(HoLKs) HOME-LAB KITS UTILIZING ARDUINO SCIENCE JOURNAL APP: ENHANCING SCIENTIFIC ATTITUDES IN A NEW NORMAL GRADE 7 CLASSROOM OF BIÑAN SECONDARY SCHOOL OF APPLIED ACADEMICS

MICHAEL V. VINLUAN
Teacher III
Biñan Secondary School of Applied Academics

ABSTRACT

One classic problem in science education is non-participation to scientific inquiry. In an initial FGD conducted, eight (8) out of eleven (11) teacher participants mentioned that leaner's participation in scientific activity may lack as they will be given less opportunities to discover learning thru hands-on or laboratory activities due to the current situation of New Normal Education.

The study determined if the (HoLKs) Home-Lab Kits was able to enhance scientific attitudes of selected students of Biñan Secondary School of Applied Academics. (HoLKs) Home-Lab Kits is an enrichment learning kit to support the provided Self-learning Modules (SLMs). It was composed of three (3) hands-on laboratory activities in Grade 7 Physics, activity sheets and safety measure provisions all contained in a plastic box. For the measuring device in the four activities, students utilized the Arduino Science Journal mobile application.

Initial and final SAI II results for positive (PPS) and negative (NPS) position statements were analyzed by t-test for Paired Two Sample for Means. The Initial SAI II results for PPS means (*M=1.74, SD=0.34*) were statistically significantly higher ($t(5) = -7.94, p < 0.05$) than the Final SAI II results for PPS (*M=4.54, SD=0.53*). Meanwhile, initial SAI II results for NPS means (*M=3.08, SD=1.20)* were not statistically significantly different ($t(5) = -0.06, p > 0.05$) than the Final SAI II results for NPS (*M=3.14, SD=1.25*). Utilizing HoLKs to respondents was an appropriate and effective method to enhance scientific attitudes. The pupils who were exposed to HoLKs exhibits motivation and interest in the learning activities in Science 7.

Keywords: *scientific attitudes, learning kit, new-normal science classroom*

INTRODUCTION

This study leaned towards one of the principles wherein the Basic Education – Learning Continuity Plan (BE-LCP) stands on. It states that under section 3 (b) of D.O. 12 s. 2020 the continuity of learning should be ensured through K-12 curriculum adjustments, alignment of learning materials, deployment of multiple learning delivery modalities, provision of corresponding training for teachers and school leaders, and proper orientation of parents and guardian of learners.

Specifically, this study was anchored on the principle of aligning learning materials to the needs of students in a new-normal classroom. Since Biñan Secondary School of Applied Academics crafted a School Learning Continuity Plan catered to the results of the Learner Enrolment and Survey Form (LESF), for school year 2020-2021 the school implemented modular distance learning modality.

Therefore, learning materials to be provided are self-learning modules (SLMs) where students must be able to acquire Most Essential Learning Competencies (MELCs) just by answering the activities independently. In a focus group discussion (FGD) conducted by the researcher with all science teachers of Biñan Secondary School of Applied Academics a common theme of concern for a successful teaching-learning process to be attained is the scarcity of hands-on activities that the MDL modality could not provide learners. Ten (10) out of eleven (11) participants mentioned that they are worried if students will be answering the science SLM enthusiastically.

This was where the idea of (HoLKs) Home-Lab Kits Utilizing Arduino Science Journal App came about. It is a safe, simple but engaging experiment kit that students may take home as an enrichment activity to support self-learning modules (SLMs). One could not overemphasize the importance of teaching and learning science through providing experiments. Many scientists and educators highlighted that having experiments in science lessons is beneficial to students (Bretz, 2019).

But due to recent events, science teachers are subjected to a predicament of allowing students to conduct experiments in a distance learning format. Teachers must provide simple and safe experiments that students may perform in their houses. Hence, there is an impending issue on students' engagement to scientific activities thus leading to poor attitude towards the subject (Ural, 2016).

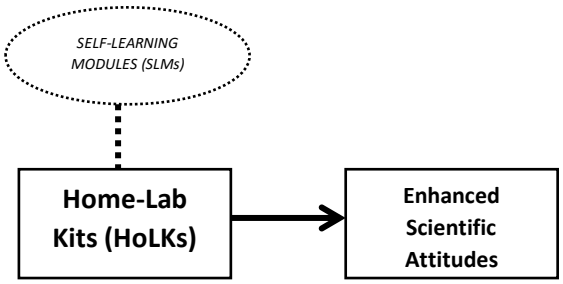
However, the new-normal classroom setting imposes a challenge for science teachers. While lecturers are slowly adjusting to remote instruction, there are some teachings and learning elements in science that cannot be replicated easily at home (Rafidi, 2020). This includes laboratory experiments necessary for the "hands-on, minds-on" process of acquiring scientific knowledge.

