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Director's Message

Dear readers,

Welcome back to the 2nd volume of SEAQIS Journal of Science Education (SciEd). SciEd is one of the platforms for Science teachers and education personnel in order to share their innovation and critical thinking skill through academic writing.

This second issue will provide you with various research from authors in Southeast Asia that can enhance your knowledge in Science Education, such as Computational Thinking skill, connection between Science and English, Experiment-based Learning, and so on.

Hopefully, all the paper published in this journal will have a significant impact for science education world. Thank you and have a fruitful reading!

Dr Indrawati
Director

From the Editor-in-Chief

Welcome to our second issue of the 2nd volume of SciEd. First and foremost, we would like to extend our gratitude to the authors, the Editorial Board, the designer, the Publishing Office Staff, and others who have contributed in this publication.

Several mistakes and errors might be found on this issue. Therefore, critics, comments, and suggestions are very much welcomed to improve the quality of the next volume. We are also inviting you to collaborate with us by submitting your best articles in order to broaden the readers' knowledge in Science. Thank you and enjoy reading!

Dr Elly Herliani
Editor-in-Chief

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The Desk

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Research Paper

Open Accsess

Digital Storytelling (DST) Media Development in Online Physics Learning Based on Computational Thinking

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Abstract

The objectives of the study are: (1) producing learning media as a component of computational thinking learning; (2) describing the effectiveness of the thinking process based on DST media of online Physics learning; (3) describing user response based on computational thinking. The type of study is “Research and Development” by the ADDIE model. The data of the study were taken from: (1) the analysis of the data from students of X class in the period 2020/2021 and curriculum document of Physics material; (2) expert validation which are lecturers and Physics teachers of SMAN 2 South Bengkulu; and (3) test source from students of X class. There were 32 students of MIPA 4 (experiment class) and 33 students of MIPA 5 (control class). The methods of the study were observation, questionnaires, and tests. The analysis of the study was qualitative and quantitative method. The results of the study showed that: (1) expert validation was stated that some components of the learning process based on computational thinking such as syntax component, social system, principal reaction, support system, instructional effect, and accompaniment impact. Each of them is valid; (2) Based on the Quasi experiment, there was a significant difference between the learning outcomes using experiment test and control test (grade t count is 2.876 in other hand grade t table in 5% and grade $p<0.005$ is 2.042); (3) the students' responses from learning computational thinking were very positive (95%) and positive (5%). The conclusion is computational thinking learning is a valid product model, practice, effective, and suitable to be used.

Keywords: computational thinking; DST; media development; online Physics learning

Introduction

The application of the National Assessment in Indonesia has changed the paradigm of education, especially in the learning process. The National Assessment (AN) was officially implemented by the Ministry of Education and Culture and the National Examination. This is based on PISA research, and it is proved that the students' abilities in primary and secondary education are inadequate. In 2018, around 70% of students had a literation competency below the minimum standard. Similar to Math and Science skills, 71% of students were below the minimum competence for Mathematics and 60% for Science (Kemdikbud, 2021). Indonesia's PISA score has been stagnant for the last 10-15 years. This condition causes Indonesia to become one of the countries that is consistent with the lowest PISA level.

The learning process should be able to increase students' reading and numeracy skills because there are relationships between National Assessment in the 21st-century skills and the measurable Pancasila student profile through the National Assessment in the form of Minimum Competency Assessment (AKM), Character Survey, and Learning Environment Survey. There are three concepts of Education and Culture in Indonesia to develop curriculum for primary and secondary school levels, which are 21st-Century skills (Fadel, 2009), scientific approach (Dyer, 2009), and authentic learning or authentic assessment (Wiggins, 2011). Furthermore, the three concepts are adapted to create Indonesia's creativity in 2045. Indonesia's creativity is supported by research that shows a shift in work in the future. The future job pyramid shows that the highest type of work is creative work. Meanwhile, the future work routine will be taken by robotic and automatic technology. Creative work needs human intelligence and creativity to produce creative and innovative products.

