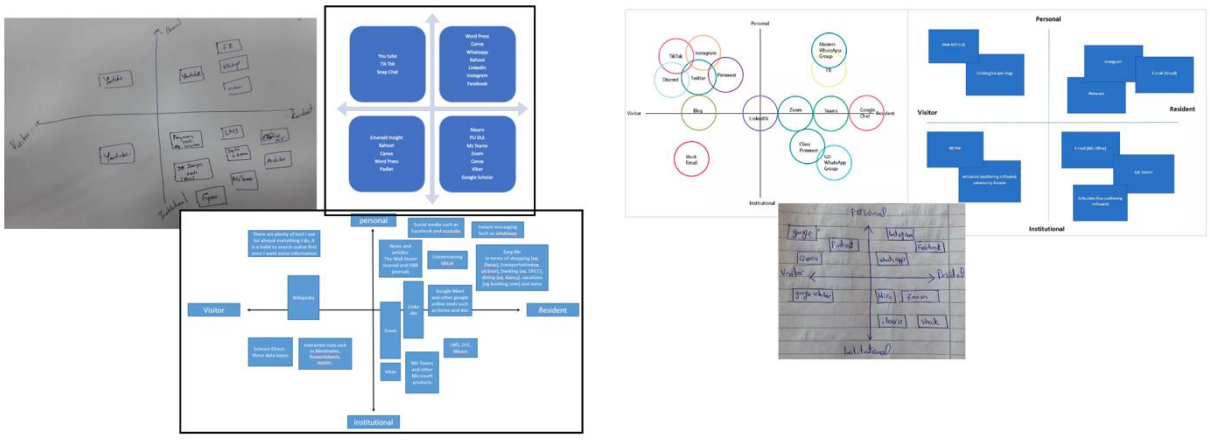
Academics were given an open invitation to participate in this study and were informed of its objectives. They participated in the study voluntarily. Their replies were not impacted by any aids, prompts, or conditions that bring in commercial values. No product promotion was involved. At the beginning of the workshop, the participants were assured that the data will be used only for academic purposes and in this study. Furthermore, the respondents' anonymity was ensured through all stages of the study.

RESULTS

Descriptive Analysis

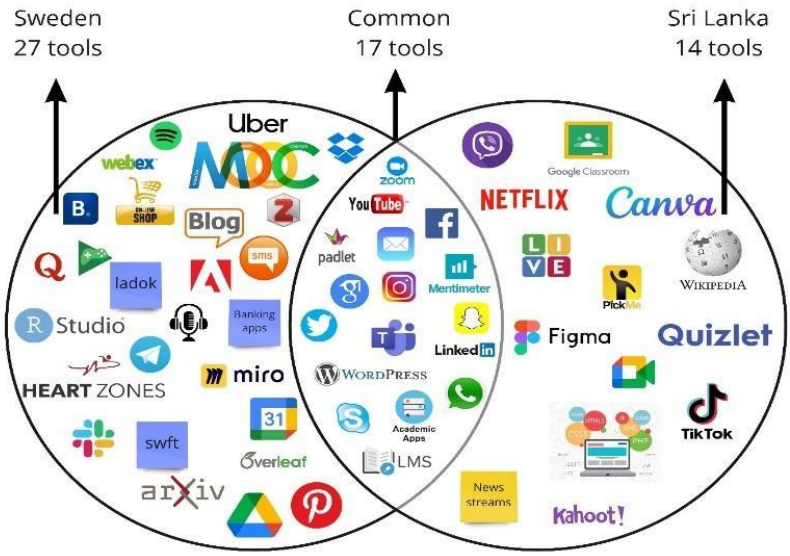
The dataset consisted of 50 data instances; 21 from Sweden and 29 from Sri Lanka. In this data set, there were V-R portraits of 22 females, 19 males, and nine academics who have not specified their gender. Some raw data samples collected are presented in figure 4.

FIGURE 4
RAW DATA – V-R SPACES DRAWN BY TEACHERS IN SRI LANKA (LEFT) AND SWEDEN (RIGHT)



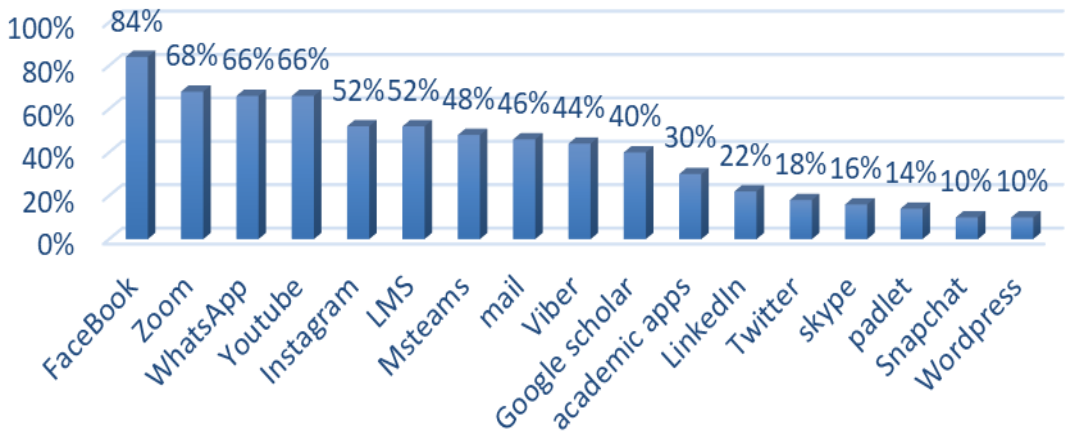
In total, academics mentioned 58 different digital tools in the V-R space. Swedish academics were familiar with 76% of the proposed tools, while Sri Lankan academics were familiar with only 53% of the tools. However, 17 tools are commonly used in both countries (c.f. Figure 5).

