Investigating pre-service teachers about their competencies, experiences, and attitudes towards technology integration

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Abstract. This study aims to obtain an overview of the competencies, experiences, attitudes towards technology integration, and technology tools that are routinely used by pre-service teachers. Participants in this study are pre-service teachers from FKIP Unsyiah. The results show that pre-service teachers competently and routinely use the technology that they have been taught through ICT course. They also show a positive attitude towards technology integration and were interested to learn more about it. Another interesting result is that smartphones and laptops are the technology tools that are often used by pre-service teachers. Therefore, the lecturers are expected to develop learning activities by utilizing both of these technology tools.

1. Introduction
The use of technology in learning activities becomes very important in this globalization era. Both current and future teachers are expected to develop innovative learning by using technology effectively \cite{1} \cite{2}. The integration of technology in learning activities is useful in improving the quality of learning and increasing students’ digital literacy. Technology is also useful for exposing students to the 21\textsuperscript{st} century learning and working environment by helping them develop cooperation, communication, problem-solving and lifelong learning skills \cite{2}.

The integration of technology in education is not a new thing anymore. In America, technology integration has started since 30 years ago. Unfortunately, many teachers who have not integrated technology effectively in their learning activities \cite{3}. There are two factors that affect teachers' integration of technology into learning activities. Both of these factors are also known as the order barrier. First-order barrier or teachers’ extrinsic factors relates to the availability of technology tools and facilities, school administrative support, and technical support on the implementation of technology integration in learning activities. Second-order barrier or teachers’ intrinsic factor relates to the attitudes, beliefs, and knowledge as well as the teacher’s ability in technology integration \cite{4} \cite{5}. However, government and education providers are more focused on facing the first-order barrier by providing technological facilities. The success of technology integration is only seen from the number and availability of technology tools and facilities only. In fact, teachers play an important role in the integration of technology into learning activities \cite{3} \cite{5}. 
The integration of technology into learning activities is strongly influenced by teachers' attitudes and beliefs. If teachers have a positive attitude and believe that technology can be useful for learning activities, then they will integrate technology into learning activities [6] [7] [8]. Furthermore, attitudes toward teacher technology integration are influenced by teachers' technological competency and experience. Technology competency is the skill and knowledge that required by teachers in using technology. Technology experience can be seen from the frequency of technology use. So, it can be said that the higher the frequency of use, the more experienced a teacher in the use of a technology [9]. Therefore, this study aimed to gain an overview of how technology competencies, experience, attitudes towards technology integration, as well as the technology tools that are often used by pre-service teachers in their learning activities. The term of technology used in this study focuses on ICT. This is due to pre-service teachers often interact with this type of technology, such as smartphones, laptops, PC / desktop, and others.

2. Methods
This study is a descriptive research that aims to explore information about pre-service teachers' perception in technology integration. Research data obtained from 70 pre-service teachers who have participated ICT-based learning activities through cross-sectional survey method [10]. Technology competency relates to the ability to use internet, software, and hardware. This variable is measured using the technology competencies scale [11]. It uses five-point Likert-type items, with 5 representing very competent and 1 representing not competent. The frequency of technology use is an indicator of technology experience [9]. This variable is measured using the technology competencies scale [11] by changing the Likert-type items to 5 representing always and 1 representing never. Furthermore, attitudes in technology integration are measured using attitudes towards technology use scale (7 items) [11]. It uses five-point Likert-type items, with 5 representing strongly agree and 1 representing strongly disagree. All of these instruments show high validity and reliability [9]. The questionnaires distributed through a web page and accessible via computer and smartphone.

3. Result and Discussion
a. Pre-service Teacher Demographic Characteristics and Frequently Used Technology Tools
Participant of this study consist of 16 people (23%) men and 54 women (77%). Furthermore, 60 participants from bachelor degree (86%) and 10 participants from master degree (14%). Participants were from 4 study programs, namely Biology Education for bachelor degree (74%), Biology Education for master degree (13%), Physics Education for bachelor degree (10%), and English Education for master degree (3%).

