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Factors Affecting ICT Integration During Teaching Practices: A Multiple Case Study of Three Indonesian Universities

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Abstract

Information and communication technology (ICT) is a strong force for economic, social, political, and educational reforms happening throughout the world including in developing countries. In this qualitative inquiry, we aimed at elaborating factors affecting ICT integration during teaching practices in pre-service teacher training programs (PTTPs) of three Indonesian universities from the perspectives of fifty-five pre-service teachers. The thematic analysis of this study revealed two major themes, barriers and enablers, which affected the integration of ICT during teaching practices. Based on the themes, this study led to the development of a conceptual model of factors affecting the ICT integration. Recommendations are made for the betterment of Indonesian PTTPs and related stakeholders.

Keywords

Focus Group Discussion, Affecting Factors, ICT Integration, Pre-Service Teachers

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Information and communication technology (ICT) is a strong force for economic, social, political, and educational reforms happening throughout the world including in developing countries. In this qualitative inquiry, we aimed at elaborating factors affecting ICT integration during teaching practices in pre-service teacher training programs (PTTPs) of three Indonesian universities from the perspectives of fifty-five pre-service teachers. The thematic analysis of this study revealed two major themes, barriers and enablers, which affected the integration of ICT during teaching practices. Based on the themes, this study led to the development of a conceptual model of factors affecting the ICT integration. Recommendations are made for the betterment of Indonesian PTTPs and related stakeholders. Keywords: Focus Group Discussion, Affecting Factors, ICT Integration, Pre-Service Teachers

Since the early modern period, improving the quality of instruction in education has been an important concern with many challenges, such as namely students' technology involvement, limited educational textbooks, reluctance to change from traditional teaching methods, ineffective teacher-student ratio in a classroom, as well as the need to shift to technology-based learning (Eryansyah, Erlina, Fiftinova, & Nurweni, 2019; Hadiyanto, 2019). Educational technology, as the study and practice of facilitating learning and improving performance through the use of technology, develops new approaches and frameworks as attempts to overcome the challenges noted above (Januszewski & Molenda, 2008). In these attempts, many educational experts have regarded information and communication technologies (ICT) as a new approach to improve the spread of information and to help overcome these challenges (Brown & Green, 2013; Hinostroza, 2018; Lim & Pannen, 2012). ICT consists of the utilization of a computer or the Internet as well as computer hardware and software, networks, and a host of devices that change the information in forms of video, recording, text, and images into digital formats (Christensen & Knezek, 2017).

The integration of ICT in educational environments such as classrooms and schools needs a predetermined process to enhance the quality of K-12 education. The predetermined process is the introduction to technology-based teaching in teacher training programs. The process helps teachers improve their teaching and foster student learning (Haryanto, Sulistiyo, Fransiska, & Yose, 2019; Mercado & Ibarra, 2019; Suwarno, Randall, & Hite, 2019). In this

context, teachers need to have leading roles in ICT integration for educational purposes, especially for instructional activities due to teachers' shifting role in 21st-century education. Required skills for future teachers' readiness are important at this point. Therefore, schools of education for future teachers have an important role in the integration process. They should be leading institutions to help improve future teachers' understanding of ICT and its integration in a meaningful condition (Brown & Green, 2013).

Many previous studies (e.g., Goktas, Yildirim, & Yildirim, 2009; Kilinc, Tarman & Aydin, 2018; Kim, Kim, Lee, Spector, & DeMeester, 2013; Schul, 2017) have discussed and identified the factors affecting ICT integration in pre-service teacher training programs (PTTPs). However, most of these studies involved pre-service teachers in developed countries as their object of research. There is a need to explore the factors from the perspective of various parties in developing countries. Therefore, this study was done aiming to elaborate on factors affecting ICT integration in Indonesia as one of the many developing countries. This study is useful to teacher educators for efficient and effective design in PTTPs. Related stakeholders benefit to gain an in-depth understanding of the practices of technology into education in PTTPs. Similar sample characteristics of research may consider this study as their guidance to further investigate factors affecting technology integration during teaching.

