The Integration of Digital Technologies into Practicum Classrooms by Smartphone-Savvy Pre-Service Teachers in Indonesia

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Abstract: The Indonesian government has declared a strong commitment to information and communication technology (ICT) education reform but has made meager progress due to inconsistent education policies, fragmentary technological infrastructure, and ill-prepared teachers. Despite these obstacles, young people in Indonesia have embraced smartphones and related technologies as important means of maintaining their socially integrated lifestyles. This project sought to measure the adoption of smartphone technologies among pre-service teachers as part of their broader ICT consciousness and teaching. We examined the ICT competencies of 220 pre-service teachers at two state universities in western Indonesia. A questionnaire was distributed to the participants toward the end of the students' final practicum during the COVID-19 closure of the schools. Results showed very high use of smartphones in private contexts, infrequent use of laptops and desktop computers, a strong rejection of institutionally available (or often unavailable) devices and services, and a skewing of ICT skills toward tools available on smartphones, especially those accessible through social media platforms.

Keywords: *ICT competence, Indonesian education, pre-service teachers, smartphones, social media.*

Introduction

Young people in Indonesia are among the most adept smartphone users in the Southeast Asian region and, in some ways, the world (Association of Indonesian Internet Service Providers [APJII], 2015; eMarketer, 2015). While they may own as many smartphones as young people in other countries, their use surpasses many other countries in terms of time spent daily (Kemp, 2021) and connection to social media (APJII, 2015). However, is this tech literacy translating into broader use of other connected devices or more extensive use of digital tools in learning? In particular, can pre-service teachers transfer their smartphone skills to their teaching? With this study, we aimed to answer the question: How are pre-service teachers' ICT competencies in smartphone use related to integrating educational technology into their practicum classrooms? This study sought to examine the nature and extent of smartphone use and the educational consequences of that use at two Indonesian universities.

Social networking is Indonesia's most common internet use (APJII, 2015). The most common time students use the internet is outside school hours (Palekahelu et al., 2016). No less than 85 percent of Internet use is through mobile phones, and less than one-third of users usually go online through laptops, desktops, or tablets (APJII, 2015). Indonesia is among the top three highest Facebook-using countries in the world (eMarketer, 2015), and up to 80 percent of users in Indonesia are between the ages of 15 and 30 (Relmasira et al., 2017). Indonesian users (aged 16-64) spend an average of 7 hours and 52 minutes per day online, well above the global average of 6 hours and 54 minutes (Kemp, 2021). Conversely, however, there is a lack of ICT skills among teachers (Azzahra & Amanta, 2021; Rahayu, 2019; Torar & Wahono, 2016) and their students. The ubiquity of smartphone use among Indonesian youth and their substantial rejection or neglect of other devices requires exploration and explanation.

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This study focuses on pre-service teachers' ICT competence and examines the factors influencing their ICT knowledge. It is essential to examine pre-service teachers' ICT skills and dispositions and their strengths and weaknesses in ICT. We intend to conduct a small-scale study to set benchmarks for later analysis in future studies. Attempts to refine the measurement of appropriate ICT competencies and understanding for pre-service teachers have been promising in many places (Pozas & Letzel, 2021), but more is needed in Indonesia.

There have been various attempts to measure, improve and, to a certain extent, regulate ICT standards in pre-service teachers (as well as teachers) so that schools, governments, or education departments might have some certainty that teachers can deliver classroom programs that are rich in ICT content (Tondeur et al., 2017). These include measuring digital competence, acceptance, and correlation with the pedagogical context of use (Amaro et al., 2017; Farjon et al., 2019; Ferrari, 2013; Knezek & Christensen, 2016; Viberg et al., 2020; Wong & Daud, 2018). These competing measures or professional development programs made a reasonable attempt to develop pre-service teachers' competence. They differed greatly in intent and scope, but they pointed to a global dilemma facing educators and regulators of schooling the difficulty of raising competency levels. There is still confusion about how pre-service teachers acquire all the required competencies (Gill et al., 2015; Uerz et al., 2018), particularly in Indonesia. There is no uniform program for assessing ICT competencies internationally or (in most cases) in individual countries such as Indonesia.

Our participants were final-year (fourth-year) education students who completed extended practicum activities during fieldwork. We were able to collect final practicum grades and measure how they were able to integrate ICT into their teaching. Our data were collected during the mid-COVID-19 closure so that we could focus on pre-service teachers who needed to muster all of their ICT resources. The project was conducted at two state universities in the western part of the Republic; university 1 in the Java region and university 2 in the Sumatra region. University 1 is located in the majority Sundanese ethnic area, and University 2 is located in a majority Malay and minority Minangkabau and Batak ethnic areas. Both locations are in the more developed western parts of the archipelago, where internet access per household is higher (Statistics Indonesia, 2020) and digital literacy is presumably better.

