The COVID-19 Pandemic: Web 2.0 Tools as an Alternative Instruction for Science in Secondary Schools

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***Abstract*—COVID-19 pandemic had caused an unprecedented impact on teachers and students in their teaching and learning process. Diverse teaching and learning tools are essential to ensure that education continues. This confinement provides an opportunity to enculture a new norm for learning among Malaysian students and teachers. Usage of web 2.0 tools has indirectly encouraged students to study on their own and communicate dynamically with peers and teachers during online lessons. A mixed-method quasi-experimental study involving pre-test and post-test was conducted to investigate the impact of using web 2.0 tools on students' achievement. 60 Form Two students were divided into control and experimental groups where the experimental group had lessons using The Product, Process, Person, and Press model of creative approach with web 2.0 tools while the control group was taught using the teacher-centered instruction. The creative approach using web 2.0 tools has not only produced advancement in students' achievement in the science subject but has also motivated them to complete the assessments given during online lessons. The findings also emanated that students' motivation to learn science through online learning was due to the usage of 2.0 tools. Hence, science teachers ought to be better prepared with the skills as well as better-designed learning modules and experiences to incorporate integrated online learning and face-to-face class with a blended learning approach seamlessly.**

***Index Terms*—COVID-19, web 2.0 tools, quasi-experimental design, teaching strategy, four P's model of creativity.**

I. Introduction

The coronavirus disease 2019, also known as the Covid-19 pandemic, has affected us in many aspects, including our educational system. Universities, schools, and colleges were near-totally closed worldwide. Most countries have drastically shut down educational institutions in an attempt to stop the spread of Covid-19. It is said that approximately 1.725 billion learners worldwide were affected due to these closures. As reported by UNICEF [1], about 98.5 percent of the world's student populations were impacted, when 134 countries implemented nationwide closures and 38 more implemented local closures. Thus, impacted not only students, teachers, and families, but also in-class face-to-face learning.

How can educational systems worldwide continue an ongoing education for students amidst the current COVID-19 pandemic? In response to that, UNESCO suggested using a distance learning method, where schools and teachers can reach learners remotely, limiting the disruption of education. Fortunately, most countries have some form of distance education technical infrastructure, which they can immediately use to provide ongoing educational opportunities. Furthermore, since no one can predict this pandemic's trajectory, but assuming it continues over the next several months, education systems may wish to shift to distance learning entirely.

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II. Research Background

A. Integration of Web 2.0 Tools in Teaching

The Movement Control Order (MCO) has been implemented by the Malaysian government in containing the COVID-19 outbreak. Thus, it has significantly impacted the Teaching and Learning (T&L) and assessment activities of our educational system nationwide, as all educational institutions are closed, which has affected 8 million students. So, the teaching and learning process has to turn into the new norm – e-learning, where students will go through home-based learning; this means they will be fully embracing a digital education environment. As such, in making sure knowledge is well retained, web 2.0 tools are among the mechanisms that are suitable [2]. Besides, the integration of technology will benefit and also enhance the process of teaching and learning [2]-[5].

The usage of web 2.0 tools to support knowledge management practices and sharing information has been acknowledged by various studies [2], [6]. Some studies declared that web 2.0 tools facilitate a more socially connected web, enabling people to communicate, collaborate, participate, and also share knowledge [7], [8]. It can encourage the exchange of knowledge in academic libraries [9]. Lai [10] commented that using interesting and creative delivery methods such as Information and Communication Technologies (ICT), Computer Assisted Learning (CAL), and web 2.0 tools by teachers can engage and attract students to learning.

The environment where we live today, according to Gomez-Gala [11], enables us to use interactive technologies. As an example, smartphones and tablets are in favor of the development of digital competence. In this same line, Mobile Learning, Flipped Classrooms, Online Learning, Social Networks, Virtual Reality, and many other technological methods will be the main technological trends in education for the next few years in the future [12]. Furthermore, a pandemic may happen again at any time in the future. Using web 2.0 tools as a teaching method is considered a preparation for teaching in the future. Hence, having this type of instruction will surely be beneficial to all stakeholders in

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the education system.