FIGURE 5
CLASSIFICATION OF DIGITAL TOOLS USED BY TEACHERS



The total 58 different used by the teachers in Sweden and Sri Lanka indicate different popularity levels as shown in Figure 6. Irrespective of the country, Facebook is the most popular tool, mentioned by 84% of academics. Zoom, WhatsApp, and YouTube are among other frequent choices (c.f. Figure 6). 41 tools have less than 10% of popularity, i.e., they were used by two participants or fewer.

FIGURE 6
TOP 17 DIGITAL TOOLS TEACHERS USE IN THEIR PERSONAL AND PROFESSIONAL LIFE



Out of the 17 common tools, Facebook, Zoom, and YouTube are equally popular in Sweden and Sri Lanka. Tools such as Learning Management Systems (LMS), e-mail services, Google Scholar, different academic apps, Twitter, Skype, Padlet, WordPress, and Mentimeter are frequently used by Swedish academics. Sri Lankan academics mostly use WhatsApp, Instagram, MS Teams, LinkedIn, and Snapchat (see Table 1).

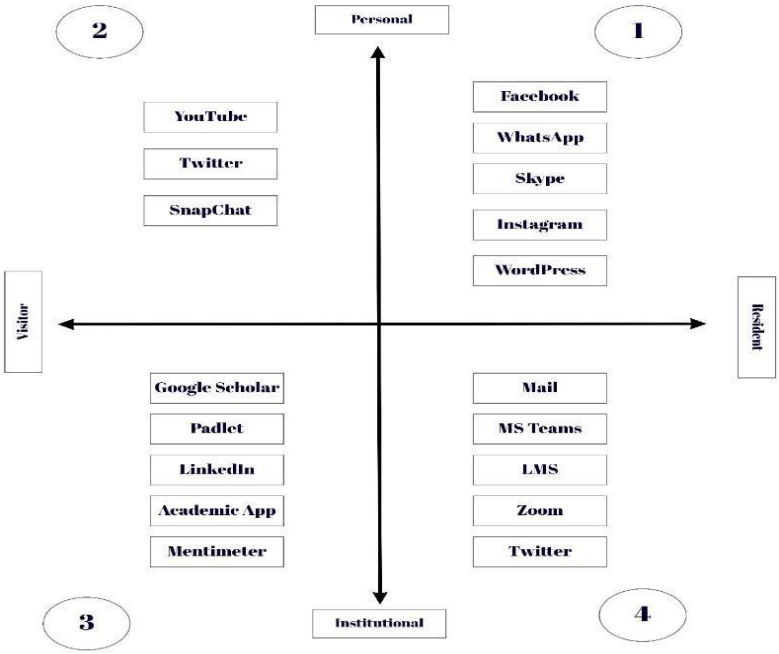
TABLE 1
USAGE OF DIGITAL TOOLS ACCORDING TO COUNTRY

Tool used	In Sweden		In Sri Lanka		Total Use
	Count	%	Count	%	
Facebook	19	45%	23	55%	42
Zoom	18	53%	16	47%	34
WhatsApp	8	24%	25	76%	33
YouTube	15	45%	18	55%	33
Instagram	8	31%	18	69%	26
LMS	16	62%	10	38%	26
MS teams	5	21%	19	79%	24
mail	18	78%	5	22%	23
Google Scholar	19	95%	1	5%	20
academic apps	12	80%	3	20%	15
LinkedIn	3	27%	8	73%	11
Twitter	7	78%	2	22%	9
Skype	6	75%	2	25%	8
Padlet	5	71%	2	29%	7
Snapchat	2	40%	3	60%	5
WordPress	3	60%	2	40%	5
Mentimeter	3	75%	1	25%	4

Visitor or Resident?

