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The Relevance of Demographic Factors to the Use of Web 2.0 Applications among Science Teachers

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Abstract
This study aims to identify whether there are differences in teachers' evaluation of the effectiveness of Web 2.0 applications in teaching and learning (T&L) based on demographic factors. This quantitative study utilised a survey method. A total of 217 Science teachers were selected as respondents randomly. Data were collected using a questionnaire containing 21 question items. The data of this study were analysed descriptively and inferentially using SPSS version 26. Overall, the study's findings showed significant differences between teachers' evaluations of the effectiveness of the use of Web 2.0 applications in T&L based on age. However, there were no significant differences between teacher assessments based on gender, location, and teaching experience. The implications of this study provide input to school leaders of age factors influencing teachers' evaluation of the effectiveness of the use of Web 2.0 applications. Therefore, teachers need to be given exposure such as courses or workshops on implementing Web 2.0 applications to be more confident in integrating teaching and learning. For further studies may want to explore how teacher can adopt the 21st century teaching learning methods.
Keywords: Web 2.0, Science, Teacher Assessment, Age

Introduction

In the 21st century, Malaysia faces various challenges in globalisation and the development of technology and information. Therefore, education plays a vital role in preparing competent and competitive students on the world stage to face the challenges of the Industrial Revolution 4.0 (IR 4.0). In line with time, the transformation of education needs to take place mainly in teaching and learning (T&L). Communication tools such as the internet and electronic tools such as computers are a combination of aids that teachers can use to enable students to access and find information in learning for this digital age. Thus, the student-centred teaching and learning (T&L) process need to lead towards a revolution in the use of digital technology in the classroom (Siong & Kamisah, 2018).

Along with time, technology-based communication is seen as an integral part of the currents of modernity. The ideal society is representative of a combination of time and space. Technological changes influencing new forms of interaction and interpersonal communication in the information age lead to observed changes in social life (Eraslan & Kukuoglu, 2019). With the development of internet technology, Web 2.0 applications stand

out with innovations that have completely changed the internet. Web 2.0 allows one to create content more easily on the internet. In addition, Web 2.0 applications have facilitated collaboration and social interaction in themselves. The area of use of Web 2.0 technology is increasing day by day. This is because technology makes interactions between users, applications and access to information very easy on the internet. Even these features are inevitable for use in the world of education (Darmaji et al., 2019). In conclusion, teachers as leaders and teachers of the future should be more complete, open to learning and follow innovation at all times.

Web 2.0 Applications

To date, teachers face challenges in terms of the use of Web 2.0 applications where there is no proper guidance to use Web 2.0 applications. This prevents the student from participating in Science learning activities more effectively (An et al., 2010). Furthermore, the level of use of Web 2.0 applications in T&L Science in the classroom is limited (Akgunduz & Akinoglu, 2016). This is because the method of learning science in school occurs by memorising facts, theories and laws of science alone (Poobalan et al., 2019). Now, with the rapid development of technology, students are more independent in acquiring knowledge. As a result, pupils begin to feel bored with teaching and learning sessions (T&L) that are only didactic and conventional (Lin et al., 2017). Thus, students need innovation in their learning. Therefore, to overcome this problem, blended learning methods were introduced. The blended learning method is a teaching and learning (T&L) method that combines face to face teaching in the classroom and online (Aida, 2018). This is an innovation in the field of education as an effort to diversify the methods of knowledge delivery as well as to produce competent and scientific people.

Moreover, the National Science Teacher Association (2011) concluded that 21st Century Skills encompasses technological skills (McComas, 2014). Thus, in a report (National Council of Teachers of Mathematics, 2015), effective teachers can optimise technology in developing students' understanding, stimulate their interest, and improve their mastery of learning in the classroom. Metcalf & Tinker (2004) state that although Science standards demand increased use of technology in the school, teachers are often less practising the use of technology in the classroom. Furthermore, Aslan & Zhu (2016) believe that teachers often use basic ICT skills. For example, teachers use PowerPoint slides and projectors in classroom presentations. Teachers rarely integrate technology in T&L Science. At the same time, teacher competencies are limited to basic Web 2.0 skills and are not interested in integrating Web 2.0 skills into their teaching practices. In addition, a report by the Malaysia Ministry of Education (2017) pointed out that only about 80% of teachers have spent less than an hour a week in integrating Web 2.0 applications in teaching. Thoroughly, the integration of Web 2.0 applications of teachers in the classroom is at a low level in using Web 2.0 applications as teaching tools.