B. Knowledge of Acid-Base

Form Two students (14 years old) will be learning acid-base topics in Science subjects. However, that topic has posed many problems to students of various backgrounds. Burns [13] indicates that high school students are also facing difficulties on this topic. Several other studies showed that students held several misconceptions about acid-base [14]-[17]. In this same line, there are also several studies which have been documented referring to misconceptions about acid-base, held by students and teachers alike [18]-[25]. As such, in this paper, we decided to introduce an alternative instruction in teaching and understanding acids and bases for Form Two students.

In Malaysia, the topic of acid-base is introduced in Year Three at primary school within the scope of a science subject. Later, they will learn more about this topic in Form Two when they enter secondary school. However, studies showed that students are having difficulties and misconceptions about this topic. For example, some students define neutralization as an acid breaking down rather than considering neutralization as a reaction between an acid and a base. Another misconception regarding acid-base is that acid eats material away, and acid can burn you [16]. Concepts of acid-base continue to be a problem for students at all levels of schooling, as indicated by several past studies [18], [20], [23]-[25]. As such, alternative instruction is required to overcome students' difficulties and misunderstandings on this topic. Therefore, this research aimed to study the impact of using web 2.0 tools as an instructional approach to teach Form Two acid-base concepts compared to the traditional teacher-centered instruction.

C. Rhodes Theory of Creativity

Rhodes [26] emphasized the significance of a holistic perspective on creativity in four areas of study and wished that it would form the basis of a single creative theory. This theory offers a useful instrument for understanding the multidimensional nature of creativity and the study of creativity theories [27]. Four common themes of creativity, which he called "four creative Ps," were classified by Rhodes [26]. To complete beyond the interaction chain among four creative Ps, the potential existence of all four aspects must be accountable for an accurate and comprehensive definition of creativity [28]. A creativity framework of 4Ps includes: "Product" denotes as a thought or physical objects, system, ideas, process or other material; "Process" refers to motivation, perception, learning, experience, thinking, and communication; "Person" relates to personality, self-concept, attitudes, intellect, physique, self-concept, value systems, temperament or behavior; and "Press" implies the association among human beings and their environment. In this research, this four-dimensional conception of creativity led the design, conduct, and evaluation.

D. The "Four P's" Model of Creativity

The Four P's model of creativity identified by Rhodes [26], brings significant practical implications in various fields, including education, business, engineering, et cetera [29]. According to Gruszka and Tang [29], this 4P's model of creativity can be effectually used to guide the researcher's concentration to learn more about the different ways to foster creativity in different settings. As an example, this model is appropriate for the implementation in the education field during the Covid-19 pandemic, where teachers and students have to teach and learn fully online; thus, it might probably improve educators' teaching and students' learning. Furthermore, the application of 4P's model would expedite students' problem-solving skills in the academic learning domain. Liu and Chang [30], who manipulated a systematic review and meta-analysis study has espoused that there was significant effective result contributed by the 4Ps Creativity Teaching approach. A similar result propounded from a dissertation study conducted by Alsahou [31], which emphasized the creativity and educational practices for nurturing creativity in science classrooms, claimed that this model positively supported teachers' and students' creativity skills in the science classrooms. Four components were adopted as guidance in this current research which was based on the 4P's Model of Creativity: i) product, ii) process, iii) person and, iv) press of the environment [28], [32].

E. Research Questions

- What is the science (acid-base) achievement level in pre-test and post-test for the control and experimental group?
- Is there any significant difference between traditional instruction and the alternative instruction on the "Four P's" model of Creativity using web 2.0 tools on the achievement of science (acid-base) among the Form Two students?
- What are the students' opinions of using web 2.0 tools as an alternative instruction in learning the acid-base topic?

F. Research Hypothesis

Ho1: There is no significant difference between the traditional instruction and the alternative instruction of using the "Four P's" model of Creativity using web 2.0 tools on the achievement of science (acid-base) among the Form Two students.

