ASIAN JOURNAL OF INFORMATION TECHNOLOGY
MEDWELL PUBLICATIONS

Science Teacher's Attitude and Knowledge Toward ICT Based on School's Location and Teacher's Working Experiences in West Sumatra

[1]Erman Har, [2]Muslim and [3]Yetti Morelent
[1]*Biology Education, Faculty of Education and Training, University of Bung Hatta, Padang, Indonesia*
[2]*Civil Education, Faculty of Education and Training, University of Bung Hatta, Padang, Indonesia*
[3]*Indonesian Language Education, Faculty of Education and Training, University of Bung Hatta, Padang, Indonesia*

Key words: ICT Knowledge, ICT utilizing skills, science teachers, school location, working experiences

Corresponding Author:
Erman Har
Biology Education, Faculty of Education and Training, University of Bung Hatta, Padang, Indonesia

Page No.: 193-198
Volume: 20, Issue 9, 2021
ISSN: 1682-3915
Asian Journal of Information Technology

Abstract: The objectives of this research is to study the differences of teacher's knowledge on ICT based on school's location and teacher's working experiences, to observe the relationship between teacher's skills and attitudes on ICT' utilizing. Populations of this research is based on science teachers who work in West Sumatra and samples were determined purposively. Inference analyses used were T-test and 'One Way ANOVA' in addition, correlation product moment assessment was also employed. Research reveals that there are significant differences between science teacher's knowledge who teach in urban and rural areas ($t = 3.15$, $p = 0.002$). Teachers who teach in urban have higher knowledge about ICT compared with teachers who teach in rural areas. Moreover, there are significant differences of science teacher's knowledge about ICT based on their working experiences ($t = 1.82$, $p = 0.07$). There are substantial correlations between science teacher's attitudes and skills on utilizing ICT on science learning. There are also strong correlation between science teacher's attitude toward ICT and science teacher's attitude on ICT utilizing. Science teacher's attitude on ICT utilizing has weak and positive correlation to teacher's skills on ICT utilizing in science learning. The implications of this study are prerequisites of computer hardware, internet access and training facilities in order to improve teacher's knowledge on ICT, particularly experienced teachers.

INTRODUCTION

In the last decade, ICT is an essential part and cannot be separated in various aspect of human life, especially in education. Changing in education requires some innovation to deal with this changing leads demand to higher knowledge of graduates, both quality and quantity. Information and Communication Technology (ICT) plays

important roles in this matter. Stated that higher education institutions have given the finest by inserting ITC In their programs. Especially, e-learning triggered a huge changing on students and education institutions. According to Ali, Holder and Muhmmad[1] "in the new millennium, rapid development of computer utilities such as multimedia and internet, facilitate broader chances for teachers and students to operate, save, manipulate, gain information and boost an active and independent learning. Individual learning obligations such as long-distance learning, motivate teachers and students to keep learning out of the school hours, planning and saving learning materials, designing and facilitating files sending.[2] One factor that determines development and innovation of public educations is teachers.[3] The research reveals that teacher's attitude toward ICT is high in contrast, teacher's skills in delivering learning based on ICT is low. Furthermore, teacher's skill on ICT use in teaching science is at a modest level. The implication of this research is to recommend upgrades teacher's knowledge and skills in designing as well as delivering learning based on ICT. Teachers Training Institutions are recommended to redesign their curriculum and set computing as one of their compulsory subjects.

Advantages of ICT learning process: In addition,[4] addition explained that the cores of teacher's awareness are their understanding, acceptance and appraisal to ICT's advantages on learning process that they are applied. When individual realizes the principals of guiding, then constructs a positive attitude, it leads to increasing individual productivity. It will push him/her to develop his/her skills and competencies .Teachers require special consideration as they have mandate and problems that need to be elucidated properly in order to admit new technology that can be applied on the learning process . Prominently, effective ICT's implementation requires some provision such as private computer availability, internet access, how to integrate ICT into learning process and how ICT support the assessment of learning result [4] .

The achievement of ICT integration into curriculum depends on teachers belief in ICT as a tool on providing better access and beneficial for them and their students [5]. Stated that the effectiveness of ICT utilities rely on teacher's awareness and attitudes toward new innovations, thus skills, understanding, attitude and knowledge are urgently required.

ICT as an important tool for students: ICT is considered as an essential tool for students in leading up to requisite skills. ICT is a set of tools which is used for communication and managing information[6]. Furthermore, described that ICT in education, among others are: (a) ICT facilitates communication, students are able to communicate anytime and anywhere. Students are able to connect with their teacher's wherever they need. Students are able to collect and change information anytime and anywhere. (b) ICT propounds access to knowledge; students are able to gain advantages of global knowledge. (c) ICT enables simpler knowledge presentations. Students, individually or in group are able to make notes and presentation .This approach accommodates training for students to participate in various researches for future. Bell and Margaret[7] defined ICT advantages in education, such as: global access to knowledge, sharing experiences instantly, autonomous learning, fun and interactive learning through multimedia, stimulating experiences on learning, window of opportunity to new thinking and innovations, uplifting motivations and acquiring technological advantages for advancement.

