Research Article

Knowledge, Attitudes and Skills of Science Teachers Regarding ICT in West Sumatra

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Abstract. The objectives of this research were to study the differences in teachers' knowledge of ICT based on schools' location and teachers' working experience, and to observe the relationship between teachers' skills and attitudes about ICT. Participants were science teachers who worked in West Sumatra and purposive sampling was used. Data were analyzed using t-test and one-way ANOVA, and correlation product moment assessment was also employed. There was a significant difference between the knowledge of science teachers who taught in urban vs. rural areas ($t = 3.15$, $p = 0.002$); teachers who taught in urban areas had more knowledge about ICT compared with those who taught in rural areas. Moreover, there were differences in science teachers' knowledge about ICT depending on their working experiences ($t = 1.82$, $p = 0.07$). Science teachers' attitude about ICT had a weak and positive correlation with their skills in utilizing ICT. It can be concluded that prerequisites for learning science with the use of ICT are computer hardware, internet access, and training facilities in order to improve teachers' knowledge on ICT, particularly experienced teachers.

Keywords: ICT knowledge, ICT skills, science teachers, school location, work experience

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1. 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 change leads to demand to higher knowledge of graduates, both quality and quantity. Information and Communication Technology (ICT) plays important roles in this matter. Palloff and Prat (2000) stated that higher education institutions have given the finest by inserting ITC in their programs [1]. Especially, e-learning triggered a huge change on students and education institutions. According to Ali, Haolader and Muhammad (2013); "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 facilitate files sending [2]. Sing and Chan (2014) one factor that determines development and innovation of public educations is teachers [3].

In addition, Oladosu (2011) explained that the cores of teachers' awareness are their understanding, acceptance and appraisal to ICT's advantages on learning process that they are applied [4]. When an 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 [5] . 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 [6]. Similarly, Udo (2005) stated that the effectiveness of ICT utilities rely on teachers' awareness and attitudes toward new innovations, thus skills, understanding, attitude and knowledge are urgently required [7].

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 [8]. Furthermore, Anthony (2012) 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 teachers' 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 presentations [9]. This approach accommodates training for students to participate in various researches for the future. Bell and Margaret (2006) 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 [10].

Aina (2013) 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 have not handled very carefully and in 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 the computer software. Animation and videos of chemist complex molecules structures are available for classroom learning for all groups of students. c) Applications in physics educations [11]; most of people are assumed that physics is abstract subject it might be caused by the way of teachers' teaching bring about physics is challenging to understand [12].

When concepts of physics are taught correctly with ICT' support, they would no longer be said as abstract concepts. Truthfully, some of mechanisms 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 the primary changing agent to promote educational development in every country. Teachers' roles have vitally incorporated all aspects of growth and development on teaching-learning and scientific development. ICT Teachers' 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 toward 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 a part of a cognitive structure that people use to control experience systematization and their behavior. Guoyuan et al (2009) explained that attitude is a predisposition to respond positive or negative to an object, human or event [13]. To shore up this definition Okoli (2000) argued that attitude is constructed from a set of mind which is used by a person use to evaluate whether something is beneficial or bad. He further stated that attitude is concluded from open behaviour, verbal or non-verbal, suitable or not suitable [14]. Teachers' 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 teachers' 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 developing this integration, science teachers are facilitators and managers in ICT class's environments [15].

1.1. Research Purpose

The purpose of this research are;

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

2. METHODOLOGY/ MATERIALS

Survey of this research employed science teachers' 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-tests and 'One Way ANOVA', in addition correlation product moment assessment was also employed.

3. RESULTS AND DISCUSSIONS

This research is about the differences of teachers' knowledge on information and communication technology cultivation in science learning process based on school location, As presented in table 1.1:

Table 1.1 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 Schools' science teachers knowledge about ICT compare with rural Senior High Schools' teachers (t=3.15, p=0.002). Based on t-test assessment (p=0.002<0.05), there are significant differences on ICT knowledge

Table 1: t-test assessment, the differences of science teachers' knowledge about ICT in West Sumatra based on School Location

Variable	Independent assessment t-test samples				
	School Location	N	Mean	t	Sig
ICT's Knowledge	Urban	180	3,76	3,15	0,002
	Rural	120	3,12		
*Sig. p< 0.05					

Table 2: t-test assessment, the differences of science teachers' knowledge about ICT in West Sumatra based on teachers' education