Furthermore, in the TIMSS and PISA 2019 reports, teachers have reported a need to integrate technology into teaching and learning (T&L) while improving students' critical thinking skills. This is because about 70 per cent of teachers report that they need the integration of technology in the T&L process for future professional development of teachers in education (Martin et al., 2019). The justification is that Science teachers need technology integration skills in their T&L. This is because integrating technology in the T&L process can help improve students' mastery of Science subjects (Hu et al. 2018; and Fidan & Tuncel 2019). At the same time, teachers still use conventional methods in T&L because there are barriers

to the use of technology (Norfarahi et al., 2020). Among the obstacles is the lack of expertise in ICT, especially among teachers (Ambikapathy et al., 2020). Thus, skills factors have affected teachers' motivation in using Web 2.0 applications. Rationally, teachers have a high commitment to ensure that learning and facilitation (T&L) in the classroom can benefit students. Therefore, in-house training or workshops should be conducted from time to time. This is because Web 2.0 applications have evolved quickly, and teachers need to improve their skills in using Web 2.0 applications in the classroom. However, the knowledge and skills of Science teachers are still at a low level in the field of ICT because they are not from an ICT background (Mahfuzah et al., 2015).

In keeping with this current modernity, teachers' skills in integrating technology as the latest pedagogical tool in teaching are an excellent effort to apply ICT (Ghavifekr & Rosdy, 2015). Moreover, technology in education can assist teachers in providing teaching aids that suit students' needs, levels, and diversity (Lee, 2017). However, among the constraints identified, teachers' skills in using Web 2.0 applications in teaching and learning (T&L) limit the effective use of Web 2.0 applications (Nurulwahida et al., 2020). For example, teachers experience problems while using Toondoo software in English language learning where the software is complex. This is because teachers are unable to use the interface buttons effectively while creating content. This process has slowed down teachers in completing learning content in the classroom. Moreover, teachers do not have sufficient experience and cannot develop instructional content due to insufficient learning technology support. Therefore, teachers need to possess skills and knowledge in technology to determine the educational demands for the use of technology in education (Hursen, 2020).

As is known, teachers in schools still practice the teaching and learning (T&L) of Science subjects in a conventional manner. This conventional method is a method that requires face-to-face teaching. This traditional method starts with a talk accompanied by an explanation and then a division of tasks and exercises (Nair & Gopal, 2014). The teacher's activity is more towards explaining and the student listening or noting what the teacher is presenting. This learning creates a sense of boredom because students do not know the purpose of their knowledge and only accept the information given by the teacher. Pupils are not able to pay full attention to the teaching and learning process (T&L) that takes place in the classroom. Some diligent students work independently by re-reading notes given by the teacher outside of classroom time. However, this method is more memorising and ineffective, especially in learning Science subjects (Fadila & Chiew, 2010).

In a study, Krishnan (2005) argues that teachers find it difficult to regard Science learning as an exploratory process. Too often, Science learning is narrowed down to a typical routine mastery of conventional explanations and established Science techniques. The old pedagogy was criticised for only presenting content in a classroom format for students to memorise. Kreijins (2018) stated that interviews with teachers showed that students face difficulties understanding concepts and will spend more time in the parts they know less. This is because students' focus on T&L began to decrease after the first ten minutes (Cetin, 2018) due to learning sessions implemented in traditional methods. Che In & Ahmad (2018) stressed that students who have difficulty understanding learning would encourage them to be less interested in learning in the classroom. Even students find learning sessions no longer fun for them.

The study was conducted to answer some research questions as follows:

- To what extent is the mean difference between teachers' evaluations of the effectiveness of the use of Web 2.0 applications in teaching and learning (T&L) based on demographic factors?

Hypothesis

This study has four hypotheses as follows:

- Ho1: There is no significant difference between the mean of teachers' evaluation of the effectiveness of the use of Web 2.0 in teaching and learning (T&L) by gender.
- Ho2: There is no significant difference between the mean of teachers' evaluation of the effectiveness of the use of Web 2.0 in teaching and learning (T&L) by location.
- Ho3: There is no significant difference between teachers' evaluation of the effectiveness of the use of Web 2.0 in teaching and learning (T&L) based on teaching experience.
- Ho4: There is no significant difference between teachers' evaluation of the effectiveness of the use of Web 2.0 in teaching and learning (T&L) based on age.

Methodology

This study uses a quantitative design by using a questionnaire as a research instrument. The results of the study were analysed descriptively and inferentially. The study population consists of Science teaching in a state of Malaysia, including primary and secondary schools. In contrast, the study sample consists of 217 Science teachers in the district. The study respondents were based on the sample size determination table of Krejcie and Morgan (1970). According to their respective districts, these Science Teachers will be selected at simple random based on the schools available in the Education Office.