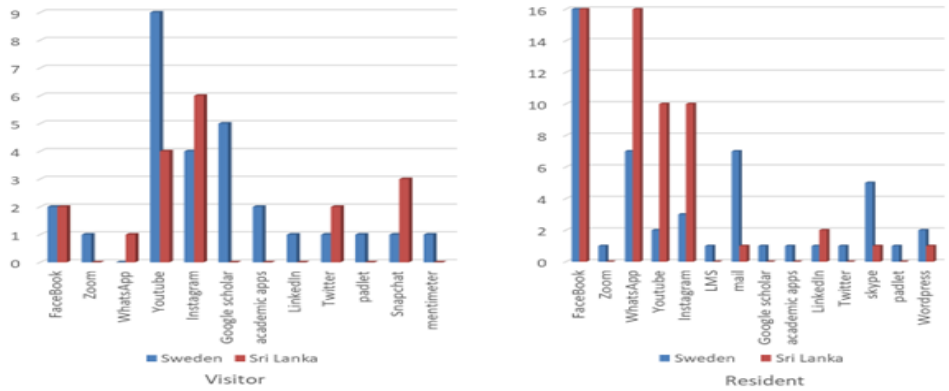
Based on the placement of digital tools in the V-R portrait by the respondents, social media tools such as Facebook, Instagram, Skype, WhatsApp, and the content management system WordPress are seemingly used by both groups of academics in their context. Most academics are residents of these tools (see Figure 7). Although academics identify themselves as residents of Zoom, MS Teams, LMS, and e-mail services they use them in institutional contexts. Twitter plays a dual role as a visitor in the personal context and a resident in the institutional context. Google Scholar, Padlet, LinkedIn, Mentimeter, and different academic apps have been used in the institutional context, but as visitors.

FIGURE 7
VISITOR-RESIDENT POSITIONING OF DIGITAL TOOLS



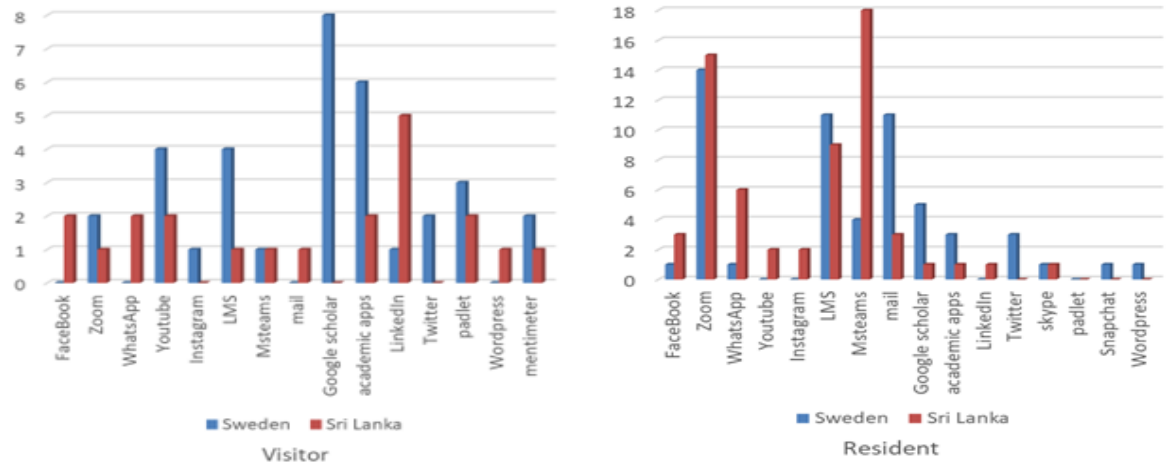
Furthermore, Swedish and Sri Lankan teachers use Facebook in general, in the personal context, and are mostly residents of the tool. They visit the profile regularly and leave their digital footprint by adding content and sharing posts among friends. WhatsApp, YouTube, and Instagram are more popular among Sri Lankan academics, who are residents and who use them in the personal context. Swedish academics also tend to use YouTube but are not as residents of the app, i.e., they use YouTube videos but do not create content. Their use of Google scholar and Skype is in a personal context. Sri Lankans rarely use these tools in a personal context (see Figure 8). Apart from the common tools mentioned above, there is no evidence of wider usage of tools such as SMS, Dropbox, Heart zone, Podcast, Webex, G cal, SWFT, Uber, and Telegram. Also, very few Sri Lankans use TikTok, Netflix, Google Meet, and Pickme, and our visitors to these tools.

FIGURE 8
THE USE OF DIGITAL TOOLS IN THE PERSONAL CONTEXT AS VISITORS AND RESIDENTS (1ST AND 2ND QUADRANT)



How teachers perceive the use of digital tools in the professional context is an important aspect of the V-R space since it impacts the digital education affordances in the university. As mentioned in the preceding sections, these insights help plan technology-enhanced learning solutions and choose the correct tools and technologies. A clear tendency toward using professional tools can be seen in the institutional context. Zoom, LMS, MS Teams, academic apps, LinkedIn, Padlet, and Mentimeter are used in both countries at quadrant 3 (the –visitor-institutional quadrant, see Figure). Google Scholar is used less by Sri Lankan academics while Swedish academics recognize their use of the tool in the 3rd quadrant (see figure 9). Furthermore, Swedish academics focus more on using different academic applications, such as Padlet and LMS, within the institutional context as visitors. Interestingly, Sri Lankan academics use LinkedIn as visitor in the institutional context the most.

FIGURE 9
THE USE OF DIGITAL TOOLS IN THE INSTITUTIONAL CONTEXT AS VISITORS AND RESIDENTS (3RD AND 4TH QUADRANT)



The fourth (4th) quadrant represents the set of tools of which teachers are institutional residents, and they mostly consist of tools such as Zoom, MsTeams, LMS, and Google Scholar that enable academic activity. Oftentimes, using most of these tools is mandatory for teachers and institutions to regulate and

install them. Notably, nine out of the seventeen common tools are placed in the 4th quadrant by both Swedish and Sri Lankan academics. A few academics use social media tools in the institutional context as residents but the tendency to do so is comparatively low (see figure 9). Only Sri Lankan academics use Viber in the institutional context as regular residents. Further, it is evident that Sri Lankan academics are given more priority in the use of communication-supporutilizingal tools than utilising academic applications within the institutional context as residents. WhatsApp is also can be recognized as a frequently used popular tool among Sri Lankan academics in both personal and institutional contexts.

