



## Research Article

# Usage of ICT by Science Teachers in Underdeveloped Regions: Accessibility, Competency, Strategy, and Attitude

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### Abstract

The integration of computer and internet technology into learning activities in the classroom becomes a necessity in today's digital era. Teachers need to have the ability to use and utilize computers and the internet to develop their professional abilities, especially learning activities, which are now increasingly directed to independent online learning. More careful research is needed to determine the mastery of computers and the internet of science teachers. Research has been conducted to learn the use and ability of ICT by science teachers in underdeveloped areas. This study aims to obtain valid data on ICT knowledge and skills of science teachers; determine the extent of knowledge and skills of teachers to implement ICT in the classroom; identify factors faced by teachers in implementing ICT in learning, and determine support and strategies for developing effective ICT to be applied to teachers. Research method using quantitative and the sampling method using purposive with population teacher and with the review the ability of teachers, level of education, location, and science teachers in Southeast Sulawesi Province in Indonesia. The results statistical analysis shows that only about 2% of teachers stated that ICT had a small effect on learning in the classroom and that training on how to do it had the most positive impact on teachers. It can be concluded that ICT training professionals need to effectively and sustainably provided; continue to improve ICT infrastructure in schools will have a positive impact on the use of ICT by teachers; attitude overall very positive teachers to develop themselves.

### Keywords:

ICT learning, Science teacher, underdeveloped regions.

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## **Introduction**

According to Law No. 14 of 2005 on Teachers and Lecturers, there are four abilities (competencies) that should be owned by professional teacher education. The four necessary abilities are professional, pedagogical, social, and personality abilities. Professional competence is the ability of a teacher to manage to learn supported by the knowledge of the subject matter, classroom management, teaching strategies, and teaching methods and the use of learning media. One of the multiple active learning media and growing used is technology media-related information, especially computers and the Internet. Computers and the Internet can stimulate the creativity of teachers to assist them in managing the class and present lessons to become better and more enjoyable. Therefore teachers need to have the ability to use and utilize computers and the internet to increase their professional skills (Hoogerheide et al. 2016).

Technically, information technology is an analog or digital technology that is used to create, collect and display information consisting of various hardware, software, and functions that make it possible to receive information or exchange information and communicate. Based on this understanding, we can know that the scope of information technology covers all matters related to information technology equipment. An outline of information technology skills component consists of the word processor, spreadsheets, processing of presentation sheets, browsing and use of search engines (e-mail), communication (e-mail), Telephone, Telex, Fax, Radio, T.V., Smartphones, video and recent computer-based technologies including electronic data interchange and e-mail are used (Khenissia et al. 2016; Shafeeq, 2016).

Specifically, the use of information technology for education, namely in terms of productivity, learning tools, information access, management education, research, collaboration, and entertainment, as well as providing easy access to collaboration in the learning system. Technology competence of teachers is the ability of teachers to develop learning innovation through information technology both in planning, implementing, and evaluating learning, both in the aspect of pedagogical competence, personal, professional, and social. Proficiency in information technology for teachers to have at least two functions, namely as the self-development and to support the learning process. Teachers can apply ICT in learning can be said to fulfill their necessary abilities as reliable. Professional teachers to carry out teaching and learning processes effectively and modern developments (Wainer et al. 2015)

The role of information technology in improving the professionalism of educators is to help teachers carry out its function as a facilitator of learning, help teachers realize interactive, innovative and creative learning models, make the learning process more effective and efficient, facilitate teachers to achieve basic

proficiency as an educator, helps teachers create self-learning system. In addition, this system can encourage students to continue to improve their skills and make students interested in the learning provided. Through the professionalism of teachers, students will be more skilful, especially in science learning and be able to create a product and be able to develop students' interest in learning (Kursat & Tortop, 2017). Based on the above, it can be concluded that their professional competence determines the professionalism of teachers. The professional capability of teachers is inseparable from the support of information technology. In other words, a professional teacher must master the necessary skills of information technology and are expected to apply and use it for educational purposes (Yang et al., 2016). Besides, during pre-service teacher training, ICT can improve study by providing access to more and better educational resources, contributing multimedia simulations of good teaching practices, catalyzing teacher-to-trainee collaboration, and increasing task productivity non-instructional assignments (Magambo, 2007).

