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EFFECT OF GOOGLE SITES ON SCIENCE ACHIEVEMENT AMONG YEAR FIVE STUDENTS

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ABSTRACT

Research has shown that students' science achievement has declined because of outdated pedagogies and a lack of innovation in teaching and learning. The penetration of digital technologies into teaching could help improve this situation. This study aimed to see the effect of Google Sites on Year 5 students' science achievement. A quasi-experimental research design was used. The experimental group consisted of 35 students exposed to Google Sites, leading to more flexible and interactive learning. The students were exposed to various teaching materials such as videos and online notes and were more actively interacting with peers and teacher. In the control group, 31 students were exposed to the conventional teaching method. The pre/post-test encompassed higher-order thinking questions on the science topic – States of Matter was the main data source. The data were analysed using Analysis of Covariance (ANCOVA) with pre-test as covariate. The findings revealed a statistical difference in the mean score of students' achievements between the control and experimental group: $F(1,65) = 31.37$, $p < .001$. The experimental group achieved better scores and gave better quality answers. The study implies that teachers could use free and user-friendly technological tools to improve the quality of their teaching. However, support and space for teachers to engage and get familiarised with these tools must be made available.

Keywords: *Google Sites, Science Achievement, Technology Integration, Science Education*

INTRODUCTION

In many nations, the decline of students' science achievement is apparent. For example, England has fallen six positions in the TIMSS 2019 for science. One of the teachers' comments was that they would like to have more training incorporating technology into teaching (Burke, 2021). Similarly, in Malaysia, the dismal performance of the students in TIMSS have pushed the education ministry to launch the Malaysia Education Blueprint 2013-2025 (MEB). The MEB incorporated eleven aspects (or shifts) to address crucial issues in Malaysia's education system to become more competitive and at par with the more advanced nations in education. One of the shifts in MEB urges teachers and students to use technology tools and integrate ICT into daily lessons.

However, uptake by teachers to integrate technology into their daily lessons seem to be poor (Francom, 2019). External drawbacks such as resources, training, and support; and internal inhibition of the individual teachers, such as their self-efficacy and the value of integrating technology into their lessons, restrain teachers from assimilating technology into their daily lessons (Alenezi, 2017). Students' learning is compromised when teachers fail to integrate technology into their daily lessons. Digital native students tend to feel bored and disengaged with learning if teachers continue to use traditional teaching approaches. If students are disengaged and demotivated, their learning progress is weakened, and their science achievement will suffer. In contrast, these students are drawn to technology because it allows learning to be flexible, accessible and provides them with the opportunity to interactively engaged in learning (Sun, Lee & Law, 2016).

Teachers could use Google Sites as a stepping stone for ICT integration in teaching and learning to bridge the gap. It is an easy platform to create a website that allows teachers to add and embed text, pictures, videos, and other features to attract students to the lesson (Bradbury, 2017; Beltran, 2018). With Google Sites, teachers can arrange the topics and corresponding assignments so that students can find the content easier and plan for the activities such as classroom discussions or answering quizzes (Emiliano, 2018). Moreover, Google Sites enables students to edit pages without requiring Web coding or design (Roodt & Villiers,2012). This makes Google Sites an effective pedagogical tool. Thus, the objective of this study was to investigate the effect of Google Sites on Year 5 students' science achievement focusing on the science topic – States of Matter.

LITERATURE REVIEW

Today's primary school children is made up of Gen Z/Alpha. These children grew up with technology, the internet, and social media. Thus, for this generation of students, teachers must try to integrate technology into the classrooms (Dziuban, Graham, Moskal, Norberg & Sicilia, 2018). Much research on Google Sites has been predominately done in higher education and secondary school settings. It is paramount to study the effect of Google Sites in learning science at the primary level since the Generation Z/Alpha children are currently at the primary school level. Unfortunately, Google Sites' usage among primary students is still limited in the classroom (Tavares et al., 2011).