Literature Review

ICT integration into PTTPs is very important for ICT integration in K-12 schools because most of the students of these schools are millennials or generation X whose daily life is inseparable from the use of technology such as smart devices, internet, computers, and smartphones. A huge investment of human and financial resources has shifted the focus of many developed countries into prioritizing the development of educational technology both practical and theoretical development (Brown & Green, 2015; Gemin, Pape, Vashaw, & Watson, 2015; Kim et al., 2013). However, in some developing countries, PTTPs have not yet done maximal efforts to facilitate pre-service teachers with sufficient technological devices, skills, competencies, and experiences to prepare them to integrate ICT as it would be needed when they become teachers (Lim & Pannen, 2012; OECD, 2015)

Various plans have been developed to effectively integrate ICTs in PTTPs, but many factors are still considered as tough challenges (Ertmer, Paul, Molly, Eva, & Denise, 1999; Lim & Pannen, 2012). The challenges are to improve the quality of lecturers, provide sufficient facilities, create more funding, and strengthen the curriculum in the training program. To facilitate these plans, the factors should be identified so that the barriers can be minimized, and enablers can be maximized. To elaborate on these factors, Justus (2017) mentioned that the reasons why teachers do not integrate ICT in an effective way should always be a consideration in educational studies, it is important to look at what they believe and do as well as what tools or equipment they do not have.

Working with ICTs is often difficult because some ICTs are new for teachers. Social routines have to be built in using ICT for the expectation to meet new challenges and to become alternative devices as a replacement of old and conventional tools such as pens, paper, chalks, and boards (Kilinc, Tarman, & Aydin, 2018; Kim et al., 2013). ICT integration in education is influenced by many factors' barriers and enablers (Lawrence & Tar, 2018; Muhaimin et al., 2019; Mukminin et al., 2019; Prasojo et al., 2019; Valtonen, Kukkonen, Kontkanen, Sormunen, Dillon, & Sointu, 2015).

Toward this end, Hinostroza (2018), Lawrence and Tar (2018), and Kilinc et al. (2018) informed barriers or hindering factors affecting ICT integration include lack of resources, inadequate training, insufficient technical support, and lack of time. Other barriers include teachers' beliefs, visions concerning technology integration, and views about teaching,

learning, and knowledge (Günes & Bahçivan, 2018; Lawrence & Tar, 2018; Marzulina et al., 2018; Parkman, Litz, & Gromik, 2017; Prasojo et al., 2017). Some other studies informed barriers of ICT integration in education were conventional teaching culture, poor infrastructures, and limited human resources (Kilinc et al., 2018; Kim et al., 2013; Valtonen et al., 2018).

On the other hand, enablers or supporting factors of ICT integration in education have also been reported in the last decades. Alt (2018) and Lawrence and Tar (2018) informed enablers affecting ICT integration such as access to hardware, quality software, the Internet, and technical, administrative, and peer support might be viewed as extrinsic enablers. Meanwhile, personal beliefs, previous success with technology, and self-efficacy might be viewed as intrinsic enablers (Aslan & Zhu, 2016; Sadaf, Newby, & Ertemer, 2016; Valtonen et al., 2015; Valtonen et al., 2018). Further, an allocation for more ICT integration budget, well-planned policies, training programs, and peer supports are also enablers discussed by some previous researchers (Lawrence & Tar, 2018; Alt, 2018). Table 1 concludes some factors affecting ICT integration in education based on recent studies, mostly in developed countries.

Table 1. Factors affecting ICT integration in education; recent studies

	Policy	Funding or budget	Professional development	Personal beliefs and perception	Infrastructure and technological support	Human resources	Efficacy and acceptance	Skills and knowledge	Prior experience
Alt (2018)	-	-	✓	✓	-	-	✓	-	-
Aslan & Zhu (2016)	✓	-	✓	✓	-	-	✓	✓	✓
Günes & Bahçivan (2018)	-	-	-	✓	-	-	✓	✓	✓
Hinostroza (2018)	✓	✓	-	-	✓	✓	-	✓	✓
Kilinc et al. (2018)	✓	✓	✓	-	✓	✓	-	-	
Kim et al, (2013)	✓	-	✓	✓	-	✓	-	✓	✓
Lawrence & Tar (2018)	✓	✓	✓	✓	✓	✓	✓	✓	✓
Parkman et al. (2017)	✓	✓	✓	✓	✓	-	✓	✓	-
Sadaf et al. (2016)	-	-	✓	✓			✓	-	✓
Valtonen et al. (2015)	-	-	-	✓	-	-	✓	-	✓
Valtonen et al. (2018)	-	-	✓	✓	-	-	✓	-	✓

Some developing countries have experienced the enablers of ICT integration in education as an innovative and effective tool for teaching and learning (Sobaih, Moustafa, Ghandforoush, & Khan, 2016). Indonesia as one of the developing countries in South East Asia spends 20% of its state budget or around $ 38 billion for education in 2018 (Republic of Indonesia, 2019). Although the government has spent that big amount of money, many PTTPs in Indonesia are still lack of ICT infrastructures (Habibi, Mukminin, Riyanto, Prasojo, Sulistiyo, Saudagar, & Sofwan, 2018; Lim & Pannen, 2012; OECD, 2015). With the rapid and invasive development of technology integration in education, Indonesian higher institutions that are in charge to run PTTPs have been not well supported by research analyzing or

evaluating the technology integration in an in-depth understanding. Therefore, this study was conducted to understand the factors affecting ICT integration during teaching practices from the perspectives of the pre-service teachers.