To perform its function as a source of learning and providers of these technical guidelines. Teachers must have the ability to operate a computer, ranging from necessary capabilities (necessary) to the more advanced capabilities (advance). Unfortunately, there are still many teachers who even lack essential computer skills. The number of teachers who still stutter a computer like this more common in schools located in disadvantaged areas Konawe, Bombana, and Konawe regency is three districts in Southeast Sulawesi set by the government as disadvantaged areas. As stated in the list of disadvantaged and border Regions *Direktorat Kawasan Khusus and Daerah Tertinggal, Kementerian Perencanaan Pembangunan Nasional (PPN)/Badan Perencanaan Pembangunan Nasional (BAPPENAS)*, based referral letter-number 2421/Dt.7.2/04/2015 Dated 21 April 2015. One of the criteria in the determination of the underdeveloped areas is a factor of human resources. In addition, Widodo (2016) reports that other indicators of a disadvantaged area caused by differences in geographical conditions, discrepancies in educational facilities and educational policies. Regional autonomy, regional growth, and uneven economic distribution. Sulisworo (2016) reported the expansion gaps between regions occurred primarily occurs between Java and the outer, between the Western Region of Indonesia (western Indonesia or KBI) - Eastern Indonesia (eastern Indonesia or KTI), as well as between specific cities and villages. That is because there are still many disadvantaged areas, including border areas of the country. It was a challenge for national development. People who live in underdeveloped regions are generally less touched by the overall development program. Therefore access to social services center, the center of economic, political and social activities become limited, especially in remote areas. In the border areas of the country, including small islands in the frontline of the country, are faced with considerable challenges despite the potential of natural resources and strategic geographical position.

On the other hand, the educational gap between the areas visible from the literacy rate of 15-24 years of age, the age of literacy rate above 15 years. School participation is level and the percentage of people who have a high school education. The literacy rate of 15-24 is an indicator of the achievement of the MDGs by 2015. The general picture of education in underdeveloped areas in Indonesia reflected aspects of the literacy rate of 92.91% lower than the average national literacy rate. Human Development Index (HDI) is under 67.2, and the duration of the school (LS) is 7.92% below the national average duration of the school. Meanwhile, for 10 underdeveloped regions that were targeted in the plan of education policies proved that literacy rates and Human Development Index (HDI), as below; (1) Pidie Jaya, literacy rates are 95.48 and 72.82 for the Human Development Index (HDI), (2) South Nias, the literacy rate is 85.28 and 67.72 for the Human Development Index (HDI), (3) Central Tapanuli, literacy rates were 95.82 and 71.63 for the Human Development Index (HDI), (4) Seluma, literacy rates were 93.96 and 67.29 for the Human Development Index (HDI), (5) Four Lawang, literacy rates are 97.83 and 69.08 for the Human Development Index (HDI), (6) Sukabumi, literacy rates are 97.35 and 71.06 for the Human Development Index (HDI), (7) districts, literacy rates are 78.25 and 63.81 for the Human Development Index (HDI), (8) East Lombok: AMH 82.89 and 63, 93 for the Human Development Index (HDI), (9) Central Lombok: literacy rates are 72.88 and 61.66 for the Human Development Index (HDI), and (10) North Kayong District: literacy rates are 88.31 and 65.75 for the Human Development Index (HDI) (Sukasni, 2017). Next, Yang & MacLeod (2018); Mailizar & Fun (2020) explained that education on a large scale is very suitable for implementing computer-supported collaborative teaching which has the potential as a form of equality perspective that aims to improve the quality of education of students who have opportunities for the professional development of teachers in rural areas. In addition, also to balance access to high-quality educational opportunities. The main thing other than one described previously is how to develop the competence of teachers in an educational process. It is because teachers are builders of human resources; if teachers are competent in learning, they will undoubtedly produce competent graduates.