Physics is one of the subjects taught at SMAN 2 South Bengkulu. This is a difficult subject for students. This subject emphasises concepts and calculations containing many formulas or equations. The first observations at SMAN 2 South Bengkulu showed that: (1) the material was taught by expository and lecture methods; (2) the students should memorise all the concepts and equations; (3) the teacher explained about solving practice questions and did not apply innovative learning models and media; (4) the material was not in line with the daily life activities (not contextual); (5) the teacher was more active than students, while students only listened, took notes, and completed UKBM (distance-learning worksheets); and (6) the students were lack of motivation: they did not participate in the learning process which resulted in lower outcomes.

The students of SMAN 2 South Bengkulu are currently the generation born in the Z-generation range (between 1996-2010) who have the challenge of being able to synergize with the rapid technological disruption. In a matter of years, advances in applied technology have changed the form of social order. To deal with this change, the skills required are becoming increasingly complex. Cognitive abilities are no longer the only strength of human being; however, literacy, numeracy, and character analysis skills must also be possessed. Generation Z of SMAN 2 South Bengkulu currently demands a system and teaching methods that is suitable for their social character. One of the efforts to face these obstacles is the development of DST media in online Physics learning based on computational thinking.

DST (Digital Storytelling) media is a combination of multimedia features in storytelling, such as digital graphics, text, voice narrative recordings, videos, and music that presents certain material within a certain duration of time using digital format (Dreon, 2011). Digital Storytelling (DST) is an alternative that can be implemented to process digital content. DST is not only moving the art of storytelling into a multimedia format containing images, videos, and audio using certain applications. Some experts claim that digital storytelling is a modern expression of ancient art in storytelling. Physics learning has a lot of material that is contextual in nature. Some materials are sometimes considered to be difficult; however, DST can help students in understanding the materials by searching for information so that students can be eager to learn them.

The determination of Higher-Order Thinking-oriented Physics learning activities reflects the basic strategy of computational thinking. It is more emphasised in the skills of abstraction, algorithms, decomposition, and pattern recognition so that students get used to it. In one learning activity, there can be one or more basic strategies for computational thinking (abstraction, algorithms, decomposition) (Wing, 2008; Wing, 2017a; Wing, 2017b). These four basic strategies are not a sequence of stages, but components of the basic strategies used to develop CT skills. In one learning model, these four basic strategies must be present and applied in their activities; but in one activity, the basic strategy does not need to be fully applied. Meanwhile, computational thinking is described as a thought process in formulating and solving problems computationally through computers, humans, or machines (Wing, 2006). The goal of computational thinking process is that students can apply the skills of abstraction, algorithms, decomposition, and pattern recognition.

The development of DST media in online Physics learning based on computational thinking facilitates students to discuss the content and makes them understand the concept of Physics lessons based on four basic strategies in computational thinking, for example, decomposition, pattern recognition, abstraction, and algorithm. Decomposition describes complex problems of the students or simpler problems system. Pattern recognition means students are sorting out and grouping the same pattern of problem. Abstraction means when students focus on the important things, but they consequently ignore the unimportant and irrelevant things. Meanwhile, the algorithm means the students solve a problem in systematic ways with SMART (Specific, Measurable, Attainable, Relevant, Time-based). The following points are the advantages of using digital media for teaching and learning process: (1) increasing students' concentration up to six times; (2) increasing students' interest in learning and analysing (especially study objects or simulations); (3) increasing savings on laboratory costs and teaching simulation media (savings can be more than 70%); (4) improving the connection of teachers and students through technology; and (5) helping teachers to conduct HOTS simulations. The idea of developing DST media in online Physics learning based on computational thinking is designed to make Physics learning become more contextual, interesting, meaningful, full of characters, and put concern on the environment so that it has an impact on increasing the competence of students.

Methodology

2.1 Research Approaches and Methods of The Study

This is a development research which aims to produce digital media in online Physics learning based on computational thinking. The product to be developed consists of several components, such as learning media, social systems, reaction principles, support systems, instructional and accompanying impacts, online Physics instructional products based on computational thinking, as well as an evaluation system to get information based on the real conditions. *Research design*

The development media which is used in this research is the ADDIE model. The ADDIE model stands for Analysis, Design, Development or Production, Implementation or Delivery, and Evaluations.

