The Pre-service Teachers' Experiences in Developing Digital Competences in Digital Literacies course

Laura Intan Mercy Febriani Simanjuntak[1], Effendi Limbong[2], Ida Wardani[3]

Mulawarman University

[1]laura.smnjtk99@gmail.com; [2]limbong_efflin@yahoo.com; [3]idawardani@fkip.unmul.ac.id

Abstract

The purpose of this study was to explore pre-service teachers' experiences in developing digital competences in Digital Literacies course. The study used DigComp 2.0 framework by Vuorikari et al. (2016). The design of the study was qualitative case study. The data sources were focus group interviews and observations with the participants of pre-service teachers of the English Language Education Department class of 2020 in Mulawarman University. The sample of the study was 29 pre-service teachers from class A and class C. The findings of the study showed that pre-service teachers have acquired knowledge and abilities in digital competence areas such as information and data literacy, communication and collaboration, digital content creation, safety, and problem-solving. However, pre-service teachers did not progress in ''Copyright and licenses'' & ''Programming'' sub-competences. Thus, the study suggested future studies to give further instruction for every sub-competence in each competence area and to use DigCompEdu framework..

Keywords: Digital competence, Digital Literacies course, Pre-service teachers' experiences

1. Introduction

The taking over of information and communication technology (ICT) in the current digital age has widespread in different sectors. Particularly in the educational sector, ICT has prominent role in the teaching and learning processes and has served as an educational necessity for some social, cultural, and health aspects in most cultures around the world (Bernate & Vargas, 2020, as cited in Cabezas-González, Casillas-Martín, & García-Peñalvo, 2021). To support pre-service teachers in technology integration, digital competence is required to be developed since it is prominently noted as the 21st century education understanding (Maderick, Zhang, Hartley, & Marchand, 2016, as cited in Wardani & Sentosa, 2022). Thus, in teachers training by making students that are literate in digital has commonly predetermined the prioritization of technical abilities in using digital tools and systems, which is believed to be appropriate within the education settings (Admiraal et al., 2017). In addition to the framework of digital competence, Europe Commission employed Digital Competence framework for citizens. The framework to digital competence is called as DigComp. It is developed based on Ferrari's (2013) digital competence framework which consists of five competence areas and 21 sub-competences. The five competence areas are information and data literacy, communication and collaboration, digital content creation, safety, and problem-solving.

Morever, Akayoglu et al. (2020) stated that in several circumstances, pre-service teachers are necessarily informed to adjust prevailing digital content for their own

circumstance, a progression which starts through initial teacher education and carries on through continual professional development. In this case, the Faculty of Teacher Training and Education of English Language Education Program at Mulawarman University employed three technology-mediated courses for pre-service teachers to enroll such as Technology in Education, Computer-Mobile assisted in Language Learning (CMALL) and Digital Literacies. Pre-service teachers can learn about the technology integration in which the teacher educators use Technological, Pedagogical, and Content Knowledge (TPACK) framework (Syamdianita, & Cahyono, 2021).

However, even though these pre-service teachers are learning about technology integration during technology-mediated courses, there are still some concerns regarding to their capabilities in using digital tools that they may use when implementing technology integration practices as addressed by several studies. List (2019) stated that they can get discouraged while facing problems in mastering technology devices, and they hardly make any effort or may utilize the technology insufficiently. Napal et al. (2018) stated that by being young does not ensure that a suffice level of the development of personal skills, and not as much with the professional skills of development skills. Syamdianita & Cahyono (2021) mentioned how the lecturer had to assist the students who were less adequate in technology literacy since they have little experience in teaching with technology. If the pre-service teachers are less literate in technology, it will be an issue since teaching with technology nowadays is unavoidable and demanded in the classroom. This is in line to the study by Nasreen & Chaudhary (2018) that found difficulties of pre-service teachers when it comes to ICT integration such as lacking ICT experiences and ICT skills. Consequently, it is crucial for being digitally literate since those problems are related to what Ng (2012) has described as part of technical skill. Furthermore, Hall (2018) stated that the pre-service teacher subjects did not honestly know what they did or did not know about technology.

In addition, numerous literature also has examined the development of pre-service teachers' digital competence based on DigComp framework (Napal et al., 2018; Reisoğlu, & Çebi, 2020; Çebi, & Reisoğlu, 2020; Hinojo-Lucena et al., 2019; Ilhami, Diniya, Susilawati, & Vebrianto, 2021). These studies explored pre-service teachers' digital competence in different contexts. Napal et al. (2018) examined pre-service teachers' digital competence from the perspective of descriptive study and found pre-service teachers to have developed the digital competence in the competence areas such as information and data literacy, communication and collaboration, and safety. Meanwhile, digital content creation and problem-solving were found to be the least developed by pre-service teachers.

Reisoğlu, & Çebi (2020) examined 24 pre-service teachers' digital competence through the lens of DigComp and DigCompEdu in the context of digital competence trainings whereas each of the five competence areas was trained for 70 h. The findings of the study found that, particularly based on the DigComp framework, pre-service teachers should be trained more for the competence areas of information and data literacy, communication and collaboration, digital content creation, safety, and problem-solving, even though pre-service teachers have already showed development in these competence areas.

Çebi, & Reisoğlu (2020) examined the opinions of 518 pre-service teachers in different provinces of Turkey about digital competence and to determine whether these opinions differ based on gender, branch and perceived level of digital competence. The findings of the study found that the digital competence of pre-service teachers is medium and that it differs considerably based on gender, branch and perceived level of digital competence.

