Web 2.0 in Secondary Science Instruction: Assessing Teachers' Self-efficacy and Integration Level and the Relationship between Them

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Abstract

Affordances of Web 2.0 applications in line with 21st century skills demonstrate the potential of Web 2.0 as a relevant learning platform. This study aims to examine the levels of teachers' self-efficacy and integration of Web 2.0 in secondary science instruction. The objectives of the study are to: (1) Identify the level of teachers' self-efficacy, (2) Examine Web 2.0 integration level in secondary science instruction; and (3) Study the relationship between teachers' self-efficacy and Web 2.0 integration in science teaching. This study is based on a quantitative method by using a set of questionnaires. Research sample consisted of 108 secondary school science teachers from nine schools in Miri, Sarawak who were selected using cluster random sampling technique. Data were analysed using descriptive statistics and Pearson correlation. Findings revealed that teachers' self-efficacy level was moderate (M = 3.23, SD = 0.60) while the integration level of Web 2.0 tools in secondary school science instruction was low (M = 2.30, SD = 0.71). Furthermore, this study found a strong significant positive correlation, r (106) = 0.62, p <.001 between teachers' self-efficacy and Web 2.0 integration level. In conclusion, the levels of teachers' self-efficacy and integration of Web 2.0 in science education can be further enhanced. Therefore, this study proposes effective in-service training for teachers to use Web 2.0 tools in teaching and learning process.

Keywords: Web 2.0; Integration; Science education; Secondary school; Teachers' self-efficacy

Introduction

Fourth Industrial Revolution (4IR) highly demands science and technological-based workforce that envisions integration of different science disciplines and digital technology in the rising trend of human cloud platform (Schwab, 2016). Responding to the paradigm shift of economy and workforce demand, future human capital has to be imbued with relevant skills. The 21st century skills, namely the 4Cs (communication, collaboration, critical thinking, and creativity) along with information and communication technology (ICT) literacy skills should be nurtured and integrated in the curriculum and classroom practices as earlier as possible in order to help learners succeed in the era of information technology (Scott, 2015; Cruz & Orange, 2016). As curriculum and delivery system have to be adapted to rapid development of technology (Lawrence et al., 2019), Malaysia's Ministry of Education (MOE) has enforced the integration of ICT elements in classroom practices. The aim of the initiative is to strengthen teaching and learning through access to interactive and engaging learning experience as well as broader content and study options such as distance learning and self-directed learning (MOE, 2012).

Over the past decade, Web 2.0 applications have attracted interests of educational researchers as potential educational tool due to the pertinence of its affordances to the 21st century skills such as enabling collaboration, communication, creation and sharing of information as well as self-learning (Jimoyiannis & Angelaina, 2012). Debry and Gras-Velazquez (2016) asserted that ICTs component such as Web 2.0 leads to pedagogical reform and supports 'Science, Technology, Engineering, and Mathematics' (STEM) approach where collaborative skill is crucial in solving multidisciplinary authentic problems. Previous studies also revealed benefits of Web 2.0 in science education such as enhancing creativity (Sahara et al., 2018), interest (Dohn & Dohn, 2017; Karahan & Roehrig, 2016) and fostering self-regulation of learning (Jena et al., 2018). In addition, Cruz and Orange (2016) claimed that studies showed Web 2.0 encourages critical thinking, creative problem solving, collaboration and communicative skill. Another reason to the relevance of researching Web 2.0 in education is due to the nature of the current Z generation students. The Z generation, also known as 'digital natives' by Prensky (2001) are accustomed with electronic gadgets and digital media especially Web 2.0 technology (Scott, 2015). Hence, traditional teaching styles may no longer be relevant to their needs and interests, as they are more reliant on new technologies to assist their learning (Javaeed et al., 2020).

Integration of current technology such as Web 2.0 may seem as a necessity in the current education context but past studies has shown that ICT integration level in Malaysian education system is still low (Irfan & Amat Sazali, 2015) and the potential of Web 2.0 technology has yet been optimally utilised in classroom (Almekhlafi & Abulibdeh, 2018; Murugaiah & Hwa, 2018). Several recent researches related to Web 2.0 in education in Malaysia were implemented but mostly focused on tertiary education level encompassing themes related to attitudes towards Web 2.0 technology (Azizul et al., 2020; Mohammad et al., 2018; Tatli et al., 2019; Yahya & Zaidatun, 2019) and application of Web 2.0 (Aliyu et al., 2018; Annamalai, 2019; Helmi et al., 2016; Lee & Teh, 2016).