Picture 1.1. *Research Procedure Using the ADDIE Model (Dick, 2001)*

2.2 Research Settings

The place of the study was SMAN 2 South Bengkulu, while the time of study was in the even semester of the 2020/2021 school year and in the odd semester of the 2021/2022 school year. The research period started from March to the fourth week of August 2021. *Population or sample (unit of analysis)* The subjects in this study were experts, students, and teachers. The experts are people who can provide valid data and content, such as linguists as well as experienced lecturers and teachers. The students are those who can provide data about the practicality and effectiveness of the model, which are Class X (IPA 4 and IPA 5) SMAN 2 South Bengkulu which consist of 64 students. The analysis of the study used random sampling.

Table 1.1 *Detailed Overview of Experiment and Control Classes*

Class	Amount Student (person)	Year Sign in	Gender (person)	Teacher	Subjects
Experiment (MIPA 4)	31	2020	L = 12 P = 20	Kristian Dinata, S.Si	Physics
Control (MIPA 5)	33	2020	L = 14 P = 19	Kristian Dinata, S.Si	Physics

2.3 Technique and Data Collection

The methods of this study were documentation, questionnaires, interviews, and observation.

a. Documentation Method

The documents derived in this study were from Physics learning of X class of SMAN 2 South Bengkulu students, research data, and during the implementation of research activities.

b. Test Method

The test of the study is an objective test using multiple choices method with five answer choices, totalling 30 items. The multiple-choices test was chosen to measure all the learning objectives and reduce the chance of guessing by students because the answer choices are more than two. The multiple-choices test was applied to determine the learning outcomes of the students in both experimental and control groups when the pre-test and post-test were carried out.

c. Observation Method

The study used an observation method which the object has been determined previously. The aim of observation is to implement the digital media in online Physics learning based on computational thinking. This observation consists of the implementation of computational thinking in online Physics learning using digital media and not (only using conventional models). An observation guide in the form of checklist was applied and divided into 4-point Likert scales.

d. Questionnaire / Questionnaire Method

This study used a closed questionnaire with a Likert scale that should be answered according to the 4 predetermined answer choices, which are strongly agree (SA), agree (A), disagree (D), and strongly disagree (SD). Respondents only put a checklist on the questionnaire given. The questionnaire was given to media experts, learning material experts, and students.

2.4 Analysis of The Data

a. The Data Analysis of The Planning Model

The research data on the planning/learning instrument was carried out by analysing a questionnaire that had been validated by the instructional media and material experts through validity construction. The validation instrument was arranged in a Likert scale with the following details: (a) Very Good (SB) with a point of 4; (b) Good (B) with a point of 3; (c) Not Good (TB) with a point of 2; and (d) Very Not Good (STB) with a point of 1 (Sujana, 2005). After that, the results of the validation media were converted into the following interpretations.

Table 1.2. *Learning Media Planning Conversion Rate*

Number	Average score	Interpretation
1.	3,01 – 4,00	Very valid
2.	2,01 – 3,00	Valid
3.	1,01 – 2,00	Invalid
4.	0,00 – 1,00	Very invalid

b. The Analysis of Practicality Learning Model Data

The analysis of the data was taken from the observation and documentation based on teacher's questionnaire. The questionnaire used the Likert scale with the criteria: (a) Very Good (VG) with a point of 4; (b) Good (G) with a point of 3; (c) Not Good (NG) with a point of 2; and (d) Very Not Good (VNG) with a point of 1. Then, the results of the practicality test for the Learning Model were converted.

Table 1.3. *The Practicality of Learning Media Conversion Rate*

Number	Average score	Interpretation
1.	3,01 – 4,00	Very worthy
2.	2,01 – 3,00	Well worth it
3.	1,01 – 2,00	Not feasible
4.	0,00 – 1,00	Not feasible

c. The Analysis of Student Learning Outcomes Data

The development of implementation stage using digital media in online Physics learning based on computational thinking was carried out using a pre-test and post-test random control group pattern. This pattern was designed by taking a sample of subjects involving a control sample as a comparison. Each sample subject was subjected to two treatments, namely before the implementation of learning (pre-test) and after the learning process (post-test). The experimental design of the pre-test and post-test random control group pattern could be described in the following table.