Issues for Pre-Service Teachers in Gaining Competence in ICT

What prevents pre-service teachers from acquiring sufficient competencies in ICT and thus makes it challenging to integrate digital technologies into their classrooms? Many studies show that pre-service teachers often have little confidence in using ICT in their teaching, which is sometimes because they do not have enough experience in teaching (Drossel et al., 2017; Grafe & Breiter, 2014; Knezek & Christensen, 2016; Shaw et al., 2018; Spiteri & Rundgren, 2020; Yusop et al., 2021). This finding could be due to the infrequent use of ICT skills (Tondeur et al., 2017; Uerz et al., 2018) or simply inadequate training (Alsaleh & Anthony, 2019; Tondeur et al., 2017). Aydin et al. (2016) have shown that for teachers, there is an underlying relationship between adequate training in ICT and successful integration of ICT in the classroom with their students.

While it is claimed that teachers' mastery of ICT skills has increased during the COVID-19 crisis (Azzahra & Amanta, 2021; König et al., 2020), skill deficits are still very evident (Bozkurt & Sharma, 2020; Seufert et al., 2021). In developing countries, these deficits have often been magnified by inadequate or inoperable devices and poor connectivity (Sá & Serpa, 2020) and the structural disadvantages of rurality (Mohamed et al., 2012; Sankaran & Saad, 2017; Widodo & Riandi, 2013).

ICT in Indonesian Education

Despite Indonesia's current high smartphone usage, the country generally lags behind many other countries (even within the region) in terms of connectivity (The Economist Intelligence Unit, 2021). School connection to the internet has been reported to be 69 percent in primary and junior high schools, and 74 percent of high schools had access to the Internet in 2018 (Statistics Indonesia, 2020). In 2016, 33.98 percent of students aged 5-24 had access to the Internet from home; by 2020, this percentage had increased to 59.33. Although the number of Internet connections has increased significantly, access to the Internet varies widely across the archipelago. In Jakarta, the percentage of households with Internet access is high at 93.33 percent. In contrast, in Nusa Tenggara Timur and Papua, it is 49.83 and 31.31 percent, respectively (ibid.). Internet use in urban areas is significantly higher than in rural areas. A difference that has unfortunately been exacerbated by the COVID-19 crisis (Azzahra & Amanta, 2021).

Government and Education Department policies can encourage the use of technology, although this has not always been the case in Indonesia. In 2013, the government removed ICT as a stand-alone subject from the national curriculum for schools and core university studies such as teacher training courses (Ministry of Education and Culture, 2013) to prioritize other subjects that were deemed to be of greater strategic importance to the republic (Azzahra & Amanta, 2021). To compensate, elements of ICT were to be integrated into all other subjects as was thought appropriate under the guise of school-based curriculum (SBC) development (Purbo, 2017). The intent was to embed the Indonesian language and digital literacy as the foundation for communication, mediation, and expression of understanding in all subject areas. However, the unintended consequences of this policy change were that schools were deprived of a structured curriculum for ICT, specialist teachers for ICT were eliminated or reassigned, assessment of ICT skills was

removed from schools (and from pre-service teacher training courses), the burden of teaching ICT was shifted to teachers whose subject and pedagogical expertise was in areas other than ICT, and teachers and schools became confused about their role in ICT teaching (Subekti et al., 2016).

The system still suffers from high levels of ICT illiteracy among teachers and students, a lack of resources to enable teachers to undertake professional development in ICT, a lack of school support, and technical problems such as poor connectivity and inadequate system maintenance (Azzahra & Amanta, 2021; Rahayu, 2019; Torar & Wahono, 2016). However, ICT has been reintroduced into the national curriculum under the National Literacy Movement (Gerakan Literasi Nasional/GLN) as part of the Siberkreasi Project (Ministry of Education and Culture, 2017).

Methodology

Research Design

This study investigated pre-service teachers' ICT competencies and explored how these competencies relate to the use of ICT in teaching practicum. It was an exploratory study (Creswell, 2013; Holden et al., 2008) that aimed to gain deeper insight into ICT use during university classes and when applied to teaching practice and personal everyday activities.

