TECHNOLOGY INTEGRATION AMONG SCIENCE TEACHERS IN THE IMPLEMENTATION OF THE 21ST CENTURY LEARNING

Chieng You Eng[1] and Tan Choon Keong[2]
[12]Faculty of Psychology and Education, Universiti Malaysia Sabah
yechieng@gmail.com, cktanums@gmail.com

ABSTRACT

The Ministry of Education (MOE) has launched a reformation of the curriculum through *Kurikulum Standard Sekolah Menengah* (KSSM) start since 2017. The new curriculum is focused on the aspects of the competencies and skills that can fulfil the need of 21st century education. Teachers play an important role in determining the outcomes of 21st century learning in terms of their knowledge and skills. Thus, the purpose of this study was to find out the integration of technology among secondary school Science teachers in their implementation of 21st century learning. The design of the study was a quantitative approach with survey method. A set of questionnaires was adapted on a 5-point Likert scale to measure the skill level among the teachers. The study involved 100 Science teachers from 11 secondary schools around Kota Kinabalu area, Sabah. Descriptive statistics and inference statistics such as mean, standard deviation, t-test and one-way ANOVA were performed using Statistical Package for Social Science (SPSS) version 25.0. The findings showed that the mean scores of secondary school Science teachers in Kota Kinabalu are high (mean = 3.73). T-test and one-way ANOVA test revealed that (i) there was no significant difference in teacher skills based on gender (ii) there was significant difference in teacher skills based on the number of courses attended.

Keywords: technology integration, 21st Century Learning, Science Teachers

INTRODUCTION

In the twenty-first century, globalisation and the advancement of information and communication technology (ICT) have drastically altered the way we work and study. As a result, the MOE has worked hard in recent years to develop the 21st century learning (Pembelajaran abad ke-21) project, which aims to equip students to confront the challenges of being able to compete worldwide in the twenty-first century. With that, students will be exposed to the skills that are said to be in line with the 21st century. Among the skills emphasized in 21st century education are the skills of collaboration, communication, creativity and critical thinking or as a 4C concept (Voogt & Roblin, 2012).

However, the problem of the implementation of 21st century learning is now gaining less attention from teachers because teachers themselves may not understand the rationale behind the implementation of 21st century learning and are more likely to simply accept orders from their superiors. In the meantime, teachers also think that the provision of a classroom that has a 21st century ecosystem is enough without appreciating the concept of 4C outlined in 21st century learning. In fact, according to Tan Sri Dr Khair Mohamad Yusof, the former KPPM:

'*Pembelajaran Abad ke-21 bukan setakat merujuk kepada penggunaan gajet, perkakasan dan perisian terkini teknologi ICT dalam bilik darjah. Sebenarnya Pembelajaran Abad ke-21 bermaksud guru menggunakan kaedah atau pedagogi PdPc berpusatkan murid (student-centred) serta menekankan elemen membina Kemahiran Berfikir Aras Tinggi (KBAT) dalam diri murid'*.
(Majalah Pendidik, Nov 2016, page 14 in Ahmad (2016))

Translation:
'21st century learning does not only refer to the use of gadgets, equipment and the latest classroom technology ICT software. It actually means that the teacher uses the pedagogy or method that is student-centred while stressing on the importance of Higher Order Thinking skills of the students'
(Educational Magazine, Nov 2016, page 14 in Ahmad (2016))

Thus, it is clear to say that the teachers' skills in terms of pedagogy are an important aspect in the implementation of this initiative. The Malaysian Education Development Plan (PPPM) has targeted that every student would master the 4C skills. This is because, according to the results of the TIMMS (Trend in International Mathematics and Science Study), our pupils have been in the lowest group of achievers since 1999. Although Malaysia's performance in TIMSS 2015 for Science subjects improved to 24th place (from 32nd place in 2011), it is still considered unsatisfactory (Abdullah, 2018) when compared to other neighbouring Southeast Asian countries such as Vietnam, Thailand, and Singapore. This clearly demonstrates that students still lack mastery of 21st-century skills in answering high-level questions, as well as the talents necessary by potential employers.

RESEARCH OBJECTIVES

The objectives of this study were to investigate the secondary school Science teachers' level of technology integration in 21st century learning. The specific objectives of this study were as followed:

1. Identify the secondary school Science teachers' level of technology integration in 21st century learning.
2. Identify the differences among secondary school Science teachers' level of technology integration in 21st century learning based on gender and the number of courses attended.

RESEARCH QUESTIONS

The following research questions based on the objectives of the study were addressed:

1. What is the level of secondary school Science teachers on the integration of technology in the implementation of 21st century learning?
2. Is there a significant difference among the secondary school Science teachers on the integration of technology in the implementation of 21st century learning by gender?
3. Is there a significant difference among the secondary school Science teachers towards the integration of technology in the implementation of 21st century learning by the number of courses attended?