Hinojo-Lucena et al. (2019) examined 140 teachers in Spain according to age, gender, experience, and branch classifications in order to scrutinize the digital competence of Permanent Education teachers, and to conclude the factors that can influence its development. The study conducted a questionnaire based on INTEF (2017) that addressed similar five competence areas of digital competence with DigComp framework by Europe Commission. The findings of the study found that teachers to have poor digital competence, and that the number of factors that could influence the digital competence development are age, type of centre, previous training on ICT, degree, the experience of teaching, and professional classification.

Ilhami, Diniya, Susilawati, & Vebrianto (2021) examined the digital literacy of 115 science education students from UIN Sultan Syarif Kasim Riau, Universitas Muhamadiyah Riau and Universitas Negeri Padang. The study conducted a questionnaire based on ''DigComp 2.1: The Digital Competence Framework for Citizens''. The findings showed that digital literacy of pre-service science teachers is moderate and found most of the students to have lacking the skill in producing digital contents.

Based on the aforementioned explanations regarding to the issues of digital competence and how previous studies have examined the development digital competence based on DigComp framework in different contexts, there is the need to examined the development of pre-service teachers' digital competence from the role of technology-mediated course. Since most of the previous studies examined pre-service teachers' digital competence development in the context of digital competence trainings (Hinojo-Lucena et al., 2019; Reisoğlu, & Çebi, 2019; Çebi, & Reisoğlu, 2020; Reisoğlu, & Çebi, 2020). Therefore, present study is aimed to explore the pre-service teachers' experiences in developing their digital competence in the context of creating and presenting their digital content by using digital technologies as project assignment in Digital Literacies course. The objectives of present study are formulated into these two following aims: (a) to identify how the pre-service teachers' digital competence have developed in digital literacies course; (b) to identify the challenges that pre-service teachers encountered in designing and presenting their digital content as project assignment in Digital Literacies course..

2. Literature Review

Digital competence as defined by Pettersson (p.2, 2018) is the skills and literacies required for the regular civilian capable to learn and steer in digitalized knowledge civilization (as cited in Reisoğlu, İ., & Çebi, A., 2020). According to Ferrari (2013), digital competence is related technical information on digital technologies utilizations, showing information of both formal and informal digital settings, evaluation and organization, communication and collaboration, digital content creation, digital media,

establishing safety, and problem-solving, job, pursuit, community diversity, acquiring the knowledge about digital tool to attain the objectives of critical, creative thinking, and in a self-assured mean (Çebi, & Reisoğlu, 2020). In the context of education, it is related to the use of digital technologies such as being capable in using software, websites, and tools that are favorable to the didactic success and targets of educational context that the importance of this competence of digital has become more and more strongly acknowledged and accentuated (Tomczyk et al., 2022).

In an earlier study, Hague & Payton (2010) developed digital literacy skills for pre-service teachers. There are eight components in the digital literacy skills such as functional skills, creativity, collaboration, communication, the ability to find and select information, critical thinking and evaluation, cultural and social understanding, and E-safety. While these skills are for digital literacy, in a recent study, there is a framework for digital competence with skills that closely similar to what Hague & Payton developed. It is called DigComp: The digital competence framework for citizens. It is developed in order to help outline the guidelines to increase digital competences of citizens at all age groups (Vuorikari et al., 2016). It is based on 15 earlier established frameworks related to digital competence. The framework of digital competence comprises of 5 areas of digital skills, and 21 sub-competences based on the framework developed by Ferrari (2013), and updated by Vuorikari et al. (2016).

Table 1. DigComp Framework for Citizens based on Vuorikari et al. (2016).

Competence areas	Sub-Competences
Information and data literacy	• Browsing, searching and filtering data, information and digital content • Evaluating data, information and digital content • Managing data, information and digital content
Communication and collaboration	• Interacting through digital technologies • Sharing through digital technologies • Engaging in citizenship through digital technologies • Collaborating through digital technologies • Netiquette • Managing digital identity
Digital content creation	• Developing digital content • Integrating and re-elaborating digital content • Copyrights and licenses • Programming
Safety	• Protecting devices • Protecting personal data and privacy • Protecting health and well-being • Protecting the environment

Problem-solving	• Solving technical problems
	• Identifying needs and technological responses
	• Creatively using digital technologies
	• Identifying digital competence gaps

The utilization of technology in the education field is undoubtedly can enhance teaching and learning (Ainley et al., 2008) In the context of technology integration in education, pre-service teachers can use appropriate framework for instance TPACK (Mishra & Koehler, 2006) as the basic knowledge which establishes variety of knowledge interactions by conjoining pedagogical content knowledge (PCK) with technological content knowledge (TCK) and technology pedagogical knowledge (TPK) (Mishra & Koehler, 2006). Moreover, the presence of technologies in language learning and teaching is of importance because teachers can use them to aid their teaching, appoint the students in their learning stages, establish realistic models of the assigned culture, and bond their classrooms (Kranthi, 2017). Thus, digital competence of pre-service teachers is different compare to other people since the goal for the pre-service teachers is to utilize digital technologies for education (Krumsvik, 2011; Røkenes & Krumsvik, 2014, as cited in Reisoğlu, & Çebi, 2020).

Previous literature showed that after pre-service teachers graduated from teacher training programs, they are still lacked with sufficient digital competence abilities (Gill, Dalgarno, & Carlson, 2015; Gudmundsdottir & Hatlevik, 2018; Tondeur, van Braak, Siddiq, & Scherer, 2016, as cited in Reisoğlu, & Çebi, 2020). Digital competence is considered to be important for pre-service teachers knowing that what pre-service teachers have experienced in regards to their digital competence during their teacher training curricula will ultimately influence the usage of digital technologies for their own teaching (Agyei & Voogt, 2011, as cited in Reisoğlu, & Çebi, 2020). That is why digital competence requires expertise since pre-service teachers are demanded to be proficient in utilizing digital technologies with adequate pedagogic-didactic discernments and cognizance of applying these digital technologies for strategies of learning and the students' digital culture (Krumsvik, 2011; Reisoğlu, & Çebi, 2020).