Role of the Researchers

This qualitative inquiry presents part of the thesis of the 1st author, a Ph.D. student in the University of Malaya. Authors 2 and 3 have intensively guided the 1st author, and they focus their research on educational technology as the topic of this study. Author 4 helped improve the methodological approach for this study. Author 4 has published qualitative articles in many reputable journals. During the process, author 5 who is a major in English language and linguistics contributed to the proofreading and editing of the article. Through this collaboration, we intend to report factors affecting Indonesian pre-service teachers' integration of ICT during teaching practices.

Method

In this study, we employed multiple case study (George, 2019; Yin, 2017) to discuss more in-depth information about factors affecting Indonesian pre-service teacher's integration of ICT during teaching practices. We chose multiple case study because we want to focus on a major-based discussion that involved science education, social science education, language education, and pre-school and elementary education. Yin (2017) argued that when researchers choose to apply a multiple case study, they would be able to examine and analyze the data for each situation and also across various situations. This qualitative approach allows a theoretical evolution and research questions of a study in wider exploration. However, a multiple case study also has its own difficulties despite the benefits which are important to consider by a researcher. One of the main difficulties that may emerge is time and cost which a researcher required more time and spend more money to create a multiple case study (Meyer, 2015).

Participants

In this research, any personal information about the participants was not reported, for instance, names of the participants were a pseudonym; that is to keep the participants confidentially and make them feel well- being as participants (Lincoln & Guba, 1985; Miles et al., 2018; Muazza et al., 2019; Mukminin et al., 2017). Experts say that for qualitative research, the number of participants is not definite; they can be one or more (Creswell, 2014; Merriam, 1995). In this study, we applied convenience sampling where we selected a group of pre-service teachers (social science education, science education, language education, and pre-school and primary education) convenient to be involved in the study (Wallen & Fraenkel, 2011). We invited eighty pre-service teachers from three Indonesia universities (University A, University B, and University C). Twenty pre-service teachers did not respond to the invitation while five pre-service teachers were not able to attend due to some conditions such as health problems and weather conditions. Fifty-five pre-service teachers finally attended the Focus Group Discussions (FGDs) (Table 2).

Table 2. Details information on the FGDs

FGD	Majors	Participant initial	Location	Length
1	Social science education	5 (SS1, SS2, SS3, SS4, SS5)	University A	1: 03: 30
2		7 (SS6, SS7, SS8, SS9, SS10, SS11, SS12)		1: 09: 15
3	Science education	7 (SC1, SC2, SC3, SC4, SC5, SC6, SC7)	University B	1: 03: 07
4		5 (SC8, SC9, SC10, SC11, SC12)		1: 33: 12
5	Language education	7 (LE1, LE2, LE3, LE4, LE5, LE6, LE7)	University A	57: 00
		8 (LE8, LE9, LE10, LE11, LE12, LE13, LE14, LE15)		59: 37
7	Pre-school and elementary education	10 (PE1, PE, PE3, PE4, PE5, PE6, PE7, PE8, PE9, PE 10)	University A	2: 03: 07
8		6 (PE11, PE12, PE13, PE14, PE15, PE16)	University B	1: 11: 49

Data Collection

The FGDs began from the defining and designing phase, developing theories and setting semi-structured interview questions by discussing with five Indonesian educational technology experts. We contacted the participants via telephone and email. We distributed consent forms and asked the participants to fill in the forms. The discussions lasted three times for 1 to 2 hours. We seek for the access and determined for the FGDs. For the places, we used rooms with no intervening sounds from outside. We borrowed the rooms from the head of research centers of University A and University B. We divided the FGDs into four groups (social science education, science education, language education, and pre-school and elementary education). Table 3 presents the details of the major, participant initial, location, and length of the FGDs' time.

Data Analysis

We analyzed the data by using within and cross-case analysis (Creswell, 2014; Stake, 2010; Yin, 2017). Within-case analysis in qualitative inquiry is a deep exploration of a case in order to know how relevant processes happened and what they revealed pertaining to the research questions of the study. Meanwhile, cross-case analysis is used for comparisons purposed within a study as the analysis allows for broader conclusions related to the research questions. The unit of analysis mentioned is any bounded unit, for example, a person, group of people, place, document, or artifact (Boddy, 2016; Creswell, 2014; Habibi et al., 2018; Miles,

Huberman, & Saldaña, 2018; Mukminin et al., 2019; Stake, 2010; Van Manen, 2006; Yin, 2017). The first activity that we did after doing the FGDs (eight sessions) is transcribing the data. The transcription of the recording was done manually using Microsoft word.