Nevertheless, look at this time; many teachers do not understand using current ICT in the learning process (Mwalimu & Bwalya: 2006). Various limitations faced by teachers, the lack of hardware and software, teacher attitudes toward technology, lack of confidence, lack of competence play a significant role in effective integration (Khokhar & Javaid, 2016). As others reported by Jones (2004), determinants of the level of engagement of teachers is very significant in ICT is the level of their confidence in using technology. Teachers who have little or no confidence in using computers in their work will try to avoid it altogether. Then the level of access to

ICT is significant in determining the level of ICT use by teachers as well as the style of training that does not low levels of use of ICT by teachers.

In other words, by implementing ICT in learning, one of the main advantages of the use of ICT in teaching and learning is that it allows schools and universities to meet the individual needs rather than the needs of the class average. Another significant advantage is that ICT can dramatically improve access to information for and communication of ideas by students with special learning needs. It can be used across the curriculum to enhance student learning. For example, students can improve the quality of their written work in any subject using a word processor, which allows them to reflect on what they have written and made changes easily (Murphy & Greenwood, 1998).

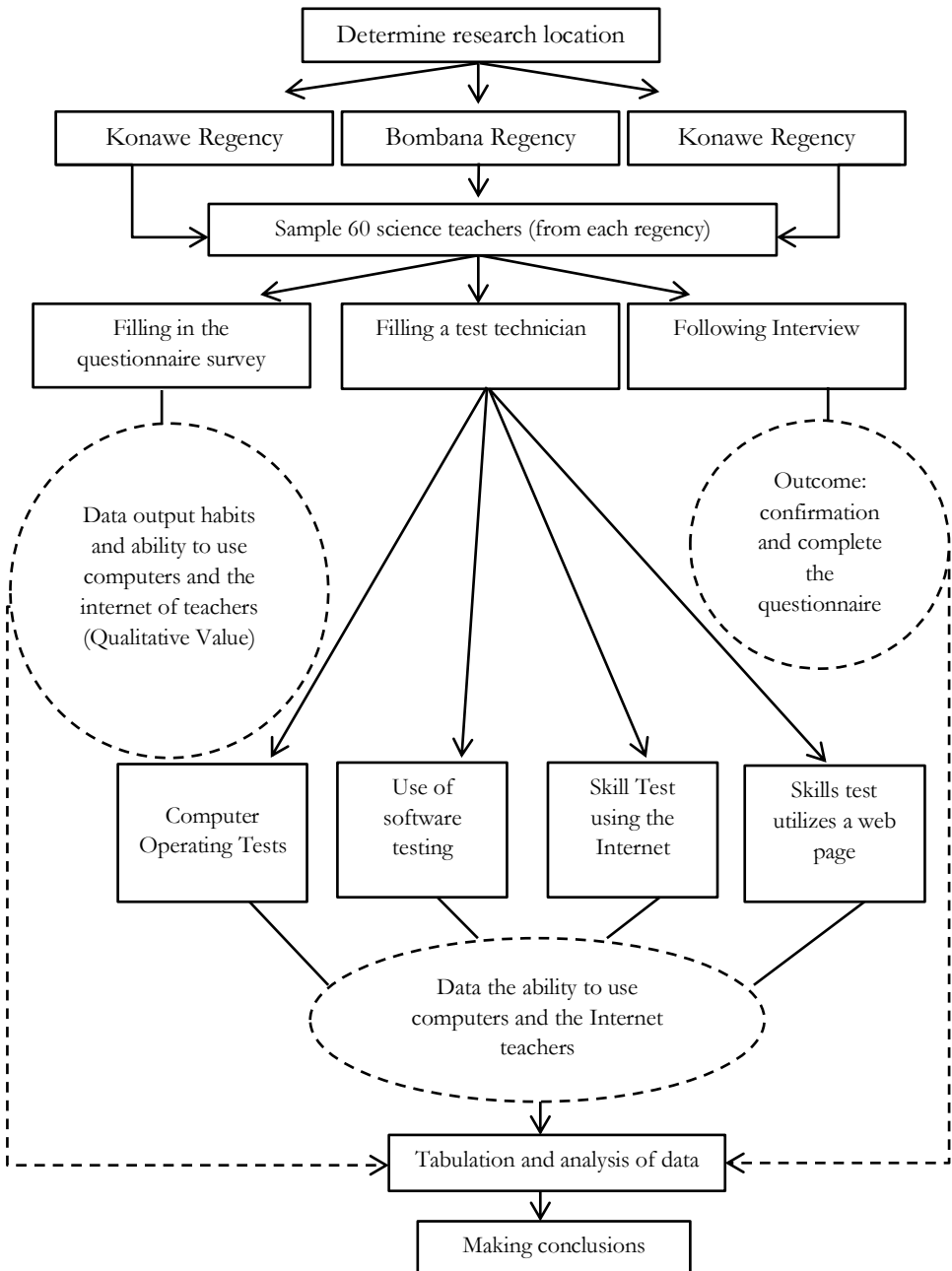
Therefore it is essential to know the competence of human resources, especially science teachers, in the three disadvantaged areas, especially about how their ability to use ICT in their learning activities. Science teacher respondents chose because in this science subjects met study topics that media widely available on the internet, e.g., laboratory experiments, demonstrations of the use of equipment/materials lab, as well as examples of natural changes that occur in the environment. So far, there have been no studies that reported data on this capability comprehensively. Another reason is that the implementation of ICT in schools is expected to contribute to national development (Bingimlas, 2009).