Table 1. Demographic characteristics of the participants

| Demographic Characteristics (N=70) | Frequency | Percentage |
|-----------------------------------|-----------|------------|
| Gender                            |           |            |
| Male                              | 16        | 23%        |
| Female                            | 54        | 77%        |
| Education Degree                  |           |            |
| Bachelor                          | 60        | 86%        |
| Master                            | 10        | 14%        |
| Department                        |           |            |
| Biology Education (bachelor)      | 52        | 74%        |
| Biology Education (master)        | 9         | 13%        |
| Physics Education (bachelor)      | 7         | 10%        |
| English Education (master)        | 2         | 3%         |

Table 2 shows the responses given by the pre-service teacher about the frequency of technology that used to assist their learning activities. The first tool is smartphone. Almost all of the participants
(56% chose always and 33% chose often) were routinely used smartphones to help their learning activities. These results indicated that the smartphone is no longer a new technology for them. Therefore, the use of smartphones in learning activities becomes a new potential in the integration of technology in learning activities. Previous research [12] [13] indicated that the lecturer at FKIP Unsyiah shows positive results and ready to integrate mobile technology into their learning activities in FKIP Unsyiah.

The second tool is laptop. Most of the participants (41% chose always and 49% chose often) were routinely used laptop to help their learning activities. This statement also shows there were 3% of them rarely used laptop and 10% of them chose sometimes. The last tool, personal computer or desktop shows the interesting results. Only 26% of the pre-service teachers regularly used PC/desktop to help their learning activities and almost half of them (44%) chose sometimes. The rest (29% chose rare and 1% chose never) were not routinely used PC or desktop to help their learning activities. The lack of frequency PC or desktop usage by pre-service teachers is due to the efficient use of such devices, where laptops or smartphones were more efficient for them [14]. This is because PC or desktop is not portable, it requires complete infrastructure, and highly dependent on electricity. In Aceh, the electricity is still not normal, so pre-service teachers were more interested in using laptop or smartphone.

**Table 2.** Frequently used technology tools by pre-service teachers

| No | Statements | 5 | 4 | 3 | 2 | 1 |
|----|------------|---|---|---|---|---|
| A  | Smartphone | 56% | 33% | 10% | 1% | 0% |
| A2 | Laptop     | 41% | 49% | 7%  | 3% | 0% |
| A3 | Personal Computer/Desktop | 10% | 16% | 44% | 29% | 1% |

Description: 5=Always; 4=Very often; 3=Sometimes; 2=Rarely; 1=Never

**b. Preservice Teacher Technology Competencies**

Table 3 shows the responses given by pre-service teachers about their technology competencies. The statement about technology competencies is in accordance with student learning courses and ICT-based courses taught in FKIP Unsyiah. Technology competencies are related to the ability to use internet, hardware, and software which is a basic need in their teaching and learning activities.

**Table 3.** Participants’ responds about their technology competencies

| No | Statements | 5 | 4 | 3 | 2 | 1 |
|----|------------|---|---|---|---|---|
| B  | What is your competence for the following statements? |  |  |  |  |  |
| B1 | Use of electronic search engine (e.g., Google) | 47% | 44% | 6% | 3% | 0% |
| B2 | Use of electronic storage devices such as CD, DVD, or flash drive | 41% | 40% | 14% | 3% | 1% |
| B3 | Use of video player (e.g., VLC player) | 31% | 36% | 29% | 1% | 3% |
| B4 | Use of printer | 37% | 46% | 14% | 1% | 1% |
| B5 | Download documents and software from the internet | 46% | 43% | 10% | 1% | 0% |
| B6 | Use of internet browser (e.g., Chrome or Firefox) | 54% | 37% | 7% | 0% | 1% |
| B7 | Sending and receiving emails | 61% | 34% | 4% | 0% | 0% |
| B8 | Use of multimedia projector | 17% | 44% | 30% | 6% | 3% |
| B9 | Use of word processing software (e.g., Ms. Word) | 54% | 40% | 3% | 3% | 0% |
| B10 | Use of scanner | 10% | 37% | 33% | 9% | 11% |
| B11 | Use of presentation software (e.g., Ms. PowerPoint) | 44% | 40% | 13% | 3% | 0% |
| B12 | Use of spreadsheet software (e.g., Ms. Excel) | 19% | 47% | 26% | 4% | 4% |
| B13 | Use of database management software (e.g., Ms. Access) | 7% | 26% | 40% | 13% | 14% |
Description: 5=High competent; 4=Competent; 3= Uncertain; 2= Somewhat competent; 1= Not competent

In the first statement, almost all preservice teacher (47% chose very competent and 44% chose competent) were able to use electronic search engines. Only a few (3%) of those who have not been able to use electronic search engines and the rest (6%) choose uncertain. In the second statement, most of the pre-service teacher (41% chose very competent and 40% chose competent) were able to use electronic storage devices such as CDs, DVDs, and flash drive. As many as 14% of them choose uncertain, while a few of them (1%) were not able to use the technology. In the third statement, regarding the use of the video player. The video player referred to in this research is a digital video player like VLC player etc. More than half of the pre-service teacher (31% chose very competent and 36% chose competent) were able to use the video player, 29% chose uncertain and the rest (1% chose somewhat competent and 3% chose not competent) were not able to use technology.

