ICT Competence of Pre-service Teachers in Vietnam: Structure and Impact Model

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Abstract

Information and Communication Technology (ICT) has created ample distance learning opportunities during the Covid-19 pandemic. That also makes a requirement for transformation in education and teacher training. ICT competence is considered a part of pre-service teachers’ professional competencies that apply technology in teaching and assessing students. This study aimed to determine the ICT competence level of student teachers by using ICT self-assessment surveys and find out the factors that affect student competence. The ICT competence structure was built based on four ICT skills frameworks containing 05 components: Using computers, using teaching and assessment applications, Using Internet resources, using peripheral devices, Communicating on an online platform. 289 pre-service teachers have participated in the survey. They self-assessed their ICT competence and answered the questionnaire about their training activities at university. The data was analyzed using the PLS-SEM method and found the positive impacts of infrastructure and learning activities on pre-service teachers’ ICT competence.

Keywords: ICT literacy, teacher candidates, pedagogy students, PLS-SEM, training activities

1. Introduction

The competitive and commercial environment in education has led many universities to make more effort to use all kinds of resources and improve their systems to adapt well to the ground. Information and Communication Technology (ICT) has long been seen as a critical factor in creating a shift from a traditional training method to a professional and flexible academic setting (Jimmy & Pelserb, 2012). These rapid ICT changes enable students to naturally gain global knowledge instead of absorbing it passively and become more engaged, innovative, and empowered (Latchem & Jung, 2010). Recent studies have shown that educators who determine how technology is used in the classroom play an essential role in integrating technology education (Kagima, 1998). Therefore,
teachers’ ICT competence and perception need to be focused on applying technology effectively in teaching. ICT competence is related to the ability to use internet resources and computers to teach and interact with students. There is a moderate positive relationship between lecturers’ beliefs in ICT integration’s effectiveness in the curriculum and their ICT use (Ly Thanh Hué & Habibah Ab Jalil, 2013). Several studies show that attitude towards ICT is one of the factors influencing (pre-service) teachers’ competencies for technology use in education (Tondeur et al., 2018). Besides, training and curriculums factors are considered.

Like other developing countries, Vietnam considers ICT as a motivation to build society and economy together with the ICT development indicator (IDI) (International Telecommunication Union, 2018). Among the Southeast Asian countries, Vietnam is in more advanced ICT stages in education than Indonesia, the Philippines, such as in terms of ICT’s dimensions in policies, ICT infrastructures in schools, teaching, and learning pedagogies (SEAMEO, 2010). Because of the importance of integrating technology in education, the Ministry of Education and Training (MOET) issued documents regarding increasing ICT use in the educational system (Ministry of Communication and Information, 2014; MOET, 2018). In particular, the Vietnamese professional framework for teachers also indicates that the proficient use of technology is one of the vital criteria.

Furthermore, during the Covid-19 pandemic, teachers must use technology for online learning. Even when the epidemic ends, the trend of blended learning is expected to develop vigorously in the near future (Nerantzzi, 2020). To prepare well for that, the pedagogical universities need to develop ICT competence for the students. Therefore, this study aims to build teacher students’ ICT competence framework and propose the school factors that impact students’ competence.

2. Theoretical Framework

2.1 ICT competence and pre-service teachers

For the last few decades, ICT has been an essential part of our lives, affecting our society as well as individual life (Bhattacharjee & Deb, 2016). To keep up with social needs, teacher students need to have all the necessary skills to develop their teaching ability (Pham, 2014). Pedagogical universities in charge of training the education sector resources need to equip their students with the required qualifications, including ICT competence. Measuring pre-service teachers’ ICT competence is the initial task before promoting any action programs to increase that competence. Koehler and Mishra (2009) argued that teacher training focused on ICT skill training and considered how ICT interacts with the training curriculum to create an ICT environment. Consequently, ICT competence has become more and more essential in education.