Choosing a Tool for Qualitative Data Analysis

In big projects of research, researchers interview many participants. When they transcribed recordings, they obtained big amounts of data in the form of texts, sometimes amounting to a thousand pages. As a result, they do not statistical tests to inform theories; they rather recommended improvements in various systems based on the experiences reported in the narrative, textual data of the study. Such projects typically aim at answering broad problems. To analyze the data, some researchers or institution have developed various software, namely computer-assisted qualitative data analysis software (CAQDAS), Non-numerical Unstructured Data Indexing Searching and Theorizing (NUD*IST), ATLAS.ti, N6, and MAXqda (Bazeley & Jackson, 2013). However, no software can actually analyze qualitative data; only the human mind can do that (Faherty, 2009).

Each FGD of this study that lasted for approximately one to two hours resulted in more than 300 pages of transcripts. Therefore, an efficient way to analyze the data was a good investment. The available software did much to help in structuring the text. Some researchers informed specific programs that can be utilized in qualitative data analysis. Microsoft Word tables (La Pelle, 2004) or Microsoft Word Macros (Ryan, 2004) were utilized for the coding and retrieving of the transcriptions. Amozurrutia and Servos (2011) and Meyer and Avery (2009) have shown how Excel can be used in the analysis of qualitative data. Prujit (2012) developed methods for using a relational database using Microsoft Access. Having explored the functions of those programs, we finally decided to use Macros due to its efficiency and functionality.

Using Macros was not easy to conduct as a set of commands that can be executed later. However, it gives efficiency for qualitative analysis (Ryan, 2004). The plan for the Macros was adapted from Ryan (2004) using extracted comment Macros. The Macros created a new document and extracted all comments; minor adjustments were made to the styles used. For this study, after we coded the transcription using the “new comment” feature in Microsoft Word, we extracted the comments. The extracted comments included a header within some information; full name of the document, name of the document creator, and date of creation. We filed the comments and metadata into some tables. For each comment, the table informs the page number, text, as well as comments.

Development of Themes

Utilizing the Macros, we were able to put the items into clusters. Since we did the coding with labels regarding the research topic, the patterns that emerged referred to the identification of categories. Therefore, we did the examination of the patterns by putting them in accordance with their themes and sub-themes (Percy, Kostere, & Kostere, 2015).

Handling the data in this way served the identification of emerging themes (primary and secondary). The researcher interpreted the data regarding how the themes addressed the research questions by showing whether initial suspicions were backed. We questioned whether appeared individual experiences disconfirmed cases that eventually contested the initial beliefs. For example, while two participants of the FGDs expressed apprehension about barriers in integration during teaching practices, they did not indicate that this was a serious problem that cannot be solved. The exploration of contradicting experiences to the emerging themes in the

data analysis served to further enhance the trustworthiness of the research findings (Booth, Carrol, Llott, Low, & Cooper, 2013).

Trustworthiness

To establish the trustworthiness of the study or to verify the accuracy of the data, findings, and interpretations, we took several measures (Creswell, 2014). We did triangulation, member checking, and reflexivity to strengthen the trustworthiness. After transcribing the data in the data analysis, we gave back the transcription to the participants of the FGDs to ensure what they said is right, as a system of checks of the data or member checking (Patton, 2002). Finally, through reflexivity, we became more self-aware to control the biases. We hid the names of the participants to keep their confidentially and to make them feel well-being as participants (Lincoln & Guba, 1985; Miles et al., 2018).

In addition, we also employed inter-rater reliability. Inspired by the methods developed by Hruschka, Schwartz, John, Picone-Decaro, Jenkins, and Carey (2004), we held a three-rounds of inter-rater reliability checks. After the review of the first FGD's transcripts, we generated more than 100 codes. The transcripts were then distributed to the two independent researchers who were my research colleagues from two universities, one Indonesian university and one Malaysian university. We held a discussion separately whereupon the feedback informed that the coding scheme would have to be revised or modified as it was just not practical due to a large number of codes (Saldana, 2009). With the independent researchers, we compared the way of data interpretation segmented. The calculation of the initial capability was conducted through percentages. The method of the negotiated agreement in order to reconcile the disagreement was applied. The process was repeated to the next round of reliability check if the independent coding process was not in accordance with our coding results.

Findings

The findings of this study include two major themes, barriers and enablers, as factors affecting Indonesian pre-service teachers' integration of ICT during teaching practices. In addition, we also elaborate on the participants' attitudes towards ICT and its integration that lead to ICT integration during teaching practices (Table 1).