Google Sites is a freelance educative tool where teachers can effortlessly build websites without writing any HTML code (Pjanić et al., 2013). Google Sites make it easier for teachers to distribute information by providing suitable links to enhance students' understanding of the content (Reese, 2013). Google Sites can be used as an interactive technology platform to exchange ideas, collaborate on tasks and for teachers to scaffold student learning and provide immediate feedback (Al-Samarraie & Saeed, 2018). The quality of teaching materials is better since teachers can use images, sound, animations, and charts in Google Sites to provide a more holistic learning experience for the students (Wu, Yu & Wang, 2018).

The application of Google Sites in the teaching and learning process aligns with social constructivism theory (Vygotsky, 1978). Learning, as defined by Vygotsky, is a social activity. Google Sites becomes a platform for students to collaborate and discuss their concerns about the lessons or share ideas about their tasks in their groups (Ma et al., 2018). Teachers or peers can scaffold learning through this platform by providing more immediate and frequent feedback (Oktalia & Drajati, 2018). Moreover, learning is contextualised as teachers have a variety of teaching materials such as videos and animations to link the subject matter to real-world scenarios. Google Sites is an effective tool in assisting teachers to deliver abstract content matter effectively. Videos or 3-D models uploaded at Google Sites can help students visualise these concepts more accurately, and these concrete examples prevent students from forming misconceptions.

Thus, Google Sites integrate technology, pedagogy, content, and knowledge that enable students to understand the science content well. It prevents students from becoming demotivated and bored as Google Sites have the features to make the content matter enjoyable, entertaining and easy to learn (Salic-hairulla, Agad, Pitonang, & Terrado, 2020). Google Sites makes the classroom interesting with high student engagement and for students to learn at their own pace (Agad, Pitonang, Terrado, & Monera, 2019; Stolaki & Economides, 2018). When teachers incorporate Google Sites in their lessons, students develop a sense of connectedness to the teacher, peers and the learning materials (Nortvig, Petersen & Balle, 2018). When student learning experiences are positive, it impacts students' achievement (Elmo, 2012).

Generally, researchers have identified a strong correlation between the integration of technology in classrooms and academic achievement (Beltran, 2018; Leo & Puzio, 2016; Mashael Nasser AlJeraisy, Mohammad, Fayyoumi, & Alrashideh, 2015). However, research focusing on Google Sites show inconsistent results. For example, Al-Amour and Alimat (2016) explored the effectiveness of Google Classroom (a component of Google Site) in acquiring biological concepts. Their sample consisted of 133 students from grade 10 in public schools. Using a quasi-experimental research method, the researchers used an achievement post-test to measure the students' acquisition of concepts. The results revealed that the experimental group showed a greater understanding of the biological concepts, indicating the effectiveness of Google Classroom in the teaching process.

Similarly, Awuah (2016) studied the effect of Google Sites on science learning among 72 students ranging from 12- to 17-year-olds. The study found that 91 % of the students' achievement was satisfactory. The satisfactory science achievement gained by these students was attributed to online learning with materials that develop self-learning skills.

However, studies have shown no differences in students' achievement when using Google Classroom. Kamberi (2020) gave a survey to 24 undergraduates to see if Google Classroom was able to enhance their achievement. The study results showed insufficient indication of its effect on academic achievement. Research that did not positively affect achievement suggested that additional technological tools should accompany Google Sites (Kamberi, 2020). For example, Olagbaju and Popoola (2020) suggested using YouTube (Google Sites) with WhatsApp enhanced academic achievement.