The research problem focused on how to map the understanding and ability to use computers and the internet of science teachers in the learning process, especially those in the underdeveloped region in Southeast Sulawesi Province. Data from this study are expected to be considered by the government as a shareholder decision-making authority in determining policy for the development of human resources competencies in these provinces. Meanwhile, for science teachers, the information from this study allows them to put and to condition him as soon as possible to adapt, at least to change attitudes and behaviors to evolve into a better direction.

## **Method**

### **Type and Research Design**

The type of research is quantitative with model design, as shown in Figure 1.



**Figure 1.**  
*Research Design*

**Population of Research**

Data from various aspects of teachers that have been asked in this survey include demographics, school ICT capacity, professional teacher training, teacher-controlled computer applications, school planning and leadership on ICT use, teacher attitudes

toward ICT, and the use of ICT in the classroom. The demographic situation of teachers in the three districts shows in Table 1. Statistically, the demographic factor in the table has a significant relationship with a score of teacher ICT capabilities gained through technical tests Male teachers, young teachers (25 - 49 years), honorary teachers and secondary school teachers tend to have higher ICT competencies. Meanwhile, demographic factors did not significantly affect the ability of ICT teachers are teachers with additional duties as an administrator, and teachers, mode/working hours teach the subjects, longer working as a teacher and school location (far / close from the district capital ).

**Table 1.***Teacher Demographic Data*

Samples teachers	Konawe Regency	Bombana Regency	Konawe Kepulauan Regency
<b>Gender</b>			
Male	11	8	12
Female	19	22	18
<b>What age are you grouped in?</b>			
Less than 24 years	0	2	0
25 to 29 years	3	4	5
30 to 39 years	10	12	18
40 to 49 years	10	9	7
50 to 64 years	7	3	0
Over 65 years	0	0	0
<b>Employment status</b>			
Government employees	22	24	21
Jobholder foundation	0	1	0
Temporary employees	8	5	9
Internship	0	0	0
<b>Level schools were teaching</b>			
Elementary school	10	10	17
Junior high school	10	6	5
Senior high school/ Madrasah aliyah/	10	14	8
Vocational high School			

The study population was all Elementary School/Junior High School/Madrasah Tsanawiyah and Senior High School/Madrasah Aliyah/Vocational high School teachers from Konawe, Bombana, and Konawe Kepulauan districts. While the study sample randomly selected from each Dinas Technical Implementation Unit (Indonesia name *Unit Pelaksana Teknik Dinas*) in each region, each of 10 teachers from each school level in each area.

This research is a survey of the scope and focus, a sample survey, which samples were taken from the population the number of science teachers in each district left

and surveyed by a particular time (cross-sectional survey); The research data obtained through filling a questionnaire survey, interviews and technical tests the use of computers and the internet to science teachers and the school as a stakeholder.