Limited studies found on Web 2.0 integration in primary or secondary school level and in the field of science education in Malaysia has shown gap in the field of research. Moreover, assessing state of ICT practices in education periodically is beneficial in providing feedback for future educational policy planning (Yalin et al., 2007). However, effective utilisation of Web 2.0 technology in education setting requires teachers' capabilities in creating meaningful learning experiences (Tambouris et al., 2012) and their proficiency to use the tools (Alhassan, 2017). Previous studies have shown that self-efficacy is a motivational construct that influences a teacher to integrate Web 2.0 into teaching (Alhassan, 2017; Blannin, 2015; Blonder et al., 2013; Pan & Franklin, 2011; Ward, 2015). Hence, this research aims to study the self-efficacy level of teachers integrating Web 2.0 in their science instruction and the current level of Web 2.0 integration in secondary school science instruction. In the interest of the study, the issue of integrating technology in STEM pedagogy is important in the effort of generating STEM human capital equipped with ICT literacy and 21st century skills.

Purpose of Study

The purpose of this study is to explore the level of teachers' Web 2.0 self-efficacy and the level of Web 2.0 integration in secondary school science instruction in Miri, Sarawak.

Research Objectives

The objectives of this study are to:

1. Examine the level of teachers' Web 2.0 integration self-efficacy in the teaching and learning of secondary school science.

2. Examine the level of teachers' Web 2.0 tools integration in the teaching and learning of secondary school science.
3. To determine if there is a significant relationship between the level of teachers' Web 2.0 integration self-efficacy and the level of Web 2.0 tools integration in the teaching and learning of secondary school science.

Literature Review

Web 2.0

Web 2.0 refers to social integrated tools (web sites/ applications) that enable users to create and customise content, actively share information, collaborate and communicate through social interactions (O'Reilly, 2005). Web 2.0 differs from the first generation of World Wide Web, 1.0 as it does not require high web skills, more interactivity and allows active participation from users to create and communicate information to selected groups or public audience (Nandhini, 2016).There are diverse types of Web 2.0 applications such as wikis, social network sites, blogs, content hosting services, folksonomies, podcast, micro blogging, social curation, forums, and cloud computing (Jena et al., 2020). Light and Polin (2010) outlined four approaches or functions of using Web 2.0 in the context of education as shown in Table 1.

Table 1
Use of Web 2.0 in the Context of Education

No.	Approaches/ Functions of Web 2.0 in Education	Types of Web 2.0 Tools
1	Create or support virtual learning	−Virtual Learning Environment/ Learning Management System (e.g. Edmodo, Moodle) −Classroom management tools −Quiz or test generating tools (e.g. Kahoot, Quizziz) −Document or resource sharing tools
2	Supporting communication and fostering social relationships	−Blog (e.g. Blogger, Weebly, Wordpress) −Instant Messaging (e.g. WeChat, WhatsApp, Line) −Social network (e.g. Facebook, Twitter)
3	As a source of support for teaching and learning	−Video sharing (e.g. YouTube) −Google application (e.g. Google Earth, Google Map) −Podcast
4	Allows students to create artifacts to represent their learning outcomes	−Text production (e.g. Wiki, Google Docs, Newsmaker) −Video production (e.g. Moviemaker, Flipcameras, Animoto, Camtasia) −Audio production (e.g. Audacity, Garage Band) −Drawing/ Poster production (e.g. ArtRage, KidPix, Glogster) −Cartoon production (e.g. GoAnimate) −Image/photo editing (e.g. Picasa) −Presentation slide production (e.g. Prezi, Voicethread)

Web 2.0 in Science Education

Wiki allows users to create, customise content, and add website links to create text collaboratively. Students use Wiki to collaborate in groups in order to produce a writing product through project approach (Freire et al., 2013; Lau et al., 2017). Proper designed wiki-

based learning framed within inquiry project based approach shown active engagement and development of Internet search skills, critical thinking and collaborative problem solving skills (Lau et al., 2017). However, Freire et al. (2013) also recommend the need of teachers' facilitation in collaborative processes and to create safe learning environments in which error is valued positively as learning opportunity. Blog refers to personal websites that are developed and maintained by individuals or small groups. Blogs are often used in collaborative project activities where students find and share information, communicate in groups and form shared knowledge (Jimoyiannis & Angelaina, 2012; Soh, 2011). Jimonyiannis and Angelaina (2012) asserted that well-planned blog activities can help students to achieve higher cognitive levels and critical thinking skills through collaboration.The cooperative learning environment through collaborative blog projects also foster leadership and communication skills (Soh, 2011).