3. Methods

The design of the study was case study in which according to Creswell (2014) that case study is a qualitative design in which the researcher seeks out in depth a program, event, activity, process, or one or more persons. The study employed case study as this study is attempted to find out the pre-service teachers' experiences in developing digital competence when creating and presenting their digital content with the use of digital technologies which is a project assignment given in Digital Literacies course.

The population of the subjects of the study was pre-service teachers in the English Language Education department of Faculty of Teacher Training and Education in Mulawarman University from class A and class C, class of 2020. The participants were chosen in the form of focus groups, three groups from class A, and three groups from class C,

class of 2020, with the total of six groups from both classes. The focus groups were decided because the data sources would be obtained from focus group interviews, and classroom observations where pre-service teachers would present their digital content creation in the form of group. Hence, the total of 29 pre-service teachers who enrolled in Digital Literacies course taken from class A, and class C, class of 2020 were selected. Moreover, the characteristics of the participants of the study were pre-service teachers who enrolled Digital Literacies course, and designed digital content for teaching material with digital tools by including digital media such as infographic, audio, and educational videos.

The data were collected by using observations, and focus group interviews. The researcher observed the classroom where pre-service teachers did presentation of their digital content. The researcher would take notes during the digital content presentation and sat at the back of the classroom since the researcher's role was non-participant observer as well. The observations were done based on the five competence areas of DigComp 2.0 framework: (1) information and data literacy, (2) communication and collaboration, (3) digital content creation, (4) safety, (5) problem-solving. The researcher would describe the activities that were observed in regards to the competence areas in DigComp 2.0 framework.

Focus group interview was used because the researcher may ask new questions during the interview to give explicit answers, and were developed based on DigComp framework (Vuorikari et al., 2016). Thus, employing semi-structured interview would gain in-depth answer from the participants' responses regarding to their experiences in developing their digital competence when using digital tools during their digital content creation.

During the focus group interview, the following are the questions as the protocol interview: *(1) How did you decide both of your learning topic and learning objectives? (2) How did you discuss the content, was there any digital applications used during discussion? (3) How was your experience when using the PACIFIC applications, and the devices to create and present your group's digital content? What were the problems that you meet and what were the cause and the solutions to solve them? (4) Did you believe that privacy is important? Explain what are the steps that you take in order to protect your personal information. (5) Do you aware of how far your digital competences have developed during the process of creating your group's digital content? If yes, explain your digital competence may have developed so far during the process of creating your group's digital content? If not, explain the way you will develop your digital competence into a better way.*

After the data were collected, the researcher analyzed the gathered data by using thematic analysis. According to Braun & Clarke (2006), thematic analysis is data analysis technique that identifies and analyzes patterns of meaning in a set of data. The researcher analyzed the data based on the six steps by Braun & Clarke (2006) such as familiarizing the data with yourself, generating initial codes, searching for themes, reviewing themes, defining and naming themes, and producing the report.

The study used data triangulation to ensure the quality of the results of the study in which the study used different sources to obtain the data such as from field notes observations, and focus group interviews. The data from field notes observation and focus group interviews were read and compared to see if there were similarities and differences found across the analyzed data

4. Result

Mind map 1. The development of pre-service teachers' digital competence

4.1.1. The pre-service teachers' digital competences development
1. Information and Data Literacy
a. Browsing, searching and filtering data, information and digital content
In regards to the area of information and data literacy, it is found that all of the pre-service teachers have displayed development in the first sub-competence that is ''Browsing, searching and filtering data, information and digital content''. They were aware of the knowledge and abilities on getting digital content from different variety of digital sources or digital applications, knowing the strategies when to explore the digital content.
b. Evaluating data, information and digital content
The second sub-competence is "Evaluating data, information and digital content'', all of the pre-service teachers were capable in ensuring the validity of the sources that they used in order to obtain their digital content. In addition, some of the pre-service teachers were also aware that not all of the sources can be used as they might not be reliable, and can be a suspicious website as well.
c. Managing data, information and digital content
The third sub-competence is "Managing data, information and digital content" all of the pre-service teachers were able to save their digital content in various digital applications.
The responses of the pre-service teachers related to their experiences are presented as below:

''Beside using e-book from the internet, we also search on YouTube for the video and the audio as well.'' – (P13, Focus group interview).

''First, we save our content on Word to evaluate. As for the pictures we just put it on Canva, while for the video we sent links first to Whatsapp group for others to evaluate whether the videos are suitable for our topic or not. If it's not suitable, we would find another video.''– (P24, Focus group interview).

''We usually make sure to use certified and trustful website, but if we want to make sure we can just check the meta data of that file in which it contains the name of the author. We can just right click and type properties option.'' – (P4, Focus group interview).

In conclusion, pre-service teachers have developed ''Information and data literacy'' competence area, particularly in '' ''Browsing, searching and filtering data, information and digital content'', "Evaluating data, information and digital content'', '' "Managing data, information and digital content" sub-competences.