Teachers' Agency in Digital Affordances in Professional and Private Contexts

Digital affordances of teachers are primarily in the line of synchronized and asynchronized communication (c.f. Figure 7). In addition, course content management is also a significant resident digital affordance, which teachers recognised the agency. The teachers inevitably need to be resident in these tools since they have to leave their digital footprints, especially in their professional capacity. Institutional Visitor quarter (Q3) mainly consist with information search tools, which is also explainable, since the probability of leaving digital footprints in search tools is almost zero. The collaboration tool Padlet however is placed in the visitor quadrant according to the choice of the majority of respondents. This may need further clarification to understand in what context the teachers include a collaborative online working space in their activities without contributing to the content in the tool. The outcome of the personal quadrant shows that the teachers were brave to admit the agency in handling social media tools. It is interesting to see that teachers use Twitter in the context of visitors in personal context. In other words, teachers share only their academic information on twitter. A similar characteristic is associated with the communication tool zoom as well. Teachers' tendency of becoming residents in academic-oriented tools are less and data highlighted a limited scope in the use of digital tools by teachers for their professional activities.

Perception of Academics on Their Use of Different Digital Tools

In the second stage of the study, randomly selected thirteen teachers from Sri Lanka and 5 teachers from Sweden were interviewed to get a deeper understanding of individual V-R portraits. The responses were recorded and analyzed using a simple spreadsheet since the quantity of data is small. The interview analysis results in three main strands of motivations/provisions as described subsequently.

Institutional Requirements

Institutions make it mandatory that teachers use some basic tools, such as LMS, in their daily teaching activities. Often, the institute subscribes to an LMS. Hence, it is often placed in the institutional and resident quadrants. As all academic operations are conducted via LMS, academics gradually become residents of the tool. One interviewee stated the following: "I received a short training on the use of LMS, that motivated me to use many functions such as discussion [forums] and calendar notifications, for example". They also stated: "During the Covid [pandemic] I opened discussion threads to answer [students'] questions. I think I have become [a] resident in LMS since the courses [are] delivered online and I learned it by doing."

Despite institutional recommendations, 48% of the academics had not mentioned LMS in their portraits. Similarly, no participant showed preference to use Zoom and MS teams, which are often the official communication channels of institutes. Even though lectures are conducted via Zoom or MS teams, 17% of academics had not mentioned them in their V-R portraits. When questioned, the respondents stated that they were "common" and "obvious" tools and that they "forgot" to mention them. One Swedish respondent explained: "Institutional subscriptions are [a] must for teachers, and there is no point of mentioning them since they are compulsory to all the teachers". Viber is used on the recommendation of the institute only by Sri Lankan academics. It is used for official group messaging among academics.

Privacy Concerns

Most academics use social media in the personal context for social connectivity. Also, social media platforms support searching for personal data of individuals, specifically to build academic friend circles and to get to know the personal engagements of colleagues. However, academics did not use social media

for academic decision-making or academic work. Almost all the teachers distinguished between tools used in the professional and private contexts. One teacher said: " I would keep my network and professional network separate. That makes me clear about my private communications and content, separate from the office work". Another response was: "I use different tools for chatting and sharing photos, and messaging with friends. I will never add my students to my Skype account". Another teacher stated: "I see LinkedIn as my professional networking point, and the personal counterpart is Facebook. I may share my family photos there, but never [on] LinkedIn". Therefore, it can be concluded that teachers have clear boundaries regarding privacy when using digital tools.

Job Orientation, Literacy, and Convenience

The interviews explored the reasons for the limited use of YouTube among academics, despite it being a popular streaming tool among the general public. Academics are mostly used YouTube for their knowledge creation, rather than utilising them directly in the classroom environment. Further, the use of collaborative tools such as Miro, Mural, Padlets, Kahoot, and Mentimeter was identified by academics as academic tools useful in delivering lectures. However, although these tools were primarily placed in the institutional context they were not used regularly, due to their complexity, lack of security, time constraint, and lack of experience in using them. Very few Sri Lankan academics use them due to limited literacy of the tool, time constraints and the unavailability of free subscriptions. The available free subscriptions have restrictions that disturb the continuous use of the tool. Furthermore, most Sri Lankan academics preferred conventional modes of delivering lectures, which saved them from embarrassment caused by technical glitches or limited knowledge of operating advanced digital tools.

Swedish teachers' main concern was the software subscriptions, and they emphasized the need for purchasing these tools and increasing training. One respondent criticized the limited training opportunities saying: "I want to use tools like Miro since it supports my students to successfully collaborate in their projects, but I cannot use it with big groups, or the features are locked [in the free version], so it [limits] the use even if I like to be a resident in it". Another responded: "I like to be [a] resident in some tools but I don't have the time for it or the financial support from the university".