Tabel 1.4. *Experimental Design*

Group	Technique Taking	Pre-test	Treatment	Post-test
E	R	O_1	X	O_2
K	R	O_3		O_4

d. Student Response Questionnaire Data Analysis

The data analysis of the student questionnaire was in a descriptive percentage in order to make it easier to be read into tables. This analysis used qualitative criteria applying Likert scale with positive and negative statements based on the opinion (Sudjana, 2005), so that the positive statement got the highest point with the following details: (a) strongly agree (SS) with a point of 4; (b) agree (S) with a point of 3; (c) disagree (TS) with a point of 2, and (d) strongly disagree (STS) with a point of 1.

Table 1.5. *Student Response Conversion Rate*

Number	Average score	Interpretation
1.	3,01 – 4,00	Very positive
2.	2,01 – 3,00	Positive
3.	1,01 – 2,00	Not positive
4.	0,00 – 1,00	Not very positive

Results and Discussion

Computational thinking-based learning is a series of learning approaches, strategies, methods, techniques, and tactics which is described from the beginning to the end of the learning process. The following are the characteristics of computational thinking-based learning.

1) The learning approach using trials and implementation based on computational thinking is a student-centred and scientific approaches which have four basic strategies in computational thinking (decomposition, pattern recognition, abstraction, and algorithm).
2) The learning strategy contains planning. The learning strategy in this study is discovery-based learning through discussion and games. The learning method used is a variety of methods, ranging from discussions, presentations, lectures, and games both individually and in groups.
3) The learning technique is the way teacher applies the learning method. In the discussion, for example, the teacher applies a rotating technique where each group does the presentation while the other groups give the responses.

In the 21st-Century, all the aspects are controlled by science and creativity. The massive changes in economic world and the internet have realised Indonesian people that they should change their mindset on education for preparing the golden generation. The ability to compete with other countries depends on the quality of education in order to prepare excellent students. 21st-Century learning requires Indonesian students to learn to know, learn to do, learn to be, and learn to live together. (Fadel, 2009) suggests three important aspects in facing the 21st-Century, which are "4C" learning and innovation, digital literacy skills, as well as life and career skills.

Table 2.1. *21st Century Skills*

Learning and Innovation "4C"	Digital Literacy	Life and Career Skills
Critical thinking & problem-solving	Information of literacy	Flexibility and adaptability
Creativity & innovation	Media literacy	Initiative and self-direction
Communication	ICT Literacy	Social and cultural interactions
Collaboration		Productivity and accountability
		Leadership and responsibility

To answer the challenges of the 21st-Century, students need to master several Higher-Order Thinking Skills, such as critical thinking, creative thinking, problem-solving, and decision-making (Brookhart, 2010). Magazine *21st Century Skills, Education & Competitiveness: A Resource and Policy Guide* (2008) stated that there were several actions needed in facing and preparing the 21st-Century generation: critical thinking and making decisions; solving complex, cross-sectoral, and infinite problems; creativity and entrepreneurial thinking; communicating and collaborating; making innovations using knowledge, information, and opportunities; as well as safeguarding financial, health, and public responsibility.

The basic strategy of computational thinking is reflecting the Higher-Order Thinking activity in Physics learning. Computational thinking is not programming but a basic skill in one's thinking that can be applied in all fields, including Science. With this skill, it is hoped that students can formulate and solve problems as a provision to face challenges of the 21st-Century (Cansu, 2019; ISTE, 2011; McNicholl, 2018; Yadav, 2014). In applying computational thinking, students do not have to use digital media technology. However, because of the challenges in the digital era, they must be exposed to the digital world in the field of information and communication technology. Thus, students need to be familiar with the learning process integrated with the use of digital media technology. A variety of digital tools can be utilised based on the learning objectives to facilitate the learning process and to assist students in their problem-solving processes.

1) Steps to develop DST media based on computational thinking

Computational thinking-based learning is a new learning model to improve the competence of students. This learning model is designed according to the needs of students and demands. The steps in developing computational thinking-based learning derive from the ADDIE model development research (Analysis, Design, Development, Implementation, and Evaluation).