III. Methodology

A. Research Design

This study used quasi-experimental by using pre-test and post-test design consisting of explanatory mixed methods design [33], [34]. Explanatory mixed-method consisted of two phases; the first phase focused on quantitative data collection followed by the second phase which focused on qualitative data collection. This study aimed to determine the difference in achievement between two groups of students. Based on Table I, Group 1 was the experimental group who underwent the "Four P's" model of Creativity using web 2.0 tools as their instruction, while another used a traditional instruction method or teacher-centered teaching and learning [34], [35]. The quantitative method was used to obtain data from the pre and post-test results of both groups. While for the qualitative method, students' responses from the open-ended questions showed their opinions on the

alternative teaching. Web 2.0 tools teaching and learning put emphasis on communication skills, learner-centredness, integrated skills, the process of learning, solving multiple solutions, and tests. By the end of this study, students who underwent the alternative teaching instruction should have all of these skills. It has been found that the "Four P"s model of Creativity using web 2.0 tools is very suitable and practical during this trying time. All students can participate actively using their handphones, tablets, and also laptops, to make sure the teaching and learning process is maintained.

TABLE I: QUASI-EXPERIMENTAL DESIGN

Group		Teaching Method	
Control Group	Pre- Test	Using traditional instruction without web 2.0 tools	Post-Test
Experimental Group	Pre- Test	Using alternative instruction "Four P's" model with web 2.0 tools	Post-Test

B. Participants

Secondary school students aged 14 years old in a national secondary school in Kedah were selected as participants. The school is advocating the secondary school standard curriculum under the Ministry of Education Malaysia. The participants consisted of 60 students in total, 30 students for each group. They completed the pre-test and post-test to compare the effectiveness of web 2.0 tools in teaching and learning.

The experimental group used Padlet, one of the web 2.0 tools for e-learning, or as a medium of instruction. It served as a platform for students to participate actively and obtain information, complete exercises, ask questions for further clarification, and also discuss with teachers and friends in a forum. Padlet presents numerous contents and activities, enabling it to engage and stimulate students in active learning. Active participation will provide information for the teacher, thereby; the teacher can plan and take further action to make sure meaningful learning is maintained. Padlet is like a paginate full of post-it notes, where students can add videos, text, links, text files, and pictures [36]. So, students can submit their assignment, quizzes, or exercise through this medium at any time.

C. Instrument

A set of acid-base topic questions was selected from the Form Three Assessment (PT3) question bank. PT3 is a summative assessment to assess students' academic achievement at the lower secondary level in Malaysia (15 years old), where the assessment covers the scope of the syllabus from form 1 to form 3 (age 13 to 15 years old). This set of questions, constructed using the google form platform, consisted of 22 multiple choice questions which covered the levels of understanding, knowledge, analysis, and application. As suggested by Jones [37], a good examination paper should comprise various difficulty levels to accommodate students' different capabilities. Simultaneously, the scoring was based on the scoring standard of the secondary school science public examination in Malaysia, where one mark will be given for each correct answer. All participants were tested on their knowledge of acid-base properties, the use of acid-base, and the importance of acid-base in life.

D. Reliability

A pilot test was carried out involving 50 Form Two students who did not belong to any group - experimental or control groups. The result from the pilot test was analyzed to determine the reliability of using KR 21. The reliability value was .88 meaning the reliability was excellent to be used in the actual study [33].

E. Face and Content Validity

Face and content validity were conducted on all items in the instrument, to ensure each item synchronizes with the content of the subject for the Form Two acid-base topic on the *Standard Document* for *Curriculum and Science Assessment* (*DSKP*). This validity test was carried out by Langkawi District Officer and two specialist teachers in Science, where they were required to evaluate the item in every aspect, such as problems, proper terms, ambiguity, and also understandability.

F. Teaching using the four P's Model of Creativity Web 2.0 Tools

Padlet was one of the web 2.0 tools being used as a teaching tool for the treatment group during online teaching and learning sessions. Padlet is designed and built to facilitate students' carry activities after class and prepare for the next class. It is also used to ensure that every assignment outside the classroom is performed and can be submitted at any time. It is an interactive virtual wall where students can share their answers and thoughts, get teaching notes, collaborate amongst them, even academically argue on specific issues [38]. Other advantages of using Padlet as a platform of online teachings are that teachers can upload materials such as videos, quizzes (web.2.0 tools), virtual science experiments, and also a discussion place among peers and teachers [39]. Four sessions of teaching and learning were carried out virtually that took four hours; therefore, it has already fulfilled the time required or allocated in an annual teaching plan for teaching acid-base topics. Videos, teaching notes, youtube links, and also virtual experiments which were uploaded in the Padlet were used by the students during the four sessions of teaching and learning activity within four weeks. Fig. 1 shows the Padlet wall and the contents in it. There was also a segment with an exercise question in the Padlet for enrichment purposes on this topic. Students have to answer this question, then upload their answers in Padlet itself to be checked and commented on by teachers as well as other students too (Refer Fig. 2). They could answer according to their preferred time. Each of the questions has been discussed virtually earlier.