Table 4. Themes and subthemes and participants who informed

Themes	Subthemes	Participant
Barriers:	Lack of time	53
Pre-service teachers' factor)	Complexity of ICT integration	41
Institutional factors)	limitation of infrastructure	48
	lack of training	41
	lack of technical support	39
Enablers:	ICT knowledge	55
Pre-service teachers' factors	Perceived usefulness	53
Other people's factors	Leaders' support	47
	Peers' support	31

Barriers

Barriers to ICT integration are obstacles, which prevent or inhibit teachers from integrating ICT into teaching and learning activities. The barriers that emerged from the analysis covered a broad range of issues. These barriers are classified into two groups of pre-service teacher factors and institutional (University and School) factors. The pre-service teacher factors include lack of time and complexity of ICT integration. Meanwhile, the institutional factors include limitation of infrastructure, lack of training, lack of access, lack of technical support, and lack of compatibility.

Lack of time

Lack of time to integrate ICT during teaching practices which was responded by almost all FGDs participants is one of the most significant factors preventing pre-service teachers from integrating ICT-based teaching during their teaching practices. One of the participants (SS3) in the social science FGD informed that their time in teaching does not give them much opportunity to integrate ICT during his teaching. Additionally, a language pre-service teacher also revealed the same issue,

> I think we are not provided much time to integrate technology during our teaching practices. More exactly, not much time for teaching, the schedule available for me to teach was only two times a week within a duration of 60 minutes of each meeting. (LE8)

Another important thing related to the lack of time is the limited time addressed for the pre-service teachers to attend professional development of ICT integration training in education. Representatively, SS5 and PE4 felt that they had not much time attending professional training for ICT integration since they had many tasks and courses to attend either in their university or in outside the university. Overall, the lack of time to integrate ICT during teaching practices and attend technology integration training for teaching is among the barriers reported by Indonesian pre-service teachers in the series of FGDs of this study.

Complexity of ICT integration

The ICT integration into teaching practices is very complex, the integration involves various tools with many developed applications used to increase teaching and learning performance. The complexities prevent Indonesian pre-service teachers from integrating ICT during teaching practices. From the data analysis, many participants (41 pre-service teachers) informed that they had difficulties in making the use of technology fit for the addressed materials they taught. One of the participants said (Quoted verbatim),

> I do realize the importance of ICT integration in our teaching. However, using ICT in teaching is complicated and complex. I have to have the skills of ICT and the pedagogical skills and they should support each other. It sometimes makes me persistent integrating ICT in my teaching practices. (SC12)

Other participants from science education reported that they sometimes had lack of knowledge to integrate new ICT tools during their teaching practices. The integration involves various tools with many new applications used to increase teaching and learning performances like Lectora inspire, Flash player, and Interactive learning videos. The complexities of the

integration as reported in this study could prevent Indonesian pre-service teachers from integrating ICT during teaching practices.

Limitation of infrastructure

The limitation of infrastructure might be the strongest barrier of ICT integration in Indonesian education (Habibi et al., 2018). In this study, 48 pre-service teachers reported this barrier. They were mostly doing their teaching practices in middle-tier and bottom-tier schools where facilities were not so fascinating compared to top-tier ones. Their concern regarding infrastructure largely related to its limitation. Electricity blackout was quite frequent in Indonesia and it is a problem for schools that have no electrical generators.

> In my school where I was assigned to teach, the electricity really mattered. Once or twice a week, the blackout frequently happened and made us be resistant using ICT tools, a very problematic thing for Indonesia as a developing country. (PE10)

Another pre-service teacher (LE9) reports Internet connectivity was another major problem; the internet connection was not stable and slow if the connection was available. However, most of the time, the Internet was not accessible during teaching hours. Regarding this limitation, the three conditions that might hinder Indonesian pre-service teachers' use of ICT during their teaching practices are the instability of electricity and lack of Internet access in the schools (lower-tier and middle-tier).

Lack of training

Insufficient preparation to use technology is one of the many causes for teachers do not systematically use technology in their teaching activities. Professional development is required for teachers to effectively integrate technology to improve teaching and learning quality in their classes.

The findings of this study also informed that technology training for teaching was still limited in Indonesian education. One of the pre-service teachers, SS2 informed that she was only attended training regarding ICT integration into teaching for twice. This lack of training inhibited the FGDs participants to systematically integrate ICT during their teaching practices. From the response, there are 41 participants reported lack of training as one of the barriers affecting pre-service teachers' ICT integration during teaching practices.