This study uses a questionnaire instrument that contains 21 question items consisting of 11 items related to the respondents' background, 10 items related to aspects of Science teachers' evaluation of the effectiveness of the use of Web 2.0 applications in teaching and learning (T&L). The questionnaire used contained a five-point Likert scale of 5 (Strongly agree), 4 (Agree), 3 (Not sure), 2 (Disagree) and 1 (Strongly disagree). This questionnaire instrument was adapted from a study conducted by (Suzlina Hilwani & Jamaludin, 2015). The questionnaires were distributed during the COVID-19 pandemic period. The collected data will be coded for analysis using SPSS software (Statistical Package For Social Science) version 26.0. Descriptive and inferential statistical analysis was used to analyse the findings. A total of 217 teachers were taken as the study sample. A pilot study was also conducted on 33 respondents who were not involved in this study to see the reliability of this instrument. Cronbach's Alpha value was obtained as 0.875.

Table 1. Reliability statistics

Reliability Statistics	
Cronbach's Alpha	N
0.875	33

Results

Inferential statistical analysis (independent sample t-test and One-Way ANOVA) was used to analyse the demographics of the respondents to answer the research questions.

Demographics

Table 2. Showed the demographic of 217 respondents in this study

Category	Demographic	Frequency	Percentage (%)
Gender	Male	42	19.4
	Female	175	80.6
Location	Urban	113	52.1
	Rural	104	47.9
Teaching experience	Less than 5 years	2	0.9
	6 – 10 years	25	11.5
	11 – 15 years	75	34.6
	16 years and above	115	53.0
Age	20 – 30 years	4	1.8
	31 – 40 years	89	41.0
	41 – 50 years	94	43.3
	51 years and above	30	13.8

Inferential Analysis

Research question : To what extent is the mean difference between teachers' evaluation of the effectiveness of the use of Web 2.0 applications in teaching and learning (T&L) based on demographic factors?

Gender

Ho1: There is no significant difference between the mean evaluation of science teachers on the effectiveness of the use of Web 2.0 in teaching and learning (T&L) by gender.

Table 3. Independent sample t-test analysis of differences in Science teachers' assessment of the effectiveness of the use of Web 2.0 in teaching and learning (T&L) by gender

Construct	Gender	n	Mean	SD	Value-t	df	Significance Level
Science Teacher Assessment	Male	42	3.85	0.065	-1.394	215	0.165
	Female	175	3.96	0.036			

Table 3 shows no significant differences in the evaluation of Science teachers when implementing Web 2.0 in T&L based on gender. In terms of mean, male teachers (M = 3.85, SD = 0.065) were lower than the mean of female teachers (M = 3.96, SD = 0.036). The value of t = 1.394 and sig. = 0.165 (p> 0.05). This indicates that the null hypothesis failed to be rejected because there was no significant difference in the evaluation of science teachers on the effectiveness of the use of Web 2.0 in teaching and learning (T&L) according to gender. Although there was a difference in mean score readings between the two groups, the difference was not significant. This means that the differences in the evaluation of science teachers on the effectiveness of the use of Web 2.0 in teaching and learning (T&L) are at the same level between male and female teachers.

Location

Ho2: There is no significant difference between the mean evaluation of science teachers on the effectiveness of the use of Web 2.0 in teaching and learning (T&L) by location.

Table 4. Independent sample t-test analysis of differences in Science teachers' assessment of the effectiveness of the use of Web 2.0 in teaching and learning (T&L) by location

Construct	Location	n	Mean	SD	Value-t	df	Significance Level
Science Teacher Assessment	Urban	113	3.99	0.461	1.731	215	0.085
	Rural	104	3.88	0.471			

Table 4 shows no significant difference in the evaluation of Science subject teachers when implementing Web 2.0 in T&L based on location. In terms of mean, urban (M = 3.99, SD = 0.461) is higher than the rural mean (M = 3.88, SD = 0.471). The value of t = 1.731 and sig. = 0.085 (p> 0.05). This indicates that the null hypothesis failed to be rejected because there was no significant difference in the evaluation of science teachers on the effectiveness of the use of Web 2.0 in teaching and learning (T&L) by location. Although there was a difference in mean score readings between the two groups, the difference was not significant. This means that the differences in the evaluation of science teachers on the effectiveness of the use of Web 2.0 in teaching and learning (T&L) are at the same level between teachers living in urban areas and teachers living in rural areas.