Fig. 1 shows how the Padlet was used for the experimental group containing teacher's notes, exercises, students' work, and virtual experiments. Students were free to upload assignments and conduct online referrals at any time. The assignment could be assigned according to their creativity based on the teaching materials provided in the Padlet. The circle shows evidence that some students used handwriting, and pictures were taken and sent to the Padlet. This means all the students could use their creativity in responding to learning activities. At the same time, the teacher would respond to each student's work that they have displayed in the Padlet individually. This shows that Padlets are very

beneficial for e-learning and create interesting and stimulating activities for students in active learning.

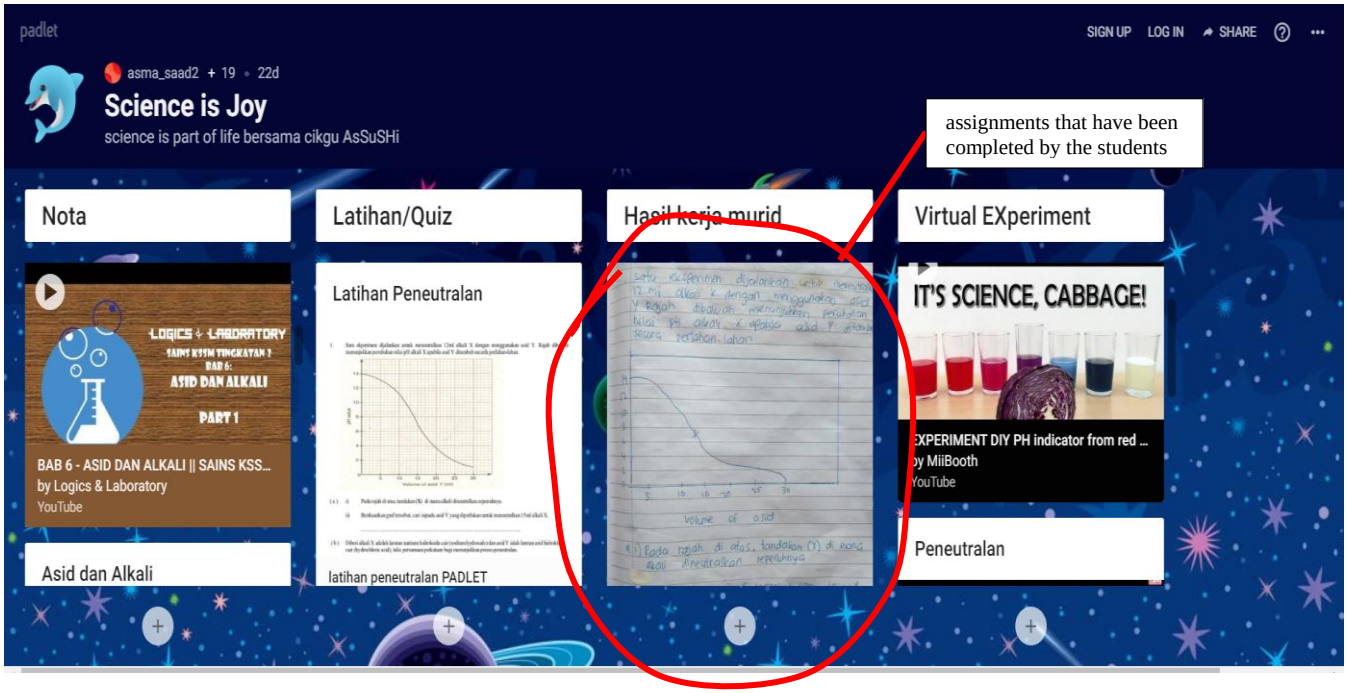

Fig. 1. Padlet wall for Science acid-base topic.