The implementation of model development was carried out in two classes, which were class X MIPA 4 (experimental class) and X MIPA 5 (control class). The number of samples from the two classes was 64 students. In class X MIPA 5, conventional and lecture methods were applied with questions and answers session. Meanwhile, class X MIPA 4 applied DST media development in online Physics learning based on computational thinking. After being given treatment, both classes were given a post-test. The data obtained were analysed by using independent sample T-test statistics. However, before the t-test, the prerequisite tests were carried out (normality and homogeneity). From the results of the normality test, it was found that the student learning outcomes data were normally distributed. Then, the homogeneity test was carried out using the Lavene Test on the pre-test scores of both classes. The results of the homogeneity test are shown as follows.

Table 2.2

Levene Statistic	df1	df2	Sig.
,006	1	62	,940

The data showed p-value = 0.940 > 0.05, then the data of the two classes were homogeneous. Then, the independent sample t-test was conducted to test whether there was an effect of DST media development in online Physics learning or not on student learning outcomes. Here are the results of the t-test.

Table 2.3. *Group Statistics*

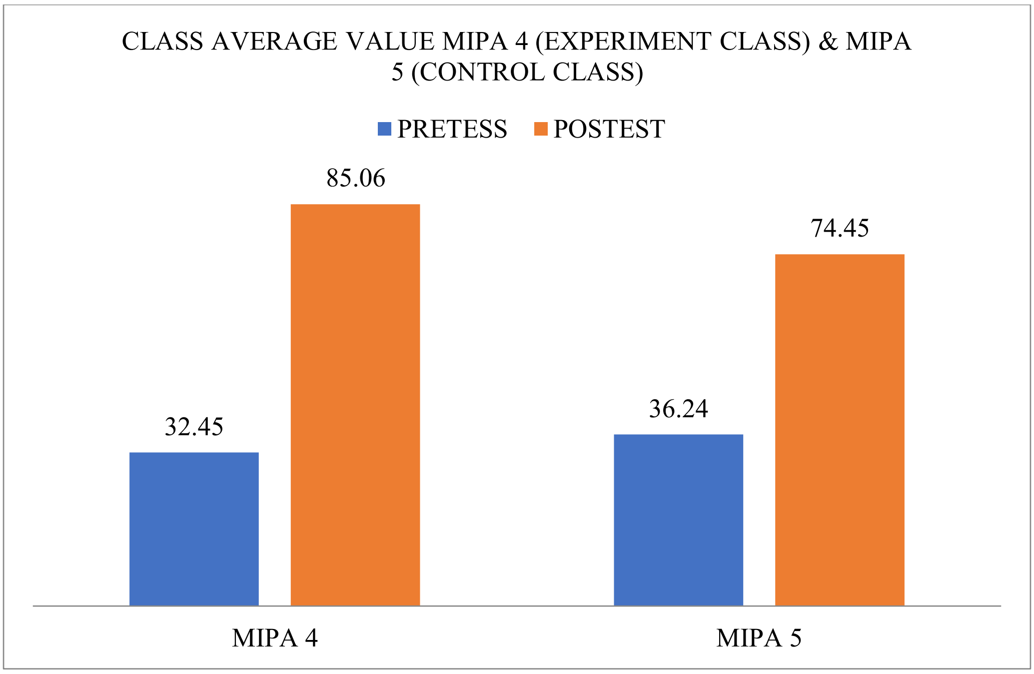
Class	N	Mean	Std. Deviation	Std. Error Mean
Value Class X MIPA 4	31	85,0645	9,47254	1,70132
Class X MIPA 5	33	74,4545	18,36963	3,19774

Table 2.4. *Independent Samples Test*

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Value	Equal variances assumed	13,484	,001	2,876	62	,006	10,60997	3,68946	3,23484	17,98510
	Equal variances not assumed			2,929	48,532	,005	10,60997	3,62216	3,32919	17,89075

The t-count for class X MIPA 4 (experiment) was 2.876. The t-table was valued at the 5% significance level and the p value < 0.05 was 2.042. Because of the value of t-count > t table, there was a significant difference between the learning outcomes of students with DST media development and those who were taught using conventional models on compound nomenclature.