2.   Communication and Collaboration
        a.   Interacting through digital technologies
Regarding to the competence area of communication and collaboration, in sub-competence ''Interacting through digital technologies'', most of the pre-service teachers experienced on using digital platforms for the purpose of discussion during the process of creating their digital content.
        b.   Sharing through digital technologies
In sub-competence ''Sharing through digital technologies'' the pre-service teachers stated that they have used variety of digital applications to share the information and content they got from the different variety of sources. The response of the pre-service teacher related to the experience is as follow:
        c.   Engaging in citizenship through digital technologies
In sub-competence ''Engaging in citizenship through digital technologies'', all of the pre-service teachers did participate during the online discussion through social media.
        d.   Collaborating through digital technologies
In sub-competence ''Collaborating through digital technologies'', the pre-service teachers said that they created their digital content through digital application as part of the collaboration for the project.
        e.   Netiquette
Related to those sub-competences, the pre-service teachers were also aware of the importance in respecting people and using appropriate language in digital settings which is reflected to the sub-competence of ''Netiquette''.
        f.   Managing digital identity
Moreover, some of the pre-service teachers stated that they managed the accounts they created for the digital applications by only using it on secure digital settings which is reflected to the sub-competence of ''Managing digital identity''.
The responses of the pre-service teachers related to their experiences are presented as below:
''So I shared my Power Point on Whatsapp group, but before I converted to Power Point, I previously used Microsoft Power Point then I would send it to Whatsapp. We already discussed it beforehand that we would create it on Power Point then we would send it so the

next person who's responsible for the next sub-topic should add their Power Point to that. So, it's like in order''. – (P15, Focus group interview).

''So, after we searched the topic, we would forward it to Whatsapp then we moved it to Google Doc.'' – (P13, Focus group interview).

''First thing first is to not offend any particular tribe, religion, race, and in-between groups. It often happens when discussing through digital technologies when a group of people would offend or belittle certain belief or other people's opinion. In fact, communication in digital environment attitude is very important. (…) It is wise when communicating in digital environment to always behave appropriately, do not be a prejudice individual, and do not attack other people with malice comments.'' – (P22, Focus group interview).

''There are two types of my personal digital identity that I use which are formal and informal. Personally, I often use my informal type of digital identity especially in digital world because I am very protective of my privacy. For the formal identity itself I only use it in certain occasion such as when I am going to access specific module or journal as reliable source, I will use my formal identity, or e-mail for educational purposes. That means I trusted that website's security. Furthermore, I often use my informal digital identity when I am downloading pictures from Pinterest, since Pinterest has always been my main source to search all of the types of pictures that I want whether it is educational or for entertainment purposes only such as anime pictures, K-POP, food and cooking, etc.'' – (P22, Focus group interview).

In conclusion, pre-service teachers have developed ''Communication and collaboration'' competence area, particularly in '' ''Interacting through digital technologies'', ''Sharing through digital technologies'', '' ''Engaging in citizenship through digital technologies'', '' ''Collaborating through digital technologies'', '' ''Netiquette'', '' ''Managing digital identity'' sub-competences.

3. Digital Content Creation

    a. Developing digital content

In regards to the competence area of digital content creation, almost all of the pre-service teachers were capable in making digital contents such as infographics, and audio to their Power Point slides as it is related to the sub-competence of ''Developing digital content''. The data from field notes also showed that pre-service teachers have incorporated variety of digital media into their Power Point, and using digital tools and devices to help them when presenting their Power Point. Moreover, some of the pre-service teachers also got creative in creating their own character illustrations to support their infographics by using the available graphics provided by certain digital application.

    b. Integrating and re-elaborating digital content

It is found that some of the pre-service teachers also did modify the graphic elements they used for the infographics which is reflected to the sub-competence of ''Integrating and re-elaborating digital content''. In addition, the pre-service teachers have shown to be able to use different variety of digital applications that are useful for their digital content creation.

The responses of the pre-service teachers related to their experiences are presented as below:

''I used Canva and Pinterest for the pictures. So, for the infographic I used pictures that illustrate when a person is offering help to someone else since my topic is about asking for help.'' – (P24, Focus group interview).

'' (…) Since there are a lot of stickers elements on Canva, we decided to re-modify the elements. We searched with keyword murid students which we got the uniforms illustration. We had to change the color of the uniform into SMA's uniform because there are some elements that their colors can be adjusted accordingly.'' – (P9, Focus group interview).

In conclusion, pre-service teachers have developed ''Digital content creation'' competence area, particularly in ''Developing digital content'', ''Integrating and re-elaborating digital content''.

The result from observation is presented below:

Group, Class and Topic	DigComp Competence Area	Description
G4 class A – Greetings and Self-Introduction	Digital content creation	Group used different digital media formats such as GIFs, illustration pictures for infographics and design, audio, and video for assessment.
G1 class C – Talking about Self	Digital content creation	Group used different digital media formats such as GIFs, illustration pictures for infographics and design, and video as assessment.

Based on the observation result, pre-service teachers have incorporated several digital media into their digital content when doing the group presentation. This shows that pre-service teachers have acquired knowledge and skills in ''Developing digital content'' sub-competence.

4.   Safety
    a.   Protecting devices
In regards to safety competence, the pre-service teachers were already aware of the importance in protecting their devices which is relate to the sub-competence of ''Protecting devices''. The pre-service teachers stated that they installed anti-virus software for their laptop to avoid such as virus and malware that can harm the device and the data contained in that device.
    b.   Protecting personal data and digital identity
In sub-competence of ''Protecting personal data and digital identity'' all of the pre-service teachers voiced the same perspective that protecting their personal information is very important especially when using digital technologies that is linked to their accounts which contain their personal data.
    c.   Protecting health and well-being
In sub-competence of ''Protecting health and well-being'' the pre-service teachers stated similar experiences that using digital technologies could exhaust their mental state and physical health. They also explained how important it is to take rests and limit the digital technologies usage.
    d.   Protecting the environment

In sub-competence of ''Protecting the environment'', it is revealed that only few of the pre-service that aware of the solutions to problems arises from digital technologies negative impacts on the environment.