Variable	Independent assessment t-test samples				
	Education	N	Mean	t	Sig
ICT's Knowledge	Undergraduate	199	3,98	1,82	0,07
	Postgraduate	101	3,03		
*Sig. p< 0.05					

between urban Senior High Schools' science teacher and rural Senior High Schools' science teachers, mean score of urban Senior High Schools' science teachers (mean score= 3,76,) compare with mean score of rural Senior High Schools' science teachers (mean score=3,12). In other words, ICT's knowledge of urban Senior High Schools' science teachers is higher than rural Senior High Schools" science teachers. The differences of science teachers' knowledge about ICT based on education is seen on Table: 1.2

t-test assessment about ICT's knowledge of science teachers based on teachers' education in Senior High School (SHS) in West Sumatra shows that the differences of science teachers' 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 teachers' knowledge on cultivating Information and communication technology based on teachers' working experiences, presented on table 1.3.

One way ANOVA Analysis about teachers' knowledge on ICT based on Teachers' 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 teachers' knowledge about ICT based on working experiences. One way ANOVA analysis, to see

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

Resources	Total Quadrant	dk	Mean Quadrant	F	Sig.
Among Group	89,57	2	44,78	2,93	0,054
In Group	4525,69	297	15,23		
Total	4615,26	299			
*Sig. p< 0.05					

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

Resources	(I) working experience	(J) working experience	Mean Difference (I-J)	Sig.
Teachers' knowledge about ICT based on working experiences.	0-15 yrs	16-30yrs	-,64928	,415
		> 31yrs	,79674	,373
	16-30yrs	0-15yrs	,64928	,415
		> 31 yrs	1,44602(*)	,043
	> 31 yrs	0-15 yrs	-,79674	,373
		16-30yrs	-1,44602(*)	,043
*Sig. p< 0.05				

the differences of science teachers' knowledge about ICT based on teachers' working experiences is shown on table 1.4

Furthermore, Table 1.4; Tukey's HSD test describe that there are considerable differences between teachers who have 16-31 years of working experience and teachers who have working experience>31 years (Mean difference (I-J)= 1,44602(*), p=0,043). However, there are no significant differences between teachers who have experience 0-15 years and teachers who have 16-30 years working experience. Moreover, there are no differences of teachers' knowledge based on working experiences. Correlations between teachers' skills and attitude on ICT-based science learning, is demonstrated on table 1.5.

Table 1.5 demonstrates that science teachers' attitude toward ICT and science teachers' attitude on utilizing ICT have strong coefficient correlation 0,796 (**), it means that there is positive correlation with 99 % of faith level. Teachers' skills on using ICT in learning process and science teachers' attitude toward ICT, have significant correlations at the same time as weak coefficient correlations 0,503(**), while Faith level is 99%. Science teachers' attitude to ICT utilizing have positive and weak correlation to teachers' skill on utilizing ICT on science learning process, coefficient correlation 0,395 (**), where faith level is 99%.

TABLE 5: Test Result about the correlation of teachers' attitude to ICT and teachers' skills on utilizing ICT on learning process.

Resources	Teachers' attitude to ICT	Teachers' attitude on ICT utilizing	Teachers' skills on utilizing ICT on learning process
Science teachers' attitude to ICT	1	.796(**)	.503(**)
		.000	.000
Science teachers' attitude to ICT utilizing	.796(**)	1	.395(**)
	.000		.000
Teachers' skills on utilizing ICT on learning process	.503(**)	.395(**)	1
	.000	.000	
** Correlation is significant at the 0.01 level (2-tailed).			

4. CONCLUSION AND RECOMMENDATION

Based on schools' locations there are differences between ICT's knowledge of senior high schools' science teachers. Science teachers' knowledge about ICT in urban senior high schools is higher than rural senior high schools' teachers. Moreover, based on education, there are also found differences between ICT's knowledge of undergraduate science teachers and postgraduate science teachers. Similarly, ICT's knowledge of science teachers is defined by their working experiences, experienced teachers have lower knowledge about ICT whereas less experienced teachers have higher knowledge about ICT. Science teachers' attitudes toward ICT have strong correlations to science teachers' attitude on ICT's utilizing. Teachers' skills of utilizing ICT on learning process and science teachers' attitude toward ICT have significant yet slightly weak correlation. Science teachers' attitudes on ICT utilization have positive but weak correlation to teachers' skills on using ICT in science learning process. The implications of this study are prerequisites of computer hardware, internet access, and training facilities in order to improve teachers' knowledge on ICT, particularly experienced teachers.

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More information in the website https://elehic.bunghatta.ac.id

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