Therefore, it can be concluded that the learning outcomes of students taught with DST media development are better than those who being taught by conventional method. This result is supported by the mean of the pre-test and post-test results of the two classes which is illustrated by the following graph.



Picture 2.2. *Graph of Average Value of Experiment and Control Class*

Problems, learning needs and requirements through interviews, questionnaires and direct observation were identified at the Analysis step. At the Design step, learning objectives were formulated and several items were designed: (1) the syntax concept of the learning model; (2) social systems; (3) reaction principles; (4) support systems; (5) instructional and accompaniment impacts; and (6) the learning media used to support the developed syntax model. After that, all of these components were validated by several expert teachers and lecturers to determine the feasibility of learning instruments based on computational thinking. Next, a limited trial was conducted by applying the learning model in IPS 3 class consisting of 32 students to find out some issues that needed to be fixed and improved. In this step, computational thinking in Physics learning was implemented in MIPA 4 class. Meanwhile, conventional learning models were applied in MIPA 5 class. In the Evaluation stage, the effectiveness of learning model was evaluated as the final revision after dissemination.

2) The effectiveness of DST media based on computational thinking

The effectiveness of computational thinking-based learning products using DST media could be seen from the increase of student learning outcomes in the experimental class (MIPA 4). A statistical test was required in both classes. The results of the paired sample t-test showed that there was a significant difference between computational thinking-based learning and experimental class learning. Meanwhile, the control class utilised conventional learning models. This showed that the application and implementation of computational thinking-based learning could improve student learning outcomes.

The effectiveness of computational thinking-based learning in improving student learning outcomes are as follow: (1) Computational thinking-based learning is able to encourage students to be actively involved in learning by providing contextual phenomena (the phenomena of real events in daily life); (2) The seriousness of students' learning is balanced with the experience of fun activities through integrated discussions and games to find the concept of cooperation-competition. In-class cooperative-competition strategies, implementation of team projects and problem-based learning are essential in seizing opportunities for experienced learners to learn; (3) Computational thinking-based learning provides more time for students to think about why teachers ask them about the phenomena related to learning and to seek for the information from various sources at the stage of reading literature; (4) Computational thinking-based learning is constructivist in which students build their knowledge through fun activities (games) so that the problem-solving in the final stage will be easier. This is in line with the opinion of Durkin and Barber (2002) that the use of games in general learning provided a learning atmosphere that motivated students to be involved in it and had a pleasant effect on those involved in learning. In addition, computational thinking-based learning also requires teachers to be active and creative in thinking about learning designs that are attractive to students, for example, deciding the objects that should be brought by students and the types of games that are suitable with the characteristics of materials and students.

The implementation of Physics learning based on computational thinking from the trial phase and the implementation stage accompanied by revisions show that there are several activities that must be carried out by the teacher. First, the teacher must create a learning atmosphere that can make all students get involve in the contextual phenomena. Phenomena must be presented as attractive as possible through storytelling technique, video, or interesting illustrative images. Second, the teacher must be patience and allow students to think and discuss in analysing phenomena and making questions based on the phenomena given. Third, the teacher must be able to conclude various kinds of students' questions into one or more general questions that can accommodate all the questions of students. One thing that needs to be considered by the teacher is to ensure that all students' questions have been accommodated so that students can focus on the learning process. Fourth, teachers must plan and prepare all sources of literacy. Fifth, the teacher must determine the types and rules of the game and integrate them with discussions containing constructivist questions. Sixth, the teacher should be able to guide students in solving problems and making conclusions.

3) The response of teachers (media users) and students to learning based on computational thinking assisted by DST media

The results of the observations showed that students' responses were in the form of prominent activities. After that, the activities were described as instructional and accompaniment impacts. These instructional impacts have the purpose of increasing the ability of students in several ways, such as: observing phenomena; asking questions; literacy; building concepts; assessing; solving problems; drawing conclusions; and Higher-Order Thinking skills (the emergence of higher order thinking questions). The accompanying impacts that arise during learning are collaboration skills, positive attitudes towards learning, independence or autonomy in learning, leadership skills, verbal skills, and honest attitudes as part of strengthening character education.

