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## Profile of information and communication technologies (ICT) skills of prospective teachers

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**Abstract.** ICT skills are skills that prospective teachers must possess. Smartphones owned by all prospective teachers allow to be applied in ICT-based blended learning. The purpose of this study was to determine the profile of ICT skills of prospective teachers through ICT-based learning on the concept of cell communication. ICT skills using the ETS framework Binkley 2012 are measured by two tools, that are observation and self-assessment on prospective teachers with the assignment of articles review. The study was conducted on one hundred and four at second semester prospective teachers at one of the universities in West Java. The results of the study show that prospective teachers are at the level of mastering independently for all ICT skill indicators. ICT skill indicator covers basic knowledge, download, search, navigate, classify, integrate, evaluate, cooperate and create. This study can be concluded that prospective teachers have ICT skills as pedagogical skills.

### 1. Introduction

The development of the world from the industrial era in the 20th century to the digital era in the 21st century, increased awareness of the importance of the skills that support the success of life in the 21st century. Implementation mobile-based technology Learning is recommended to shift conventional learning. Educational aspects which include cooperative, contextual, constructivist learning and authentic learning in conventional learning are also interesting to be applied in ICT-based learning. ICT-based learning facilitates learning that takes place over time and is not limited to space. Information technology is used effectively to improve some skills as a result of the learning process. The use of technology in the learning process is by applying ICT-based learning. ICT-based learning contains several dimensions related to easy access to computers, the use of the internet as a learning resource, and training some of the skills related to information technology that are provided in the learning process. The rapid development of information technology influences the learning process into internet and mobile based learning.

The use of information technology networks is more effective in communicating and a means of finding reference sources to support the learning process. ICT skills which are one of the 21st century skills need to be provided and trained in ICT-based learning so that students are expected to have ICT skills. Educators must be more literate about information technology so that they can guide their students later in practicing the learning process by using internet facilities [1, 2], where interaction between educators and students uses information and communication technology in order to facilitate the function of educators in process learning to students [3-5].



In some countries, the use of information and communication technology as a learning tool has been integrated into the curriculum [1] even the use of portable technology in the learning process, that are using smartphones in the learning process [3]. The role of prospective teacher candidates in the 21st century is important to provide ICT skills in which the modernization model of education requires a pedagogical model in science learning that facilitates the context of subject matter in the learning process with blended learning methods [5], as pedagogical skills in digital-based learning for practice ICT skills [4]. Skills, competencies, and attitudes towards information technology are provisions that need to be developed and trained in prospective teachers [6], considering future learning by using online-based information and communication technology. The experience of ICT-based learning explores learners with many online learning environments [7] and has the opportunity to succeed in improving the academic abilities of prospective teachers.

## 2. Methods

This study aims to determine ICT skills in prospective teachers. This research was conducted using a self-assessment questionnaire and observation sheet to measure ICT skills. Qualitative descriptive data analysis to understand ICT skills of prospective teachers in ICT-based biosel learning. The population in this study was one hundred and four prospective biology teacher candidates in the second semester who took Biosel courses at one of the State Islamic University Colleges in West Java in the academic year 2017/2018. Data collection was carried out with an observation sheet in the ICT-based learning process on the concept of cell communication and self-assessment questionnaire after learning ended. The research was conducted in the ICT-based learning process in the Biosel course. In the ICT-based learning process, prospective teachers are asked to review articles with the theme of individual cell communication. Measuring ICT skills using the ICT skills framework from ETS [8] which includes the basics, downloading, searching, navigating, grouping, integrating, evaluating, working together, and creating. Retrieval of data through observation by using observation rubric and independent assessment questionnaire with Likert method. ICT skills include four levels of criteria, that are 1) requires intensive guidance, 2) mastering with learning in others, 3) mastering independently and 4) proficient with development. Data analysis was carried out by measuring ICT skill levels and then calculating the percentage of each prospective teacher with an ICT skill level. The following is an ICT skills framework according to ETS which is used to measure ICT skills in teacher candidates described in Table 1.