The responses of the pre-service teachers related to their experiences are presented as below:

''I always protect my data with strong security. Firstly, I set my smartphone and laptop with password in order to be used so not everyone can use my devices unauthorized. Secondly, I also set passwords for few applications in my smartphone before using it. Thirdly, in my laptop I installed specific software that detects any virus, so it can be said that I already managed my devices with super strict security settings.'' – (P16, Focus group interview).

''Privacy is so important to me. In order to protect my private information, I use different password on every account that I have, and also not to click on any suspicious link.'' (P1, Focus group interview).

''Usually when I am already tired of the internet, especially with social media, I would try to deactivate my account such as Instagram temporarily, and for other things I also would try not to open them. I would try bunch of different things that can comfort me and make me forget the things that tire me. If somebody makes me stressed, I will hide or block that person.'' (P15, Focus group interview).

''Of course, I am aware. What I know about the impact of environment from using digital technologies is that it can cause global warming. So that is why I am aware to only use technologies when I need it and turn it off after I am done using it.'' – (P20, Focus group interview).

In conclusion, pre-service teachers have developed ''Safety'' competence area, particularly in ''Protecting devices'', '' ''Protecting personal data and digital identity'', ''Protecting health and well-being'', ''Protecting the environment'' sub-competences.

5.   Problem-Solving

      a.   Solving technical problems

In regards to the competence area of ''Problem-solving'', as shown from the data that all of the pre-service teachers have the knowledge in order to solve the problems, they experienced in creating their digital content by using several digital applications as well as presenting their digital content in the classroom. Pre-service teachers also experienced some of technical problems and were able to solve the problems when they were presenting their digital content by using devices and digital application in which they were SMART TV, laptop, Inknoe Classpoint and Power Point in which reflected in ''Solving technical problems'' sub-competence.

      b.   Identifying needs and technological responses

In addition, when they were using digital applications to make their infographics, all of the pre-service teachers stated they encountered some problem related to the accessibility of using that digital application such as the requirement to pay subscription in order to use the full version of it since they found the elements that they wanted to use are for premium users. This prompted them to search for other different sources which they could use, hence these pre-service teachers were able to find technological solution to their necessity, as reflected to the sub-competence of ''Identifying needs and technological responses''.

      c.   Creatively using digital technologies

As for the sub-competence of ''Creatively using digital technologies'', the data showed that all of the pre-service teachers have used the digital technologies for creative purposes. For example, pre-service teachers knew how to create their infographics through different variety of digital technologies such as Canva, Iseli, Visme, Blush Design, PixStone, etc, to create an interactive quiz through the use of Inknoe Classpoint in which the audience can give real time responses, and to use SMART TV to display their Power Point so that the audience can see their digital content clearly and audibly.

   d.   Identifying digital competence gaps

In regards to the sub-competence of ''Identifying digital competence gaps'', it is revealed from the data that most of the pre-service teachers were able to identify their digital competence as they could utilize certain digital technologies when creating their digital content. Some of them also expressed the need to further improve their digital competence.

The responses of the pre-service teachers related to their experiences are presented as below:

''There was a problem when presenting using my laptop. The presentation wouldn't show up on the TV's screen, just my laptop's background picture appeared on the TV screen. So, what we do was to plug the HDMI cable to the TV first until the laptop's screen showed up on the TV's screen then we opened the Power Point after that, because if we opened the Power Point file first then what happened is that the Power Point wouldn't show up but only just the background.'' – (P7, Focus group interview).

''The problem was that many of the elements on Canva are priced which make them off limit. So, what I do was to find other elements that are free, or get them from different sources.'' (P13, Focus group interview).

''The reason why I still use Canva is because it is pre-paid meanwhile other applications can't be used. Second is that I believe the animations are still lacking, since I don't want to use any random application because it has to be in accordance to what I wish for. For example, the backgrounds in Iseli are all pretty cool but the animations are less varied. So, I only took the backgrounds meanwhile the elements or animations I used were from Canva. (…).'' – (P15, Focus group interview).

''I believe my digital competence during the process of creating content has starting to get better. For example, previously I didn't know how to use Inknoe Classpoint and now I am able to use that application. That is also because I learned it together with my group friends, and now I knew how to operate Inknoe Classpoint. In addition, I knew how to develop my digital competence so I can be better by learning the tutorials on Youtube and learning together with friends that are knowledgeable about the application that was learned previously.'' – (P23, Focus group interview).

In conclusion, pre-service teachers have developed ''Problem-solving'' competence area, particularly in ''Solving technical problems'', ''Identifying needs and technological responses'', '' 'Creatively using digital technologies'', ''Identifying digital competence gaps''.

   The result from the observation is presented below:

Group, Class and Topic	DigComp Competence Area	Description
G1 class A 2020 – Congratulating and	Problem-solving	Group presented the content they made from

Complimenting		the topic they chose by using Power Point and displayed it through laptop and SMART TV.
G4 class C 2020 - Invitation	Problem-solving	Group had a technical problem related to displaying answers from Slide Drawing feature of Inknoe Classpoint in which the presenter accidentally closed the display of answers submission that was not saved in the first place; hence the answers were lost. So, the presenter had to start over the answer submission session.

Based on the observation result, it is showed that pre-service teachers have utilized digital technologies to support their presentation, and were able to solve technical problems. This shows that pre-service teachers have obtained knowledge and skills in '' Creatively using digital technologies'', ''Solving technical problems'' sub-competences.

4.1.2. The challenges pre-service teachers encountered in designing and presenting digital content as project assignment in Digital Literacies course

Pre-service teachers stated the challenges they encountered in designing and presenting digital content when using digital technologies.

1. Finding free elements suitable for topic materials

During digital content creation process, pre-service teachers explained that they struggled to find free elements that are suitable for their topic materials. Pre-service teachers stated that the elements they found were limited and priced, so in order to use the elements they have to pay full subscription of the digital application. The following is the statement that one of pre-service teachers stated in regards to the challenge that she experienced when designing her digital content:

''My problem was the elements in Canva that are mostly priced in which making them limited. I had to find another element that is free.'' – (P12, Focus group interview).

