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# DEVELOPMENT AND EVALUATION OF DIY SCIENCE PROJECTS LEARNER'S MATERIAL GUIDE IN PAARALANG SEKUNDARYA NG LUCBAN INTEGRATED SCHOOL FOR SY 2020-2021

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## ABSTRACT

***This study aimed to develop and evaluation of Do-It-Yourself (DIY) Science Projects Learner's Material Guide in Paaralang Sekundarya ng Lucban Integrated School of SY 2020-2021. It sought to achieve the following objectives: Find out the level of acceptability of the DIY Science Projects Learner's Material Guide in terms of appearance, content, usefulness, conformity, accuracy, clarity and originality. Determine the mean performance of the student-respondents in pretest and posttest. Find out the statistically significant difference in the achievement between the two groups of students in terms of pretest and posttest. Identify the perceived benefits of the students on the use of DIY Science Projects Learner's Material Guide in their affective aspect. Quasi-experimental form of research was utilized in the study. Two Grade 10 sections with sixty-three (63) students each served as control and experimental groups. The tools in the study were subjected to analysis and validated by experts and statisticians. It was found out, DIY Science Projects Learner's Material Guide in terms of appearance, content, usefulness, conformity, accuracy, clarity, and originality were all "highly acceptable" to teachers and students' respondents.***

***Posttest scores revealed that developed material is as effective as the implemented tool provided by DepEd in enhancing students' academic performance as seen from the result of their assessments. In addition, the use of DIY Science Projects Learner's Material Guide in student's affective aspect showed that both high and low performing students benefited. This means Science teachers may adopt developed material in delivering and improving lessons to the students in the New normal classroom or tie up with the local government units for the other possible DIY projects that may benefit the school and community.***

**INDEX TERMS—** ***DIY Science Projects Learner's Material Guide, acceptability, performance mean scores, benefits, effectiveness***

## 1. INTRODUCTION

Nothing in the millennial student's everyday experiences has prepared them to sit still for an hour and absorb information as mentioned by [9]. Learners from this period can easily divert or lose their focus in studying as well as doing activities. Engaging the students in classroom tasks or activities is a crucial and challenging role for the teachers nowadays. [14] mentioned that the teachers should know how to plan the lessons to be introduced as to gain attention of the students and arouse the interest in the lesson. The activities on the lesson are intended to supplement the student's knowledge, understanding, and appreciation as emphasized by [2]. Many of the learners today were technologically-inclined and sometimes just relying themselves on technologies. Moreover, some students may think if the experiment or task for a day is time-consuming for them, they got bored easily especially when the results of the activity cannot be observed at once. At this point, it may leave a question mark for them because the time is limited. They also have the tendency not to finish the task assigned by the teacher. This will then result to learners who were "mema", a colloquial term in Lucban, Quezon which means "may maipasa lamang" in the end. In other words, it means passing outputs to the teachers without trying to exert some efforts and doing the best that they can. Hence, activities allow the students to their learning capability as they use it and also serves them as their motivation upon achieving high scores and rating according to in the study of Surbano (2015). Many just got bored so the tendency were to get odd to themselves and think and do something about it. Even before, it had been determined that people already had the DIY Culture in their body from the moment people realized that the only way was to keep going, move forward, got their selves together and

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do things for themselves.

Nowadays, people also spend more time in browsing the net and looking for alternative ways that will supply their necessities in life. Since alternative activities had been mentioned, one approach meeting this challenge is the Do-It-Yourself (DIY) Science Projects. This is used by some STEM schools in other countries such as United States of America. There is also a leading group called DIYBio.org that focused on education by teaching members basic knowledge via seminars, workshops, and by hands-on activities, by building community labs because some of their goals were to have interdisciplinarity, design and use of cost-effective tools and equipment, focus on open source and open science innovation, and democratization and self-empowerment as the biggest difference to conventional research activities [16].

From the analysis to be made, DIY Science Activities may provide opportunities for the learners to have focus and attention as well as be involved in experiments and activities in studying concepts and ideas in Science. This may also serve as supplemental material for the low academic performing students.

## 2 OBJECTIVES

This research aims for the development and evaluation of DIY Science Projects Learner's Material Guide in Paaralang Sekundarya ng Lucban Integrated School for S.Y. 2020-2021.