ICT competence of student teachers is considered a part of career competence. It is not limited to ICT application (knowledge, skills related to ICT use in education) but to other aspects (applying ICT to change teaching methodology, and so on). ICT competence originated from the ability to use digital and communications technology to access, administrate, accumulate, evaluate, and create information. The person with ICT competence can master software applications, process data, and understand basic technology principles to develop the completed technological products (Martin Senkbeil, 2018). According to the authors, A teacher who has ICT competence can successfully use computer software, peripheral devices, and internet resources to teach and communicate with students in direct and virtual environments.

ICT competence has changed according to science and technology development. Hence, evaluation criteria have changed, too. Many ICT frameworks are used worldwide, such as UNESCO, ETS, etc... (Educating testing service, 2006; Flowers & Algozzine, 2000; UNESCO, 2011). In Vietnam, the Ministry of Communication and Information has also published the ICT standards in Regulation 03/2014/TT-BTTTT (Ministry of Communication and Information, 2014) (see figure 1).
Based on the frameworks in figure 1 and the ICT competence definition, this research proposed an ICT framework for student teachers, including 05 components: Using computers, using teaching and assessment applications, using Internet resources, using peripheral devices, communicating on an online platform (see figure 2).

- Using computers has 05 items refers to the ability to use computer software; connect the laptop with wireless devices; find, copy, and store the files and folders.
- Using teaching and assessment applications contains five items: using M.S. office to make lesson plans, using teaching software to make e-learning, video, the test; using apps for formative assessments.
- Using Internet resources contains five items related to accessing the website, registering, and logging in to some websites, information security when surfing the web, searching, and getting the resources from the internet like pictures, videos, and questions banks so on.
- Using peripheral devices like printers, scanners, and projectors that support the teaching process so on.
- Communication in the online platform: online platform brings more opportunities for a teacher to create activities to increase interactions between teacher and students. This aspect relates to designing learning activities like forums and talk shows on online platforms like Moodle and M.S. Teams, sending and receiving email so on.
Factors that impact student ICT competence

2.2 Factors that impact student ICT competence

Aesaert et al. (2015) proposed 03 factors that impact student ICT competence, including school (ICT coordinator, Policy, Infrastructure), classroom, and pupil. The data was collected from students, teachers, and coordinators pointed out that pupil factors (ICT attitude, learning style, analytic intelligence, motivation) have the most substantial influence. Conducting similar research, Hinojo-Lucena et al. (2019) studied teachers' ICT competence. They showed that teaching experience and previous ICT training directly impact ICT competence. Similarly, Hammond et al. (2011) indicated that when lectures applied technology in their lessons, they also allowed students to experience technology for themselves. In a modern class, they are introduced to many teaching tools and resources that help them naturally gain ICT competence. Likewise, Haydn and Barton (2007) indicated that technological experience through direct activities and observation of teacher educators is crucial for nurturing teacher students' ICT competence. Based on the discussion, this study proposes the following hypothesis:

H1: Taking part in technology training courses impacts pre-service students' ICT competence.
H2: Classroom activities using technology at university impacts pre-service students' ICT competence.
H3: Technological infrastructure at university impacts pre-service students' ICT competence.
H4: Curriculum at university impacts pre-service students' ICT competence.

The way teachers apply technology in their lessons reflects their teaching and learning beliefs (Prestridge, 2012). Instefjord and Munthe (2017) confirmed that teacher educators’ ICT competence has weak positive correlations with management’s development support but stronger positive correlations with their beliefs in ICT advantages. Besides, students’ pedagogical beliefs are formed for ages by experiencing various professional context teachers (Keys, 2007). Richardson (2003) argued that although it is difficult to change a teacher's belief, instructions and schooling is the most important factors to change pre-service teachers' beliefs on pedagogy. Therefore, this study proposed 02 more hypotheses:

H5: Classroom activities using technology at university impacts pre-service students’ beliefs in ICT effectiveness.
H6: Beliefs in ICT effectiveness impacts pre-service students’ ICT competence.

The model is proposed in figure 3.
3. Methodology

Survey research was applied in this study to assess the student teacher’s ICT competence via the self-assessment tool. The questionnaire was designed based on the proposed structure and factors that impact student ICT competence.