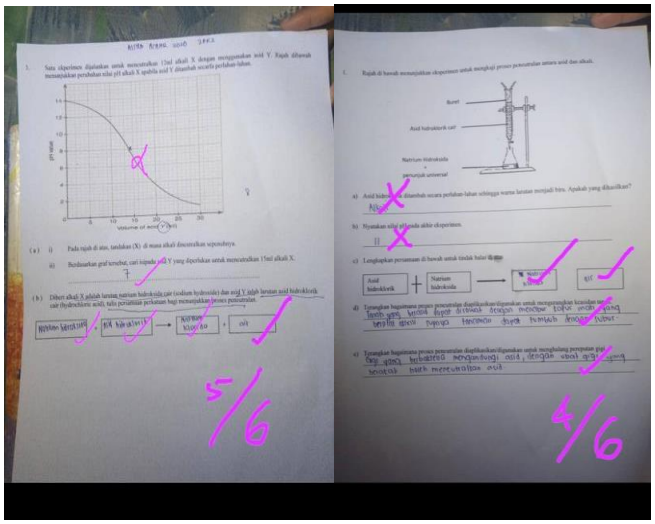

Fig. 2. Student's task.

Fig. 2 shows examples of students' assignments shared in the Padlet application. The answers were marked accordingly. Communication in the Padlet application helped the teacher to guide students to make corrections for any wrong answers. Any uploaded materials in the Padlet could be used repeatedly thus increasing students' understandings and they would have the chance to review the materials at any time convenient to them.

Besides Padlet, other social media such as the WhatsApp application was also actively used. The Padlet link was shared with the students through the WhatsApp channel. Students seemed comfortable and were active, having the chance to ask and respond virtually. Fig. 3 shows some of the interactions that take place through the WhatsApp application.

Fig. 3 shows an example of a discussion that took place between students from the experimental group with a class teacher. Through the WhatsApp application, it was easier for teachers and students to solve learning problems at any time, even outside of school hours. In addition, students also used the Padlet application as a medium for discussion of learning content from time to time.

Fig. 3. Example of the discussions in the WhatsApp group.

G. Traditional Method Teacher-Centered Instruction

The traditional method is a teacher-centered teaching method practiced during teaching and learning sessions for the control group. In this method, students focused entirely on the teacher. The teacher did all the information sharing while students would only listen. The teacher presented information or explained things regarding acid-base to the students who received the knowledge being presented passively. This group also used a science textbook produced by the Ministry of Education, as shown in Fig. 4. The students answered the reinforcement questions given by the teacher. There were no active engagements, no collaboration. Students had to work alone and did as told by the teacher. Any active learning was discouraged. This learning took four hours to complete; as such, it has already fulfilled the

requirement as allocated in the annual teaching plan.

Upon completion of the four hours teaching and learning session, which took four weeks to complete, the post-test was carried out for both groups – the experimental group and the control group.

Fig. 4. Form 2 science text book.

H. Data Collection Procedure

The learning activities of acid-base topic implemented through quizizz application (refer to Fig. 5). All students from both groups had to answer the 22 multiple choice questions by clicking the google form link posted in the WhatsApp group. The pre-test and post-test data were collected using the same instrument and the same approach for both students' groups. The collection process began with a pre-test, which was taken place before any intervention or learning session was started. Once the pre-test was completed, treatment sessions were conducted for both groups with different approaches. The collection data for the post-test was carried one month after the pre-test has taken place, which was upon completion of the learning sessions for both groups of students. Meanwhile, qualitative data using open-ended questions were collected through a google form, which was also sent through the WhatsApp application. Students typed their feedback in the google form, as shown in Fig. 6. It was carried out after the completion of the teaching and learning session for both groups.

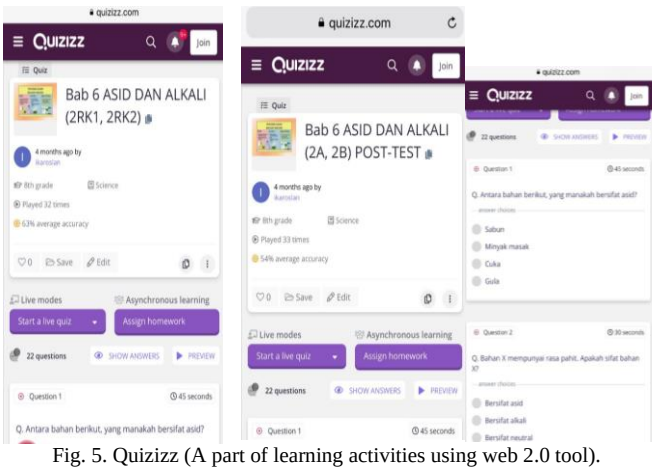

Fig. 5. Quizizz (A part of learning activities using web 2.0 tool).