DISCUSSION AND CONCLUDING REMARKS

Technological advancement and the usage of tools considerably impact the quality of education. The COVID-19 pandemic transformed traditional teaching and popularised online or hybrid methods of teaching. Now, teachers have to experiment with new digital tools for presenting teaching and learning activities (Mucundanyi & Woodley, 2021). Technology is updated and upgraded regularly, making it necessary for teachers to learn the uses of new digital tools or the new functions of tools already in use (Woods & Rosenberg, 2016). Different tools have unique features and can be classified to easily understand their specific uses in digital education development (Goldin et al., 2022). Hence, some tools support learning management while others support content searching, creation, sharing and collaboration, and so on. However, teachers' knowledge of available tools and their uses is essential in embedding digital tools in teaching (Mucundanyi & Woodley, 2021).

Discussion of Study Outcomes

LMS is a virtual space supporting education courses, content management, and course administration (Goldin et al., 2022), making it an essential tool for institutions. This virtual space enables frequent connections between teachers, students, and the course (Cabero-Almenara et al., 2019). Teachers in both countries are residents of LMS, indicating high awareness and ability to manage the tool. Also, teachers need to utilize technology when designing and delivering the courses, specifically in online and distance education. A more digitally connected environment promotes interactivity among students and enhances their learning experience (Shang et al., 2022). Unlike in the physical classroom, different conferencing tools that facilitate voice, video, and content sharing connect the teacher and the student in distance education. Zoom, MS Teams, and Skype are the most common video conferencing tools used by academics in the

institutional context. Zoom is Sweden's most popular conferencing tool, while Sri Lankans use both Zoom and MS Teams. As the operation of these tools requires the user's identity, and as they are used in daily teaching, most academics are residents of these tools. The selection of some tools, however, depends on institutional policy and management. This research shows that teachers follow institutional recommendations due to concerns about the security of data and personal information, legal bonds (such as subscriptions) of the university, and the provision of training and support from IT departments. The residency of LMS and conferencing tools of academics from both regions are due to those tools being promoted by the university. In both contexts these video conferencing tools are prescribed by the institution, which has become a mandatory requirement for the teachers. However, some academics neither mentioned these tools in their portrait nor recognized themselves as residents of these tools, which could indicate their lack of interest in using them. Developing a positive attitude, self-motivation, and self-efficacy could better connect teachers to digital tools (Bilici et al., 2013). In addition, having an understanding of the basic features of tools motivates teachers to use them and to try new functionalities (Mucundanyi & Woodley, 2021). Therefore, in the absence of literacy, motivation, and efficacy, the use of tools is done merely to fulfill an institutional requirement. As a result, the expected outcomes of using digital tools cannot be obtained. Hence, self-motivation, encouragement, and support to use digital tools are more effective than regulations. The institutions should also train teachers so that they can use digital tools to their full capacity.

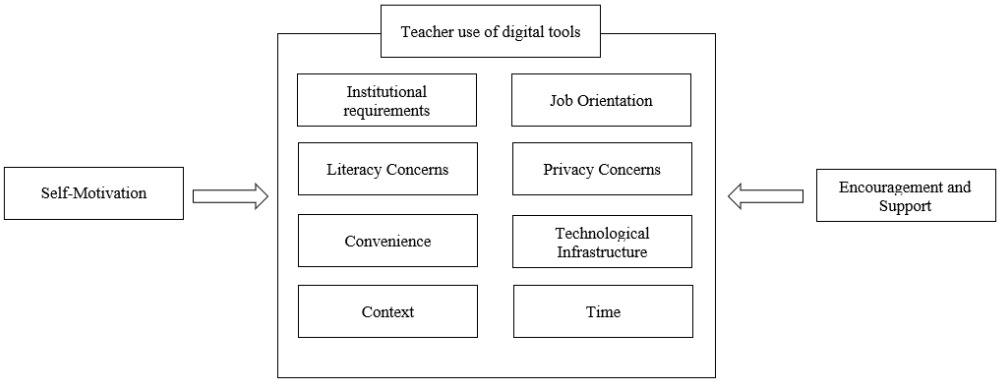
The study also showed that teachers use different messaging tools and social media tools such as WhatsApp, Facebook, and Instagram in the personal context and that many teachers are residents in them. Typically, tools such as WhatsApp are used in informal and formal contexts to ensure immediate student connectivity (Gachago et al., 2015). The study showed that social media tools are less popularly used in teaching than in virtual learning environments. While virtual learning platforms such as LMS focus on academic goals, social media, and messaging tools mainly focus on networking (Lacka et al., 2021). It is noteworthy that Swedish academics had not mentioned digital assessment tools. However, Sri Lankan academics use them in a limited manner. Digital assessment tools require considerable preparation and hands-on technical experience (Wang & Tahir, 2020), which demotivates teachers from using them. The findings of Çekiç and Bakla (2021) also confirm the teachers' passive behavior in using these tools, mainly due to time constraints and the complexity of the tool. Moreover, these tools demand intensive infrastructure. Digital assessment tools, however, are listed as necessary in digital educational development to optimize academic integrity and security and to provide real-time feedback to students (Çekiç & Bakla, 2021). Therefore, it may be advantageous for teachers to consider the potential of digital assessment tools. Though game-based learning is an innovative teaching approach, not much concern is given to it in both countries. It is questionable if a novice teacher of digital tools could use them and if they can be supported in the process. Hence, to popularise these types of tools, it is important to develop teachers' self-determination and acceptance of technology, instead of following a robust top-down approach when introducing technologies. This will likely result in self-motivation among teachers to use digital tools that cater to their pedagogical variations and teaching styles (Langset et al., 2018). In addition to using embedded digital boards and screen sharing, Padlet and Miro are some alternative tools useful to share content and do collaborative tasks. Further, digital whiteboards can be used to enable more student interactions (Michael & Cutrim, 2010). As observed in this study, teachers use them in the institutional context, not actively, but as visitors. Sweden's use of collaborative tools is encouraging. But very few Sri Lankan academics use them, mainly due to high costs, limited capacity, and lack of time and familiarity with the tool.