RESEARCH HYPOTHESIS

Two null hypotheses are formed in this study as shown below:

H_o1: There is no significant difference among the secondary school Science teachers towards the integration of technology in the implementation of 21st century learning by gender.

$H_0 2$: There is no significant difference among the secondary school Science teachers towards the integration of technology in the implementation of 21st century learning by the number of courses attended.

LITERATURE REVIEW

These 21st-century skills have been emphasised since the twentieth century (Mosenson & Fox, 2011). Partnerships for 21st Century Skills by P21 and enGauge 21st Century Skills by NCREL & Meitiri Group are two organisations or agencies in the United States that have established this 21st century skills framework (Voogt & Roblin, 2012). Most of these frameworks have laid the groundwork for key topics to be supported by 21st century skills, or the 4C concept: collaboration skills, communication skills, creative skills and critical thinking skills (MOE, 2018).

21st century learning should be based on student-centred learning because 21st century students, namely generation Z who were born from January 1996 to the present (Tapscott, 2009) have a different way of learning. However, there are still teachers who teach using a teacher-centered approach (Embi, 2016). Thus, in realizing the transformation of education in the 21st century, a shift in the delivery process of a teacher in the classroom is necessary as they are facing the generation-Z group. Teachers who act as facilitators in the classrooms must prepare students for collaborations in a variety of scenarios by using various types of methods, including the use of technology (Embi, 2016). Apart from that, the partnership for 21st century skills has also emphasized the need of a teacher in thinking, planning, discussing in the implementation of 21st century learning (Voogt & Roblin, 2012).

As a result, the Ministry of Education (MOE) began implementing 21st century learning in 2014, in line with the global trend. This 21st century learning concept is a student-centred learning method that focuses on the development of four core standard skills: collaboration, communication, creativity, critical thinking, and values and ethics. Thus, MOE has trained a number of coaches at all levels to improve the quality of teachers with this method (MOE, 2018).

Past Studies

There have been various studies that focused on the application of 21st century learning in Malaysia. Amran and Rosli (2017), for example, employed qualitative methodologies to investigate secondary school Mathematics teachers' understanding of 21st century skills. According to the findings of this study, teachers evaluate 21st century abilities from two perspectives, thinking skills and technology skills. This clearly shows the importance of a teacher's technology skills in assisting them in conducting the teaching and learning process more confidently.

According to Abdullah et al., (2018), there are four key factors in implementing and practicing 21st century learning. Their study found that the aspects of teacher readiness in conducting the 21st century learning were still low in terms of their readiness. As a result, further effort must be made to improve oneself as a teacher so that they can be more confident in the classroom, which includes the use of technology. Furthermore, a study by Rusdin and Ali (2018) indicated the problems that teachers had in implementing this 21st century learning for Arabic Language topics. Lack of expertise, time, resources, and ICT equipment are all obstacles as they are shown in all the previous studies. Although teachers are enthusiastic about the

implementation, they believe that it will be impossible to carry out without the necessary knowledge and skills, which include ICT skills.

METHODOLOGY

This is a quantitative study that uses a survey as an instrument. The study included 11 secondary schools in Sabah, which were located in the Kota Kinabalu area. A total of 104 science teachers from secondary schools were chosen randomly, however, only 100 questionnaires were analysed. After obtaining permission from the Education Department of Sabah and the school administrators, the researcher administered the questionnaire at the schools. Part A of the research instrument constitutes the demographic information, and Part B is about teachers' technology integration in the implementation of 21st century learning, which is adapted from the previous studies. The questionnaire used a "Likert" scale of five options: (5) very agree, (4) agree, (3) disagree, (2) disagree, and (1) strongly disagree.

The reliability of the questionnaire was reported using the value of Cronbach's Alpha coefficient. According to Hair et al., (2018), values between 0.6 - 0.7 are considered as the minimum acceptable level while Cohen et al., (2011) suggested a value of 0.8 as an acceptable reliability value. Since the reliability value of the skill variable is 0.92, then the instrument of this study can be said to have acceptable reliability.

FINDINGS

Data for this study were processed using Statistical Package for the Social Science version 25.0 (SPSS). The respondents' profile analysis and descriptive analysis such as frequency, mean, percentage, and standard deviation were used. To address the first research question, a descriptive analysis was performed. The researcher used Table 1 to interpret the mean score level in order to answer the study question.