Lack of technical support

Lack of technical support was reported as one of the factors that prevented the use of ICT integration during teaching practices. Fifty-one pre-service teachers reported this lack of technical support. One of the participants, SS1 stated that there were many broken tools such as in focus and computers that were stored in the school laboratory. This fact informs that there were problems with technical support that should be adequate for the tools' maintenance. Without quality technical support in the school, pre-service teachers are reluctant to integrate ICT during their teaching practices. As quoted by one of the participants: "Support from technicians is very important. I have once met a problem with digital in focus where it could not be turned on. The school had lack of technical support and No one could fix it for me" (PE11).

In addition, one of the participants also revealed that providing schools with internet connections should be supported by skillful technicians who understand how to deal with not only software's problems but also hardware's since it is crucial to provide the schools with technical support regarding the repair and maintenance for the continued integration of ICT in schools.

Enablers

Enablers in this study are defined as factors that support the integration of ICT during teaching practices. Some subthemes that emerged are ICT knowledge, perceived usefulness, perceived ease of use categorized as pre-service teachers' factors. Meanwhile, leaders' support and peers' support are the category of other people supporting factors.

ICT knowledge

The integration of ICT among pre-service teachers in this study is strongly governed by their knowledge of ICT. The teachers' characteristics factor is described by knowledge of ICT that emerged from the case analysis, which is found to explain the integration of ICT during their teaching practices. The case evidence shows that teachers' ICT knowledge is an important concept in understanding the adoption and integration of ICT. Teachers integrate ICT into teaching and learning activities if they have knowledge. The findings of the FGDs shows that all the pre-service teachers or 55 participants informed that they have good knowledge of ICT because they were millennial accustomed to using technological devices such as smartphone, laptop, tablet, and in focus. Representing the perception, SC8 reported, "We are good at technology use for learning. We can operate almost all tools provided by the school. In addition, we also bring our own laptop into the classroom."

Perceived usefulness

Perceived usefulness in this study is defined as the degree to which a person believes that using a particular system would improve his or her job performance (Davis, 1989). Almost all participants of this study in the FGDs were informing the usefulness of ICT in education during their teaching practices. As many 53 participants are related to the usefulness of ICT in teaching. SS said that ICT was very important to support teaching and learning activities; the use of ICT could improve students' creativity. In addition, they also believed that using ICT during their teaching practices can improve the performance of their teaching. One of the participants informed, "I believed that by integrating ICT during teaching can improve my teaching performance. Teaching and learning will be more dynamic if it is supported by the integration of ICT teaching practices" (PE15)

Leaders' support

The role of leaders is also informed as a key factor determining ICT integration. Most of the pre-service teachers (47 participants) informed that school principals, tutor teachers, and university supervisors support them to integrate ICT during their teaching practices. One of the participants, SS2 stated that his tutor teacher always asked him to use an educational application such as Edmodo to support his teaching. Another participant reported, "The role of the principal and university supervisor is also important. They always mentioned the use of technology in teaching and I feel responsible to do what they asked me to." (LE15)

The leadership is not only expected to carry on the duty for integration within the institution. Leaders should also take responsibility to overcome the resistance to ICT integration and organize required resources as well as get involved in the integration process. In this study context, the roles of principals, tutor teachers, and university supervisors as leaders for the pre-service teachers support the integration of ICT during their teaching practices.

Peers' support

Pre-service teachers always mingle with their peers in the school. Therefore, they are affected by their peers' influences. Some of the participants of this study (31 pre-service teachers) informed that peer's influences and support affected the integration of ICT during their teaching practices. "I experienced discussing with my colleagues about the use of ICT in my practice teaching. It is an encouragement that I have supporting friends during the integration. We shared ideas and materials while doing our teaching practices." (SS10)

Peers' support has also been informed as a factor affecting the use of technology in teaching and learning processes. The importance of peers' support as an enabler for teachers for appropriate technology integration through sharing ideas, knowledge and teaching material should always be considered.

Discussion

We aimed to elaborate on factors affecting ICT integration in Indonesia as one of the many developing countries. Two salient themes that emerged from the analysis of the data are barriers and enablers. They generate attitudes towards ICT and its integration during teaching practices.