3.1 Instrument

There are three main parts in the questionnaire. The first part gathers demographic information of participants. The second contains 22 items that describe the ICT competence’s behavior. ICT competence scale according to the Likert scale with five levels from 0 to 4, in which (0)- knowing nothing (without any knowledge, skill, and experience in ICT use) and (4)- using creatively. Five factors impact ICT competence are set in part C. (figure 3). The scale for part C is the 5-point Likert from (1) completely disagree to (5) completely agree to study the effect of those factors on student ICT competence (Duong & Le, 2018).

3.2 Questionnaire analysis

Part B - student teacher’s ICT framework

The student teacher’s ICT framework has 05 groups. Cronbach’s alpha values for each group are above 0.8, which confirms the good internal reliability of the structure. After eliminating destructive items, the five-factor model illustrates acceptable goodness-of-fit indexes ($\chi^2/DF = 2.38$, CFI = 0.916, SRMR = 0.06). All features of the model have excellent reliability (CRs > 0.7), convergent validity (AVE > 0.7) and discriminate validity (SQRTAVE > Inter-Construct Correlations). The detail values are display in table below.

Table 1: Model fits 1

<table>
<thead>
<tr>
<th></th>
<th>No</th>
<th>CR</th>
<th>AVE</th>
<th>MSV</th>
<th>MaxR</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer</td>
<td>5</td>
<td>0.83</td>
<td>0.50</td>
<td>0.30</td>
<td>0.84</td>
<td>0.70</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Applications</td>
<td>4</td>
<td>0.84</td>
<td>0.51</td>
<td>0.35</td>
<td>0.85</td>
<td>0.55*</td>
<td>0.71</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
3.3 Context and participants

This study was carried out at the University of Education, which is a member of Vietnam National University, Hanoi. VNU University of Education strives toward a research-oriented university to train teachers at all levels. 100% of courses there have to apply blended learning; therefore, ICT is used widely. This research aims to assess students’ ICT competence and how some school factors impact that competence.

A total of 289 students from 6 majors: Mathematics, Physics, Chemistry, Biology, Literature, History, of which 87.5% are female, participated in our study. The participants’ demography is shown in Table 3.

Table 3: A description of the questionnaire sample

<table>
<thead>
<tr>
<th>Courses</th>
<th>Number of students</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>289</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>36</td>
<td>12.5%</td>
</tr>
<tr>
<td>Female</td>
<td>253</td>
<td>87.5%</td>
</tr>
<tr>
<td>Second-year students</td>
<td>72</td>
<td>25.3%</td>
</tr>
<tr>
<td>Third-year students</td>
<td>133</td>
<td>46%</td>
</tr>
<tr>
<td>Fourth-year students</td>
<td>83</td>
<td>28.7%</td>
</tr>
<tr>
<td>Majors</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mathematics</td>
<td>42</td>
<td>14.5%</td>
</tr>
<tr>
<td>Physics</td>
<td>63</td>
<td>21.8%</td>
</tr>
<tr>
<td>Chemistry</td>
<td>35</td>
<td>12.1%</td>
</tr>
<tr>
<td>Biology</td>
<td>31</td>
<td>10.7%</td>
</tr>
<tr>
<td>Literature</td>
<td>78</td>
<td>27.0%</td>
</tr>
<tr>
<td>History</td>
<td>40</td>
<td>13.8%</td>
</tr>
</tbody>
</table>

3.4 Data collection and analysis

The paper questionnaire was sent directly to students in their class. The participants were guided clearly about the purpose and the content of the survey. After collecting, the data was clean and prepared for further analysis using SPSS, PLS-SEM, and Conquest software.
4. Findings

4.1 ICT competence of student teachers

Firstly, the descriptive-statistical data of five ICT competence components were calculated to verify teacher students' achievement levels. The results based on 5 point Likert (0-4) showed that students are good at exploiting internet resources (2.98/4 – SD = 0.5) and need to improve skills using supported devices (Mean = 1.66, SD = 0.9) and interacting indirectly (Mean = 1.8, SD = 0.97).