Though data exchange and cloud systems enable teachers to increase connectivity (Goldin et al., 2022), they are not very popular. Teachers prefer static storage spaces (PC or printed versions of material) and maintain the physical spaces instead. This could be because these cloud tools need IT infrastructure. Similarly, academics show limited use of the digital library. The most popular digital library tool among Swedish academics is Google Scholar, which they use as visitor. The behavior of Sri Lankan academics in the present study contradicts the findings of Wickramanayake (2010) who states that Sri Lankan academics are information seekers who are familiar with accessing digital libraries. However, Wickramanayake (2010) has highlighted the academics' demand for more IT infrastructure to connect to digital libraries worldwide.

According to Hinostroza et al. (2016), most academics use general tools and very rarely search for specific tools to make their teaching more interactive. In addition, academics use a range of social media platforms, different commercial applications, and many other tools in the personal context. However, they rarely support teaching-learning activities.

The use of digital tools varies depending on the context. For example, in the professional context, academics are bound to follow the rules and the requirements of the institute. However, as stated before, self-motivation is more effective than rules in making teachers residents of tools. Compulsion results in limited use of tools, whereas providing mediation and motivating teachers will enable them to be digitally active (see figure 10).

FIGURE 10
SUMMARY OF FINDINGS



Concluding Remarks

Academics in both countries frequently use digital tools. As stated in the activity theory, the selection of digital tools could be influenced by the teaching context (Kirkup & Kirkwood, 2005). However, the findings show a distinction between digital tools used for teaching and learning and those used for personal activities. Academics actively use popular digital education tools. Their choices are, however, moderated based on institutional demands, privacy concerns, job orientation, fluency, convenience, time consumption, and the availability of technological infrastructure. Most tools regularly used in the academic context are supported by the respective institutions. Although the institute inevitably influences an academic resident's behavior in using digital tools, it is compulsory to have the support of the institute to access tools essential for teaching. A limited scope can be seen in the teachers' use of digital tools and their use is mostly shaped by the institutions. The attitude of academics toward using digital tools, however, influences the use of tools significantly more than institutional demands.

Academics from both countries do not seem to exploit the full potential of digital tools. However, as a developed country in the global North, Swedish academics are much more aware, literate, and exposed to tools than Sri Lankan academics who are from a developing country in the global South. This is due to better IT infrastructure and financial support in Sweden. In contrast, accessing technology has become more expensive for countries like Sri Lanka, which demotivates academics from using digital tools. Institutions do not sufficiently facilitate academics with these tools or provide information about open-access tools that could be used as alternatives. This indicates a lack of interest in academics and other related responsible parties in promoting the use of digital tools in education. In conclusion, irrespective of the country, both groups of academics indicated that the lack of self-motivation hinders efforts to enhance teaching using technology. Teachers need external support in place of rules. Future research could investigate academics' perceptions towards using digital tools, understand the changes that can result from applying digital tools, and address the limitations faced by teachers in using digital tools. This could reduce the disparity between developed and developing nations in technologically enhanced teaching and learning.

REFERENCES

Bali, M. (2016). *Knowing the Difference Between Digital Skills and Digital Literacies, and Teaching Both* [Education]. Literacy Now. Retrieved from https://www.literacyworldwide.org/blog/literacy-now/2016/02/03/knowing-the-difference-between-digital-skills-and-digital-literacies-and-teaching-both

Balyk, N., Vasylenko, Y., Shmyger, G., Barna, O., & Oleksiuk, V. (2020). *The Digital Capabilities Model of University Teachers in the Educational Activities Context*. Retrieved from http://dspace.tnpu.edu.ua/handle/123456789/16742

Bilici, S.C., Yamak, H., Kavak, N., & Guzey, S.S. (2013). Technological Pedagogical Content Knowledge Self-Efficacy Scale (TPACK-SeS) for Pre-Service Science Teachers: Construction, Validation, and Reliability. *Eurasian Journal of Educational Research*. Retrieved from https://eric.ed.gov/?id=EJ1060363

Bligh, B., & Flood, M. (2017). Activity theory in empirical higher education research: Choices, uses and values. *Tertiary Education and Management*, *23*(2), 125–152. https://doi.org/10.1080/13583883.2017.1284258

Cabero-Almenara, J., Arancibia, M., & Prete, A.del. (2019). Technical and Didactic Knowledge of the Moodle LMS in Higher Education. Beyond Functional Use. *Journal of New Approaches in Educational Research (NAER Journal)*, *8*(1), 25–33.