The fourth statement about the ability to use the printer. More than some pre-service teacher (37% chose very competent and 46% chose competent) were already able to use the printer. Few of them (1% chose somewhat competent and 1% chose incompetent) have not been able to use the printer. Furthermore, 14% of them chose uncertain. The fifth statement regarding the ability to download documents and software from the internet. Most of the pre-service teacher (46% chose very competent and 43% chose competent) were able to download documents and software from the internet. Furthermore, 10% of them chose uncertain and only 1% were not able to download documents and software from the internet. The sixth statement about the ability to use internet browsers. Most of the pre-service teachers (54% very competent and 37% competent) were able to use internet explorer, 7% of them chose uncertain, only 1% of them were not able to use internet explorers.

The seventh statement regarding the ability to send and receive emails. Almost all of the pre-service teachers (61% very competent and 34% competent) were able to use email, only 4% of them chose uncertain. The eighth statement regarding the ability to use multimedia projector. Almost half of the pre-service teachers (17% very competent and 44% competent) were able to use the projector. One-third (30%) of them chose uncertain and the rest (6% somewhat competent and 3% not competent) were not able to use the projector. The ninth statement regarding the ability to use word processing software (e.g., Ms. Word). Almost all of the pre-service teachers (54% very competent and 40% competent) were able to use word processing software. The remaining 3% chose uncertain and 3% were not good at using it.

The tenth statement about the ability to use the scanner. Almost some of the pre-service teachers (10% very competent and 37% competent) were able to use scanners. One-third of the pre-service teachers (33%) were still unsure of their ability and the rest (9% somewhat competent and 11% incompetent) were not able to use the scanner. The eleventh statement regarding the ability to use presentation software (e.g., Ms. PowerPoint). Most of the pre-service teachers (44% very competent and 40% competent) were able to use the presentation software. Furthermore, 13% of them were still not convinced and the remaining 3% is not good at using presentation software. The twelfth statement about the ability to use spreadsheet software (e.g., Ms. Excel). Some of the pre-service teachers (19% very competent and 47% competent) were able to use the number processing software. One-quarter of them (26%) were still unsure and the rest (4% somewhat competent and 4% not competent) were not yet good at using the software. The thirteenth statement regarding the ability to use database management software (eg Ms. Access). One-third of the pre-service teacher (7% chose very competent and 26% chose competent) were able to use database management software. Almost some of them (40%) were still not convinced and the rest (13% chose somewhat competent and 14% chose incompetent) were not yet good at using it.

The results of this questionnaire show that pre-service teachers’ technology competency will be high if the competence was taught in the classroom or frequently performed by them [9]. The internet used including using search engines, downloading documents and software, as well as sending and receiving emails, are not obstacles for pre-service teacher. In the user of software, there are many pre-
service teacher who were able to use word processing software, presentation, and video player, but the results are different between the users of data processing software and database management software. Therefore, the lecturers need to give special attention to improving pre-service teacher’ ability in using these software. Finally, on the use of hardware, pre-service teacher need to give their attention to the use of scanners and projectors. Many pre-service teacher who have not been able to use these tools. This is because both of these tools are an important tool and frequently used when they become a teacher.

c. Preservice Teacher Technology Experiences
Table 4 shows the responses given by pre-service teacher about the frequency of their use of technology. The statements about the frequency of technology use are the same as the statement in Table 3. The technology experiences deal with the frequency of internet users, hardware, and software.