YouTube is used as a video-based teaching resource to deliver Science content such as experiments and science topic content (Chimo, 2012; Koto, 2020; Wilson & Boldeman, 2012). In addition to watching and downloading videos, users are free to create and upload videos on YouTube site. The use of video has been found to be more appealing to nowaday's students and helps them to understand activity directions better than written instruction (Wilson & Bolderman, 2012). This statement is supported by Koto (2020) who states that well-selected videos in discovery learning setting improves students' procedural knowledge rather than just factual and conceptual knowledge. Social networking applications are used as a medium for discussion of science topics or sociocultural issues. Findings showed that using Facebook helps in students' understanding through scholarly discussions, assists teachers in detecting and correcting misconceptions (Rap & Blonder, 2015), and aids students in relating curriculum to real-life issues (Dohn & Dohn, 2017). The study by Abualrob and Nazzal (2020) on the extent of WhatsApp Instant Messaging being used to teach chemistry and biology to tenth-graders revealed higher participation in discussion, more real-life related questions were posed and WhatsApp is proven to be effective in facilitating instructions and expanding classroom activities.

Web 2.0 tools in the form of Virtual Learning Environment (VLE) such as the Learning Management System (LMS) or cloud-classroom (online classroom) lead to blended learning approach. Project assignments using LMS such as Edmodo and Moodle in teaching have shown to enhance students' engagement and motivation (Chimo, 2012; Jarosievitz, 2012). Pietarinen et al. (2018) researched on collaborative inquiry learning of interdisciplinary science (biology and chemistry) supported by web-based Virtual Baltic Sea Explorer found that students' positive affect prevailed during all phases of collaboration, which boosted the students' confidence and interests when working with tasks given. Jena et al. (2018) and Jena et al. (2020) who researched on using combination of several Web 2.0 tools such as Slideshare, Wiki, WhatsApp, and YouTube to study effects on learning performance, retention and self-regulation of secondary school students in the topic of tissues found significant better effects on learning performance, retention and self-regulation of learning by using Web 2.0 tools over traditional approach. Jena et al. (2020) also insisted that the retention level found satisfactory was not achievable in traditional learning approach.

Theory of Self-Efficacy

Self-efficacy is defined as beliefs, self-perceptions and self-evaluations of one's ability to handle a situation and to plan actions necessary to succeed in the particular situation (Bandura, 1986). The concept of self-efficacy was derived from Bandura's Social Learning Theory (Bandura, 1977). Bandura (1994) claimed that individuals with high level of self-efficacy will

have high intrinsic motivation that enables them to cope with difficult tasks, maintain commitment and recover quickly from failure. Thus, measuring the level of self-efficacy provides the information about how people think, feel, behave and motivate themselves in making decisions and act (Bandura, 1977). In this study, measuring the level of teachers' Web 2.0 integration self-efficacy could provide a picture pertaining to their self-perception of readiness and ability to use Web 2.0 in their teaching practices.

Teachers' Self-efficacy and Web 2.0 Integration in Teaching and Learning Process

Previous studies on levels of teachers' Web 2.0 self-efficacy and integration in teaching practices as shown in Table 2 revealed that teachers' self-efficacy level varies, from low to high while Web 2.0 integration level ranges from low to medium. In addition, most studies showed significant positive relationship between the level of teachers' Web 2.0 integration self-efficacy and the degree of Web 2.0 integration in teaching and learning.

Table 2
Findings of Previous Studies Regarding Levels of Teacher's Self-efficacy and Web 2.0 Integration in Teaching and Learning

Author (Year)	Findings		
	Teachers' Self-efficacy Level	Web 2.0 Integration Level	Relationship between Teachers' Self-efficacy and Web 2.0 Integration
Pan & Franklin (2011)	Low	Moderate	Positive relationship and one of the significant predictor
Tweed (2013)	-	-	Positive significant relationship between levels of teachers' self-efficacy and technology usage
DoBell (2013)	Moderate to High	Low	No significant relationship
Ward (2015)	High	Low	Strong positive significant relationship
Hickson (2016)	High	-	No significant relationship between teachers' self-efficacy with ability to integrate technology
Sarfo et al. (2017)	Low	-	-
Alhassan (2017)	Moderate to High	Moderate	Strong positive significant relationship
Bingimlas (2017)	-	Low	-
Fathimath et al. (2016)	Low	Low	Moderate positive significant relationship
Wright & Akgunduz (2018)	High	-	Positive relationship between TPACK self-efficacy and usage of Web 2.0