The students' responses were as follow: (1) Students were active, enthusiastic, and motivated to learn Physics using computational thinking-based learning; (2) Students strongly agreed that computational thinking made learning Physics more contextual or relevant in daily life; (3) DST media learning helped students to understand the concept and solve problems; (4) Computational thinking-based learning increased their creative communication skill and relationships with each other. Therefore, computational thinking-based learning is able to present a combination and integration of scientific approaches and 21st-Century learning skills. Based on the results of this study, computational thinking-based learning has met three quality criteria for learning models, namely: validity, practicality, and effectiveness.

Conclusion

Based on the results of the study, it is concluded that computational thinking-based DST learning media is developed using the ADDIE model containing syntax components, social systems, reaction principles, support systems, as well as instructional and accompaniment impacts. The results of the expert validation show that the supporting components of computational thinking-based DST learning media are consistent and related to each other. The results of a simple quasi-experimental study show there are significant differences between the experimental group and the control group (t count was 2.876 while t table was at the 5% significance level and $p < 0.05$ was 2.042). It means that there are significant differences between students which are taught using computational thinking-based learning and those who are taught using conventional models. There are positive (5%) and very positive (95%) students' responses to the computational thinking-based DST learning media.

References

Brookhart, S. M. (2010). How to Assess Higher-Order Thinking Skills in Your Classroom. Los Angeles: presented at the annual meeting of ASCD.

Cansu, E. A. (2019). An Overview of Computational Thinking. International Journal of Computer Science Education in Schools. Vol. 3, No. 1.

Dick, W. A. (2001). The Systematic Design of Instruction. New York: Longman.

Dreon, O. K. (2011). Digital Storytelling: A Tool for Teaching and Learning in the YouTube Generation.

Middle School Journal, 42 (5): 4-9.
Durkin, K., & Barber, B. (2002). Not so doomed: Computer game play and positive adolescent development. Journal of applied developmental psychology, 23(4), 373-392.
Dyer, L. (2009). Meningkatkan kemampuan Bicara Anak. Jakarta: Bhuana Ilmu.
Fadel, B. T. (2009). 21st Century Skills Learning for Life in Our Times. San Fransisco: Wiley.
ISTE. (2011). Operational definitions of computational thinking. Retrieved 02 09, 2021, from https://c.ymcdn.com/sites/www.csteachers.org/resource/resmgr/CompThinkingFlyer.pdf
Kemdikbud, G. B. (2021). Guru Belajar Kemdikbud Seri AKM. Retrieved from Guru Belajar Kemdikbud: www.gurubelajarkemdikbud.go.id
McNicholl, R. (2018). Computational thinking using code.org. ello World, 4, 37.
Skills, C. (2008). 21st Century skills, education & competitiveness, a resource and policy guide.
Sudjana. (2005). Metode Statistika. Bandung: Transito.
Wiggins, G. A. (2011). The Understanding by Design guide to creating highquality units. Alexandria: VA: ASCD.
Wing, J. (2006). Computational Thinking. ACM, 33-35.
Wing, J. (2008). Computational Thinking and Thinking about Computing: Philosophical Transactions of the Royal Society. 66; pp. 3717-3725. Melbourne University Press. Chapter 8.; pp. 127-14.
Wing, J. (2017a). A Conversation About Computational Thinking: Future Frontiers: Education for an AI World. Melbourne University Press. Chapter 8.; pp. 127-140.
Wing, J. (2017b). Computational Thinking's Influence on Research and Education for All. Itallian Journal on Educational Technology. 25(2); 7-14. Melbourne University Press. Chapter 8.; pp. 127-140.
Yadav, A. M. (2014). Computational thinking in elementary and secondary teacher education. ACM Transactions on Computing Education (TOCE), 14(1), 5.

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Research Paper Open Accsess

Projectile Horizontal and Vertical Component of Motion Independence Demonstrator

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Abstract

This paper developed an instructional tool called Projectile Horizontal and Vertical Component of Motion Independence Demonstrator, user manual, and learning module to physically demonstrate the projectile motions' abstract concept. Specifically, it was pursued to develop an instructional tool, user manual, and learning modules on projectile motion, determine its evaluation results from the experts, and determine recommendations drawn from the evaluators for the improvement, utilization, and dissemination of developed instructional tools and learning modules. Quantitative and qualitative data were gathered using a four-rating Likert scale evaluation sheet. Results showed that instructional tool and user manual are "very satisfactory" and suggestions for improvement, utilization, and dissemination of the instructional materials are forwarded. Further, it is recommended for replication and use in secondary school as instructional material.