### **Data Collection Tools**

This research is a survey of the scope and focus, a sample survey, where samples were taken from the population the number of science teachers in each district left and surveyed by a specific time (cross-sectional survey) — research data obtained through filling out questionnaire surveys, interviews, and technical tests. The contents of the test include the use of computers and the internet in science teachers and schools as stakeholders. Quantitative data collection and analysis is used to explore more broadly the parameters of integrating ICT into science learning in secondary schools in the province of Southeast Sulawesi, and to identify the competencies of science teachers responsible for this responsibility.

### **Data Analysis**

The data obtained were then analyzed with quantitative descriptives. Descriptive analysis is used to simplify all data collected, present systematically, then process, and interpret the data collected.

## **Result and Discussion**

Information and communication technology (ICT) is generally associated with the technology used for accessing, collecting, manipulating, and presenting or communicating information. Technology can include hardware, computers and other devices, applications software, and connectivity, access to the internet, local network infrastructure (Yusuf, 2016). For more than thirty years, most classrooms in European countries have integrated ICT in the teaching process to learn how to use technology and competence ICT also known as ICT literacy, which involves knowledge of the basic concepts and operations, the use of computers, word processor, spreadsheets, databases, file management, documentation, presentations, and information communication (Aris, 2000; Copriady, 2015). This study focuses more on analyzing teacher competence which consists of multiple reviews as outlined in the following themes:

### **Theme 1. Computer Application Mastered**

The adoption of ICT in education is a general term that refers to the use of ICT in teaching, learning, and administration, which aims to strengthen the achievement of goals, priorities, and strategies for education. There is encouraging evidence that ICT can be a useful tool in supporting teaching and learning. There is a common belief among educational policymakers in many countries that the conditions needed to introduce the technology into schools, especially effectively is the availability and accessibility of ICT resources. Support includes computer hardware, software,



communications infrastructure, digital content, technical and financial support for the operation, and maintenance of ICT (Nurjana et al. 2017).

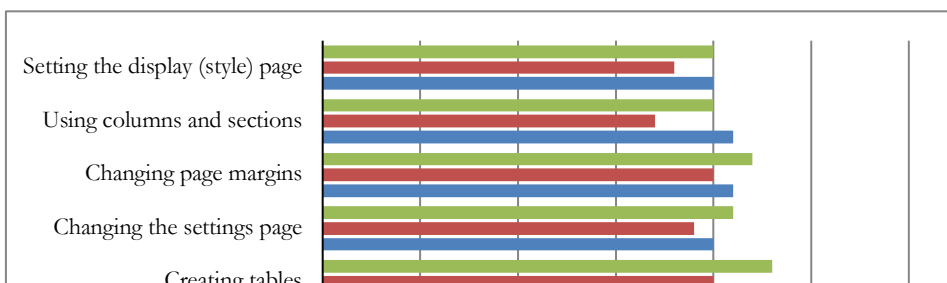
Some applications commonly used by teachers and their mastery level shown in Table 2 and found that the application of ICT was used and controlled by an average of more than 50% of teachers are word processing, presentation processing, spreadsheets, email, internet, and navigation documents. Budiman (2012) reported that the use of ICT in learning is closely related to the use of computers and the Internet. That is why computers and the Internet become an essential part of the development of the use of ICT. Computers are not only electronic devices that help teachers prepare to teach materials using Microsoft Office (Word, Excel, and PowerPoint) but also as a means of communication that can be done via e-mail facilities, video conferencing, live streaming. In short, ICT has become one of the media that are widely used to improve the effectiveness and efficiency of the learning process (Rahim, 2011).

**Table 2.**

*The Application Used by the Teachers and Their Level of Mastery*

Applications mastered by teachers	%		
	Konawe Regency	Bombana Regency	Konawe Kepulauan Regency
Word processing	72	74	73
Presentation	65	49	48
Microsoft Excel	58	50	47
Internet	58	53	49
E-mail	58	54	43
Document navigation	59	65	56
Microsoft access	21	27	17

Word processing is the most popular application and controlled by more than 70% of teachers in the three districts, although there are still teachers who have never used the app at all. In detail, word processing mastery shown in the graph in Figure 1. Using columns and sections, spell checking and managing page styles are the skills in this application with the lowest ability level, 56%, 60%, and 60%, respectively, by the teachers from Konawe Regency.