Methodology

Research Design

This study is based on a quantitative approach using questionnaire with analysis using descriptive and inferential statistics. The use of questionnaire has the advantage in providing the desired results, simple, time-saving, broad-based prospects and thus higher statistical significance with little or no subjectivity of the researcher (Sincero, 2012).

Sample

The population of this study consisted of all secondary school science teachers in Miri, Sarawak from 13 secondary schools under the supervision of Miri District Education Office. Cluster random sampling technique was used where nine secondary schools (clusters) were randomly selected. Cluster random sampling was chosen due to its advantages as being easier to conduct in schools, less time consuming compared to simple random sampling and useful when it is difficult to select individual samples using simple random sampling method (Fraenkel et al., 2012). To ensure acceptable representation of study population, random sample of secondary schools were selected from each of geographical area. Study sample, n = 108 secondary school science teachers based on Krejcie and Morgan (1970) sample size determination table were selected from the selected schools.

Instrument

The questionnaire employed in the study consisted of three sections. Section A explained definitions of Web 2.0 and Web 2.0 tools while section B was used to collect data regarding demographic aspects such as gender, age, teaching experience, education level and exposure to Web 2.0 training / courses in education. Section C contained two translated and modified research instruments from previous study (Pan & Franklin, 2011). Part C (I) consisted of Web 2.0 Integration Instrument (W2II) containing eight items to measure the degree of Web 2.0 integration in teaching of science in terms of how often they use Web 2.0 tools by responding to five-point Likert scale ranging: (5) Daily, (4) At least once a week, (3) At least once a month, (2) At least once a year, (1) Never. Data of examples of Web 2.0 applications used for each Web 2.0 tool in the study were also collected. Part C (II) contained Web 2.0 Tools Integration Self-efficacy Instrument (W2ISE) consisted of 30 items measuring teachers' self-efficacy in using the eight types of Web 2.0 tools studied in their practices of teaching science by responding to five-point Likert scale ranging: (5) Strongly agree, (4) Agree, (3) Not sure, (2) Disagree, (1) Strongly disagree.

Instruments used were translated to Malay language and modified to suit current advancement of Web 2.0 tools. The validity of the instruments used were reviewed by three faculty members of the Teacher Education Institute to ensure the integrity of the translation as well as the appropriateness of the terms used and items for intended measurement in the study. Under the recommendations of the examining panel, amendments were done for some terms used in the items. Next, a pilot study was conducted a month before the actual study in two secondary schools of sample size, n = 30, involving secondary school science teachers who did not participate in the actual study. Browne (1995) stated the use of at least sample size, n=30 to estimate a parameter. Adjustments to instruments were made based on feedbacks from pilot study respondents regarding the clarity of instructions. The instruments' reliability in terms of internal consistency were examined with Cronbach Alpha analysis. The Cronbach Alpha value for W2II was 0.82 while W2ISE was 0.95 in the study. According to George and Mallery (2003), Cronbach's alpha value of > 0.9 is very good and > 0.8 is good and acceptable. Thence, instruments are deemed to have reliable internal consistency.

Implementation of the study

Prior to conducting the study, permission to conduct study was obtained from the Education Policy Planning and Research Division and the Sarawak State Department of Education. Questionnaires were administered manually on paper. The researcher met with the school principals to explain the purpose, sample of the study and the administration date of questionnaires at schools. Next, the researcher administered the questionnaires at the specified time and date. The questionnaires were collected after the respondents had completed the questionnaires.

Data Analysis

Descriptive analysis of mean and standard deviation were used to examine teachers' self-efficacy level while mean and standard deviation as well as frequency and percentage analysis were used to identify the level of Web 2.0 tools integration in teaching and learning of science. Level interpretations were determined based on Jamil (2002) mean scale, ranging 1.00-2.33 (Low), 2.34-3.66 (Medium) and 3.67-5.00 (High). Pearson correlation test was conducted to determine the bivariate correlation between teachers' Web 2.0 integration self-efficacy level (independent variable) and the level of Web 2.0 tools integration in teaching and learning of science (dependent variable). Correlation analysis was interpreted based on the strength, direction of the relationship (positive or negative) and whether the relationship was significant ($p < 0.05$). Pearson correlation strength interpretation was determined based on Cohen's (1988) coefficient r, ranging $0.1 \leq |r| < .3$ (weak correlation), $0.3 \leq |r| < .5$ (medium correlation) and $|r| \geq .5$ (strong correlation).