I. Data Analysis

Data analyses were divided into two parts namely the quantitative part (descriptive analysis to answer research question 1 and ANCOVA test analysis to answer research question 2). Meanwhile, for the qualitative part, thematic analysis was used to analyze data from open-ended questions based on students' opinions towards using web 2.0 tools in teaching and learning.

To measure the achievement of the science topic among students, the SPSS program was used in obtaining descriptive analysis using the percentage. ANCOVA analysis was done to obtain the impact of using the Web 2.0 Four P's Creative Model teaching approach. In addition, ANCOVA analysis was also conducted to compare the mean values between both groups [40]. Following are the levels of achievement for both pre-test and post-test of Form Two science students' achievement for the acid-base topic: 85% - 100% (Excellent), 61% - 84% (Good), 41% - 60% (Satisfactory), 0% - 40% (Weak). The data from open-ended questions collected using google form were transcribed. The findings were analyzed by labeling according to themes, and conclusions were made based on the research question [41]. Thematic content analysis was used because the focus of data analysis from open-ended questions was on thematic content that was identified, categorized, and elaborated based on systematic research. Themes were generated inductively from raw information obtained from student feedback through open-ended questions. The data were analyzed according to the following steps namely i) selection of the subtext, ii) sorting materials into the categories, iii) Producing conclusions from the results. There were two open-ended questions made namely: i) "How do you feel about learning science using web 2.0 tools?" ii) "What is your opinion on learning science using web 2.0 tools and traditional method (textbook)?". The themes extracted were 'more fun, easier to comprehend the content knowledge, interesting to learn, and also provide new experiences to both teachers and students.

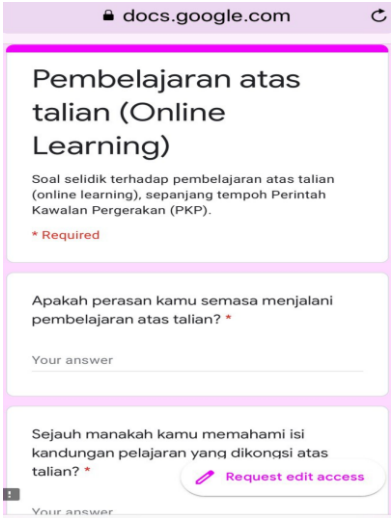

Fig. 6. Google form for qualitative data collection.

IV. Finding

The findings are reported in two parts, which are quantitative and qualitative.

A. Quantitative Result

Table II shows the mean level of achievement for both groups where the mean for the experimental group was

higher (14.94) compared to the mean for the control group (13.12).

TABLE II: MEAN LEVEL OF ACHIEVEMENT FOR CONTROL GROUP AND EXPERIMENTAL GROUP

GROUP	Mean	Std. Deviation	N
CONTROL	13.12	2.012	32
EXPERIMENT	14.94	2.285	32
Total	14.03	2.323	64

Table III shows the pre and post-test achievement of the control group. The findings showed that students' achievement was excellent with 3.2 % (*n*=1), satisfactory with 53.2% (*n*=17). Students' achievement for both good and weak were 21.8% (*n*=7) each. The result in the post-test showed increment in good and satisfactory at 46.8% (*n*=15) each. Only 6.4 % was weak.

TABLE III: PRE-TEST AND POST-TEST CONTROL GROUP

Method	Category	Pre-test		Post-test	
		f	%	*f*	%
Using traditional instruction without web 2.0 tools	Excellent	1	3.2		
	Good	7	21.8	15	46.8
	Satisfactory	17	53.2	15	46.8
	Weak	7	21.8	2	6.4

Table IV shows the achievement for the experimental group. Pre-tests showed that a considerable number of students were at a satisfactory level of 59.4% (*n*=19) and weak was 12.5% (*n*=4). None of the students obtained an excellent scoring category. The increment score showed after the completion of the lesson using alternative instruction with web 2.0 tools. The results showed an increment in the number of excellent categories that was 15.7% (*n*=5) compared to the pre-test. It was a significant increase in the satisfactory category at 62.5% (*n*=20), and none of the students were in the weak category.