Table 1: Interpretation of the Min Score

Min Score	Level of Min Score
1.00 – 2.33	Low
2.34 – 3.66	Medium
3.67 – 5.00	High

Source: Jamil (2002)

The researcher employed an independent sample t-test to see the differences in the level of technology integration in 21st century learning based on gender. Meanwhile, based on the number of courses taken, the ANOVA test was used to see whether there were any differences in teachers' levels of technology integration in 21st century learning. Both second and third research questions were addressed using inferential analysis.

Respondents Profile

Table 2 shows that female teachers represent the majority of respondents (81%) while male teachers represent only 19% of the respondents. The analysis also found that the majority of respondents at 51% had attended courses from 1 to 3 times. Meanwhile, a total of 29% respondents have attended 4 to 6 times and 17% respondents for more than 6 times and only 3% had never attended any course before.

Table 2: Respondents' Profile

Background	Respondents	Frequency	Percentages (%)
Gender	Male	19	19
	Female	81	81
Total		100	100
Times to attend the course	Never	3	3
	1-3 times	51	51
	4-6 times	29	29
	More than 6 times	17	17
Total		100	100

Descriptive Statistic Findings

The mean score was 3.73 at average. There were seven items that had a high mean score ranging from 4.00 to 3.67, three items with a moderate mean score ranging from 3.65 to 3.59, and zero items with a low mean score. The descriptive statistical findings for the first research question are included in Table 3.

Table 3: Science teachers' level of technology integration in 21st century learning

Item	Min	Standard Deviation (SD)	Interpretation
Item 1	3.60	.696	Medium
Item 2	3.79	.640	High
Item 3	3.84	.631	High
Item 4	3.68	.601	High
Item 5	3.69	.734	High
Item 6	3.65	.672	Medium
Item 7	3.80	.667	High
Item 8	4.00	.725	High
Item 9	3.59	.767	Medium
Item 10	3.67	.711	High
Average	**3.73**	**.520**	**High**

Inference Statistic Findings

According to Mayers (2013), Skewness and Kurtosis values that are in the range ± 1.96 are indicators of normally distributed data. Thus, it was found in this study that the value of Skewness is in the range of 0.266 to -0.325, while the value of Kurtosis is in the range of -0.623 to -0.107. As a result, it can be assumed that the study data have been normally distributed and thus t-test and ANOVA test are achievable. Table 4 shows the result of univariate normality using Skewness and Kurtosis values to reach the parametric test assumption.

Table 4: Value of Skewness and Kurtosis

Item	Skewness		Kurtosis	
	Statistic	Std. Error	Statistic	Std. Error
1	.183	.241	-.310	.478
2	.216	.241	-.623	.478
3	.137	.241	-.522	.478
4	.266	.241	-.613	.478
5	-.218	.241	-.107	.478
6	.145	.241	-.331	.478
7	.042	.241	-.363	.478
8	-.325	.241	-.137	.478
9	.034	.241	-.363	.478
10	.235	.241	-.500	.478

After the researcher performed data normality analysis as a basic condition and assumption of the adequacy of the data obtained, the parametric tests of t-test and ANOVA were performed. The following tables (Table 5 and 6) show the results of inferential statistics for both the null hypotheses.

H_o1: There is no significant difference among the secondary school Science teachers towards the integration of technology in the implementation of 21st century learning by gender.

The result of t-test based on gender has shown that there is no significant difference for teachers' level of technology integration as shown in Table 5. It was found that female teachers have more skills (mean = 3.78, SP = 0.51) than male teachers (mean = 3.52, SD = 0.49); t (1.985), df = 98, p = 0.05. Since the significant value is more than the value of p <.05, so, it can be concluded that the null hypothesis 1 was not rejected.

Table 5: T-Test result based on gender

Variable	Group						t-test		
	Male			Female					
	Mean	SD	N	Mean	SD	N	t	df	Sig.
Technology Integration	3.52	0.49	19	3.78	0.51	81	-1.985	98	0.050

**significant $p < 0.05$

$H_0$2: There is no significant difference among the secondary school Science teachers towards the integration of technology in the implementation of 21st century learning by the number of courses attended.

The results of the one-way ANOVA test based on the number of courses attended showed significant differences for the four categories are shown in Table 7. It was found that one-way ANOVA test results showed significant differences between groups with, F (3, 96) = 4.24, p = 0.00. Since the significant value is less than the p value of .05, this means that there is at least one factor that is significant than the others. So, it can be concluded that hypothesis 2 was accepted. Thus, this finding indicated that there is a difference in teachers' level of technology integration based on the number of courses attended.

Table 6: One way ANOVA result based on the number of courses attended

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	3.13	3	1.04	4.24	.007*
Within Groups	23.623	96	0.25		
Total	26.75	99			

*significant $p < 0.05$

To determine these differences, a post-hoc *Tukey* HSD comparison test was conducted as shown in Table 7. The results of the post-hoc test indicated that the mean score for the significant difference between the numbers of courses attended more than 6 times with 1 to 3 times and 4 to 6 times.