Sample and Data Collection

Researchers developed a questionnaire that could be completed on a mobile device, loosely based on several measures previously used to assess participants' self-attested ICT competencies. Our questionnaire was adapted from a survey of schools on ICT conducted by the European Schoolnet and the University of Liège under the supervision of the European Commission in 2011 and 2012 (European Commission, 2013) and repeated with an adapted version of the questionnaire in 2018 (European Commission, 2019a, 2019b). This institution has validated the survey prior to its use for measuring the ICT competence of teachers across the European continent. For this reason, we did not conduct another validity test for this survey. The survey was intended as a benchmarking instrument of the ICT within 31 European countries (27 EU member states, plus Croatia, Iceland, Norway, and Turkey) which was translated and matched our intention of using it to benchmark ICT competencies in pre-service teachers in Indonesia. It consisted of five aspects of ICT use in education and learning, including access and competence, service in the study, daily life, and ICT tool availability in universities and schools. The questionnaire consisted of 27 main questions. Each step in the research process met the ethical approval requirements of each university. The questionnaire was translated into Indonesian and distributed to participants through smartphones and tablets.

We drew our sample from final-year students in all major educational programs in the two universities. A random group of students who passed the teaching practicum program participated in this research from nine different study programs. Table 1 presents the demographic information of the participants of this study.

As appeared in table 1, a sizable majority of the participants of both universities were female (90.5 percent), and the remainder were male (9.5 percent). These proportions in the sample matched the proportions in the population from which it was drawn. We intended to capture the cohort of students who progressed straight from school into education degrees at university so that we would eliminate different extraneous variables such as special entrants and mature-age entrants. We showed to achieve that objective as a vast 97.3 percent came from the same age level (18-22 years old). Approximately half the participants came from each of the two universities sampled. In terms of their majors, half of them (109 out of 220 participants) came from elementary school education, followed by other specializations suited to elementary or secondary education, as shown in the table. Our sample represented the cohort from which it was drawn.

Table 1. Demographic Profile of Survey Participants (n = 220)

Category		n	%
Gender	Male	21	9.5
	Female	199	90.5
Age group	18 – 22	214	97.3
	23 and above	6	2.7
University	University 1	101	45.9
	University 2	119	54.1
Teaching specialization	Elementary School Education	109	49.5
	English Language Education	69	31.4
	Japanese Language Education	16	7.3
	Physics Education	15	6.8
	Others (incl. Early Childhood Education, Guidance and Counselling Education, Mathematics Education, Chemistry Education, and Sports Coaching Education)	11	5.0

Analyzing of Data

A descriptive quantitative analysis was selected to measure ICT access and usage in terms of percentages, means, and standard deviations. Pearson correlation was also employed to test correlations between practicum scores and ICT competencies; thus, t-test and ANOVA were used to test significant differences between means of ICT attributes and competencies.

Findings / Results

Tests for dispersion of responses (including tests for variance and standard deviation) were performed for each item and variable in the questionnaire. All were within normal ranges. Figure 1 shows the personal availability of devices among the pre-service teachers in the sample. The question did not specifically ask students whether they 'owned' a device but whether they had a device available to them that they could personally "use" at the university or a school in their teaching practicum.
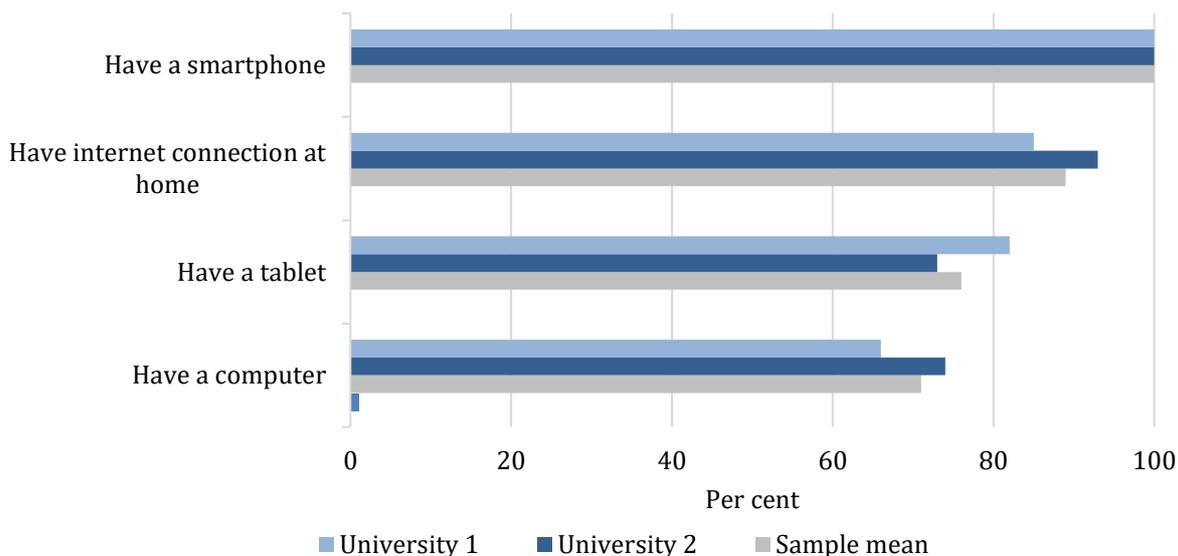