Findings and Discussion

Respondents' Profile

Study respondents consisted of secondary school science teachers in Miri, Sarawak who teach core and elective science (biology, chemistry and physics) subjects. Table 3 shows the demographic profile of the respondents.

Table 3
Respondents' Demography Profile

Category			Frequency (n)	Percentage (%)
Gender	Male		21	19.4
	Female		87	80.6
Age (years)	55 - 60 (Baby boomers)		4	3.7
	40 - 54 (Generation X)		37	34.3
	25 - 39 (Generation Y)		65	60.2
	21 - 24 (Generation Z)		2	1.9
Teaching experience (years)	0 – 10		48	44.4
	11 – 2 0		48	44.4
	> 20		12	11.1
Education level	Diploma		1	1.1
	Degree		91	84.3
	Master degree		16	14.8
Exposure to courses related to Web 2.0 usage in education	Yes	Effective	24	22.2
		Ineffective	22	20.4
	No		62	57.4

Majority of the respondents were female (80.6%) compared to male (19.4%). Age groups are defined by four distinct generations (Kasasa, 2020; Robinson, n.d.), which are as follows:

1. Baby boomers: Born in 1946-1964
2. Generation X: Born in 1965-1979
3. Generation Y: Born in 1980-1994
4. Generation Z: Born in 1995-2012

Most of the respondents were of the Y generation (60.2%) and followed by the X generation (34.3%) while the number of respondents from the Baby boomers generation (3.7%) and Z generation (1.9%) were significantly lower. The percentage of respondents with teaching experience of 0 to 10 years and 11 to 20 years were both same percentage of 44.4% while percentage of veteran respondents with more than 20 years of teaching experience was low (11.1%). In terms of education level, vast majority of respondents has bachelor's degree (84.3%), followed by master's degree (14.8%) and only one respondent (0.9%) has a diploma. Most of the respondents (57.4%) had never been exposed to any course or training related to Web 2.0 usage in education while 20.4% of respondents who attended related courses reported that the courses attended were ineffective.

Teachers' Web 2.0 Self-efficacy Level in Teaching and Learning of Secondary School Science

Table 4 shows the overall level of teachers' self-efficacy in integrating Web 2.0 tools in the teaching and learning of secondary school science for sample size, n = 108 is moderate (M = 3.23, SD = 0.60). Teachers demonstrate high self-efficacy in the use of Instant Messaging (IM) applications and Google applications in teaching science while at moderate level for other Web 2.0 tools. Findings also show that teachers are most confident in integrating IM applications in teaching science (M = 3.83, SD = 0.62) while showing lowest level of self-efficacy in utilising podcast in their teaching (M = 2.49, SD = 0.87). This finding is in line with past study by Alhassan (2017) in which the level of teachers' self-efficacy level ranges from moderate to high for closely similar Web 2.0 tools being studied (i.e. social media, multimedia sharing, content management website, blog, podcast).

Table 4
Descriptive Analysis of Teachers' Web 2.0 Tools Integration Self-efficacy Level in Teaching and Learning of Secondary School Science

Web 2.0 tools	Mean	Standard Deviation
IM	3.83	0.62
Google applications	3.75	0.68
Social network	3.50	0.65
Media sharing	3.46	0.69
LMS	3.07	0.93
Blog	2.73	0.99
Wiki	2.72	0.90
Podcast	2.49	0.87
OVERALL	3.23	0.60

Teachers' Web 2.0 Integration Level in Teaching and Learning of Secondary School Science

Table 5 shows the overall level of Web 2.0 tools integration in teaching and learning of secondary school science for sample size, n = 108 is low (M = 2.30, SD = 0.71). In terms of frequency and percentage, the majority of respondents, n = 25 (23.1%) uses IM applications with students daily and the majority of respondents use IM applications, media sharing applications and Google applications at least once a week or once a month. The use of other Web 2.0 tools such as social networks, LMS, Wiki, blogs and podcasts in teaching and learning are low with vast majority of teachers never use the tools, especially podcasts with n = 87 teachers (80.6%) never use podcast in science teaching.