Table 4: Descriptive statistics

<table>
<thead>
<tr>
<th>Component</th>
<th>Mean</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Using computer</td>
<td>2.51</td>
<td>0.68</td>
</tr>
<tr>
<td>Using teaching and assessment apps</td>
<td>2.45</td>
<td>0.72</td>
</tr>
<tr>
<td>Using internet resources</td>
<td>2.98</td>
<td>0.50</td>
</tr>
<tr>
<td>Using educational peripheral device</td>
<td>1.66</td>
<td>0.96</td>
</tr>
<tr>
<td>Communication in online platform</td>
<td>1.80</td>
<td>0.97</td>
</tr>
</tbody>
</table>

After that, Scale model is applied to measure students’ competence score using Conquest software. Students’ score is calculated and converted to logit-scaled values. The score distribution is displayed in table 4.

The ICT score range is mainly from -2.17 to 3, which is suitable with the competence score scale (-3 to 3). The mean score is 0.0019 (SD = 1.03), the values for mode and median are similar, at -0.13 and -0.84, respectively.

Table 5: Statistics

<table>
<thead>
<tr>
<th>ICTscore</th>
<th>Valid</th>
<th>Missing</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>0.0019</td>
<td>0</td>
<td>289</td>
</tr>
<tr>
<td>Median</td>
<td>-1.300</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Mode</td>
<td>-0.84</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Std. Deviation</td>
<td>1.03984</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Minimum</td>
<td>-2.17</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Maximum</td>
<td>6.86</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Percentiles</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>-7.800</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>50</td>
<td>-1.300</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>75</td>
<td>5.800</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

a. Multiple modes exist. The smallest value is shown.

Figure 4: ICT score
4.2 Impact model of student teachers' ICT competence

The research model was used to estimate the power of 0.4 school factors on students' beliefs about ICT advantages and their ability to use it. Firstly, the model's fit indicators showed an excellent fit and confirmed the model's structure.

The results indicate that the more students believe in ICT advantages, the higher their ICT competence score. The path coefficient for that relationship is 0.18 (p = 0.016). Next, using technology infrastructure in schooling has a direct positive impact on students' competence (0.15, p = 0.03). Besides, classroom activities are proved to enhance students' beliefs but not directly improve ICT competence. Regarding curriculum and training ICT courses, none of these factors make a significant distribution in the model.

Figure 5: Path coefficients of the impact model.

5. Discussion and Conclusion

The present study offers some answers to predict what factors affect teacher students' ICT competence at teacher-training universities. The findings show that students have ICT competence at an average level and that experience factors (learning and using infrastructure at university) significantly impact ICT competence.

In the first instance, the results indicate that teacher students have good skills in using computers, the internet, and applications. That is in line with Peeraer and Van Petegem's (2011) findings that showed the successful ICT integration at teacher education institutions in Vietnam. In addition, approximately 70 percent of citizens in Vietnam have access to the internet reported in January 2020 (Kamp, 2020), which creates a suitable environment for students to foster their digital skills. Communication in the online platforms and using peripheral educational devices are not as good as other skills. However, Blended learning and online platform development in covid-19 time may help students practice and get better at those skills.

Many studies have shown that context, family background, self-efficacy, school management have a significant impact on students' ICT competence (J Peeraer, 2011; Hatlevik et al., 2015b; Hatlevik et al., 2015a). This study focuses on school factors at pedagogical universities to create an impact model and suggest for training. According to the results, belief in ICT advantages and infrastructure directly impact student ICT competence. In comparison, learning experience in the classroom is proven to make students more robust in believing in ICT benefits, which indirectly influences their
competence. Peeraer and Van Petegem (2011) also pointed out that teaching experiences are strongly associated with teachers' beliefs on ICT.

In conclusion, the implementation of ICT at pedagogical universities needs to be devoted to learning activities with technological support. The effectiveness of applying ICT in the classroom will give students many chances to encourage their competence through observing and practicing ICT, especially some featured teaching skills with ICT such as communicating on online platforms, using the educational technique. An interesting finding in this study is that the path estimates between joining training ICT courses and ICT competence is negative, but the result is not significant. In further research, we will study more about that relationship to explain and improve the impact model.

References