Specifically, the study seeks to achieve the following objectives: Find out the level of acceptability of the DIY Science Projects Material Guide to the Science teachers and students in terms of appearance, content, usefulness, conformity, accuracy, clarity, and originality; Determine the mean performance of the student-respondents in pretest and posttest; Find out the statistically difference in the achievement between the two group of students in terms of pretest and posttest; Test the effectiveness of DIY Science Projects Material Guide; and Identify the perceived benefits of the students on the use of Do-It-Yourself (DIY) Science Learner's Material Guide in their affective aspect.

## 3. METHODOLOGY

The quasi-experimental research was used in this study. Data were gathered through an adapted questionnaire from [12] and [6] to find out the level of acceptability of the DIY Science Projects Learner's Material Guide. Then, it was tested to the two classes to determine the statistical difference on the achievement of students on pretest aand posttest and to test its effectiveness. A 50-item pre-test and post-test were given to the students before and after the administration and utilization of DIY Science Activities conducted by the researcher with the aid of the school's chosen mode of learning delivery based from the school's Learning Continuity Plan (LCP) which is the printed modular distance learning which served as the control group and experimental group. Then, a self-made 15-item questionnaire was given to the students with low performing scores on the test to identify the perceived benefits of the material in their affective aspect.

## 4. LITERATURE REVIEW

As emphasized by [8], even before the rise of Mythbusters or the STEM (Science, Technology, Engineering and Mathematics), DIY had been done by schools, parents and their kids but the trend of at-home science experiments continues to blossom although there were some cases wherein many of the experiments remained somewhat the same but always exciting for younger students and projects for older ones. DIY Science Projects means to Do-It-Yourself Science Projects. These are set of activities and ideas to be done by an individual especially to the students. This is a way or a procedure of creating, modifying, transforming, producing, reconstructing and even just repairing things with the use of materials drawn from the natural environment which can provide creative-recreational and cost-saving activities. [4] stated that anyone can be a scientist by just starting his or her own experiments through the aid of DIY Science projects.

Hence, [17] stated that there were DIY Projects that can barely operate a drill and can be done in less than an hour since some kind of simple projects may be for the laziest and ineptest of crafters. Hence, [7] mentioned the greatness of DIY projects as everything since an individual can make items of themselves, choose projects that suits to their tastes, create them by own choice of colors/ textures and then use the DIY projects through heart's content whether the objective or goal of the creator is aiming for efficiency, fun or self-sufficiency.

In Philippines, livelihood awareness has become significantly important because of the country's economic status and difficulties. This can one of the reason why people keep on looking simplified thoughts and ideas to put into practice nowadays which lead to the advent of DIY Science projects, arts and crafts and, etc. In addition, [3] stated that DIY projects provide opportunities for money-saving projects which does not need materials which were costly but in a good quality. Students may train themselves for being resourceful individuals yet at the same time productive individuals.

By tinkering with objects and sharing knowledge via various communicative devices – websites, blogs, wikis, forums, videos – do-it-yourself biologists aim to create a new, collective and open economy of scientific equipment and render biology more accessible to citizens [10].

In addition, [11] concluded that highly acceptable instructional materials as regard to its usability, adequacy, clarity, and relevance increased the level of performance of the students in the subjects or topics the learner's need to study.

[5] proves that there must be clarity of the material for it to be significant and the target concepts in the given lesson may be achieved. Therefore, instructions should be clear and easy to understand so that learners will be properly guided of what they have to achieve. There must be also an accuracy of the material since it plays a vital role for the understanding and reliability of the material [1].

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## 5 DISCUSSION

**Table 1. Level of Acceptability of the DIY Science Projects Learner's Material Guide in terms of:**

| Indicative Statement | Teacher | | | Student | | |
|---|---|---|---|---|---|---|
| | M | SD | DR | M | SD | DR |
| **I. Appearance** | | | | | | |
| 1. The material guide shows an attractive and eye-catching cover. | 3.34 | 0.50 | SA | 3.73 | 0.45 | SA |
| 2. The material guide is handy and easy to carry. | 3.49 | 0.50 | SA | 3.98 | 0.16 | SA |
| 3. The illustrations are appropriate to the levels of their understanding. | 3.36 | 0.48 | SA | 3.93 | 0.27 | SA |
| 4. The material guide also provides information for visual learning. | 3.46 | 0.53 | SA | 3.95 | 0.22 | SA |
| 5. It provides key ideas and colorful illustrations that help to motivate the users. | 3.49 | 0.53 | SA | 3.88 | 0.33 | SA |
| *Overall Mean* | *3.43* | *Highly Acceptable* | | *3.89* | *Highly Acceptable* | |
| **II.Content** | | | | | | |
| 1. The procedures in the activities of the material guide conveys simple and understandable instruction. | 3.44 | 0.52 | SA | 3.98 | 0.16 | SA |
| 2. The process in the activities follow proper sequence. | 3.46 | 0.50 | SA | 3.93 | 0.27 | SA |
| 3. There are participative concepts integrated into Science concepts. | 3.34 | 0.50 | SA | 3.98 | 0.16 | SA |
| 4. There are clear explanations in each set of activities. | 3.40 | 0.52 | SA | 3.83 | 0.38 | SA |
| 5. The material guide's activities show occurrence of obtaining and evaluating information. | 3.30 | 0.54 | SA | 3.80 | 0.41 | SA |
| *Overall Mean* | *3.39* | *Highly Acceptable* | | *3.90* | *Highly Acceptable* | |