Figure 1. Personal Use of Devices at Sample Universities (N = 220)

Every student in the sample had a smartphone available to them. As many as 89 percent of students had an internet connection at home, and 76 percent had a tablet (described in the question as 'a tablet PC, netbook or notebook computer'). Surprisingly, as many as 29 percent of students in the sample did not have exclusive personal access to a computer for their studies or their teaching practicum (and an even higher 34 percent for students at University 1). The personal use of devices between the two universities was similar, although access to the internet and computer access was lower at University 1. We were interested to know the effect of a third of the students in the sample not having access to a computer and how this would impact their teaching.

Our analysis showed that students used computers infrequently for university learning. A mean was calculated by allocating a value to the alternative responses with 'always' being given 5, 'often' given 4, 'sometimes' 3, 'rarely' 2, and 'never' 1. Among the activities listed, searching the internet for information (with a mean score of 3.95 out of a possible 5.00) was the most frequent activity. Chatting online about my studies (3.69) and collecting online information, and organizing it into files (3.68) also scored higher. Thirty percent of students rarely used computers to create and contribute to blogs and forums, send or read emails and participate in online forums. Considering these findings, the lack of these students' capacities to deliver programs in schools online may have been seriously compromised.
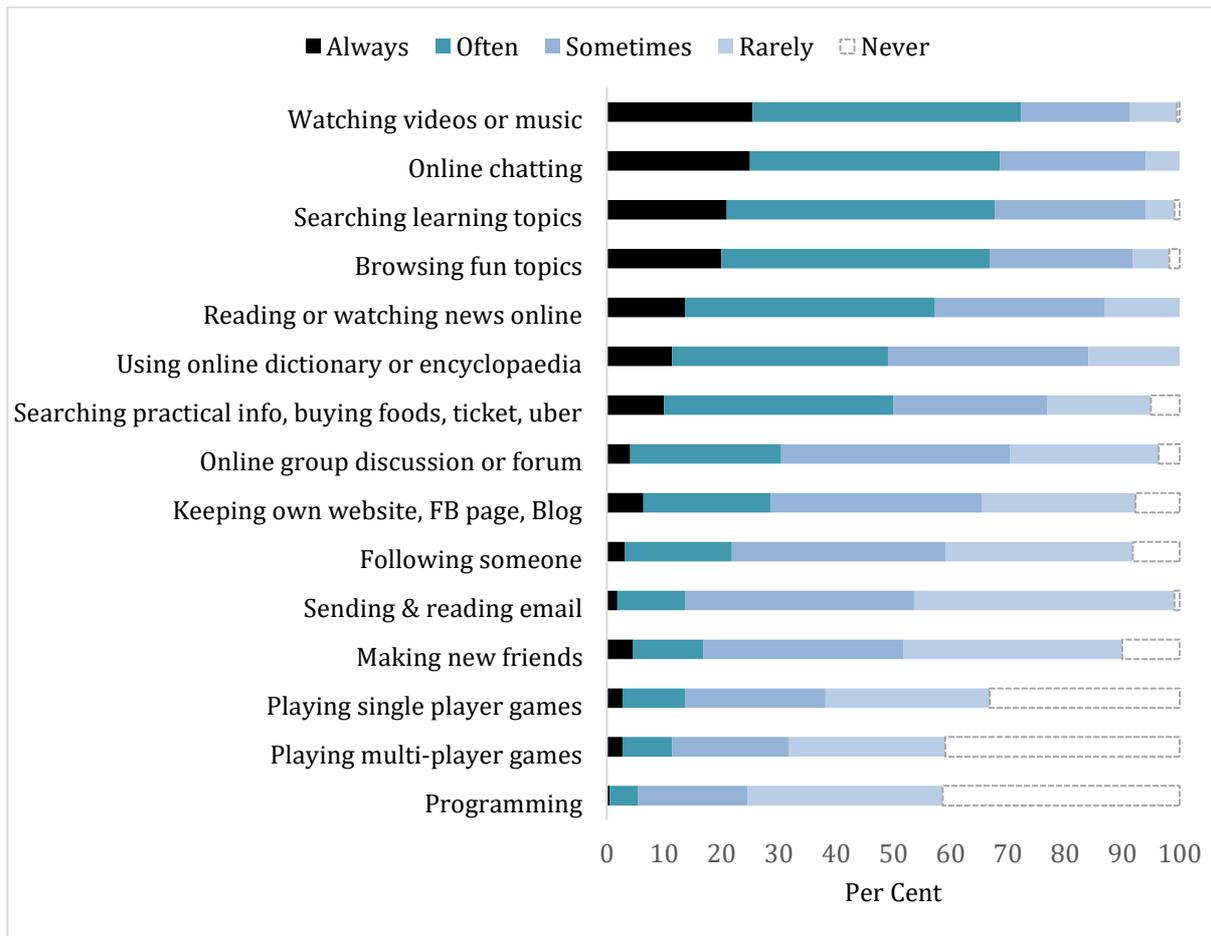
Figure 2. Regularity of Free-Time 'Everyday ICT Skills' Outside University