Teaching Experience

Ho3: There is no significant difference between the evaluation of science teachers on the effectiveness of the use of Web 2.0 in teaching and learning (T&L) based on teaching experience.

Table 5. One -Way ANOVA test results for Science teacher evaluation based on teaching experience

Construct	Source	Sum of Square	df	Mean Square	F	Sig.
Science Teacher Assessment	Between Groups	0.39	3	0.13	0.59	0.62
	Within Groups	46.86	213	0.22		
	Total	47.25	216			

Table 5 shows that the One-Way ANOVA analysis for Science teacher evaluation based on teaching experience showed that null hypothesis failed to be rejected. There was no significant difference between the group and within a group, F (3,213) = 0.59, p = 0.62. These values indicate no significant interaction between the less than 5-year-old group, the 6 to 10-year-old group, the 11 to 15-year-old group and the 16-year-old group and on Science teachers evaluation of the effectiveness of Web 2.0 use in teaching and learning (T&L).

Ages

Ho4: There is no significant difference between the evaluation of science teachers on the effectiveness of the use of Web 2.0 in teaching and learning (T&L) based on age.

Table 6. One -Way ANOVA Table for age -based Science teacher assessment

Construct	Source	Sum of Square	df	Mean Square	F	Sig.
Science Teacher Assessment	Between Groups	1.99	3	0.67	3.14	0.026
	Within Groups	45.25	213	0.21		
	Total	47.25	216			

Table 6 shows the results of One-Way ANOVA analysis for age-based assessment of Science teachers showing that the null hypothesis was rejected and there was a significant difference between groups and within groups, F (3,213) = 3.14, p = 0.026. This value indicates a significant interaction between groups aged between 20 to 30, 31 to 40, 41 to 50 and 51 years and above based on the evaluation of science teachers on the effectiveness of the use of Web 2.0 in teaching and learning (T&L).

Table 7. Scheffe post-hoc test of differences in Science teachers' assessment of the effectiveness of Web 2.0 use in teaching and learning (T&L) based on age

Ages	n	Subset of alpha = 0.05	
		1	2
20 – 30 years	4	4.03	
31 – 40 years	89	4.00	
41 – 50 years	94	3.94	
51 years and above	30		3.71

Based on table 7, Scheffe post-hoc test at significance level p <0.05 was conducted to identify differences between groups. The post-hoc test results in table 4.28 show that the evaluation of Science teachers aged 51 years and above (M = 3.71, SD = 0.51) was significantly lower than that of Science teachers aged 20 to 30 years (M = 4.03, SD = 0.26), 31 to 40 years (M = 4.00, SD = 0.49) and 41 to 50 years (M = 3.94, SD = 0.41).

Discussion

Gender

An independent sample t-test analysis was conducted to obtain findings on the evaluation of science teachers on the effectiveness of the use of Web 2.0 in teaching and learning (T&L) by gender. The study's findings are in line with previous studies where Science teachers ’evaluation of the effectiveness of Web 2.0 use in teaching and learning (T&L) by gender is no significant difference (Kauts & Kaur, 2020; Singh, 2021). This is because the use of Web 2.0 applications does not differ by gender. This shows male and female teachers together using Web 2.0 applications for the T&L process in the classroom. These results may indicate that the traditional gender gap where men are more confident in using Web 2.0 applications than women disappears. The similarity of Web 2.0 application usage between male and female teachers is not a surprising finding as Female and male teachers often use Web 2.0 applications for different educational and daily activities. For example, Web 2.0

applications like Google share documents with students using file-sharing tools like Dropbox, collaborate with colleagues using collaboration tools like Google Drive and communicate with students and peers using online communication tools like Facebook and email. Thus, the use of Web 2.0 applications among teachers can bridge the gap between female and male teachers.

Location

An independent sample t-test analysis was conducted to obtain findings on the evaluation of science teachers on the effectiveness of the use of Web 2.0 in teaching and learning (T&L) by location. The study's findings are in line with previous studies where Science teachers' evaluation of the effectiveness of the use of Web 2.0 in teaching and learning (T&L) by location is that there is no significant difference (Senthamarai & Amutha, 2016; Vivakaran & Maraimalai, 2018). This is because the use of Web 2.0 applications does not vary by location. This shows that Web 2.0 applications among teachers in urban areas are not different from rural areas. Thus, the researchers found that urban and rural teachers have similar beliefs about the value of technology integration and have equal access to Web 2.0 applications. Reducing this digital divide is primarily due to rural and urban communities being able to access resources and develop good infrastructure. Thus, urban and rural teachers value and use Web 2.0 applications well for the T&L process in the classroom. Furthermore, the quality of urban and rural teachers is similar as they both have basic computer knowledge and skills learned while at university.