TABLE IV: PRE-TEST AND POST-TEST EXPERIMENT GROUP

Method	Category	Pre-test		Post-test	
		f	%	*f*	%
Using alternative instruction "Four P's" model with web 2.0 tools	Excellent			5	15.7
	Good	9	28.1	20	62.5
	Satisfactory	19	59.4	7	21.8
	Weak	4	12.5		

ANCOVA test analysis was performed to see the differences in achievement for the control and treatment groups. Levene's test was to make sure both groups were homogeneous prior to any treatment given. Table V shows that the test result was (p=0.867, >0.05), homogeneity through Levene's test was insignificant, which meant that both groups were of the same level at the beginning of the study.

TABLE V: LEVENE'S TEST

F	df1	df2	Sig.
0.028	1	62	0.867

The test between-subject effects schedule is the result of the ANCOVA test (refer Table VI). The output showed the effect of independent learning method variables on post-test results ($F(2,61) = 13.0$, $p<0.05$). These results indicated that there was a significant difference between traditional teaching method and alternative instruction on science (acid base) topic among form 2 students (1.61 = 11.88, $p<0.05$) based on student achievement. It meant that hypothesis null was successfully rejected. Therefore, it could be concluded that the method used did significantly affect the students' science achievement.

TABLE VI: ANCOVA TEST ON THE METHOD OF TEACHING PROCESS

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	99.428[a]	2	49.714	12.609	.000
Intercept	428.666	1	428.666	108.722	.000
PRETEST	46.866	1	46.866	11.886	.001
Method of teaching	51.488	1	51.488	13.059	.001
Error	240.509	61	3.943		
Total	12940.000	64			
Corrected Total	339.938	63			

B. Qualitative Results

For the open-ended questions, the researchers labeled the themes found in the responses. The themes for scientific learning sessions using the Four P's model of Creativity with Web 2.0 Tools were more fun, easy to comprehend the content knowledge, interesting to learn and give new experiences in the learning process. The findings showed that most students agreed that the creative approach using web 2.0 tools were exciting and enjoyable in the learning session, and this allowed them to learn science joyfully. Below are some of the students' responses from the open-ended questions:

"I feel fun to be able to learn even online. Online learning is not boring. I could understand the content of lessons shared online just like I can understand the content of lessons in school." (S9)

"I have much fun while having an online learning. Online learning is not boring. I can understand many aspects." (S16)

"I have more time and feel more comfortable when learning online. Online learning is not boring because it provides a new experience for me and it is more comfortable at home doing online learning." (S30)

Students established that learning using web 2.0 was an enjoyable learning session and has provided them with new learning experiences. Four P's model of Creativity with Web 2.0 tools was recognized as useful as it was also linked to the creative model, videos, Padlet, Quizizz, and WhatsApp. Moreover, it provided a significant experience for students from their perceptions of scientific subjects. Consequently, students' attraction to scientific for acid and based topics was also enhanced.

V. DISCUSSION

The findings of this research were able to address the

research objectives set earlier, which were i) Form Two students' acid-base topic achievement level in pre and post-tests for both control and experimental groups, ii) significant difference between traditional instruction without web 2.0 tools and the alternative instruction on "Four P's" model of Creativity with web 2.0 tools on the achievement in the acid-base topic among the Form Two students, iii) students' opinion on using web 2.0 tools as an alternative instruction for the acid-base topic. The following will be a thorough discussion of the findings to address the three research questions.

The findings in the control group from the pre-and post-test showed a significant improvement in overall student achievement in the post-test. On the other hand, for the treatment group, the post-test results showed most students have improved to satisfactory, good, and excellent categories. No one was in a weak category. Prior, the pre-test results showed the two selected groups were comprised of good, satisfactory, and weak achievers. There was a significant difference between the control group compared to the treatment group whereby the achievement of the treatment group using web 2.0 tools were better than teaching without web 2.0 tools. This result is in line with [3]−[5], who claimed that the integration of technology in teaching can benefit and enhance the teaching and learning process. In addition, Mosha [2] added that web 2.0 tools are considered among the mechanisms that can be used in teaching and learning sessions. This study has proven that there was a significant difference between the control and treatment groups on the achievement of Form Two students on the acid-base topic. Hence, it shows that the teaching method using web 2.0 tools was better than the traditional method.