Table 5
Descriptive Analysis of Web 2.0 Tools Integration in Teaching and Learning of Secondary School Science

Web 2.0 tools	Frequency (%)					Mean	SD
	Daily	At least once a week	At least once a month	At least once a year	Never		
IM	25 (23.1%)	29 (26.9%)	21 (19.4%)	10 (9.3%)	23 (21.3%)	3.21	1.45
Media sharing	11 (10.2%)	31 (28.7%)	38 (35.3%)	10 (9.3%)	18 (16.7%)	3.06	1.21
Google applications	13 (12.0%)	35 (32.4%)	23 (21.3%)	10 (9.3%)	27 (25%)	2.97	1.38
Social network	3 (2.8%)	31 (28.7%)	14 (13.0%)	17 (15.7%)	43 (39.8%)	2.39	1.34
LMS	3 (2.8%)	9 (8.3%)	26 (24.1%)	19 (17.6%)	51 (47.2%)	2.02	1.14
Wiki	2 (1.9%)	13 (12.0%)	17 (15.7%)	16 (14.8%)	60 (55.6%)	1.90	1.17
Blog	0 (0%)	1 (0.9%)	18 (16.7%)	11 (10.2%)	78 (72.2%)	1.46	0.80
Podcast	0 (0%)	3 (2.8%)	14 (13.0%)	4 (3.7%)	87 (80.6%)	1.38	0.82
					OVERALL	2.30	0.71

Although the level of self-efficacy was found to be moderate (Table 4), the overall level of Web 2.0 tools integration in teaching and learning of secondary school science was found to be low (Table 5). This finding is in accordance with previous findings which conclude low level of Web 2.0 integration in education (Fathimath et al., 2016; Pan & Franklin, 2011; Ward, 2015). In addition, findings regarding integration level of Web 2.0 tools also consistent with Bingimlas' (2017) in which he found that the level of use for IM, video sharing applications and social networks were moderate while the use of blog, Wiki and LMS applications were low.

Table 6 shows that teachers use various types of Web 2.0 tools in teaching and learning of secondary school science. Among different types of Web 2.0 tools, IM applications such as

WhatsApp and Telegram (n = 59) as well as the most preferred media sharing application, YouTube shown significantly higher number of users (respondents) compared to other applications. On the other hand, blog and podcast applications show very few users. However, there are also respondents who did not fill out the open response section on the types of Web 2.0 applications used. This finding shows that science teachers have extensive knowledge and experience in using diverse types of Web 2.0 applications in teaching science especially Web 2.0 applications for the purposes of communicating, media sharing and file management.

Table 6
Open Response on Types of Web 2.0 Applications Used Ranked according to Frequency (Number of Users)

Web 2.0 applications being used				
	Rank 1 (n)	**Rank 2 (n)**	**Rank 3 (n)**	**Others (n)**
IM	WhatsApp (65)	Telegram (59)	WeChat (7)	Facebook Messenger (2)
Media sharing	YouTube (55)	Instagram (11)	Pinterest (5)	Khan Academy (2), Fourshared (1), Photobucket (1), Dailymotion (1)
Google applications	Google Drive (41)	Google Chrome (32)	Google Doc (9)	Google Form (8), Google Sheet (7), Google Map (6), Google Slides (3)
Social network	Facebook (32)	Twitter (2)	-	-
LMS	Google Classroom (33)	Edmodo (2), Blackboard (2)	Schoology (1) Padlet (1)	-
Wiki	Wikipedia (36)	Wiktionary (1), Wikihow (1)	-	-
Blog	Blogger (11)	Wordpress (7)	Tumbler (1), Weebly (1), LinkedIn (1)	-
Podcast	iTunes (5)	Netflix (4)	Spotify (3)	Soundcloud (1)

Note: There were some unfilled responses

Alhassan (2017) claimed that IM and social networks are popular Web 2.0 tools to help teachers maintain relationships with students as well as encourage them to work cooperatively and collaboratively. Nonetheless, integration of IM were found to be higher than social network applications and was the highest among the Web 2.0 tools involved in this study. This finding is consistent with the current scenario where IM is the most frequent digital activity and its usage is much higher compared to social networks as platform for communication and collaboration, just as mentioned by Mark Zuckerberg in a question-and-answer session in November 2014 (Montaque, 2019). IM's relevance in the field of education was also explained by Bouhnik and Deshen (2014) who stated that IM applications such as WhatsApp are used for communication and dialogue, promoting sharing and as a learning platform. IM gains wide preference due to its advantageous traits such as ease of use, low cost and instant communication. Though not the most widely used Web 2.0 tool for integration in science education, findings showed Facebook as the most popular social networking application. This finding can be explained by Malaysian Communications and Multimedia Commission's (MCMC) survey in 2018 that estimated 97.3% of social network users have Facebook accounts

and this made it the most popular social networking platform in Malaysia and thus the most preferred choice of social networking platform in teaching.