Uses of ICT in science education: Aina[8] explained that ICT utilities on each science educations such as in biology, chemist and physics as follows: (a) Computer helps students visualizing tiny and invisible objects. For example; computer can be used to visualize human anatomy, internal structures of human and animals' cells. (b) Applications in chemist educations; most of chemical substances and chemical reactions are dangerous for human body particularly when they are not handled in very careful and special treatment. In most cases, chemical reactions are hard to understand by students without watching them directly. Generally, teachers explain the reaction abstractly and draw diagrams of molecules. For those purposes, ICT is crucial, as students can watch chemical reactions lively from computer software. Animation and videos of chemist complex molecules structures are available for classroom learning for all groups of students. Applications in physics educations; most people are assumed that physics is abstract subject[9] it might be caused by the way of teacher's teaching bring about physics is challenging to understand.

When concepts of physics are taught correctly with ICT' support, they would no longer be said as abstract concepts. Truthfully, some of mechanism may be complicated to explain, however, technology has solved these problems through educational software. Educational software can be used to teach difficult concepts or to learn challenging skills in physics. For example; teaching electric generator on physics can be facilitated by educational software. Spindle rotation in the magnetic field is clearly explained when students are shown it through this software.

Teachers are agents of change in education: Teachers are the primary changing agent to promote educational development in every country. Teacher's roles are vital incorporated all aspects of growth and development on teaching-learning and scientific development. ICT

Teacher's knowledge of teaching-learning, problem solving skills, capacity development and other issues related to education. For teachers, to be able to manage functions of these electric technology or ICT, the right attitudes need to be cultivated towards ICT as teaching-learning tools. Attitude is collective feeling or individual opinion about particular thing[4] .It is an actual behavioral control of individual either conscious or unconscious.

Attitude is part of the cognitive structure: Attitude is a part of a cognitive structure that people use to control experience systematization and their behavior.[10] explained that attitude is a predisposition to respond positive or negative to an object, human or event. To shore up this definition[11] argued that attitude is constructed from a set of mental which is used by a person use to evaluate whether something is beneficial or bad. He further stated that attitude is concluded from open behavior, verbal or non-verbal, suitable or not suitable. Teacher's attitude toward ICT is about their opinion whether they accept or refuse ICT as learning tools. There should be a forum for teachers to grow their ICT' ability in order to set positive attitude. ICT has facilitated teacher's knowledge and professionalism, skills and capability, broadening their subject knowledge, enabling more efficient planning and teaching preparations. In order to boost ICT's classroom integration, teachers are identified as a major factor in develop this integration, science teachers are facilitator and manager in ICT class environments[12] . In terms of gender, the biology teacher's attitudes and biology teacher ICT knowledge influence biology learning[13.] Contrastingly, biology teacher ICT facilities, biology teacher ICT skills and abilities in making ICT-based teaching material do not significantly influence.

Moreover, the biology teacher ICT skills, biology teacher ICT facilities, biology teacher ICT knowledge and biology teacher ICT attitudes are some of the most influential variables. Facilities and attitudes are positively correlated with ICT just as knowledge and attitudes. The biology teacher skills in making teaching aids and their attitudes are positively correlated with ICT and have a positive and strong correlation.

Research purpose: The purpose of this research is:

- Finding out the differences of teacher's knowledge about ICT, based on school location
- Studying the differences of teacher's knowledge about ICT, based on teacher's education
- Examining the differences of teacher's knowledge based on working experiences
- Examining the relationship between attitude and teacher's skills on utilizing ICT in science learning

MATERIALS AND METHODS

Survey of this research employed science teacher's population in West Sumatra. Research samples were determined purposively. Around 300 respondents have given their response to research instruments. SPSS program was applied in processing data from the instrument. Inference analyses used were T-test and 'One Way ANOVA' in addition correlation product moment assessment was also employed. This research is about the differences of teacher's knowledge on information and communication technology cultivation in science learning process based on school location, as presented in Table 1.

Table 1 shows T-test assessment about ICT's knowledge of science teachers based on Senior High School location in West Sumatra. It demonstrates considerable differences between urban Senior High School's science teachers knowledge about ICT compare with rural Senior High School's teachers ($t = 3.15$, $p = 0.002$). Based on T-test assessment ($p = 0.002<0.05$), there are significant differences on ICT knowledge between urban Senior High School's science teacher and rural Senior High School's science teachers, mean score of urban Senior High School's science teachers (mean score = 3.76) compare with mean score of rural Senior High School's science teachers (mean score = 3.12). In other words, ICT's knowledge of urban Senior High School's science teachers is higher than rural Senior High School's science teachers. The differences of science teacher's knowledge about ICT based on education is seen on Table 2.