Consequently, another classic problem in science education of non-participation to scientific inquiry was perceived to progress. Eight (8) out of eleven (11) teacher participants of the FGD mentioned in their answers that leaner's participation in scientific activity may lack as they will be given less opportunities to discover learning thru hands-on or laboratory activities. According to Iksan, Osman and Salehudin (2018), this may lead to not enhancing scientific attitudes which is an important aspect on promoting greater interest towards science.

This imposing threat of students' engagement in science activities made the researcher interested on creating

enriching materials to teach scientific concepts and promote positive scientific attitudes to students. Thus, this study was aimed to determine if the kit enhanced scientific attitudes of selected Grade 7 Students in Biñan Secondary School of Applied Academics.

The idea of the study is shown in the conceptual framework below:



Conceptual Framework of the study.

(HoLKs) Home-Lab Kits is an enrichment learning kit to support the provided Self-Learning Modules (SLMs) by DepEd. The idea is that this additional learning material was able to enhance students' scientific attitudes.

(HoLKs) Home-Lab Kits was composed of three (3) hands-on laboratory activities in Grade 7 Physics, activity sheets and safety measure provisions all contained in a plastic box. For the measuring device in the four activities, students utilized the Arduino Science Journal mobile application. Shown below is the list of activities provided in HoLKs.

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HoLKs Activity No.	TITLE
HoLKs Activity 1	*HAVE A BALL*
HoLKs Activity 2:	*SOUND SAFARI*
HoLKs Activity 3:	*DISCOVERING SHADOWS*

METHODOLOGY

The study employed one-group quasi-experimental research design. To gather data for the study, the researcher utilized selected Grade 7 students in Biñan Secondary School of Applied Academics.

The respondents/participants of the study were selected purposively from the sections being handled by the teacher researcher. Since the sectioning for Grade 7 in BSSAA is heterogeneously arranged, the researcher selected thirty (30) students from the four sections being handled to become respondents. All selected participants were utilizing Modular Distance Learning as their modality of learning delivery.

To answer the research questions crafted, this study utilized Scientific Attitude Inventory II (SAI II) questionnaire developed by Richard W. Moore and Rachel Leigh Hill Foy of Miami University, Oxford, Ohio in 1997. The SAI II uses a five-point response Likert Scale which was validated in a study by Moore and Foy in 1997.

The questionnaire includes 40 Likert-type attitude statements which was derived from 12 position statements, six opposing positive and negative, representing the universe of content, namely, attitudes toward science.

The twelve position statements which was the basis for discussion of the study is shown in the table 2. Six positions are positive and are labeled 1-A through 6-A. Six are negative and are labeled 1-B through 6-B. The A and B pair for each position are opposites of each other. The useful scales for analysis are 1-AB through 6-AB for each position and the positive and negative scales consisting of 1-A through 6-A and 1-B through 6-B, respectively.

Table 2: Position Statements of SAI II Instrument

Position Statements	Code
The laws and/or theories of science are approximations of truth and are subject to change.	1-A
The laws and/or theories of science represent unchangeable truths discovered through science.	1-B
Observation of natural phenomena and experimentation is the basis of scientific explanation. Science is limited in that it can only answer questions about natural phenomena and sometimes it is not able to do that.	2-A
The basis of scientific explanation is in authority. Science deals with all problems and it can provide correct answers to all questions.	2-B
To operate in a scientific manner, one must display such traits as intellectual honesty, dependence upon objective observation of natural events, and willingness to alter one's position based on sufficient evidence.	3-A
To operate in a scientific manner, one needs to know what other scientists think; one needs to know all the scientific truths and to be able to take the side of other scientists.	3-B
Science is an idea-generating activity. It is devoted to providing explanations of natural phenomena. Its value lies in its theoretical aspects.	4-A
Science is a technology-developing activity. It is devoted to serving mankind. Its value lies in its practical uses.	4-B
Progress in science requires public support in this age of science, therefore, the public should be made aware of the nature of science and what it attempts to do. The public can understand science and it ultimately benefits from scientific work.	5-A
Public understanding of science would contribute nothing to the advancement of science or to human welfare, therefore, the public has no need to understand the nature of science. They cannot understand it and it does not affect them.	5-B
Being a scientist or working in a job requiring scientific knowledge and thinking would be a very interesting and rewarding life's work. I would like to do scientific work.	6-A
Being a scientist or working in a job requiring scientific knowledge and thinking would be dull and uninteresting; it is only for highly intelligent people who are willing to spend most of their time at work. I would not like to do scientific work.	6-B

The procedure for data collection is shown in Figure 1. An initial SAI II Assessment was delivered to the 30 student participants using Google Form. Student participants were given 24 hours to accomplish the survey and submit their responses. The responses were then tabulated and analyzed using statistical treatments.