Content on the topic -States of Matter was chosen as the pre/post-test achievement test. States of Matter has a great potential for misunderstanding because it involves various concepts such as cooling, heating, vaporising, boiling, and water cycle (Keinonen et al., 2008). Using textbooks to explain these concepts leads to a lack of understanding, especially regarding the water cycle process (Bergqvist, Drechsler, & Rungdgren, 2016). Chua and Karpudewan (2017) had shown that primary students' understanding of the water cycle process is still lacking. Students also had some trouble specifying the changes of states of Matter because they did not understand the unrealistic pictures in the textbook during changes of states (Keong & Karpudewan,2013). To make matters worse, these misunderstandings still exist when students are at the undergraduate levels (Cardak, 2018).

The literature review showed that much research on Google Sites is done at the tertiary level. Their findings seem inconsistent, and the topic – States of Matter- seems to be a difficult topic among primary school students. Thus, this study aimed to investigate the effect of Google Sites on Year 5 science achievement when learning the topic – Statement of Matter.

METHODOLOGY

This section will discuss the research methodology, which includes the research design, sample, instrument, and procedure.

Research Design

This study was a quasi-experiment design using pre-test and post-test, which suits educational research because of the impossibility of randomly selecting the sample (McMillan & Schumacher, 2010). Table 1 shows the research design for this study. The experimental group was taught using the Google Sites platform as their main source of information, and the control group was taught using chalk-and-talk and predominantly the textbook. After seven weeks of intervention, a post-test was administered to both groups. The same teacher taught both classes to avoid any biases.

Research Participants

Table 1
The research design of the study

Group	Pre-test	Experiment	Post-Test
(Experimental) A	O_1	x	O_2
(Control) B	O_1	-	O_2

Sample

The sample consisted of Year 5 students in a primary public school in Selangor. The school was chosen as a convenient sampling because one of the researchers was a teacher in that school. Two classes were randomly chosen as the experimental and control group. There were 35 students in the experimental group and 31 students in the control group.

Instrument

An achievement test was used as the pre-test/post-test to collect the relevant data for this study. The achievement test consisted of 10 multiple choice questions and three subjective questions on the topic of Matter. Questions were selected from topical tests found in activity books and the UPSR examination. The higher-order thinking questions were categorised based on Bloom's Taxonomy. The researcher discussed the selection of questions with a teacher educator and four teachers currently teaching Year 5 science. The content validity was checked by the researchers using Kappa and CVI. The result of CVI was 0.981, and Kappa was 0.974, which is more than 0.75 (excellent) (Polit et al., 2007). During the pilot study, the subjective questions showed a Cronbach alpha of 0.712, and the KR-20 for the multiple-choice questions was 0.654.

Procedure

After obtaining all the relevant documents to conduct the research, the researcher administered the pre-test to both groups. In the following seven weeks, the experimental group underwent the intervention, and the control group was taught using the traditional way. The researcher taught both classes on the topic States of Matter. Students in the experimental group were taught using videos, online quizzes, and online notes in the platform of Google Sites. The researcher became the facilitator. At the beginning of the lesson, the researcher explained the Google Sites platform and gave a briefing about what they would be doing in the coming weeks. During the lessons, the students were asked to answer the online questions, and the feedback was given immediately to help students reflect on what they had just learnt. Students were encouraged to collaborate among themselves with the online notes to gain knowledge.

The lessons would continue at home, where students could watch the selected YouTube videos, do online quizzes and read online notes. These materials were chosen to align with the curriculum, all explanations in the teaching materials were correct, and there were elements of humour. The students were also encouraged to collaborate and communicate with their peers through online chats. The online quizzes were done in Kahoot! and Quizizz paying attention to the higher-order questions.

In the control group, the students carried out the activities in the classroom with chalk-and-talk, textbook, mah-jong paper, group work, classroom discussions and Q&A sessions. At the end of the seven weeks, the experimental and control groups did the post-test. The post-test consisted of the same questions in the pre-test but arranged differently.

Data Analysis

Data obtained was analysed using Statistical Package of Social Science (SPSS), version 19.0. The ANCOVA analysis was used to determine the effect of Google Sites on Year 5 students' achievement.

FINDINGS

Based on the pre-test and post-test scores, the statistics descriptive of students' achievement are presented in Table 2.