2. Problems with the digital technologies and devices used in presentation

During the presentation of digital content, pre-service teachers were observed to have problems they when using digital technologies and devices. Pre-service teachers were troubled in operating Inknoe Classpoint especially when displaying the quiz on SMART TV's screen through Power Point. The following is the result of the observation of pre-service teachers encountered challenges when presenting the group's digital content:

Group, Class and	DigComp Competence	Description

Topic	Area	
G1 class C – Talking about Self	Problem-solving	The Power Point slides that were displayed through Inknoe Classpoint's website did not occur on the audience's mobile phone. The solution was the presenter of the group chose to display the slide containing the question and answers options on SMART TV's screen. For the cause of the problem was unknown

This is line to what pre-service teacher stated when she was interviewed regarding to the challenge her group encountered in presenting group's digital content.

''When doing the presentation with Inknoe Classpoint there was a problem. It was when I was going to display the slide with Inknoe Classpoint's quiz on the television, there was review page appeared on top of it. What I meant to do is to explain the question first but it was covered by the review slide. So that is the problem, just like other friends did, on the slide section on television I had moved the question slide, but on the audience's handphone the question did not show up for them to answer the question in the Inknoe Classpoint. I restarted the question section, when the review slide appeared again, I ended it so that I can explain the question first then I can reappear the review slide. For the slide that was not appear at that time, after so many times trying, the slide eventually appeared on the audience's handphone. I just moved the slide to previous slide and moved it again to the slide's question section.'' – (P16, Focus group interview).

The conclusion is that pre-service teachers still have challenges in using digital technologies namely Inknoe Classpoint. However, pre-service teachers were able to solve the problem when encountered such challenge.

In addition, pre-service teachers also had trouble in displaying their Power Point through TV's screen by using laptop. The following is the result of the observation of pre-service teachers encountered challenges when presenting the group's digital content:

Group, Class and	DigComp Competence	Description

Topic	Area	
G2 class A – Asking and Giving Opinion	Problem-solving	The group had trouble in finding the class code for Inknoe Classpoint. The solution was presentation mode from Power Point was closed and displayed the Power Point slides again on SMART TV's screen while the other member of the group was giving direction to the presenter who was experiencing the trouble.

This is line to what pre-service teacher stated when he was interviewed regarding to the challenge his group encountered in presenting group's digital content.

''The class code [Inknoe Classpoint's class code] sometimes doesn't appear when presenting with laptop during presentation mode. So, the solution to that is firstly we plugged the HDMI cable to the TV before we open the Power Point. This is because if we showed the Power Point after the HDMI cable was plugged in, then the presentation slides wouldn't appear since only my laptop's background that would appear. So, that is why in order to fix that HDMI cable had to be connected to the TV first and then we can open the presentation. During the presentation mode, the screen was already showed up on TV's screen so the Inknoe Classpoint features can used. On my laptop, I chose duplicate screen to switch my screen, where the display on TV is the same as the one on my laptop, then we can activate the Inknoe Classpoint features.'' – (P7, Focus group interview).

The conclusion is that pre-service teachers still have challenges in using digital technologies and devices namely Power Point, and laptop. However, pre-service teachers were able to solve the problem when encountered such challenges.

5. Discussion

4.2.1 The pre-service teachers' digital competence development
a. Information and data literacy

Pre-service teachers were shown to have developed in the competence area of ''Information and data literacy'', in sub-competences such as ''Browsing, searching and

filtering data, information and digital content'', ''Evaluating data, information and digital content'', and ''Managing data, information and digital content''. This research concluded that the pre-service teachers have the knowledge and abilities on getting digital content from different variety of digital sources or digital applications, knowing the strategies when to explore the digital content, ensuring the validity of the sources, being aware of not all of the sources can be used, and saving digital content in various digital applications.

These findings are in line with these following previous studies. Galindo-Domínguez & Bezanilla (2021) revealed that pre-service teachers have medium perception toward information and data literacy. Similarly, Reisoğlu & Çebi (2020) found that the pre-service teachers' digital competence developed after digital competence training as they have obtained the knowledge and skills in getting digital content from numerous sources, planning the searching process, using particular searching strategies, storing information in digital locations, apprehending information may not be reliable, being cautious about website extensions and making sure websites are qualified, Çebi and Reisoğlu (2020) also showed similar findings that the pre-service teachers have improved the abilities in terms of employing searching plans, retrieving information, assessing the validity and reliability of information, disposing and saving information after the digital competence training. Napal et al. (2018) showed that the pre-service teachers only competent in browsing, storing and retrieving digital data and contents.

b. Communication and collaboration

Pre-service teachers obtained knowledge and abilities in the competence area of ''Communication and collaboration'' which including the sub-competences such as ''Interacting through digital technologies'', ''Sharing through digital technologies'', ''Engaging in citizenship through digital technologies'', ''Collaborating through digital technologies'', ''Netiquette'', and ''Managing digital identity''. It was established that pre-service teachers improved their knowledge and abilities in interacting through digital platforms during the process of digital content creation, using variety of digital applications to share the information and content, participating in online discussion through digital applications, creating digital content through digital applications as part of the collaboration for the project, being aware of the etiquette in communicating in digital settings, and managing the accounts created in digital settings.