Caroline, K. (2017). Undividing the Digital? The Power of Narrative Research to Uncover the Hidden Complexities of Students' Digital Practice. *European Distance and E-Learning Network (EDEN) Conference Proceedings*, *1*, 280–295.

Çekiç, A., & Bakla, A. (2021). A Review of Digital Formative Assessment Tools: Features and Future Directions. *International Online Journal of Education and Teaching*, *8*(3), 1459–1485.

DeVane, B., & Squire, K.D. (2012). Activity Theory in the Learning Technologies. In *Theoretical Foundations of Learning Environments* (pp. 242–267). Routledge. https://doi.org/10.4324/9780203813799-12

Elmqvist, N., & Fekete, J.-D. (2010). Hierarchical Aggregation for Information Visualization: Overview, Techniques, and Design Guidelines. *IEEE Transactions on Visualization and Computer Graphics*, *16*(3), 439–454. https://doi.org/10.1109/TVCG.2009.84

Fraillon, J., Ainley, J., Schulz, W., Friedman, T., & Duckworth, D. (2020). *Preparing for Life in a Digital World: IEA International Computer and Information Literacy Study 2018 International Report*. Springer Nature. https://doi.org/10.1007/978-3-030-38781-5

Gachago, D., Strydom, S., Hanekom, P., Simons, S., & Walters, S. (2015). Crossing boundaries: Lecturers' perspectives on the use of WhatsApp to support teaching and learning in Higher Education. *Progressio*, *37*, 172–187.

García-Martín, S., & Cantón-Mayo, I. (2019). Teachers 3.0: Patterns of Use of Five Digital Tools. *Digital Education Review*. Retrieved from https://eric.ed.gov/?id=EJ1220147

Goldin, T., Rauch, E., Pacher, C., & Woschank, M. (2022). Reference Architecture for an Integrated and Synergetic Use of Digital Tools in Education 4.0. *Procedia Computer Science*, *200*, 407–417. https://doi.org/10.1016/j.procs.2022.01.239

Herodotou, C., Sharples, M., Gaved, M., Kukulska-Hulme, A., Rienties, B., Scanlon, E., & Whitelock, D. (2019). Innovative Pedagogies of the Future: An Evidence-Based Selection. *Frontiers in Education*, *4*. Retrieved from https://www.frontiersin.org/article/10.3389/feduc.2019.00113

Hinostroza, J.E., Ibieta, A.I., Claro, M., & Labbé, C. (2016). Characterisation of teachers' use of computers and Internet inside and outside the classroom: The need to focus on the quality. *Education and Information Technologies*, *21*(6), 1595–1610. https://doi.org/10.1007/s10639-015-9404-6

Hung, D.W.L., & Wong, A.F.L. (2000). Activity Theory as a Framework for Project Work in Learning Environments. *Educational Technology*, *40*(2), 33–37.

Jones, D. (n.d.). *Mapping the digital practices of teacher educators: Implications for teacher education in changing digital landscapes*. The Weblog of (a) David Jones. Retrieved June 28, 2022, from https://davidtjones.wordpress.com/category/publications/

Jones, D., Albion, P., & Heffernan, A. (2016). *Mapping the digital practices of teacher educators: Implications for teacher education in changing digital landscapes*, pp. 2878–2886. Retrieved from https://www.learntechlib.org/primary/p/172103/

Khalid, Md.S., Slættalíð, T., Parveen, M., & Hossain, M.S. (2015). A systematic review and meta-analysis of teachers' development of digital literacy. *Proceedings of the 1th D4|Learning International Conference Innovations in Digital Learning for Inclusion (D4Learning, 2015)*, pp. 136–144.

Kirkup, G., & Kirkwood, A. (2005). Information and communications technologies (ICT) in higher education teaching—A tale of gradualism rather than revolution. *Learning, Media and Technology*, *30*(2), 185–199. https://doi.org/10.1080/17439880500093810

Koslowski, F.A. (2006). Quality and assessment in context: A brief review. *Quality Assurance in Education*, *14*(3), 277–288. https://doi.org/10.1108/09684880610678586

Lacka, E., Wong, T.C., & Haddoud, M.Y. (2021). Can digital technologies improve students' efficiency? Exploring the role of Virtual Learning Environment and Social Media use in Higher Education. *Computers & Education*, *163*, 104099. https://doi.org/10.1016/j.compedu.2020.104099

Langset, I.D., Jacobsen, D.Y., & Haugsbakken, H. (2018). Digital professional development: Towards a collaborative learning approach for taking higher education into the digitalized age. *Nordic Journal of Digital Literacy*, *13*(1), 24–39. https://doi.org/10.18261/issn.1891-943x-2018-01-03

Li, M., & Yu, Z. (2022). Teachers' Satisfaction, Role, and Digital Literacy during the COVID-19 Pandemic. *Sustainability*, *14*(3), 1121. https://doi.org/10.3390/su14031121

McGuinness, C., & Fulton, C. (2019). *Digital Literacy in Higher Education: A Case Study of Student Engagement with E-Tutorials Using Blended Learning*. Retrieved from http://www.jite.org/documents/Vol18/JITEv18IIPp001-028McGuinness5256.pdf

Michael, T., & Cutrim, S., Euline. (2010). *Interactive Whiteboards for Education: Theory, Research and Practice: Theory, Research and Practice*. IGI Global.