**Figure 1.**

*Mastery of the word processor science teachers from three districts*

**Theme 2. The capacity of current ICT in schools, the use, and accessibility****Figure 1.**

*Mastery of the Word Processor Science Teachers from Three Districts*

Availability of ICT facilities, the use, and accessibility in all three counties shown in Table 3. Anything to note in this section is the technical support, both on the hardware and software. There is no technician specifically assigned to provide such assistance. Usually, these teachers simultaneously act as technicians for themselves or their colleagues. Chisango & Lesame (2019) reported that the infrastructure, technical infrastructure and insufficient to inhibit the use of ICT in the learning system, especially in the learning process. While Ghavifekr & Rosdy (2015) suggests a significant success in implementing ICT-based learning is ICT facilities and infrastructure therein includes a computer lab and inadequate ICT equipment.

Meanwhile, one way to fill the gap between uses is necessary to increase technology awareness for teachers, encourage technology acceptance, and then provide training to develop teacher digital literacy and technological pedagogical content knowledge. Assuming that promote recognition of the technology, and then provide training to develop digital literacy of teachers and technical, pedagogical content knowledge. Thus, the initiative that very useful, such as ICT-based teaching units, open through the leadership approach, offering many opportunities to motivate the proper form of integration of ICT in education (Yang et al. 2018).

**Theme 3. Professional Training**

Computer training is the most widely followed by teachers is a primary computer and word processing, while the least followed is training databases (Table 4). From all the training has been developed, the science teachers from schools in these districts assume that the basic computer training that most benefits them. UNESCO

report ICT Competency Framework for Teachers is a useful tool to inform education policymakers, educators, and providers of professional learning about the role of ICT in education. To support this achievement, various types of training, especially for science teachers in disadvantaged areas. However, the use of ICT in learning, especially in remote areas not only experienced by the Indonesian state. Chigona et al. (2016) in the study of the use of ICT in learning in South Africa reported that although schools and educators value the benefits of ICT in learning and are ready to adopt technology, there are a number of factors that hinder the integration of ICT in teaching and learning including professionalism in the use of ICT, Capability, and accessibility in its use.

**Table 3.**

*ICT Capacity, Usage, and Accessibility*

School ICT capacity	%		
	Availability	Used	Ease of access
Technical support	29	28	27
Computer PC / Laptop for own use	79	73	71
Notebook / Laptop for teaching	54	51	50
Individual email account	80	73	73
A printer	87	79	79
Digital camera	36	29	30
Digital Projector (LCD)	66	49	53
Computers in the classroom for student use	4	4	4
Computer in another room (library/lab) for student use	37	34	36

#### **Theme 4. The Use of ICT in the Classroom**

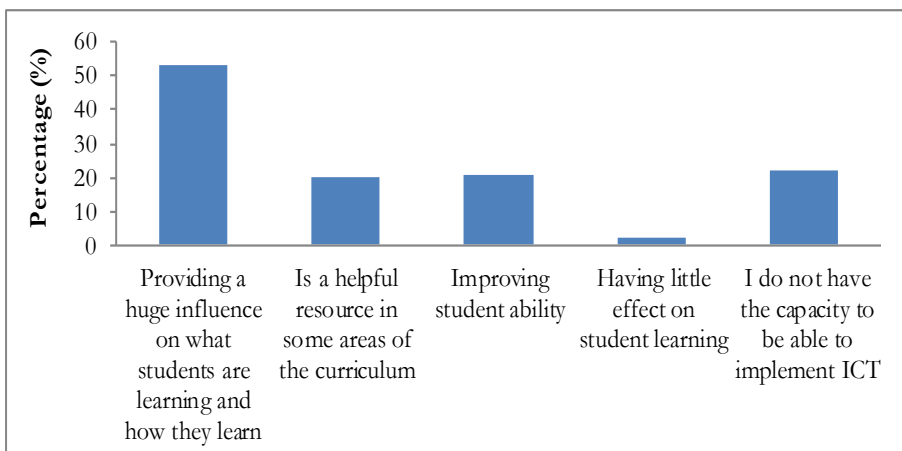
The diagram in Figure 2 shows how the responses of teachers from the three regions on the extent to which they apply ICT in learning activities and how much results. There are 53% of teachers who think that ICT has a significant influence on what students learn and how they learn; 21 % state that ICT can improve students' ability to learn, and only 2% think that ICT has a small effect on student learning. However, there are still about 22% of teachers stating lacked the capacity and capability to be able to apply ICT in learning (Figure 2).