| Indicative Statement | Teacher | | | Student | | |
|---|---|---|---|---|---|---|
| | M | SD | DR | M | SD | R |
| **III.Usefulness** | | | | | | |
| 1. The materials presented provide tools for understanding and testing ideas | 3.43 | 0.50 | SA | 3.85 | 0.36 | SA |
| 2. The activities include instructions which are easy to understand | 3.49 | 0.53 | SA | 3.90 | 0.30 | SA |
| 3. Students were able to develop their values according to their findings on the activity. | 3.41 | 0.50 | SA | 3.73 | 0.45 | SA |
| 4. The activities are organized and clear for the students. | 3.41 | 0.52 | SA | 3.83 | 0.38 | SA |
| 5. The topics presented are on the level of the learners. | 3.36 | 0.51 | SA | 3.95 | 0.22 | SA |
| *Overall Mean* | *3.42* | *Highly Acceptable* | | *3.85* | *Highly Acceptable* | |
| **IV. Conformity** | | | | | | |
| 1. The material guide shows the individual differences and learning. | 3.38 | 0.51 | SA | 3.88 | 0.33 | SA |
| 2. The presentation of the lesson shows plainly experiential learning. | 3.36 | 0.53 | SA | 3.85 | 0.36 | SA |
| 3. The different set of activities and organization of the learning material clearly show to understand the Science concepts. | 3.36 | 0.51 | SA | 3.83 | 0.38 | SA |
| 4. The lesson facilitates oral recitation and discussion. | 3.09 | 0.62 | A | 3.88 | 0.33 | SA |
| 5. The different hands-on-activities wherein target users fully apply the lesson to their daily lives. | 3.35 | 0.51 | SA | 3.90 | 0.30 | SA |
| *Overall Mean* | *3.31* | *Highly Acceptable* | | *3.87* | *Highly Acceptable* | |

| | | | | | | |
|---|---|---|---|---|---|---|
| **V.Accuracy** | | | | | | |
| 1. The ideas and concepts are well-expressed in the material. | 3.38 | 0.51 | SA | 3.85 | 0.36 | SA |
| 2. It uses vocabulary and proper words in presenting topics. | 3.44 | 0.52 | SA | 3.85 | 0.36 | SA |
| 3. The contents and concepts are scientifically accurate. | 3.29 | 0.48 | SA | 3.88 | 0.33 | SA |
| 4. The topics show accuracy to develop and enhance their understanding. | 3.38 | 0.51 | SA | 3.85 | 0.36 | SA |
| 5. The material guide is accurate for the experiences of the target users. | 3.41 | 0.49 | SA | 3.85 | 0.36 | SA |
| *Overall Mean* | *3.38* | *Highly Acceptable* | | *3.86* | *Highly Acceptable* | |
| **VI.Clarity** | | | | | | |
| 1. The concepts in the material guide are clear and easy to understand. | 3.50 | 0.53 | SA | 3.98 | 0.16 | SA |
| 2. The material has adequate margins, legible and properly arranged. | 3.23 | 0.50 | SA | 3.88 | 0.33 | SA |
| 3. The lessons are well-arranged to provide sequence of understanding. | 3.41 | 0.54 | SA | 3.90 | 0.30 | SA |
| 1. The illustrations are appropriate to each lesson. | 3.35 | 0.48 | SA | 3.88 | 0.33 | SA |
| 2. The terms used are simplified for the target users. | 3.28 | 0.45 | SA | 3.88 | 0.33 | SA |
| *Overall Mean* | *3.35* | *Highly Acceptable* | | *3.90* | *Highly Acceptable* | |
| **VII.Originality** | | | | | | |
| 1. The illustrations are presentable and use different approaches. | 3.33 | 0.55 | SA | 3.75 | 0.44 | SA |
| 2. The presentation of the concepts serves as a new technique in bringing motivation into the Science classroom. | 3.46 | 0.50 | SA | 3.80 | 0.41 | SA |
| 3. The method of presentation used catches the interest of the target users. | 3.30 | 0.46 | SA | 3.88 | 0.33 | SA |
| 4. The material guide carefully studies to accommodate alternative technique for the users. | 3.40 | 0.52 | SA | 3.90 | 0.30 | SA |
| 5. The material guide includes adequate development of Science concepts which are sustainable to the students. | 3.53 | 0.50 | SA | 3.83 | 0.38 | SA |
| *Overall Mean* | *3.40* | *Highly Acceptable* | | *3.83* | *Highly Acceptable* | |