Media sharing tool is the Web 2.0 tool with the second highest level of integration in this study and YouTube is the most widely used media sharing application among the respondents. This finding is in accordance with the findings of MCMC (2018) survey on Internet usage in Malaysia which showed that the most shared content among Malaysians on YouTube is educational content (71.3%). Furthermore, Dogtiev (2019) described YouTube as the most popular media sharing application and the second largest search engine. This demonstrates the potential of YouTube as a relevant Web 2.0 tool in the education for the digital natives.

Google applications is the Web 2.0 tool with the third highest level of integration found in this study. Google Apps for Education (GAFE) such as Google Drive, Google Docs, Google Slides, Google Forms, Google Sheets, Google Drawings, Google Hangouts, Google Chrome and Google Map are perfect for classroom use and are fully online (cloud-based), thus enable resources to be accessed from any devices with an Internet connection (TeachThought Staff, 2018). Moreover, Google applications are user-friendly and its capabilities in allowing sharing as well as collaboration make GAFE a useful tool for teachers (Brown & Hocutt, 2015). Study shown that teachers are able to integrate a wide variety of Google applications such as Google Drive, Google Chrome, Google Docs, Google Forms, Google Sheets, Google Map and Google Slides but most of the teachers use Google Drive and Google Chrome while other Google applications are not widely applied.

The most popular LMS among respondents is Google Classroom. The choice of using Google Classroom might be due to MOE's initiative in promoting the use of digital learning platform through Google Classroom since July 2019 (Rajaendram, 2019). Nevertheless, the levels of teachers' integration of the tool and their self-efficacy were found to be low due to the lack of training and implementation of the learning platform is still considered in its infancy among the respondents. Web 2.0 tools like podcasts, Wiki and blogs showed low integration or usage especially podcasts. Alhassan's (2017) study also found that podcasts are used the least because of its seemed similar functionality to that of YouTube makes the advantage of this tool looked ambiguous and also due to the fact that it is less well-known compared to YouTube.

The reasons why some tools are rarely used and vice versa as well as how teachers integrate these tools (teaching approach and learning activities) may provide more comprehensive picture of the real potential level of Web 2.0 applications being used in educational practices spark interest for future studies. Strategies and approaches in utilising technology for teaching and learning process are significant because according to Fullan and Donnelly (2013), the use of technology without appropriate teaching strategy that requires deep and higher learning tasks by changing conventional heavy content-based or repetitive basic skills practice that aims to reproduce existing content knowledge is a waste of technological investment that only results in slightly more entertaining content delivery.

Relationship between Teachers' Web 2.0 Integration Self-efficacy and Web 2.0 Integration in Teaching and Learning of Secondary School Science

Pearson correlation (Table 7) shows a strong and significant positive correlation between the teachers' Web 2.0 integration self-efficacy and the level of Web 2.0 integration in teaching and learning of science, $r(106) = 0.62$, $p < .001$.

Table 7

Correlation between Teachers' Web 2.0 Integration Self-efficacy and Integration of Web 2.0 Tools in Teaching and Learning of Science

Pearson's Correlation *(r)*	.618**
Significance Level (*p*)	.000
n	108

** Correlation significance at 0.01 (2-tailed)

The correlation found between the variables is consistent with findings from previous studies (Alhassan, 2017; Pan & Franklin, 2011; Tweed, 2013; Ward, 2015; Wright & Akgunduz, 2018). Aside from this, this finding agrees with the theory of self-efficacy which states that level of self-efficacy induces high intrinsic motivation to cope with difficult tasks and maintain commitment (Bandura, 1994). Therefore, high self-efficacy is crucial for teachers to increase the integration of Web 2.0 technology in challenging educational environment. This statement is supported by Sadaf et al. (2016) who stated that self-efficacy is a strong indicator of teachers' intentions to integrate technology, particularly in terms of their ability to use Web 2.0 tools and their ability in classroom and instruction management. However, the inconsistency between the level of teachers' Web 2.0 integration self-efficacy and the integration of Web 2.0 tools in classroom practices shows that there are other factors aside from self-efficacy affects the teachers' desire and real integration of Web 2.0 tools in teaching. This inconsistency opens up the opportunity for further studies.