ICT contributes to learning, as reported by Dawes (2012) that the use of ICT in the learning system makes lessons more enjoyable, more comfortable, more fun for teachers and students, motivate students and more fun, improve the presentation of the material, allowing greater access to a computer for personal use, giving more power to teachers in schools, giving teachers more prestige, making administration more efficient teachers and provide professional support via the Internet. Cahyani & Cahyono (2012) argue that the use of ICT to make teaching more fun, but it requires the readiness of teachers. Use of the Internet, for example, no longer limited

to the need to access, store, and distribute materials to improve learning. The application of ICT by computer study teachers implies that the facilities as set out in the computer study syllabus used in teaching subjects (Computer Studies). The use of ICT also indicates the use of a variety of technology tools and resources together with related documentation to communicate, create, disseminate, store and manage and retrieve information (Francis et al. 2017). Meanwhile, Improving the quality of access to student education and developing teacher competencies in regions lagging in utilizing ICT in learning to need more attention. Developing countries make remote areas the main focus, especially in improving the quality of education.

**Table 4.***ICT Professional Training Followed by Teachers*

Type of Training	%		
	Participate	Organized by the school	Effective?
Basic computer training (how to use a computer)	30	13	24
Use computers for student information systems and arrangement of the curriculum	14	11	13
Word processing training	28	16	21
Excel Training	21	13	18
PowerPoint Training	28	16	21
Access Training (Database)	9	6	6
Training in how to integrate technology into the curriculum	17	12	17



**Figure 2.**

*The Response of Teachers from the Three Areas of the Extent to which They Apply ICT in Learning Activities*

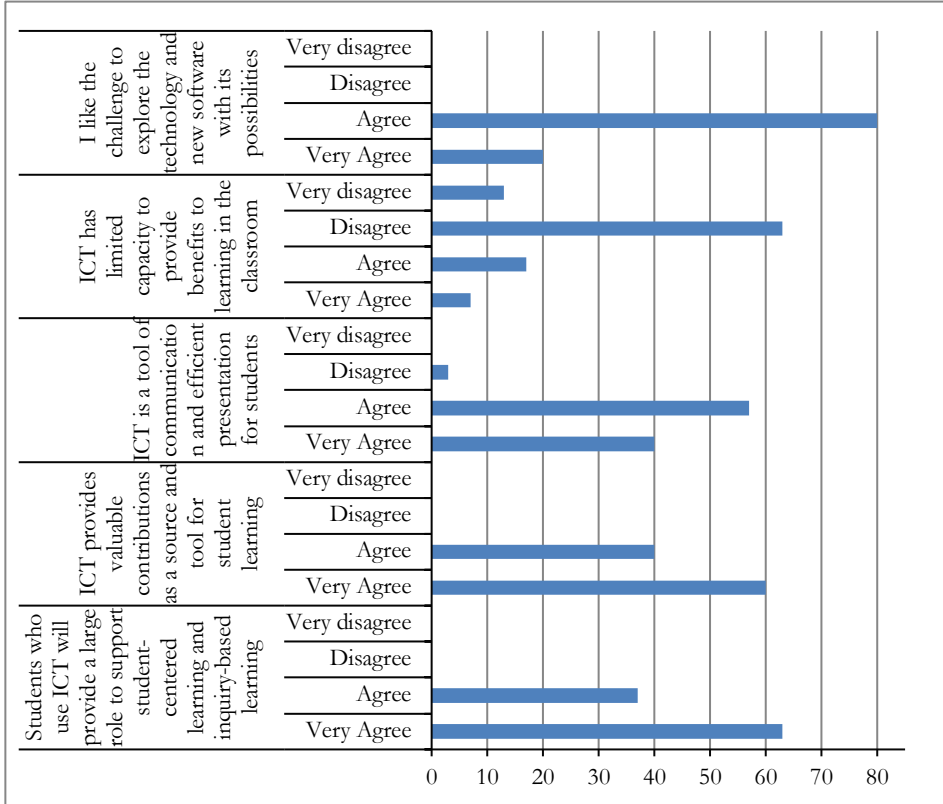
The results of the study (Table 4) show that many teachers have used technology. Thus, the application of computer software and the use of laptops for teachers to use PowerPoint presentations for teaching and learning activities daily. In line with the study conducted by Li & Walsh (2011), teachers need to be given more useful technology applications. For example, in using power-point presentations, teachers must be trained to use a variety of features such as pictures, sounds, and movies that a power-point presentation will not be similar to the presentation of the board. As said by Kern & Warschauer (2000), many teachers remain skeptical of the value of technology (e.g., the use of computers in general). The survey outcomes they reviewed showed that 59% of foreign language programs and 65% of English as a second language (ESL) programs did not use this form of computer technology in their courses, placing language teaching at the bottom of the academic list of the studied areas.