For a period of three (3) weeks, the utilization of HoLKs were conducted. Thirty (30) Kits were then distributed to selected students for usage. Since Self Learning Modules

(SLMs) were not available for the third grading period, the researcher opted to utilize the Learning Packets (LeaP) provided by the Region IV-A as the main material to be supplemented with HoLKs.

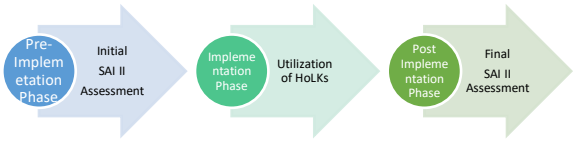

Figure 1. Procedure for data collection

Every Monday of the week, an "Online Kumustahan" was scheduled together with the student participants for explanation and further clarification of the HoLKs Activities.

In the last Friday of the three (3) week period of HoLKs utilization, a culminating activity was conducted via Online Meeting using Google Meet. Students presented their works and reflection from the implementation week. The activity ended with students answering the Final SAI II Assessment using Google Form.

Responses from the Final SAI II Assessment were tabulated and analyzed using statistical treatments.

RESULTS

The study determined the results of the Initial and Final SAI II Assessment and tested for the significant difference between the Initial and Final SAI II Assessment Mean for Positive position statements (PPS) and Negative Position Statements (NPS).

The scientific attitudes for positive position statements (PPS)

The scientific attitudes for positive position statements (PPS) of the respondents before and after the implementation is presented in Figure 2.

A difference of 3.13 were calculated on the mean for PPS 1 which is about respondents' eventually strongly agreeing that the laws and/or theories of science are approximations of truth and are subject to change.

For PPS 2, respondents were mildly disagreeing in the Initial SAI II Assessment (M= 2.42). However, during the Final SAI II Assessment (M= 4.33), respondents were already mildly agreeing whether the basis of scientific explanation is in authority and that science deals with all problems and it can provide correct answers to all questions.

Respondents on the other hand, initially mildly agreeing with NPS 3 (M= 4.42). Then, eventually mildly disagreeing with tabulated mean of 1.72. NPS 4, which is about science as a technology-developing activity and that it is devoted to serving mankind and its value lies in its practical uses, tabulated a mean of 1.52 in the Initial SAI II Assessment, while a mean of 4.65 was tabulated during the Final SAI II Assessment.

Lastly, a mean of 3.20 and 4.46 were calculated from the Initial SAI II Assessment for NPS 5 and NPS 6 respectively. Yet, after the Final SAI II Assessment, NPS 5 and 6 gathered a mean of 2.11 and 2.88 respectively.

The scientific attitudes for negative position statements (NPS)

Figure 3 shows the scientific attitudes for negative position statements (NPS) of the respondents before and after the implementation. A difference of 1.00 were calculated on the mean for NPS 1 which is about respondents' eventually mildly agreeing that the laws and/or theories of science represent unchangeable truths discovered through science. For NPS 2, respondents were mildly disagreeing in the Initial SAI II Assessment (M= 2.13). However, during the Final SAI II

Assessment (M= 4.71), respondents were already Neutral/Undecided whether observation of natural phenomena and experimentation is the basis of scientific explanation and that science is limited in that it can only answer questions about natural phenomena and sometimes it is not able to do that.

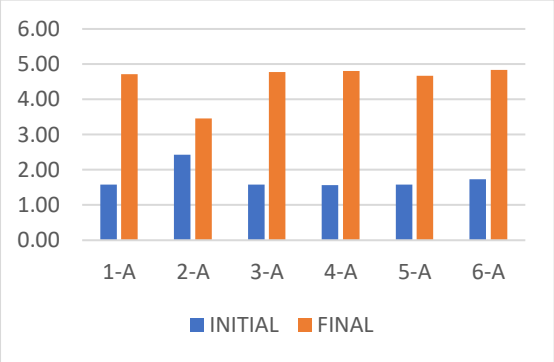

Figure 2. The scientific attitudes for positive position statements (PPS) of the respondents before and after the implementation

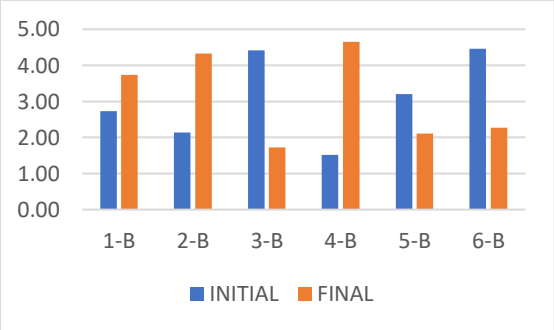

Figure 3. The scientific attitudes for negative position statements (NPS) of the respondents before and after the implementation

Respondents on the other hand, initially mildly disagreeing with PPS 3 (M= 1.58). Then, eventually strongly agreeing with tabulated mean of 4.77. PPS 4, which is about Science as an idea-generating activity and is devoted to providing explanations of natural phenomena, tabulated a mean of 1.57 in the Initial SAI II Assessment, while a mean of 4.81 was tabulated during the Final SAI II Assessment.