These results are similar with the findings from a study by Napal et al. (2018) in which found that pre-service teachers were more capable in terms of ''interaction and share information'', ''browse, store, and retrieve digital data and contents'' sub competences. Particularly, pre-service teachers were unaware of the codes employed in digital media (netiquette), the concept of digital identity, or incapable to create true cooperation online, in contrast to the present study that has shown the difference in terms of netiquette, engaging in citizenship through digital technologies, and managing digital identity. Nuangchalerm, Prachagool, & Dostál, (2020) showed closely similar result in which pre-service teachers during digital learning were able to participate in learning management by numerous online cooperation and select to utilize the appropriate online application to exchange cooperation such as e-mail and Facebook. Çebi and Reisoglu (2020) also found that the pre-service teachers to be more advanced in communication and collaboration. Reisoğlu, & Çebi (2020) pointed out that only sub-competence of ''Engaging in citizenship through digital

technologies'' of the opinions by the pre-service teachers was not expressed due to the time for the study was limited as it is required for adequate practices.

   c. Digital content creation

   Pre-service teachers have shown development in the competence area of ''Digital content creation'' in ''Developing digital content'' and ''Integrating and re-elaborating digital content'' sub-competences. Pre-service teachers obtained the knowledge and abilities in terms of making digital contents such as infographics and Power Point with the use of several digital technologies and devices. This is because pre-service teachers were encouraged by the teacher educator to create their digital content such as infographics by using digital applications and devices. In addition, during the observation of pre-service teachers' group presentation, it is found that pre-service teachers have incorporated several digital media into their digital content for their Power Point. In the slides of their Power Point contained several digital media which were created based on the topic they chose.

   However, pre-service teachers did not develop in the sub-competences of ''Copyright and license'' and ''Programming''. This is because pre-service teachers were not aware of the importance of the copyrights and license since they thought the digital applications that they chose are free to use, and not included the creator's name into their digital content. In addition, they did not develop their knowledge and skills in terms of programming since the digital applications they used are already programmed with features that support them in creating and presenting their digital content and not allowing them to employ programming language. Similar study by Rizal et al (2019) also reported that pre-service teachers did not develop programming sub-competence area because using particular language program for writing a computer program as one of the indicators in digital content creation from the study is located in the lower category. Thus, the study reported digital content creation as the lowest developed competence area.

   On the contrary, Reisoğlu, & Çebi (2020) found that the pre-service teachers did not create their digital content from the existing content and prefer to create it from the scratch and they also have improved their knowledge and abilities regarding to the importance of intellectual property rights and licensing, and comprehending the algorithm logic. However, the study also proved that pre-service teachers have progressed in developing their digital content such as making infographics, animated presentations, and educational videos which is similar to the findings of this present study. Galindo-Domínguez & Bezanilla (2021) found that pre-service teachers perceived themselves with extreme troubles, or where they posed superior deficiency in their knowledge in regards to digital content creation dimension area. Çebi and Reisoglu (2020) showed the pre-service teachers did not develop simple forms of content with digital technologies utilization because of the lack of implementations for content development. Napal et al. (2018) found digital content creation was the least developed areas in digital competence.

   d. Safety

   Pre-service teachers increased their knowledge and abilities in ''Protecting devices'', ''Protecting personal data and privacy'', ''Protecting health and well-being'', ''Protecting the environment'' sub-competences in ''Safety'' competence area. It can be concluded that pre-service teachers were able to taking precautions to protect devices and data privacy, being aware of the threats and risks to their physical health and psychology when

using digital technologies, and being aware of the impact from using digital technologies. Similarly, several previous studies have the same findings as present study. Reisoğlu, & Çebi (2020) explained how the pre-service teachers obtained knowledge and abilities in safety competence area such as being able to take precautions to protect personal information, knowing the legal process of privacy act, be aware of personal risks and threats in digital environments, to take precautions to protect digital devices, be aware of risks and threats that can be caused by other devices. However, the study found that pre-service teachers have not increased their knowledge and abilities in terms of the sub-competence ''Protecting the environment'' due to the training broadly focused on the protection of personal information.

Meanwhile, study by Rizal et al. (2019) only reported the safety competence based on one indicator that is found to be in medium level which is updating one or more security products at least irregularly. It is found that pre-service teachers repeatedly update security software is because of the update reminder system which is available in numerous security software. This indicator can be similarly included in protection of devices sub-competence area. The study by Çebi and Reisoglu (2019) established similar findings with present study in which pre-service teachers have increased their knowledge and abilities in sharing personal information, safety policies for protecting personal information, knowing the fitting ways to protect digital devices and content and identifying risks and threats in the digital setting which was all because of the digital competence training (Reisoğlu, & Çebi, 2020). On the contrary, study by Napal et al. (2018) established different findings that found pre-service teachers have insufficiencies regarding to ''Protecting personal data and privacy'', ''Protecting health and well-being'', ''Protecting the environment'' sub-competences in ''Safety'' competence area.

e. Problem-solving

Pre-service teachers gained knowledge and abilities in the competence area of ''Problem-solving'' in ''Solving technical problems'', ''Identifying needs and technological responses'', ''Creatively using digital technologies'', ''Identifying digital competence gaps''. It can be concluded that pre-service teachers have improved their knowledge and abilities in solving technical problems related to the digital technologies and devices used to create their digital content, identifying the needs and solve them by using digital tools, using digital technologies for creative purposes, and recognizing the necessities and improvement for digital competence. Similar to the findings of this study, Reisoğlu, & Çebi (2020) found that pre-service teachers have created progression in terms of discovering technological answers in accordance to their necessities, recognizing the knowledge and needs about digital competence. However, the study also discovered that pre-service teachers did not make any progress in terms of ''Creatively using digital technologies'' because the time assigned for the pre-service teachers to use digital technologies creatively was not sufficient which is contrast to what present study have found in regards to that particular sub-competence area.