**Theme 4. Teacher Attitudes Toward ICT**

The attitude and motivation of science teachers from three districts to ICT presented in the graph in Figure 3. Overall, their attitude and motivation are positive. However, there are still teachers who disagree with the statement that ICT is an efficient communication and presentation tool for students. Positive expression of the attitudes of science teachers supported by findings reported by Judi (2016) that the attitude of teachers towards ICT is positive. Kaur & Arya (2019), in his study, said that students have positive attitudes and views on computer education received in their respective schools. Some students suggested revamping traditional teaching modes by introducing ICT. They assume that by incorporating ICT in learning, the learning process will be more enjoyable.

Meanwhile, Albirini (2006), in the study, explained that teachers have a positive attitude towards the implementation of ICT in learning. Teacher attitudes provide opportunities for the development of competencies, and the use of technology in their knowledge and their introduction to schools shape their behavior towards the practice of using technology in learning. Ghavifekr et al. (2016) inferred that the main issues and challenges found significant use of ICT tools by teachers are: limited accessibility and network connections, unlimited technical support, the lack of sufficient training, time is limited, and the lack of competence of teachers. While on the other hand, teachers are required to be creative and present lessons using ICT. During the learning process, lessons should be presented in such a way that learning

will be fun, more exciting and useful through integration with information management and pedagogical methodology and practical competence (Copriady, 2015) while the majority of respondents described having little or no skill in working most of the computer's functions required by teachers (Zhou et al., 2010).



**Figure 3.**  
*Attitudes and Motivations of Science Teachers*

The findings of this study have implications for the approach to applying ICT in learning systems, especially in disadvantaged areas. Schools are required to provide sufficient facilities for direct teacher experience. With acquired ICT skills and a positive attitude towards ICT, teachers must enter a productive computing activity in the learning process.

### Conclusion

Based on these results it can be concluded that the ICT training professionals need to effectively and sustainably supplied either in quantity or quality, continue to improve the technical support of ICT infrastructure in schools will have positive impact on ICT use by teachers, attitude overall very positive teacher to develop themselves in terms of mastery of ICT. The results of this study provide some information about the ability to master computer science teachers, ICT facilities in schools, and how far science teachers implement ICT in learning activities in the

classroom at schools in disadvantaged areas in Southeast Sulawesi Province. Next, This study implies that the theory about teaching teachers is critical in influencing teachers to use ICT in teaching. If teachers are given the latest technology and support networks, the teachers may not be quite enthusiastic about using it in class. Teachers need to be given evidence that ICT can make their lessons more interesting, more comfortable, more enjoyable for them and their students, more fun and more motivating

Therefore, teachers need to have the ability to use and utilize computers and the internet to develop their professional abilities. Moreover, learning activities are now increasingly directed to independent learning online.

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