Teaching and learning through web 2.0 tools is convenient for both sides – teachers and students. Students have ample time to download notes, watch YouTube videos, or whatever materials being uploaded by the teachers in the Padlet. Students could also interact and discuss the lessons learned among peers without time constraint. Furthermore, assignments or tasks posted in the Padlet enabled students to complete them at their own time and place virtually. The communications through the Padlet wall among students and teachers enabled everyone to recall and read again and again. Everyone was able to share whatever material, either notes or answers to the exercises presented by the teacher. The Web 2.0 tool has also enabled teachers to virtually access the assignments and monitor the development of their students' learning.

Four P's Creative Model of Teaching was used in the classroom with web 2.0 tools (experimental group) and without web 2.0 tools (control group). The experimental group underwent learning activities that encouraged interaction using the Padlet and checking the answers and discussing the task given. Teaching using web 2.0 tools showed that students were having a good time and gave a positive impact on the students' interest, hence improving their achievement in understanding the acid-base topic. The web 2.0 tools have actually assisted teachers to expand the use of ICT in teaching, to improve their teaching quality and thus improve the quality of student achievement.

While this study has proven that using web 2.0 tools as an alternative instruction is good, there are still some factors that need to be explored. Some restrictions faced in the implementation of web 2.0 tools were teachers' skill in using web 2.0 tools for teaching; and internet coverage problems in certain areas. It is hoped that this study will help teachers change the way they teach the science subject in the classroom and allow teachers to monitor the level of student achievement easily through the use of web 2.0 tools. As such, the teacher can also identify the students' weaknesses and provide direct guidance directly and personally. This study was conducted only on the science subject in secondary schools. For further study, other future researchers can also study the implementation of web 2.0 tools in pre-schools and higher education to enhance learning in other subjects.

VI. Conclusion

In conclusion, the quantitative findings of this study have shown that the use of (Padlet as a component) web 2.0 tools had a significant effect on students in terms of i) students' achievement scores in science-acid and base topic, ii) performance comparison among control and treatment groups which proved that using the four P's model of creativity integrated with the use Padlet as a teaching medium has encouraged student growth. Meanwhile, the qualitative findings from the open-ended questions proved that the use of the four P's model of creativity with Padlet as Web 2.0 tools have i) given enjoyment and fun when students learned the acid and base topic, ii) helped students comprehend easily and more interestingly, iii) provided a new learning experience in this confinement as well as provided mutual communication among students and teachers during the online class session. The use of web 2.0 tools in online learning should be practiced by science teachers in other critical topics, and other subjects generally, to assure that students embrace science as a fun subject. The use of web 2.0 tools in learning is parallel with the present trend, in line with the national education agenda towards the 4.0 industry revolution. This study has successfully substantiated that the use of technology in teaching and learning contributes to the enhancement of students' achievement and interest in learning. Despite the fact that this study does not reflect the overall improvement of students' achievement throughout the country, the researchers believe that teaching instructions using web 2.0 tools will enable student learning sessions to be more significant. This present study has only emphasized the acid and base topic; hence it is recommended that other researchers pursue a study of a different creative model or other teaching strategies and approaches inside or outside the classroom. Undoubtedly, it is a need to provide expert training to teachers, master the skills to design, and implement the application of technology in the teaching and learning process.

Conflict of Interest

The authors declare no conflict of interest.

Author Contributions

Dr. Nurulwahida Azid was the lead researcher and she

provided the accurate data analysis and advice on the research process to be implemented and suggested related literature review while Lee Yi Shi, Asma Saad and Suhaini Che Man are teachers who were involved in the implementation of quasi-experimental and data collection. Dr Yee Mei Heong conducted the review editing of this paper to make sure it was related to the aims and scope of the journal. All authors were committed to review the final manuscript.

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mathematics classroom," Master thesis, Rowan University, New Jersey, United States, 2017.

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