Figure 2 shows students' regularity in completing various tasks in their free time at any place other than the university, designated as 'Everyday ICT skills.' The items in the table and figure are arranged in mean order. The 15 items in this question were designed to measure the 'everyday' tasks that required connection to the internet, and that filled a young person's leisure time. This series of items is intended to measure students' capability in non-learning-related activities that might be compared to the skills and tasks directed explicitly to the course they were undertaking. There could be considerable overlap between the tasks in this group of items and learning-related tasks and skills.

The top five activities most frequently done by the respondents were:

- Watching video clips, downloading music, games, and software from the internet (3.89 means)
- Chatting online (3.88)
- Searching online for information and learning about particular topics I am interested in (3.82)
- Browsing the internet for fun (3.77)
- Reading or watching the news online (3.58)

The ICT activities listed in Figure 2 could all be performed on the smartphone (with the possible exception of programming, which, in itself, was unable to be performed by more than 75 percent of participants). The figure demonstrated, therefore, the broad capacities these pre-service teachers had to complete tasks in their free time on mobile devices. However, were such ICT tasks also able to be performed within the context of university classes and on devices other than smartphones?

Measures of confidence in performing skills in ICT, designated as 'ICT skills,' are shown in Figure 3. The ICT competencies included information and data literacy, communication and collaboration, safety, problem-solving, and digital content creation. Respondents were given four alternative responses ('a lot', 'somewhat', 'a little', and 'none') to each item - skills related to their university studies and the practicum.
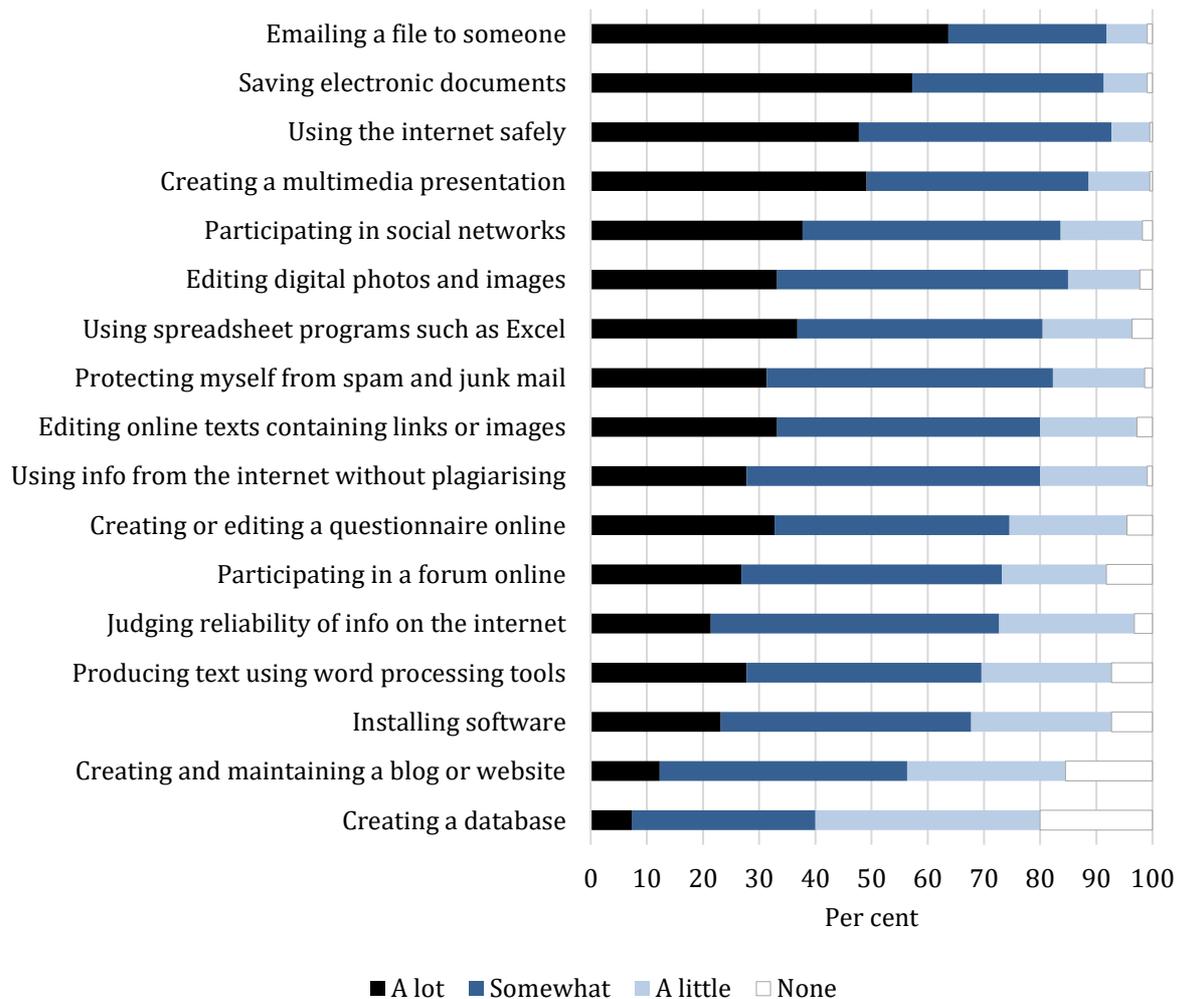
Figure 3. Confidence in Performing 'ICT Skills in Educational Contexts' (n = 220)