Barriers

Lack of time to integrate ICT during teaching practices is one of the most significant barriers preventing Indonesian pre-service teachers' ICT integration during teaching practices. Studies regarding ICT integration in education also support this case (e.g. Hinostroza, 2018; Kilinc et al., 2018; Kim et al., 2013; Lawrence & Tar, 2018). They also found that lack of time is the major and crucial barrier for integrating ICT in education. In this study context, the time of attending teaching practices vary for each major. However, the maximum length of time they attended the course is one year. Therefore, it is very important for the policymaker to extend the time of teaching practices for Indonesian pre-service teachers. Besides, the complexity is also one of the barriers. This finding is consistent with what Lawrence and Tar (2018) found in his study where complexity of integrating ICT-based instruction as one of the reported barriers for ICT integration. Complexity has been consistently reported to inhibit technology integration in education which leads to less integration, implementation, and diffusion. The complexity in this study refers to the application of new technologies for educational purposes

In addition, the limitation of infrastructures might be the strongest barrier of ICT integration in Indonesian education. Educational infrastructures are not distributed accordingly with so many K-12 schools and higher institutions are still left behind regarding the infrastructure. In fact, some Indonesian schools have no access to the Internet. Some even have no access to electricity. Regarding this, Lawrence and Tar (2018) reported that teachers in using technology are frustrated when the Internet is slow and inaccessible; when clicking on a link, it needs a very long time to open it and when the page is open, it is not useful anymore. Infrastructure problems' concerning Internet connectivity was a crucial factor for ICT

integration that can be potentially invincible barriers for teachers wishing to integrate ICT for their teaching activities. Lack of training has also been reported to be one of the barriers in this study. The findings of this study also informed that technology integration training for teaching are still limited in Indonesian education. Alt (2018), Aslan & Zhu (2016), and Parkman et al. (2017) revealed a similar phenomenon informing that the lack of training as a barrier that affects technology integration in classroom practices. This insufficient preparation to use technology is one of the many causes for teachers not using technology in their teaching activities. Professional development is required for teachers to effectively integrate technology to improve teaching and learning quality in their classes.

Lack of technical support was another factor reported in preventing ICT integration during teaching practices. Similarly, this factor has also been revealed by several previous empirical studies (Hinostroza, 2018; Kilinc et al., 2018; Kim et al, 2013; Lawrence & Tar, 2018; Parkman et al., 2017) that have reported lack of technical support as a factor hindering the ICT integration in instruction. The importance of technical support was not only a matter of ICT tools availability but also the maintenance. School administrators should put their serious consideration to these matters.

Enablers

Besides the barriers to ICT integration, the findings of the FGDs also inform the enablers of ICT integration. Indonesian pre-service teachers have good knowledge of ICT because they are millennials who are accustomed to using technological devices such as smartphones, laptops, tablets, and projectors. These reports are supported by some previous studies (e.g. Aslan & Zhu, 2016; Parkman et al., 2017; Sadaf et al., 2016; Valtonen et al., 2015; Valtonen et al., 2018). They found that adopter characteristics such as knowledge or perceived ease of use of technological devices can influence the integration of technology in the classroom. Indonesian pre-service teachers' technology knowledge relates positively to ICT integration during teaching practices.

Almost all participants informed the usefulness of ICT in education during their teaching practices. This result has also been reported by many previous studies (e.g., Aslan & Zhu, 2016; Hinostroza, 2018; Kilinc et al., 2018; Kim et al, 2013; Lawrence & Tar, 2018, Parkman et al., 2017) that similarly focused on the perceived usefulness as one of the main factors affecting the integration of ICT in teaching and learning process. Perceived usefulness in this study is defined as the degree to which a person believes that using a particular system would improve his or her job performance. Most Indonesian pre-service teachers admitted that ICT can have a big impact on the quality of teaching.

The roles of leaders and peers are also informed as a key factor determining ICT integration. The leadership is not only expected to carry on the duty for integration within the institution. Leaders should also take responsibility to overcome the resistance to ICT integration and organize required resources as well as get involved in the integration process. In this study context, the roles of principals, tutor teachers, and university supervisors as leaders for the pre-service teachers support the integration of ICT during their teaching practices. Since they always mingle with their peers in the school, peers' support is also important (Ertmer et al., 1999; Sadaf et al., 2016). The importance of peers for appropriate technology integration could be obtained through sharing ideas, knowledge and teaching material.

Attitudes towards ICT and its integration during teaching practices

In this study, the attitudes are governed by barriers and enablers reported by the participants of the study. The attitudes of teachers towards ICT can affect directly to the ICT

integration during teaching practices (Figure 1). If a pre-service teacher has more negative attitudes derived from more barriers than enablers towards ICT and its integration, he/she will be likely to not integrate technology during his/her teaching practices. Most participants during the FGDs informed more attitudes towards the use of ICT in teaching. Therefore, it could be a hint that they rarely integrated ICT during their teaching. Attitude towards ICT refers to the teachers' general feeling of barriers and enablers for the use of ICT in teaching and learning process (Alt, 2018; Aslan & Zhu, 2016; Günes & Bahçivan, 2018; Lawrence & Tar, 2018).