**Table 1.** ICT Skills Indicators with ETS framework [8]

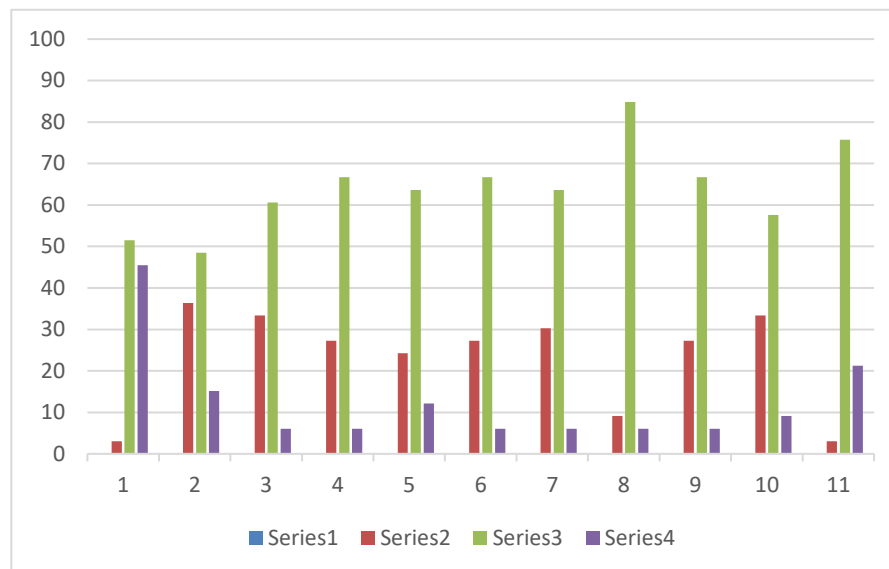
| No | Categories       | Skill  |
|----|------------------|--|
| 1  | <i>Basic</i>     | Can open software, sort and store information on a computer, and can use other simple skills in using computers and other software       |
| 2  | <i>Download</i>  | Can download various types of information from the internet  |
| 3  | <i>Search</i>    | Know how to get access and information   |
| 4  | <i>Navigate</i>  | Able to direct yourself in digital networks, learning strategies for using the internet  |
| 5  | <i>Classify</i>  | Able to organize information according to certain classification schemes   |
| 6  | <i>Integrate</i> | Can compare and collect various types of information related to multimodal texts   |
| 7  |                  | Identify and then choose a representative website address as a source of information when browsing files, images, animations and videos  |
| 8  | <i>Evaluate</i>  | Identify and then choose the right computer application to process information data to produce ICT-based products                        |
| 9  | <i>Cooperate</i> | Can take part in internet-based learning interactions and utilize digital technology to work together and take part in internet networks |

| No | Categories | Skill   |
|----|------------|---|
| 10 | Create     | Create an animation model, a series of images, a chart or flowchart that can visualize a student's understanding of a concept by using the appropriate application program to create mind map or video models |
| 11 |            | Make e-mails, send e-mails and know how e-mail works  |

ICT skill score then the ICT skill percentage is measured in each indicator, then anava test is performed to find out the variance equation of ICT skills average and the profile level of ICT skills in prospective teachers through observation and self-assessment.

### 3. Result and Discussion

ICT skills in prospective teachers are measured through observation and self-assessment questionnaires in the ICT-based learning process on the concept of cell communication. ICT skills of prospective teachers are described in the following Figures 1 and figure 2.



**Figure 1.** Graph of ICT skill percentage through observation on prospective teachers [Description: series (1) requires intensive guidance, (2) mastering with learning in others, (3) mastering independently and (4) proficient with development]



**Figure 2.** Graph of ICT skills percentage through self-assessment on prospective teachers [Description: series (1) requires intensive guidance, (2) mastering with learning in others, (3) mastering independently and (4) proficient with development

Figures 1 and 2, illustrate the percentage of ICT skills of prospective teachers both through observation and self-assessment for all aspects of the indicator, on average prospective teachers are at level three by independently mastering. This proves that the prospective teacher has mastered ICT independently and uses technology as a tool and source of learning. Measurement of ICT skills is done through observation and self-assessment carried out to test the equality of differences between observation and self-assessment. The variance test between ICT skills on prospective teachers through self-observation and assessment is explained in Table 2 below.