To measure the level of acceptability of the DIY Science Projects Learner's Material Guide, weighted mean is used. The tables reveals the acceptability level of the DIY Science Projects material guide falls under the scale of *Highly Acceptable* based on the overall mean (M=3.40) for the teachers and (M=3.83) to the students. This means that the material guide suits its intended purpose of presenting ideas adequate development of Science concepts which are sustainable to the students and provide alternative and new technique in bringing motivation in a new normal classroom. From that, Naval (2014) states a well-designed instructional material can be a useful tool for teaching and learning basic concepts in Science especially Physics. Moreover, an effective instructional material must possess good characteristic.

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**Table 2. Performance in Pretest and Posttest of the Control Group and Experimental Group**

| Group Test | Mean | SD | Remark |
|---|---|---|---|
| **Control** | | | |
| • *Pretest* | 14.11 | 7.12 | *Very Low Mastery (VLM) |
| • *Posttest* | 27.32 | 7.47 | *Average Mastery (AM) |
| **Experimental** | | | |
| • *Pretest* | 19.59 | 9.86 | *Low Mastery (LM) |
| • *Posttest* | 31.56 | 8.19 | *Moving Toward Mastery (MTM) |

To compare the mean performance of the student-respondents in the pre-test and post-test, data were subjected to analysis and adapted the National Education Testing and Research Center (DepEd) (Santos, 2020)

| Group Performance Mean Scores | Remarks |
|---|---|
| 43-50 | Mastered (M) |
| 36-42 | Closely Approximating Mastery (CAM) |
| 29-35 | Moving Toward Mastery (MTM) |
| 22-28 | Average Mastery (AM) |
| 15-21 | Low Mastery (LM) |
| 8-14 | Very Low Mastery (VLM) |
| 1-7 | No Mastery (NM) |

It can be gleaned from the table 2 the pretest mean scores of the two groups. The control group has mean (M=14.11, SD=7.12) has a *Very Low Mastery* in the topics while the experimental group compared to control group has a mean score (M=19.59, SD=9.86) indicating a *Low Mastery.*

Based from table, it can be seen also that Control group has a mean score (M=14.11, SD=7.12) in their pretest indicating a *Very Low Mastery* on their pretest while there is an *Average Mastery* to their posttest having a mean (M=27.32, SD=7.47).

On the other hand, the experimental group has mean score (M= 19.59, SD=9.86) in the pretest stipulating a *Low Mastery* while on the posttest indicates *Moving Toward Mastery* having a mean score (M=31.56, SD=8.19).

It also shows that experimental group having a mean score (M=19.59, SD=9.86) in the pretest has *Lower Mastery* compared to the posttest of having a mean score (M=31.56, SD=8.19) which shows *Moving Toward Mastery.*

It can be seen also from the posttests of control group having a mean score (M=27.32, SD=.47) falls under the scale of *Average Mastery* while the posttest of experimental group has (M=31.56, SD= 8.19) which indicates *Moving Toward Mastery.*

**Table 3. Pretest and Posttest Mean Scores of the Control Group and the Experimental Group**

| Group/Test | Pretest | Posttest | Mean difference | t-ratio | *p*-value | Analysis |
|---|---|---|---|---|---|---|
| Control | 14.11 | 27.32 | 13.21 | 22.784 | 0.000 | Significant |
| Experimental | 19.59 | 31.56 | 11.97 | 14.056 | 0.000 | Significant |
| Group/Test | Pretest | Posttest | Mean difference | t-ratio | *p*-value | Analysis |
| Control | 14.11 | 27.32 | 13.21 | 22.784 | 0.000 | Significant |
| Experimental | 19.59 | 31.56 | 11.97 | 14.056 | 0.000 | Significant |

To determine if there is no significant difference in the achievement between the two groups in terms of pretest and posttest, data were subjected to statistical analysis using t-test for independent sample means. The result obtained a t-ratio of 22.784 on the control group with a mean difference on the pretest and posttest of 13.21 and a p-value of 0.000 which means the group who did not use the DIY Science Project Learner's material guide is significant. Therefore, the null hypothesis is accepted.