The figure ordered the ICT skills in descending order by the mean score to permit a more careful examination of the levels of confidence students had. This item did not specify the device upon which the ICT skills might have been demonstrated. Some of the listed tasks were more easily completed on a computer than on a smartphone. The four skills that the respondents completed with the most confidence were:

- Emailing a file to someone (3.54 out of a possible 4.00)
- Saving electronic documents (3.47)
- Using the internet safely (3.40)
- Creating a multimedia presentation (3.37)

The graph was a disparate group of tasks ranging from communication to safety to manipulation of information.
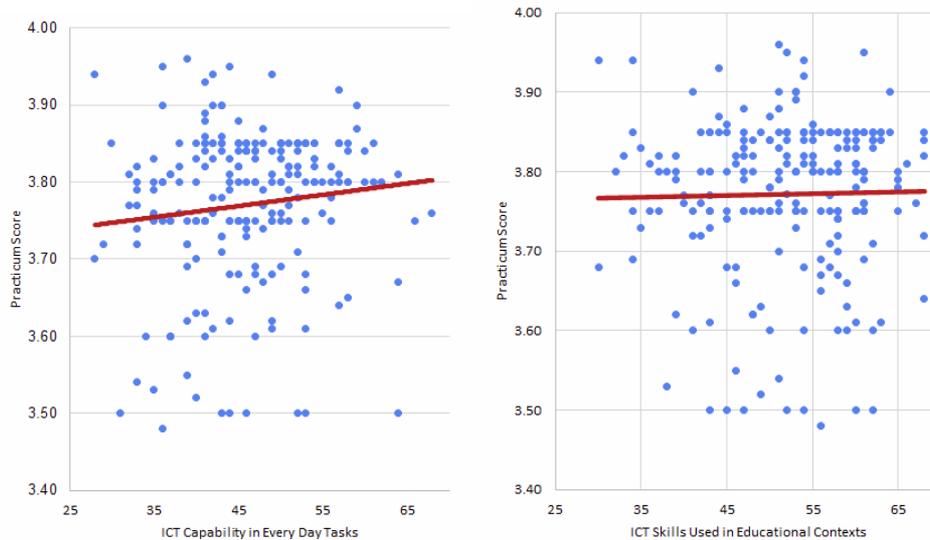
Figure 4. Comparison of Aggregate Scores in ICT Skills and Everyday ICT Skills (N = 220) and Practicum Scores (N = 217)

Figure 4 shows the intersection of scores in everyday ICT skills (see items in Figure 2) and ICT skills used in educational contexts (Figure 3) to the practicum scores in their final (Semester 8) teaching practicum. Practicum scores were derived from grades from the mentor teacher (40 percent of the allocated score) with whom they taught on the final extended teaching practicum and the university lecturer (40 percent) and to which the grades from several assessable practicum tasks (20 percent) were added. A score out of four (to two decimal places) was statistically calculated. The trendline is shown in red in both graphs. There was a significant difference between the ICT skills used in everyday tasks and practicum score (in the first graph) and no significant difference between the ICT skills used in educational settings and the practicum (as shown in the right-hand graph). Analysis of these relationships is shown in Table 2.