T-test assessment about ICT's knowledge of science teachers based on teacher's education in Senior High School (SHS) in West Sumatra shows that the differences of science teacher's knowledge between undergraduate and postgraduate teachers are not significant ($t = 1,82$, $p = 0.07$). Based on T-test assessment ($p = 0.07>0.05$), there are no significant differences of ICT's knowledge between undergraduate science teachers and postgraduate science teachers, mean score of undergraduate science teachers (mean score = 3,98) compare with mean score of postgraduate science teachers (mean score = 3,03).The differences of teacher's knowledge on cultivating Information and communication technology based on teacher's working experiences, presented in Table 3.

One way ANOVA Analysis about teacher's knowledge on ICT based on Teacher's working experiences reveals that there are considerable differences on faith level 95% ($F, 2.299 = 2.93$, $p = 0,054$), therefore there are significant differences on science teacher's knowledge about ICT based on working experiences. One way ANOVA

Table 1: T-test assessment, the differences of science teacher's knowledge about ICT in west sumatra based on school location

	Independent assessment T-test samples				
Variables	School location	N	Mean	t	Sig.
ICT's knowledge	Urban	180	3,76	3,15	0,002
	Rural	120	3,12		

*p< 0.05

Table 2: T-test assessment, the differences of science teacher's knowledge about ICT in west sumatra based on teacher's education

	Independent assessment T-test samples				
Variables	Education	N	Mean	t	Sig.
ICT's knowledge	Undergraduate	199	3,98	1,82	0,07
	Postgraduate	101	3,03		

*p< 0.05

Table 3: Science teacher's knowledge about ICT based on working experiences

Resources	Total quadrad	dk	Mean quadrad	F	Sig.
Among group	89,57	2	44,78	2,93	0,054
In group	4525,69	297	15,23		
Total	4615,26	299			

*p< 0.05

Table 4: Tukey's HSD test science teachers' knowledge about ICT based on working experiences

Resources	(I) working experience (years)	(J) working experience (years)	Mean difference (I-J)	Sig.
Teachers' knowledge about ICT based on working experiences	0-15	16-30	-0.64928	0.415
		>31	0.79674	0.373
	16-30	0-15	0.64928	0.415
		>31	1.44602(*)	0.043
	>31	0-15	-0.79674	0.373
		16-30	-1.44602(*)	0.043

*p< 0.05

Table 5: Test Result about correlation of teacher's attitude to ICT and teacher's skills on utilizing ICT on learning process

Resources	Teacher's attitude to ICT	Teacher's attitude on ICT utilizing	Teacher's skills on utilizing ICT on learning process
Science teacher's attitude to ICT1	1	.796(**)	.503(**)
		.000	.000
Science teacher's attitude to ICT utilizing	.796(**)	1	.395(**)
	.000		.000
Teacher's skills on utilizing ICT on learning process	.503(**)	.395(**)	1
	.000	.000	

**Correlation is significant at the 0.01 level (2-tailed)

analysis, to see the differences of science teacher's knowledge about ICT based on teacher's working experiences is shown on Table 4.

Furthermore, Table 4 Tukey's HSD test describe that there are considerable differences between teachers who have 16-31 years working experiences and teachers who have working experiences >31 years (Mean difference (I-J) = 1,44602(*), p = 0,043). However, there are no significant differences between teachers who have experiences 0-15 years and teachers who have 16-30 years working experiences. Moreover, there are no differences of teacher's knowledge based on working experiences. Correlations between teacher's skills and attitude on ICT based science learning is demonstrated on Table 5.

Table 5 demonstrates that science teacher's attitude toward ICT and science teacher's attitude on utilizing ICT have strong coefficient correlation 0,796 (**), it means that there is positive correlation with 99 % of faith level. Teacher's skills on using ICT in learning process and science teacher's attitude toward ICT, have significant correlations at the same time as weak coefficient correlations 0,503(**) while Faith level is 99%. Science teacher's attitude to ICT utilizing have positive and weak correlation to teacher's skill on utilizing ICT on science learning process, coefficient correlation 0,395 (**) where faith level is 99%.