Lastly, a mean difference of 3.10 and 3.11 were calculated from the PPS 5 and PPS 6 respectively.

Paired t-test for the comparison of significant difference of the Initial and Final SAI II Assessment Mean for PPS and NPS

To test the null hypothesis that the Initial SAI II results for PPS (M=1.74, SD=0.34) and the Final SAI II results for PPS (M=4.54, SD=0.53) were not significantly different, a t-test for Paired Two Sample for Means was performed, as shown in Table 3.

The null hypothesis of no significant difference was rejected, t (5) = -7.94, $p < 0.05$. Thus, the Initial SAI II results for PPS means were statistically significantly higher than the Final SAI II results for PPS.

On the other hand, as shown in Table 4, another t-test for Paired Two Sample for Means was performed to determine if the Initial SAI II results for NPS (M=3.08, SD=1.20) was significantly different from the Final SAI II results for NPS (M=3.14, SD=1.25).

The null hypothesis of no significant difference was accepted, t (5) = -0.06, $p > 0.05$. Thus, the Initial SAI II results for NPS means were not statistically significantly different than the Final SAI II results for NPS.

DISCUSSION

The focus of the study is to develop a safe, simple but engaging experiment kit that students may take home as enrichment activities to support self-learning modules (SLMs). Furthermore, the study determined if the kit was able to enhance scientific attitudes of selected Grade 7 Students in Biñan Secondary School of Applied Academics.

Results from the Initial SAI II Assessment shows students before the implementation of HoLKs were not motivated in learning Science concepts.

Table 3. *t-Test*: Paired Two Sample for Means of Positive Position Statements (PPS)

Implementation	n	Mean	SD	t	t-crit	df	p	Decision
Initial	6	1.74	0.34	-7.94	2.02	5.00	0.000256	Reject H_O
Final	6	4.54	0.53					

Table 4. *t-Test*: Paired Two Sample for Means of Negative Position Statements (NPS)

Implementation	n	Mean	SD	t	t-crit	df	p	Decision
Initial	6	3.08	1.20	-0.06	2.02	5.00	0.48	Accept H_O
Final	6	3.14	1.25					

Most of the respondents are disagreeing that science can provide explanations to natural phenomenon. Furthermore, they are agreeing that a scientist or working in a job requiring scientific knowledge and thinking would be dull and uninteresting; it is only for highly intelligent people who are willing to spend most of their time at work.

However, After the implementation of HoLKs as a supplementary activity for LeaP Worksheets, results of the Final SAI II Assessment shows that more student respondents agree in statements where they would enjoy studying science. Moreover, all students agree that they may not make great discoveries but working in science would be fun.

A significant difference on the Initial and Final SAI II Assessment results shows that exposing students to simple laboratory activities enhance their attitudes towards learning new concepts in science. This supports the study of Bretz (2019), that providing laboratory activities to students would be beneficial to their learning.

Based on the journal entries of the teacher-researcher in the implementation of HoLKs, the intervention utilized to the respondents was said to be an appropriate and effective method to enhance scientific attitudes. The pupils who were exposed to HoLKs exhibits motivation and interest in the learning activities in Science 7.

The teacher-implementor realized that the existing challenges being encountered due to the current situation of distance education at the time the study was being conducted would not be an excuse to support students' learning of science concepts. Providing safe and enjoyable laboratory activities students can perform in their own houses would help solve the issue on students' engagement to scientific activities thus leading to poor attitude towards the subject (Ural, 2016).

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To God be all the Glory.

REFERENCES

Bretz, S. L. (2019). Evidence for the importance of laboratory courses.

Iksan, Z. H., Osman, K., & Salehudin, S. N. M. (2018). Take-Home-Experiment: Enhancing Students' Scientific Attitude. Journal of Baltic Science Education, 17(5), 828-837.

Rafidi, R. (2020). Teaching in the New Normal. New Straits Times, New Straits Times Press. https://www.nst.com.my/education/2020/06/599580/teaching-new-normal.

Supardi, R.S., Istiyono, E., Setialaksana,W. (2019). Developing Scientific Attitudes Instrument of Students in Chemistry. Journal of Physics: Conference Series, 1233 (012025).

Ural, E. (2016). The effect of guided-inquiry laboratory experiments on science education students' chemistry laboratory attitudes, anxiety and achievement. Journal of Education and Training Studies, 4(4), 217-227.