Table 4. Participants’ responds about their technology experiences

| No | Statements                                                                 | 5  | 4  | 3  | 2  | 1  |
|----|---------------------------------------------------------------------------|----|----|----|----|----|
| C  | How frequent do you do the following activities?                          |    |    |    |    |    |
| C1 | Use of electronic search engine (e.g., Google)                           | 61%| 36%| 3% | 0% | 0% |
| C2 | Use of electronic storage devices such as CD, DVD, or flash drive         | 34%| 51%| 14%| 0% | 0% |
| C3 | Use of video player (e.g., VLC player)                                   | 27%| 44%| 24%| 4% | 0% |
| C4 | Use of printer                                                           | 41%| 41%| 17%| 0% | 0% |
| C5 | Download documents and software from the internet                        | 43%| 46%| 11%| 0% | 0% |
| C6 | Use of internet browser (e.g., Chrome or Firefox)                        | 64%| 30%| 6% | 0% | 0% |
| C7 | Sending and receiving emails                                            | 40%| 49%| 11%| 0% | 0% |
| C8 | Use of multimedia projector                                             | 13%| 36%| 43%| 8% | 0% |
| C9 | Use of word processing software (e.g., Ms. Word)                         | 64%| 33%| 3% | 0% | 0% |
| C10| Use of scanner                                                           | 7% | 21%| 49%| 21%| 1% |
| C11| Use of presentation software (e.g., Ms. PowerPoint)                      | 37%| 44%| 19%| 0% | 0% |
| C12| Use of spreadsheet software (e.g., Ms. Excel)                            | 10%| 39%| 44%| 7% | 0% |
| C13| Use of database management software (e.g., Ms. Access)                   | 3% | 17%| 43%| 24%| 13%|

Description: 5=Always; 4=Very often; 3=Sometimes; 2=Rarely; 1=Never

The first statement regarding the frequency of electronic search engine usage (such as Google). Almost all of the pre-service teacher (61% chose always and 36% chose frequently) were routinely used electronic search engines, only 3% of them who were not regularly used it. The second statement concerning the frequency of electronic storage devices usage such as CD, DVD, or flash drive. Most of the pre-service teacher (34% chose always and 51% chose frequently) were routinely used electronic storage devices and the rest (14% chose occasionally) were not used it. The third statement regarding frequency of video player usage (e.g., VLC player). Most of the pre-service teacher (27% chose always and 44% chose often) were routinely used the video player. Furthermore, 24% of them were not often used it and the remaining 4% were rarely used it.

The fourth statement concerning the frequency of printer usage. Almost all of the pre-service teacher (41% chose always and 41% chose often) were routinely used the printer and the rest (17%) were not routinely used it. The fifth statement regarding the frequency of downloading documents and software from the internet. Most of the pre-service teacher (43% chose always and 46% chose often) were routinely downloading documents and software from the internet and the rest (11%) were not. The sixth statement about the frequency of internet browsers usage (e.g., Chrome or Firefox). Almost all of the pre-service teacher (64% chose always and 30% chose often) were routinely used internet browsers and only 6% of them chose sometimes. The seventh statement regarding the frequency of sending and receiving emails. Most of the pre-service teacher (40% chose always and 49% chose
often) were regularly sending and receiving emails and the rest (11% chose sometimes) were not routinely used it.

The eighth statement regarding frequency of multimedia projector usage. Almost half (13% chose always and 36% chose often) routinely use projectors, some others (43% chose sometimes) do not routinely use it, and the remaining (8%) rarely use it. The ninth statement concerning the frequency of word processing software usage (e.g., Ms. Word). Almost all of the pre-service teacher (64% chose always and 33% chose often) were routinely used word processing software and the rest (3% chose sometimes) were not routinely used it. The tenth statement about the frequency of the scanner usage. One-third of the pre-service teachers (7% chose always and 21% chose often) were routinely used the scanner. Almost half of the pre-service teachers (49% chose sometimes) were not routinely used the scanner and 21% were rarely used it, even 1% of them never use the scanner.

The eleventh statement regarding the frequency of presentation software usage (e.g., Ms. PowerPoint). Most of the pre-service teachers (37% chose always and 44% chose often) were routinely used presentation software and the rest (19% chose sometimes) do not routinely used it. The twelfth statement regarding the frequency of the use of data processing software (e.g., Ms. Excel). Almost half of the pre-service teachers (10% chose always and 39% chose often) were routinely used the software to process the numbers. Almost half of them (44% chose sometimes) were not routinely used it and the rest (7%) were rarely use the software. The thirteenth statement regarding frequency of database-management software usage (e.g., Ms. Access). A fifth of the pre-service teachers (3% chose always and 17% chose often) were routinely used this software. Almost some of the pre-service teachers (43% chose sometimes) were not routinely used it, 24% of them were rarely used it and the rest 13% never used it.