RESULTS AND DISCUSSION

In this study that there was a significant difference between the knowledge of science teachers who teach in urban and rural areas This finding is different from the research conducted by who found that student's SPS increased with the use of ICT . However, learning through the environment is highly recommended in teaching and learning activities[2] one factor that determines development and innovation of public

educations is teachers. Based on the location of the school between teachers in the city and those in the village there are also significant differences. In other words, the ICT knowledge of high school science teachers in urban areas is higher than that of high school science teachers in rural areas. According to Ali, Holder and Muhmmad[1] "in the new millennium, the rapid development of computer utilities such as multimedia and internet, facilitate broader chances for teachers and students to operate, save, manipulate, gain information and boost active and independent learning. Individual learning obligations, such as long-distance learning, motivate teachers and students to keep learning out of the school hours, planning and saving learning materials, designing and facilitating files sending. In this case, to increase teacher's ICT knowledge, training is given but because it can be seen it is used less often computer skills, lack of equipment acts as a barrier[14] using this approach into science teaching.[3] Teachers who have ICT facilities divided into several categories; the number of teachers who have computer facilities is less than who have not. While the amount of teachers who have internet facilities is higher than who have not have internet facilities. The number of teachers who have never learned computing is higher than those who have. In addition, the number of teachers who have printers is higher compared to who have not.

CONCLUSION

Based on school's locations there are differences between ICT's knowledge of senior high school's science teachers. Science teacher's knowledge about ICT in urban senior high schools is higher than rural senior high school's teachers. Moreover, based on education, there are also found the differences between ICT's knowledge of undergraduate science teachers and postgraduate science teachers. Similarly, ICT's knowledge of science teachers are defined by their working experiences, experienced teachers have lower knowledge about ICT whereas less experienced teachers have higher knowledge about ICT. Science teacher's attitudes toward ICT have strong correlations to science teacher's attitude on ICT's utilizing. Teacher's skills of utilizing ICT on learning process and science teacher's attitude toward ICT have significant yet slightly weak correlation. Science teacher's attitudes on ICT utilizing have positive but weak correlation to teacher's skills on using ICT in science learning process.

ACKNOWLEDGMENT

We have to express out our gratitude and appreciation for greatly support particularly to Bung Hatta University, The Ministries of research, technology and Higher Education, Head of education department West Sumatra province, who have given authorization for this research, students who have assisted us on data collecting and all participants who have given contributions for the research completion.

REFERENCES

1. Ali, G. , F.A. Holder and K. Muhammad, 2013. The Role of ICT to Make Teaching-Learning Effective in Higher Institutions of Learning in Uganda. Intern J of Innovative Res. in Sci, Eng. Technol., 2: pp 4061-4073.
2. Singh, T. K. R. and S. Chan, 2014. Teacher readiness on ICT integration in teaching-learning: A Malaysian case study. Intl. J. Asian Soc. Sci., 4: 874-885.
3. Roza, w., A. Khairi and E.M. Har, 2019. Teachers' Skills and ICT Facilities for Science Learning at Senior High School in Padang City. http://journal.acce.edu.au/index.php/AEC/article/view/177
4. Oladosu, K., 2012. Basic technology teachers awareness and attitude towards the use of information and communication technology for sustainable development in Lagos State Education Districts: I, IV and VI. J. Educ. Pract., Vol. 3, No. 13.
5. Yusuf, M.O., 2005. Integrating Information and Communication Technologies (ICTS) in Nigeria tertiary education. J. Afr. Educ. Res. Netw., 5: 43-50.
6. Tinio, V.L., 2003. ICT in education. UNDP, E-ASEAN Task Force, New York, USA., pp: 1-34. http://2002.bilisimsurasi.org.tr/egitim/eprimer-edu.pdf.
7. Bell, M. and P. Avis, 2006. Information technology in education. Microsoft Encarta, Microsoft Corporation, Redmond, Washington, USA.
8. Aina, J.K., 2013. Effective teaching and learning in science education through Information and Communication Technology (ICT). IOSR. J. Res. Method Educ., 2: 43-47.
9. S.A. Adeyemo., 2010. Teaching/learning of physics in nigerian secondary schools: the curriculum transformation, issues, problems and prospects. Int. J of Educ. Res and Technol., 1: pages 99-111.
10. SANG, G., M. VALCKE, J. V. BRAAK and J. TONDEUR , 2009. Factors support or prevent teachers from integrating ICT into classroom teaching: A chinese perspective. Proc. of the 17th Int. Conf. on Com. in Educ, 1: pages 819-815.
11. Okoli, C.O., 2000. Educational and Psychological Measurement. Behenu Press Printer, Shomolu, Lagos, Nigeria,.

12. Jegede, P.O., 2008. Information and communication technology attitudinal characteristics and use level in Nigerian teachers. Issues Inf. Sci. Inf. Technol., 5: 261-266.
13. Har, E., K. Osman and W. Roza, 2020. Influence of the Use of ICT in Biology Learning Junior High Schools West Sumatera, Indonesia. J. Eng. Appl. Sci. 15: 803-809.
14. Schoepp, k. 2005. Barriers to Technology Integration in a Technology-Rich Environment. Gulf Perspectives, 2: 1-24.