Table 2. Correlations Between Practicum Score and Other Variables (n = 220)

Variable	Pearson Correlation	Sig. (2-tailed)
ICT skills in educational settings	.035	.605
Everyday ICT skills	**.132**	**.050***

Figure 5 indicates the devices and tools available to the respondents in schools during teaching practicum. During online learning throughout the COVID-19 lockdowns, schools were expected to provide representative tools to facilitate learning opportunities for the children.
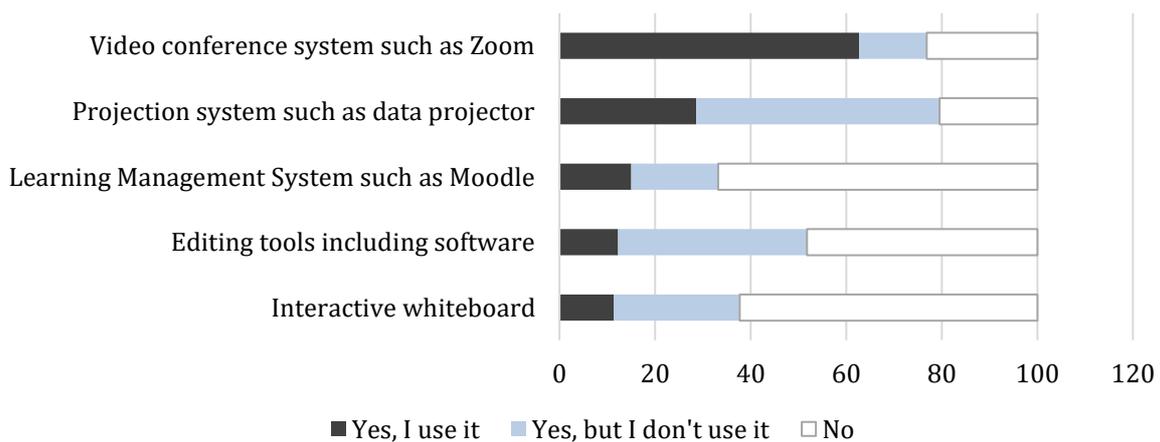

Figure 5. Devices and Tools Available and Used During School Practicum

The findings showed that none of the pre-service teachers surveyed were in schools that provided all the five tools or devices listed in the questionnaire. The practicum schools did not have fully supportive facilities in ICT as, no doubt, in many regions in Indonesia. We noted that the most commonly available technology was video conference systems which were gratifying, considering the necessity of homeschooling which these pre-service teachers were expected to manage. However, we also noted that as many as 37.27 percent of respondents were unable or unwilling to use video conferencing

systems during their practicums. Projection systems were widely available to almost 80 percent of students, but only 28.64 percent used them. Two of the items in this series were found to be significantly linked with success in the practicum - firstly, the use of 'video conference systems such as Zoom' (with an Anova level of significance of 0.001) and the use of a 'Learning Management System such as Moodle' (significance level of 0.023). Students who used these devices and tools had higher scores in the practicum. However, for most of the items in this series, two factors seemed to contribute to poor use of ICT tools and devices in schools, namely, insufficient skill or will to use these systems or inadequate availability of the devices or tools in the practicum schools. Poor internet connectivity in remote schools was also a likely factor in discouraging the use of these devices.

Discussion

Two of our strongly contrasting findings on ICT use demanded discussion and explanation. On the one hand, better ICT skills demonstrated in university classes and practicum schools were found to be unrelated to the achievement of better practicum scores. However, everyday ICT skills acquired outside of school hours and outside of the university, especially with smartphones, were significantly associated with better practicum grades. We wanted to know what characteristics of everyday ICT use are responsible for better performance in the teaching practicum. Several explanations come to mind. First, everyday ICT use was primarily self-taught, through peers or intuitively (possibly with the help of Google and YouTube), rather than through formal instruction in university ICT courses. The finding confirms that Indonesian pre-service teachers also suffer from a lack of confidence in using ICT in their teaching and learning due to a lack of skills (Bozkurt & Sharma, 2020; Yusop et al., 2021) and a lack of training (Alsaleh & Anthony, 2019; Tondeur et al., 2017).

Second, everyday tasks and tools were integrated into participants' life experiences. Tasks included chatting with friends, following friends, ordering food, buying tickets, and booking Uber or 'ojek' (motorcycle) taxis - tasks that require sophisticated ICT knowledge—watching, downloading, and sharing music, videos, and games, in itself a variable correlated with better teaching scores, demonstrated smartphone mastery.