The results obtained through the technological experiences statements (Table 3) were not much different from the results obtained from technological competencies (Table 2). Previous research [9] found that the most important aspect influencing pre-service teachers’ technology competencies was technology experiences. The frequency of the pre-service teachers’ internet usage has been routine, including the users of search engines, download documents and software, as well as send and receive emails. The pre-service teachers were also routine in using word processing and presentation software as well as video players, as well as the used of hardware in the form of electronic storage and printers. However, the pre-service teachers are not routine, rarely or even never use software such as spreadsheet and database management software and the used of hardware such as scanners and projectors. Interestingly, the projector is not a rare tool in FKIP Unsyiah. Therefore, the lecturers need to pay special attention to the users of projectors in their learning classes. It aims to make the pre-service teachers familiar with using this tool.

d. Preservice Teacher Attitudes towards technology integration

Table 4 shows the responses given by the pre-service teachers about their attitudes towards technology integration in learning activities. The statement about the pre-service teachers' attitudes toward technology integration in these learning activities concerns the impact of the technology used in learning activities for themselves.

| No | Statements | 5 | 4 | 3 | 2 | 1 |
|----|------------|---|---|---|---|---|
| D1 | I would like to have more information about the use of technology in learning | 73% | 24% | 3% | 0% | 0% |
| D2 | I find technology supported learning is entertaining | 56% | 36% | 8% | 0% | 0% |
| D3 | The use of technology increases my interest in learning | 49% | 40% | 11% | 0% | 0% |
| D4 | The use of technology improves my permanency in learning | 24.5% | 50% | 24.5% | 1% | 0% |
| D5 | The use of technology has a positive impact on my learning | 31% | 51% | 17% | 0% | 0% |
The first statement about the need to have more information about the use of technology in learning. Almost all of the pre-service teachers (73% chose strongly agree and 24% chose agree) want more information about the use of technology in learning activities and the rest of them (3%) chose neutral. The second statement on the impact of technology-supported learning on the pre-service teachers. Most of the pre-service teachers (56% chose strongly agree and 36% chose agree) were recognized that technology supports in learning activities makes learning activities fun. The rest of the pre-service teachers (8%) were chose uncertain. The third statement on the impact of technology usage on student interest in learning. The use of technology increases my interest in learning. Almost all of the pre-service teachers (49% chose strongly agree and 40% chose agree) were assuming the use of technology can increase their learning interest. The rest of the pre-service teachers (11%) were chose uncertain.

The fourth statement concerning the impact of technology use on student's memory. The use of technology improves my memory in learning. Most of the pre-service teachers (24.5% chose strongly agree and 50% chose agree) agree that the use of technology is able to improve their memory, 24.5% of them choose uncertain and the remaining 1% chose disagree. The fifth statement on the impact of technology use on student achievement. The use of technology has a positive impact on most of the pre-service teachers (32% chose strongly agree and 51% chose agree) achievement. The remaining (17%) of them were chose uncertain. The sixth statement regarding the use of technology increases participation in learning. Most of the pre-service teacher (30% chose strongly agree and 56% chose agree) agree that the use of technology can increase their participation in learning. The remaining 14% chose uncertain.

The seventh statement regarding the use of technology makes learning more student-centered. Most of the pre-service teachers (24% chose strongly agree and 49% chose agree) assuming that the use of technology makes learning more student-centered and the rest as much as 27% were choose uncertain. The results of the pre-service teachers' response (table 4) shows positive attitudes toward technology integration in learning activities.

4. Conclusion
Pre-service teachers’ technology competency is related to their technology experience. The pre-service teachers have high competencies on the knowledge that gained from computer and ICT-based course, such as internet usage, word processing and presentation software, and the use of some types of hardware. The same results were also obtained on the technology experience by measuring the frequency of use from certain technologies. The pre-service teachers were routinely used software and hardware that have been taught or associated with learning activities. Therefore, further and comprehensive research is needed to study about the relationship between pre-service teachers’ technological competence and experience. Furthermore, the pre-service teachers showed a positive attitude towards the integration of technology into learning activities. These results provide a positive signal for lecturers to integrate technology into their learning activities. Another interesting result is smartphones and laptops were technology tools that were frequently used by the pre-service teacher to help their learning activities. This research will be used as initial data in developing and designing learning activities based on technology integration in Indonesia, especially in Aceh.
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