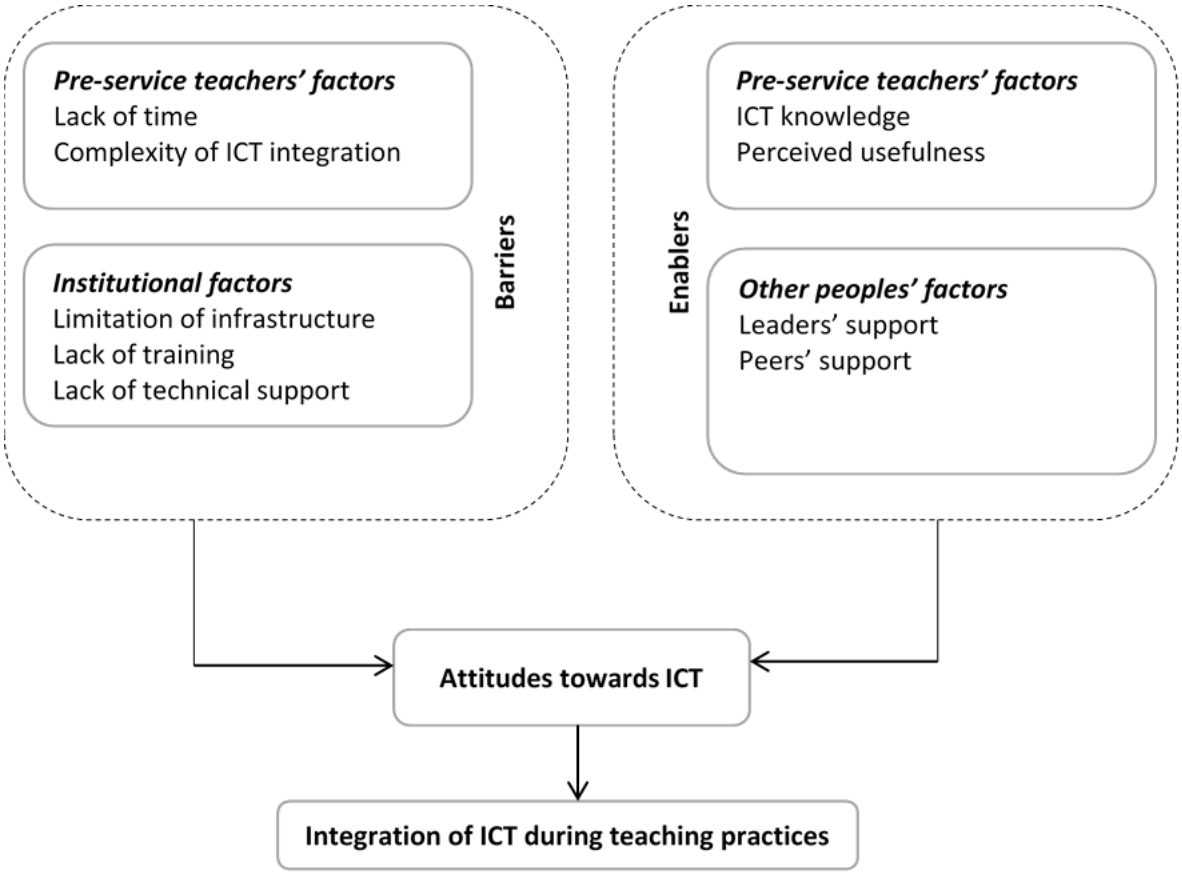

Figure 1. Conceptual model of the study

We used the findings from this study to develop a theoretical model for conceptualizing the organizational issues around the integration of ICT during teaching practices in Indonesia PTTPs. The findings are discussed within the categories emerging from the data analysis process. Figure 1 shows a model that functions as an initial formulation of the key factors that affect Indonesian pre-service teachers' integration of ICT during teaching practices.

It attempts to show a conceptual model of this study. We understand that the conceptual model proposed by this study is only a simple version of "the conceptual framework" (Miles & Huberman, 1994, p. 20) being investigated. No claim is reported that the factors presented in this study are fully comprehensive or exhaustive. Future studies of the integration of ICT in other settings are recommended to conduct to modify the idea presented or the way academics build on each other's' work (Orlikowski, 1993). The central elaboration of this study has been in gaining deep insight into the factors that affecting pre-service teachers' integration of ICT during teaching practices. The study has identified and discussed the factors that positively or negatively affect ICT integration. The study has developed an integration of ICT model that

consider barriers and enablers which explained the integration of ICT during teaching practices. The theoretical and empirical evidence is offered to all stakeholders in order to improve Indonesian pre-service teachers and PTTPs performance utilizing technology in education. Therefore, it helps them better understand and explain ICT adoption and integration in teaching and learning. The study results provided significant support to past findings in the literature.

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