Third, the conversational skills listed in this item could be performed almost entirely through social media platforms such as Facebook or WhatsApp, which these participants used extensively. The networking capabilities of social media platforms expanded participants' skill repertoire in a highly networked virtual environment. The more proficient the participants were at demonstrating their everyday ICT skills, the better their practicum scores were. It did not necessarily mean that the participants with better practicum scores had integrated the ICT skills they possessed into their teaching. Our data were not able to confirm such a direct relationship. The data are contrary to the suggestion that students were unable to relate their ICT skills to their subsequent use of ICT in their teaching (Aydin et al., 2016). A more focused assessment of classroom practice and integrating educational technologies into that practice would be a worthwhile study for the future. However, the skills acquired in using social media appeared to be an essential factor that enabled participants to perform well in the teaching practice conducted in a lockdown environment.

The critical factor in these pre-service teachers' superior teaching practicum results was their ability to integrate smartphone use into their daily activities. This research found many ICT features that participants could demonstrate in their university classes but were less likely to use in teaching. The scarcity or unusability of devices influenced ICT use in schools-especially in remote schools. Until ICT functions that can be used in classrooms become commonplace, the technological transformation of Indonesian education will be limited.

Conclusion

While pre-service teachers in this Indonesian sample were savvy users of smartphones and used social media extensively, these skills were not demonstrated in integrating digital technologies in the practicum classroom. Instead, better instructional outcomes were achieved when superior digital skills were integrated into students' lifestyles.

This study has shown that much work still needs to be done to develop the ICT skills of Indonesian pre-service teachers. Their ICT skills were significantly promoted by everyday use rather than formal ICT university training. They showed they were savvy smartphone users but needed help integrating ICT into regular classroom programs. This study provided a means to refine the measurement of appropriate ICT competencies and understandings for pre-service teachers in Indonesia. The competency of teachers to deliver school programs in a technologically saturated learning environment is key to regenerating the Indonesian economy and technologically empowering the Indonesian population. Although the Indonesian government has identified digital literacy as one of its five national priorities (Cabinet Secretariat of the Republic of Indonesia, 2020), there is little clarity on how it will be achieved in the education system and, more broadly, in society at large (The Economist Intelligence Unit, 2021). We, therefore, conclude that universities should revise their course offerings to promote a deeper understanding of laptops and desktop computers, consider expanding strategies for using mobile learning, rethink methods for assessing ICT competence, and encourage the practical application of digital learning strategies in practicum schools. They could be done by revising the ICT curriculum, but could also be supported by establishing research projects in selected practicum schools to develop new strategies for applying ICT learning in schools.

Recommendations

Based on the findings, we would provide suggestions for future research and policy development:

- We suggest that the critical factor in these pre-service teachers' superior results in the teaching practicum was their capacity to integrate smartphone use into their daily routine activities.
- A regular standard measurement of the ICT competence of teachers (including pre-service teachers) in Indonesia would allow us to monitor progress toward digital literacy among them.
- Indonesian pre-service teachers' reliance on smartphones (and associated digital tools) and corresponding limited understanding of desktop and laptop computers must be addressed in university teacher education curricula.
- Teachers need professional development programs to help them develop attitudes and dispositions to integrate ICT into their teaching.
- Further research would benefit from examining how much Indonesian teachers depend on mobile technology in their classrooms.
- Examining the extent of smartphone literacy among teachers and pre-service teachers could help explain the value of smartphone processes in classroom practice.

Limitations

This project was limited to a small sample of pre-service teachers in relatively affluent regions of Indonesia. It could be valuable to replicate it in many different settings throughout the archipelago. In addition, a more comprehensive study could collect data on actual performance in using ICT outside and in the classroom rather than relying on participants' claims about their skills and understanding of competence. We found little difference between male and female participants, between teachers of elementary or secondary school pre-service teachers, or between different disciplines in the acquisition of ICT skills. However, a broader study might reveal some significant differences in this direction.

Acknowledgments

Authorship Contribution Statement

Salim: Contributed to the design and implementation of the research, the results analysis, and the manuscript's writing proportionally. Waterworth: Conceived the presented idea, developed the theory, performed the computations, supervised the research, and contributed to the final version of the manuscript. Daud: Contributed to the research by setting up questionnaires, distributing the questionnaires to the respondents, collecting some additional qualitative data, and writing up some introductory information and discussion of the research paper. Dahnilsyah: Developed the theoretical formalism and performed the analytic calculations. Hanif: Performed the numerical analysis.

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