Teaching Experience

One -way ANOVA test analysis was conducted to obtain findings on the evaluation of science teachers on the effectiveness of the use of Web 2.0 in teaching and learning (T&L) according to teaching experience. The study's findings are in line with previous studies where Science teachers'evaluation of the effectiveness of Web 2.0 use in teaching and learning (T&L) according to teaching experience is no significant difference (Hol & Aydın, 2020; Chung-Yuan et al., 2020). This is because the use of Web 2.0 applications among teachers do not differ according to teaching experience. This makes teachers feel confident to use Web 2.0 applications in the classroom. Teacher-minded researchers have shown that they have no problems managing classrooms and integrating educational tools and Web 2.0 applications effectively in the first years of their teaching. The use of Web 2.0 applications on age does not impact many years of teaching experience. For example, with academic education experienced with traditional boards and blackboards for many years and teachers willing to change at any time where young teachers and senior teachers tend to integrate Web 2.0 applications into their teaching. This is because a teacher's teaching experience does not affect the acceptance of technology. The findings of this study are in line with the study of Marni Izzati (2020), who stated that young teachers and senior teachers could accept the innovation of this virtual learning environment in their T&L. In summary, as long as the teacher works in the school, the teacher can improve themselves in using technology in the school.

Ages

One -way ANOVA test analysis was conducted to obtain findings on the evaluation of science teachers on the effectiveness of the use of Web 2.0 in teaching and learning (T&L) according to age. The study's findings are in line with previous studies where Science teachers'

evaluation of the effectiveness of the use of Web 2.0 in teaching and learning (T&L) by age is that there are significant differences (Sabeh et al., 2018; Doley, 2021). This is because the use of Web 2.0 applications among teachers varies with age. The study's findings showed that teachers aged 20 to 30 years, 31- to 40 and 41 to 50 were more active in using Web 2.0 applications than teachers aged 51 years and above. Perspective researchers for young teachers were born and raised in the era of Web 2.0 applications. Thus, teachers are more interested in using Web 2.0 applications such as Moodle or Glogster, using other Web 2.0 application teaching strategies, such as MOOCs, and not limiting themselves to using tools traditionally used in teaching strategies: video, projectors and computers. Their level of use of Web 2.0 applications continues to increase, and they will continue to practice online teaching both inside and outside the classroom. Thus, digital competencies will depend on good teaching practices and their positive inclinations towards this type of teaching method. Nevertheless, teachers aged 51 and above show teachers are still limited by their practical thinking, which encourages them to reproduce the knowledge and ways of teaching classes that they have acquired throughout their schooling. These teachers continue to use traditional methods without producing innovative changes in teaching practice.

Conclusion

This study was conducted quantitatively using a questionnaire. The summary of this study shows that Science teachers in this study have a moderate level of knowledge and skills, and a high level of attitude to implement T&L online. Science teachers' evaluation of the effectiveness of the use of Web 2.0 in teaching and learning (T&L) by gender, location, and teaching experience showed no significant differences. However, there were significant differences in ages. The MOE needs to pay serious attention to issues that cause teachers to use fewer Web 2.0 applications in T&L. DOE needs to increase courses and training to improve teachers' skills in using Web 2.0 applications in T&L. Schools also play a significant role in changing the situation of weak mastery of Web 2.0 applications among science teachers. Teachers are close to students when the teaching and learning process takes place in the classroom. They need to be wise to use different and appropriate teaching approaches while ensuring that Web 2.0 applications can be implemented in T&L. The limitations of this study are limited to evaluating the effectiveness of Web 2.0 applications in teaching and learning (T&L) among teachers only. This study is limited to collecting data through a questionnaire instrument and only selects one place in Malaysia to collect data. To study the factors related to the practice of Science teachers and the level of knowledge of content pedagogy technology of teachers in schools. Future studies could be conducted on a broader location and a larger sample of studies to see more specific findings. To see whether the level of readiness of teachers in integrating Web 2.0 applications in T&L has a relationship with student achievement, it is recommended that the study be conducted using questionnaires and document analysis and interviews. The readiness of Science teachers in the implementation of Web 2.0 applications during learning from home can be used as a study because it seems to be a new norm today, which is likely to be one of the new learning alternatives in the future.

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