Table 2
The Descriptive Statistics between Control and Experimental Group in Achievement

Group		Minimum	Maximum	Mean	SD
Pre-test	Experiment	3.00	12.00	6.81	2.15
	Control	2.00	11.00	6.48	1.88
Post-test	Experiment	9.00	20.00	16.81	2.61
	Control	5.00	18.00	12.81	1.88

Table 2 shows the mean score of the students' achievement of the experimental and control groups. The mean scores of the experimental and control group in the pre-test were (M=6.81, SD=2.15) and (M=6.48, SD=1.88), respectively. The total score of the achievement test was 20 marks. By referring to Table 2, the pre-test scores for the experimental group were higher than the control group. Likewise, the experimental group (M=16.81, SD=2.61) performed better in the post-test than the control group (M=12.81, SD=1.88).

The researcher had chosen ANCOVA to analyse the data with pre-test as the covariate to compare the effect of Google Sites on students' achievement. The ANCOVA analysis had an adjustment for the pre-test and found a statistically significant difference in the mean score of students' achievement between the control and experimental groups $F(1,65) = 31.37$ and $p=<.001$. Therefore, H_0 was rejected. There is a significant difference between the experimental group (Google Sites approach) and the control group (traditional teaching). The partial Eta squared value of 0.76 (small effect size according to Cohen et al., 2011) showed that 76% of the variance in the dependent variable students' achievement could be explained by the independent variable (Google Sites and traditional learning). The improvement could also be seen based on learning gain, as shown in Table 3.

Table 3
Results of Analysis of Covariance (ANCOVA) for Students' Achievement

Source	Df	Mean Square	F	Sig.	Partial Eta Squared
Pre-test	1	58.52	7.00	.001	.10
Group	1	262.20	31.37	<.001	.76

R Squared = .760 (Adjusted R Squared = .764)

The adjusted means of post-test scores of the achievement for the experimental and control groups are 16.81(SD=2.61) and 12.81 (SD=1.88), respectively. Based on Table 4, there was excellent progress in students' post-test results after being involved in the intervention (Google Sites). The result showed that the pre-test and post-test mean difference in the experimental group using Google Sites was 10.00. Meanwhile, the mean difference in the control group using the traditional teaching method was only 6.32.

Table 4
Mean Difference in Students' Achievement Between Experimental and Control Group

Group	N	Mean		Mean different
		Pre-test	Post-test	Post-test-Pre-test
Experimental	35	6.81	16.81	10.00
Control	31	6.48	12.81	6.32

As shown in Table 4, the mean difference for the experimental group was much higher than the control group. The researchers wanted to investigate if there were significant differences for the higher-order thinking questions portrayed by Bloom's Taxonomy. For each level of Bloom's Taxonomy, the experimental group showed better achievement than the control group, as shown in Table 5.

Table 5
Descriptive Statistics in Bloom Taxonomy among Experiment and Control Students

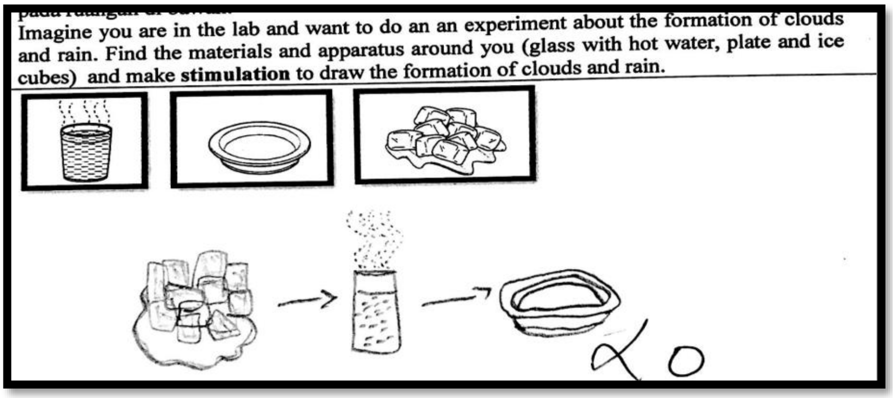
Group	Bloom Taxonomy Level	Pre-test		Post-test		Different of Mean
		Mean	SD	Mean	SD	
Experimental	Evaluate	4.08	1.60	7.03	1.01	2.95
Control	(6 questions)	4.26	1.26	6.13	1.43	1.87
Experimental	Analyze	1.43	.95	6.46	1.24	5.03
Control	(4 questions)	1.32	.94	4.48	1.67	3.16
Experimental	Create	.090	.29	1.84	.61	1.75
Control	(1 question)	.097	.30	0.97	.96	0