On the other hand, the experimental group with a mean difference of 11.97 and a t-ratio of 14.056 on the pretest and posttest with a p-value of 0.000 is also significant. Therefore, the null hypothesis is accepted.

As a whole, the experimental group who utilizes the DIY Science Projects Learner's Material Guide and the control group who did not use the material shows no significant difference in their achievement in terms of pretest and posttest. This means that the DIY Science Projects Learner's Material Guide is as effective as the traditional materials guide provided by the Department of Education. However, the data on the posttest of experimental group revealed that the developed DIY Science Projects Learners Material Guide is an effective instructional tool in enhancing students' academic performance as seen by the result of their assessments.

**Table 4. Perceived Benefits of the Students on the Use of Do-It-Yourself (DIY) Science Projects Learner's Material Guide in their Affective Aspect**

| Indicative Statement | M | SD | DR |
|---|---|---|---|
| Whenever I do the activities in the Do-It-Yourself (DIY) Science Projects Learner's Material Guide, I… | | | |
| 1. …am excited accomplishing the activities | 3.37 | 0.49 | SA |
| 2. …enjoy conducting the activities | 3.30 | 0.47 | SA |
| 3. …am interested in the activities | 3.37 | 0.49 | SA |
| 4. …feel surprised on the outcomes after doing the activities | 3.23 | 0.43 | A |
| 5. …feel confident doing the activities | 3.20 | 0.41 | A |
| 6. …do not find difficulty in doing the activities | 3.03 | 0.49 | A |
| 7. …feel that the activities help me understand more about Science lessons | 3.37 | 0.49 | SA |
| 8. …have a wonderful experience doing the activity | 3.40 | 0.50 | SA |
| 9. …become more interested learning Science subject because of the activities | 3.33 | 0.48 | SA |
| 10. …find the activities enjoyable and meaningful | 3.37 | 0.49 | SA |
| 11. …gain significant insights because of the activities despite being at home | 3.20 | 0.41 | A |
| 12. … feel a sense of adventure while doing the activities | 3.27 | 0.45 | SA |
| 13. …achieve a sense of satisfaction and pride after seeing the results of the activities | 3.17 | 0.38 | A |
| 14. …learn to appreciate simple things by doing simple experiments/ activities in Science subject | 3.33 | 0.48 | SA |
| 15. …learn autonomy and self-regulation in doing the activities aside from learning the Science lesson | 3.23 | 0.43 | A |
| Overall Mean | 3.28 | Strongly Agree | |

Before the administration of the self-made survey-questionnaire, Cronbach alpha done first to test its reliability. To measure the perceived benefits of the students on the use of DIY Science Projects Learner's Material Guide, weighted mean is used. The aesthetic value of the perceived benefits of the stu-

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dent's emotional or affective aspect in doing experiments and activities in the Do-It-Yourself (DIY) Science Projects Learner's Material Guide has been Strongly Agreed by respondents in overall. This means that it meets the purpose of providing interesting activities and meaningful experiences even students are at-home studying lessons.

## 6. CONCLUSION

Based from the inferential questions, findings and analysis of the study, the following conclusions were drawn:

The respondents described DIY Science Project Material Guide is highly acceptable in terms of appearance, content, usefulness, conformity, accuracy, clarity and originality to the teachers and students.

The developed Do-It-Yourself (DIY) Projects Learner's Material Guide is ready for adoption in delivering science instruction although no significant difference on the student's performances before and after its utilization. The developed material is still as effective as the implemented material.

The developed Do-It-Yourself (DIY) Science Projects Learner's Material Guide is an effective supplementary material to enhance the academic performance of the students even they are studying at-home.

## 7. RECOMMENDATION

In view of the results of this study, the following were recommended.

1. Science teachers may adopt DIY Science Projects Learner's Material Guide delivering lessons to the students amidst to the COVID19 pandemic.
2. Supplementary material in other subject area or grade levels may be developed.
3. Further improvement of the material may be done to make it more econcffective in improving the new normal classroom instruction.
4. Future researchers may replicate this study using other locales with increased number of respondents.
5. Tie up with the local government units for the other possible DIY projects that may benefit the school and the community.
6. Curriculum developers may include DIY Science Projects since lifelong learners is one of the goals and focus of 21st century learning.

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