Conclusion

Web 2.0 is a potential educational tool expected to yield significant impact on instruction and learning in the context of the 21st century education (Nandhini, 2016). This study addressed gap in the field of Web 2.0 integration in secondary school level specifically in science instruction. Findings revealed that whilst teachers have moderate level of Web 2.0 integration self-efficacy, the level of Web 2.0 integration in teaching and learning of secondary school science is low. The integration of Web 2.0 in science education is still far from optimal and could be further enhanced. Strong and significant positive relationship, $r(106) = 0.62$, $p < .001$ found between teachers' self-efficacy and Web 2.0 integration levels supported by demographic data related to professional development suggest the need to increase teachers' professionalism development programme related to Web 2.0 integration in education. Teachers are primary agents of educational transformation to bring about success in educational initiatives or strategic plans (Van der Heijden et al., 2015). Therefore, teachers should be ever well-prepared with the latest education innovations and improve teaching practices according to the needs of students and current trends.

Research Implications

Findings showed that there is still much opportunity to improve teachers' self-efficacy and integration of Web 2.0 technology in science teaching practices. Improvements in professionalism such as in-service training can enhance teachers' self-efficacy and Web 2.0 technology integration in education (Almekhlafi & Abulibdeh, 2018; Alhassan, 2017; O'Leary, 2016; Onbasili, 2020; Pan & Franklin, 2011; Ward, 2015). Thus, MOE should enhance professional development efforts such as in-service training, workshops, professional partnerships and courses with the focus on developing teachers' self-efficacy and skills to deliver teaching of science with effective Web 2.0 integration. The need of more trainings/ courses are also supported by demographic data showing that 57.4% of teachers (respondents)

were not exposed to courses related to Web 2.0 integration in education while 42.6% of teachers claimed to have attended related course but 20.4% of this faction claimed that the courses were ineffective and the average hourly attendance of course was only 1.7 hours. Therefore, it can be said that teachers are not well-informed about the use and potential of Web 2.0 tools in education. In addition, findings of the current levels of teachers' Web 2.0 integration and self-efficacy may deem to be the product of teachers' own personal experience and knowledge of these Web 2.0 tools. This statement was also supported by Alhassan (2017).

In terms of enhancing professionalism, Anyanwu (2015) suggested that professional development programme for Web 2.0 integration in education should be differentiated according to teachers' mastery levels of Web 2.0 technology and include various categories of Web 2.0 tools, adequate workshop duration, practical implementation of Web 2.0 tools in the classroom as well as hands-on training. Apart from professional development for in-service teachers, Onbasili (2020) recommended teacher training institutions/ universities to take into consideration the inclusion and proper planning of technology-integrated instruction into teacher training education so as to produce well-equipped future teachers. In addition, more attention should be given to skills development related to Web 2.0 tools that enable creation of creative digital learning artifacts and management of VLE such as Wiki, blogs, LMS and various GAFE or other similar Web 2.0 tools due to the fact that these tools are platforms for students to express themselves creatively, collaboratively and enable self-directed learning (Andriani & Sagala, 2020; Barajas & Frossard, 2017; Kim et al., 2019; Sutisna et al., 2018; Sahara et al. 2018).

Apart from initiatives from the higher-ups, teachers ought to be proactive and consistently keep up-to-date with the latest pedagogical methods to continuously enhance personal pedagogical skills through professional development such as courses and workshops especially in digital skills and technology applications in teaching practices. In addition, teachers need to strive for a variety of teaching methods relevant to the needs of students.

Suggestions for Future Studies

Based on the results and limitations of this study, the following are suggestions for future studies:

1) Replicate study with Web 2.0 tools according to current technological advancement with wider geographical coverage and larger sample size.
2) Conduct mix-method studies, which include both quantitative and qualitative approach to investigate how (teaching strategies/approaches and learning activities) as well as why (reasons) teachers integrate certain Web 2.0 tools in science education.
3) Examine the contributing factors and barriers to Web 2.0 integration in science education.

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