Both groups showed improvement for each higher-order level of Bloom's taxonomy (e.g. analyse, evaluate, and create). However, the experimental group showed better improvement compared to the control group. The students in the experimental group were able to judge, justify, and organise the science concepts problems. With the help of Google Sites, students were able to collaborate and engage with more diverse activities, which the control group were not given the opportunity. The limited resources among the students in the control group may have hindered their capability to organise and justify the subject matter.

Similarly, for the question on the create level of Bloom's Taxonomy, the experimental group showed better achievement than the control group. The result of control group in pre-test (Mean= 0.09, SD= 0.29) and experimental group showed (Mean = 0.097, SD= 0.30). In post-test, experimental group scored higher (Mean =1.84, SD=0.61) than control group (Mean= 0.97, SD=0.96). The higher mean scores in the experimental group's post-test can be attributed to activities such as creating videos to show the procedure of an experiment. The creation of videos instilled some essence of creativity in the experimental group, whereas these activities were absent for the control group.

To illustrate these findings, we probed into the answers that the experimental group had to offer. Figure 1 shows an example of a student's pre-test and post-test answers in the experimental group.

Pre-test : Question answered by same pupil got the same marks in pre-test.



Post-test: Question answered by same pupil in post-test.

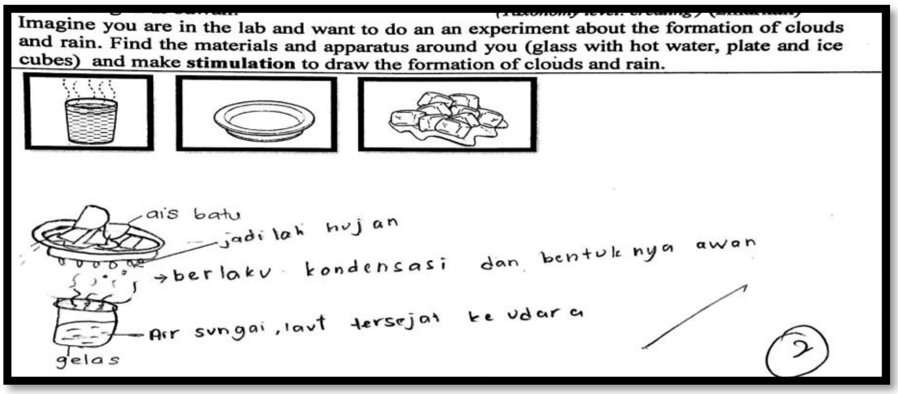


Figure 1. Example of pre-test and post-test answers by pupil in the experimental group

The question that the student had answered was categorised at the create level of Bloom's Taxonomy. This question appeared as a subjective question. The students were asked to draw an experiment on cloud formation and rain with the materials and apparatus given. The pre-test result indicated that the student did not know what the question was asking. It was because the topic was not taught to them yet. The student could not draw the cycle and did not use the apparatus and materials given. As such, no marks could be given for the answer.