**Table 2.** Average score ICT skills prospective teachers and Anava test

| Score ICT skill | Observation | Self-assesment | $F_{count}$ | $P_{value}$ | $F_{crit}$ |
|-----------------|-------------|----------------|-------------|-------------|------------|
| Average         | 31.87       | 33.34          | 1.98        | 0.164       | 3.99       |
| Variance        | 18.55       | 16.73          |             |             |            |

Table 2 with data from the analysis, it can be seen that  $F_{count} 1.98 < F_{crit} 3.99$ , so that  $H_0$  is accepted, meaning that the data variant on ICT skills of prospective teachers measured by observation is not different from self-assessment. ICT skills are pedagogical skills in 21st century science teacher candidates able to bridge the educational context through blended learning approaches [5] and pedagogical practices reflected in digital-based learning that provides ICT skills [4], ease e-learning learning to be accessed by students and applied in the learning process can improve ICT literacy [9] and ICT-based learning that applies network learning is 21st century learning [10] facilitates the process of transferring mental cognition [11]. Science learning in the 21st century is to invite students to learn and work well using 21st century skills, namely to dismantle the career domain and life skills from the new learning paradigm [12] with the development and application of m-learning and e-learning learning methods in learning environment [13]. The potential for teaching by using cellular and network technology in learning [14], learning together in a team work, using technology, in learning is a pragmatic model for effective 21st century team-based learning [15] by using the internet as a learning resource can improve critical thinking in students in learning as an implication of the effects of navigation and downloading the right files as part of literacy reading science through internet media [16]. Blended learning with conventional learning in the classroom and e-learning outside the classroom,

is a multiliteration learning approach [17] by utilizing internet information technology in the learning process is a different problem solving between media studies and study of science and technology in the learning process [18].

Skills, competencies, and attitudes towards information technology, and educator support are the keys to the success of online learning programs [6], so that the profile of ICT skills of prospective teachers needs to be known before applying e-learning, where success academics in the application of e-learning is more applied to distance education that explores sociologically online learning environments [7]. In this study it was found that the ICT skills profile of prospective teacher students is at the level of mastering independently, which means they are able to apply e-learning in the learning process of any subject as a strategy and way to improve 21st century skills by mastering digital literacy in education high [3].

The practice of ICT-based learning not only with the use of computers can also use a smartphone that has been owned by all prospective teacher students. Digital literacy can be trained with ICT-based learning [19], regardless of social status, economics, ethnicity and gender [20] because smartphone devices are owned by all people so that the practice of implementing ICT-based learning is a practice social class and pedagogy applied at any level of education, even in secondary schools [1]. Learning by using a smartphone [2] by developing a mobile application for learning practices is a social and ethical practice applied in learning [21] in the hope of improving 21st century skills in accordance with employment needs with technological knowledge [22] so that the learning process of e-learning is not only intended for distance education but also plays a role in the habitual process of training various skills in the 21st century era, so that learning by m-Learning can be applied in learning practices [23], and learning objectives with learning outcomes that focus as a result of interaction in the learning process can be achieved [24].

Good ICT skills in prospective teachers provide a great opportunity to apply learning with good ICT skills input for students. Prospective teachers with a good level of ICT skills can apply mobile learning by using certain applications on smartphones that are forum-oriented online discussion groups that can improve critical thinking skills [25] or some other skills which are 21st century skills. Mobile learning goals have been done but still lacking that supports interaction between students through online discussion forums and provides some thinking skills such as 21st century skills.

#### 4. Conclusion

The ICT skills profile of prospective teachers who are at the level of mastering independently for all ICT skills indicators shows that prospective teachers have good skills to be applied to learning through the ICT approach by utilizing various applications on smartphones that are able to provide various skills, such as the skills needed in the 21st century.

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