Table 7: *Tukey* Post-Hoc test results

(I) Number of Courses Attended	(J) Number of Courses Attended	Mean Difference (I-J)	Sig.
Never	1 – 3 times	-.04118	.999
	4 – 6 times	.01954	1.000
	More than 6 times	-.48431	.407
1 – 3 times	Never	.04118	.999
	4 – 6 times	.06072	.953
	More than 6 times	-.44314*	.010
4 – 6 times	Never	-.01954	1.000
	1 – 3 times	-.06072	.953
	More than 6 times	-.50385*	.007
More than 6 times	Never	.48431	.407
	1 – 3 times	.44314*	.010
	4 – 6 times	.50385*	.007

*significant $p < 0.05$

As indicated in Table 8, the results of the one-way ANOVA on the number of courses attended show a significant difference in teachers' level of technology integration. When comparing the mean scores of the other categories of respondents, it was found that teachers who attended courses more than six times had the highest mean scores (mean = 4.12, SD =.420, N = 17). On the other hand, lower mean scores were recorded for the other categories. For instance, teachers who attended the course 4 to 6 times had a mean score of (mean = 3.61, SD =.482, N = 29), teachers who attended the course 1 to 3 times had a mean score of (mean = 3.68, SD =.533, N = 51), and teachers who never attended the course had a mean score of (mean = 3.63, SD = 0.208, N = 3). This difference in mean scores shows that teachers who have attended the course more than six times have a higher level of technology integration.

Table 8: Descriptive analysis based on the number of courses attended

Variable		N	Mean	SD
Technology Integration	Never	3	3.63	.208
	1 – 3 times	51	3.68	.533
	4 – 6 times	29	3.61	.482
	More than 6 times	17	4.12	.420
Total		100	3.73	.520

DISCUSSION

The Primary School Standard Curriculum (KSSR) and the Secondary School Standard Curriculum (KSSM) were implemented in 2014 with the goal of enabling students to acquire the abilities needed in the twenty-first century in order to compete in the future. This project also aims to assist teachers in comprehending and preparing for changes in their teaching processes in order to make them more toward student-centred approach. According to Embi (2016), teachers should equip themselves in a variety of ways to meet the 21st century's learning needs, including ICT skills. This is in line with the findings of this study where the skills level of the Science teachers is at a high level and this shows that teachers are ready to implement 21st century learning using the technology with confidence.

The findings of this study showed that the average mean score obtained is 3.73, which was at a high level that teachers are prepared in terms of skills. The findings of this study have similarities with the findings of a study conducted by Tajudin and Abdullah (2018) in relation to the readiness of primary school teachers from other states. This directly proved that teachers are prepared from the aspect of their technology integration skills and confidence about the skills they have in the implementation of 21st century learning.

The analysis of the study showed that there was no significant difference in mean scores based on gender. This result confirmed that there should be no gender differences among teachers in mastering the technologies in this 21st century. Teachers should consider the best way to give a lesson in the classroom. Regardless of whether they are male or female teachers, the primary goal of teachers in the classroom is to transfer knowledge. In order to teach students, the concept that gender plays a role in information transmission should be avoided (Tikok, 2018).

However, when the number of courses taken was analysed using a one-way ANOVA test, significant mean score differences were detected. The study found that teachers who attended the course more than 6 times had a significant difference from those who only attended 1-3 times and those who attended 4-6 times. Hamzah and Sirat (2018) conclude that there is a significant difference in the frequency of attending training on the implementation of in-service training, which supports the conclusions of the study. Furthermore, according to Jamil (2008), the more frequent the teachers attend training, the more exposure teachers have to the knowledge and skills that are required in their professional development. This also shows that the number of courses taken has an impact on teachers' level of comprehension on technology integration relates to the implementation of 21st century learning.

CONCLUSION

The findings of this study showed that teachers' skills are crucial in adopting 21st century learning. As it is known, teaching is a teacher's primary responsibility. Teaching is more than just giving material to students; it is also about implementing curriculum content to students by utilising the skills accessible to a teacher in order to achieve 21st century learning goals. As a result, teachers should work harder to improve their existing skills so that they can better support students in mastering the skills of cooperation, communication, creativity, and critical thinking.

The implication of the study revealed that Science teachers have some form of readiness from the aspect of technology integration skills in the implementation of 21st-century learning. However, this study has some limitations. The first is in terms of the number of respondents; it

is only done on a small scale. The second is about the area where it is only done in secondary schools in urban areas. It is suggested that further studies could be expanded to the rural secondary schools to obtain more precise information on the skill readiness of Science teachers in the implementation of this 21st-century learning.

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