Mucundanyi, G., & Woodley, X. (2021). Exploring Free Digital Tools in Education. *International Journal of Education and Development Using Information and Communication Technology*, *17*(2), 96–103.

Öngören, S. (2021). *Investigation of Prospective Preschool Teachers' Digital Literacy and Teacher Readiness Levels*. Retrieved from https://dergipark.org.tr/en/pub/ijonmes/issue/67828/1052067

Perifanou, M., Economides, A., & Tzafilkou, K. (2021). Teachers' Digital Skills Readiness During COVID-19 Pandemic. *International Journal of Emerging Technologies in Learning (IJET)*. Retrieved from https://ruomo.lib.uom.gr/handle/7000/920

Popov, O. (2008). *Developing outdoor physics projects using the activity theory framework*. Retrieved from https://lekythos.library.ucy.ac.cy/handle/10797/14476

Potyrała, K., & Tomczyk, Ł. (2021). Teachers in the lifelong learning process: Examples of digital literacy. *Journal of Education for Teaching*, *47*(2), 255–273. https://doi.org/10.1080/02607476.2021.1876499

Rusydiyah, E.F., Purwati, E., & Prabowo, A. (2020). How to use digital literacy as a learning resource for teacher candidates in Indonesia. *Jurnal Cakrawala Pendidikan*, *39*(2), 305–318. https://doi.org/10.21831/cp.v39i2.30551

Sadaf, A., & Johnson, B. (2017). *Teachers' Beliefs About Integrating Digital Literacy Into Classroom Practice: An Investigation Based on the Theory of Planned Behavior*. Retrieved from https://www-tandfonline-com.ezp.sub.su.se/doi/full/10.1080/21532974.2017.1347534

Sánchez-Cruzado, C., Santiago Campión, R., & Sánchez-Compaña, M.T. (2021). Teacher Digital Literacy: The Indisputable Challenge after COVID-19. *Sustainability*, *13*(4), 1858. https://doi.org/10.3390/su13041858

Schiller, J. (2003). Working with ICT: Perceptions of Australian principals. *Journal of Educational Administration*, *41*(2), 171–185. https://doi.org/10.1108/09578230310464675

Shang, H., Sivaparthipan, C.B., & ThanjaiVadivel. (2022). Interactive teaching using human-machine interaction for higher education systems. *Computers and Electrical Engineering*, *100*, 107811. https://doi.org/10.1016/j.compeleceng.2022.107811

Stuart, K. (2014). Activity theory as a reflective and analytic tool for action research on multi-professional collaborative practice. *Reflective Practice*, *15*(3), 347–362. https://doi.org/10.1080/14623943.2014.900007

Thorvaldsen, S., & Siri Madsen. (2021). Decoding the Digital Gap in Teacher Education: Three Perspectives across the Globe. In *Teacher Education in the 21st Century: Emerging Skills for a Changing World* (pp. 1–16). IntechOpen.

Tomczyk, Ł. (2021). Declared and Real Level of Digital Skills of Future Teaching Staff. *Education Sciences*, *11*(10), 619. https://doi.org/10.3390/educsci11100619

Vandeyar, T. (2020). The academic turn: Social media in higher education. *Education and Information Technologies*, *25*(6), 5617–5635. https://doi.org/10.1007/s10639-020-10240-1

Voogt, J., Erstad, O., Dede, C., & Mishra, P. (2013). Challenges to learning and schooling in the digital networked world of the 21st century. *Journal of Computer Assisted Learning*, *29*(5), 403–413. https://doi.org/10.1111/jcal.12029

Wang, A.I., & Tahir, R. (2020). The effect of using Kahoot! For learning – A literature review. *Computers & Education*, *149*, 103818. https://doi.org/10.1016/j.compedu.2020.103818

White, D.S., & Cornu, A.L. (2011). Visitors and Residents: A new typology for online engagement. *First Monday*. https://doi.org/10.5210/fm.v16i9.3171

White, D.S., & Cornu, A.L. (2017). Using 'Visitors and Residents' to visualise digital practices. *First Monday*. https://doi.org/10.5210/fm.v22i8.7802

Wickramanayake, L. (2010). Information-seeking behavior of management and commerce faculty in Sri Lankan universities: An evaluation. *Library Review*, *59*(8), 624–636. https://doi.org/10.1108/00242531011073155

Widana, I.W. (2020). The Effect of Digital Literacy on the Ability of Teachers to Develop HOTS-based Assessment. *Journal of Physics: Conference Series*, *1503*(1), 012045. https://doi.org/10.1088/1742-6596/1503/1/012045

Woods, M., & Rosenberg, M.E. (2016). Educational Tools: Thinking Outside the Box. *Clinical Journal of the American Society of Nephrology*, *11*(3), 518–526. https://doi.org/10.2215/CJN.02570315