In addition, prior studies also showed contrary results compare to the present study. Napal et al. (2018) showed that pre-service teachers have medium knowledge in the sub-competences of solving technical problems, and identifying the needs and technological answers. Rizal et al. (2019) found problem-solving area as the least develop because pre-service teachers have constraints of skill to employ and restore impaired digital tools and the dread from the highest risk in ruining impaired digital tool if they fix the tool by themselves.

Esteve-Mon et al. (2020) reported that pre-service teachers are still less competent in problem-solving area as the study examined the correlation between computational thinking with technological literacy. The results of the study showed that pre-service teachers that have higher score in computational thinking also have high perception of digital competence in terms of utilizing hardware and software technologies. While on the other hand, pre-service teachers that have lower score of computational thinking showed to have lower perception of digital and technological competence. Çebi and Reisoglu (2020) found pre-service teachers have deficiencies in ''Problem-solving'' competence area because of the insufficient practices for technical problems.

4.2.2 The challenges pre-service teachers encountered in designing and presenting digital content as project assignment in Digital Literacies course

Although pre-service teachers have the knowledge and abilities in digital competences areas, they also encountered several challenges during the process of designing and presenting digital content as project assignment in Digital Literacies course. Pre-service teachers stated that they have difficulty in finding free elements that are suitable for their topic materials. In this project assignment, pre-service teachers used several digital technologies to design their digital content such as Canva, Piktochart Visme, Iseli, etc. However, in those applications, not all of the features can be used freely including the elements that can be used to create infographics, and design Power Point slides. For example, in Canva, pre-service teachers are required to be premium users in order to use premium elements such as graphics, photos, fonts, animations, templates, etc.

Similar to Fadzil (2018) that found pre-service teachers had the same challenge in terms of making infographic using free infographic maker such as Piktochart because the application itself has limited features.

The second challenge that pre-service teachers encountered was during the presentation of digital content. Pre-service teachers have difficulties in operating digital technologies and devices such as Inknoe Classpoint, Power Point, and connecting laptop to SMART TV. In terms of operating digital technologies such as Inknoe Classpoint, pre-service teachers have difficulty when the quiz would not occur on the audience's handphone. However, pre-service teachers were able to find the solution and was able to continue presenting their digital content. In terms of using laptop and SMART TV, pre-service teachers have difficulty when connecting the laptop using HDMI cable to SMART TV. After so many trials, pre-service teachers were able to solve the problem and continue presenting their digital content.

These challenges that pre-service encountered when using digital technologies and devices are similar to what Valtonen et al. (2020) found that pre-service teachers also stated the challenges in the areas of technology knowledge in which related to technical problems and abilities to solve the problems. Thus, with the new experiences pre-service teachers can be real teachers, and as well as facing challenges teaching in the classroom (Debreli, 2016 as cited in Syamdianita & Cahyono, 2021).

6. Conclusion

The project in Digital Literacies course enabled the pre-service teachers to create and present their digital content with the use of digital technologies and devices, and with knowledge and abilities they have acquired previously. Since technology integration will affect their future teaching in using technology in the classroom, advanced teaching with ICT obliges more than just mastery of rudimentary ICT abilities (Guskey, 2002, as cited in Napal et al. 2018). Although the study did not specifically design for digital competence training, however, during Digital Literacies course, pre-service teachers have developed their digital competence in creating and presenting their digital content. This is in line to what Gill et al. (2015) said that pre-service teachers should be given the chance to perceive, replicate, and experience how digital technologies could be utilized in learning and teaching activities (Reisoğlu, & Çebi, 2020).

It was established that there is the need for further instruction regarding to subject for the course. This circumstance occurred from the insufficiency of the awareness from pre-service teachers had in ''Copyright and license''. Pre-service teachers felt there is no need to give credits when it's due. Meanwhile, the digital applications they used to create digital content does not need them to run a sequence of clear commands for a computing system in order to perform a task, hence ''Programming'' sub-competence was not developed.

During the process of creating and presenting digital content, pre-service teachers also faced several challenges. Pre-service teachers had to find alternatives related to the elements used in making digital content such as infographics and Power Point slides. Since the elements they found in digital applications are priced, it hindered them to use these elements freely. Pre-service teachers also had trouble in displaying Inknoe Classpoint quizzes' slides and Power Point on SMART TV's screen, and connecting laptop to SMART TV, still they were able to solve these problems as well. Thus, pre-service teachers were able to overcome the challenges that they encountered during the process of creating and presenting digital content.

Moreover, this research also has several limitations. First limitation is that this research is conducted based on just one case. Therefore, the results of this case study cannot be generalized. Nevertheless, the goal of case study method is to assess the outcomes in the present context and simplify them to comparable circumstances rather than simplifying it to general population (Yin, 2003, as cited in Reisoğlu, & Çebi, 2020). Second limitation of the study is that the participants of the study were from the same major of the same year. It could be better to collect the data from different majors in order to see the differences of digital competence across majors, or from different university with the same major. Third limitation of the study is that the study only conducted classroom observations during digital content presentation based on DigComp 2.0 framework, as the result only two out of five competence areas were prominently stood out during the observations. Hence, the observations should be done during the creating process of digital content, and not solely during digital content presentation. Since this could affect the quality of the data collected, that is why it is required to have different data sources in order to solidify the trustworthiness of the study. Thus, it is suggested for future studies to conduct observations during the process of creating digital content so that all of the five competence areas in DigComp 2.0 framework are covered.

Lastly, the limitation of this study is that there is the need for different course design especially for Digital Literacies course in order to develop pre-service teachers' digital

competence. Giving project for pre-service teachers to create their digital content is not enough, it could be better if the course was designed like digital competence trainings as previous studies have implemented. In addition, this study also suggests for future researches to conduct study based on a different framework such as DigCompEdu, which is a digital competence framework specialized for educators.

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