Subsequently, when asked the question in the post-test, the student illustrated the entire water cycle process correctly and used all the materials and apparatus appropriately. The researcher had uploaded videos of various experiments using household items to create the water cycle. The students were asked to create a video of themselves doing the water cycle using items they could find in their houses. They had to upload the videos in Google Sites to share with their peers and for their peers to give comments about their experiment. This student understood and internalised the water cycle process and answered the question correctly.

DISCUSSION

The findings indicated that students' science achievement between the control and experimental groups $F(1, 65) = 31.37$ and $p=<.001$ were significant—the experimental groups outperformed the control group. The majority of the students in the experimental group scored higher than the control group in post-test (M=16.81 for the experimental group and M= 12.81 for the control group). The experimental group students scored better in higher-order thinking questions in Bloom Taxonomy (analyse, evaluate, and create). The findings concur with Al-Amour and Alimat (2016) and Auwah (2016).

Students who learned science with Google Sites have better learning experiences, which translated to better academic achievement. Maqbool (2016) stated that students get motivated to learn science because technology allows teachers to use various teaching materials and aids to help student learning. These materials are videos, interactive teaching materials, online quizzes, 3-D diagrams, and notes. This amalgam of teaching materials can cater to all students' learning styles and promote engagement (Wu, Yu & Wang, 2018). Moreover, Google Sites make the classroom more interesting with high involvement and learning at their own pace (Yang, 2019). This makes students independently find answers and information by themselves, which can upgrade their responsibility in learning. When students are engaged in their learning, they are more motivated to study and perform higher in their achievement tests (Steinmayr, Weidinger, Schwinger & Spinath, 2019).

Google Sites provides a platform for collaboration. Vygotsky (1978) has emphasised the importance of social interactions when learning. When students collaborate during a task, the cognitive load of the task is distributed among the group members (Kirschner, Sweller, Kirschner & Zambrano, 2018). As the students negotiate and interact when doing the task, they also improve their communication skills and learn to work in groups (Thomas & Watters, 2015). The students work together to learn new concepts in science. This study further indicates that Google Sites play a significant role in improving the learners' achievement test. The presence of technology in the classroom facilitates a greater understanding of course content contributes to higher academic achievement and 21st-century skills (Alt, 2015; Schindler, Burkholder, Morad & Marsh, 2017).

In traditional settings, students do not have the flexibility to approach their peers or teachers for support. Thus, if the students were completing the homework and faced difficulties, they had to wait until they met their teacher to iron out their problems in the next lesson. Working in isolation would like to frustration and demotivation in learning. In contrast, using Google Sites, students can pose any questions they have difficulties with and get feedback almost immediately from their peers or teachers. Immediate feedback boosts students' confidence in learning because they are scaffolded to take the next step in their learning. Progression of learning is smooth for these students, and they face fewer frustrations. Students can complete their work efficiently and enjoy learning with guidance and support, ultimately increasing their achievement (Fu, Chu, & Kang, 2013).

CONCLUSION

This study shows that the Google Sites application is an effective learning platform for Gen Z/Alpha. Being digital natives, these students are comfortable when technology is brought into the classroom. With the diminishing number of students furthering their studies in STEM, Google Sites may be a way to attract these students (Denton, 2012; Schneckenberg, Ehlers, & Adelsberger, 2011). Using Google Sites can effectively help students understand science concepts easily and boost their achievement.

However, many aspects contribute to the success of using technology in the classroom. Not all teachers are technologically savvy, and they would need training and support to upgrade their technical skills to support their students' learning (Ilomäki & Lakkala, 2018). Efforts must be made to develop digital self-efficacy and technological literacy among teachers. When teachers are more technology savvy, they can create more 21-century learning experiences. Even though students are digital natives, many may not have the luxury of devices that could support online learning. There must be a systemic effort to ensure students are equipped with suitable devices to participate and engage in their learning, hence improving academic achievement. If these efforts are put in place, the Malaysia Education Blueprint 2013-2025 (MEB) aspirations could be a reality.

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