Keywords: Projectile motion, Instructional tool, User manual, Learning modules

Introduction

Science education particularly the physics area is considered one of the most challenging subjects offered in a school curriculum. Hence, it is very essential for it explains the basics of living and helps people make sense of the world. However, science education in the Philippines cannot be considered a strength. Pursuant to 2014 statistics, the National Achievement Test (NAT) pass rate in science for sixth grade is only 69.21%, while the high school pass rate is much worse at only 46.38% (Ambag, 2018) [1]. This indicates that the field of science teaching in the country is relatively small and that improvements are required.

In 2018, the Programme for International Student Assessment (PISA) conducted by the Organization for Economic Co-operation and Development (OECD), ranked the Philippines last in all three areas of assessment which are Reading, Mathematics, and Science. In science literacy, the average score for the Philippines was relatively low gaining only 357 versus the OECD average of 489. The result shows a call for the education system to be reviewed, to know the different possible causes whether it affects the new (K-12) curriculum, the teacher's and student's readiness or unpreparedness in this assessment, or other possibilities like strategy in classroom instructions [2].

As science seeks to create simple descriptions and explanations for the complexity of the world, a scientific model is considered a powerful tool and a common way to represent these simplifications. From the perspective of Oh and Oh (2011), the purpose of a scientific model is to describe, explain, and predict natural phenomena [3]. According to Treagust, Chittleborough, and

Mamila (2002) [4], Models are useful tools in learning science that can be used to improve explanations, generate discussion, make a more valued prediction, provide visual representations of abstract concepts, and generate mental models,.

In grade 9 physics, one of the relevant topics is Projectile Motion. Giancoli (1980: 53) defined Projectile motion as the motion of an object that is projected into the air at an angle, near the earth's surface (McCloskey, 1983). For instance, a ball dropped from the top of a table and another ball rolled on the table which takes a horizontal distance while it drops, will reach the ground at the same time as long as it leaves the table simultaneously. The vertical distance (*d*) of the two ball is the same, and the acceleration due to gravity (*a*) is constant at 9.8 m/s2. This shows that even if the ball rolls off the top of the table and then take a horizontal distance as it drops, it will take the same time to reach the ground with that of the ball that straightly falls. The fact that one ball is moving horizontally while it is falling does not affect its vertical motion, according to Halliday and Halliday (2001: 56). Unfortunately, this concept of projectile motion is misunderstood by many and is a source of a lot of misconceptions of students [6].

To address this problem and uplift the science education curricula, an instructional tool called Projectile Horizontal and Vertical Component of Motion Independence Demonstrator can be designed, developed, and used in order to challenge and hopefully change students' misconceptions and problems related to projectile motion. Through this prototype, students will be given a chance to manipulate the model for them to learn and understand first-hand the concept of projectile horizontal and vertical component of motion.

This demonstrator was combined with learning activities by creating a module to target the required competency in studying projectile motion. The developed instructional tool and learning module will aid in providing 4 substantive discussions and explanations of projectile motion in the classroom. This will allow teachers to teach projectile motion while avoiding misconceptions that students may have.

Methodology

This descriptive-development study gathered data from the evaluation of experts in the field of science teaching. The researchers utilized an evaluation form adapted from the two sets of four-rating scale evaluation from the issued evaluation sheet of the Department of Education for Learning Resources Management and Development System (LRMDS) and from the Learning Resource Evaluation Guidelines of the Saskatchewan Ministry of Education (2020). The researchers randomly selected science expert teachers in five schools around the Division of Camarines Sur during their school meetings and on an appointment basis. Demonstration of the device functions was done face to face to facilitate proper evaluation. The time of demonstration and evaluation of the instrument for each set of teachers varies from different schools depending on questions, clarifications, and discussions with demonstrator and evaluator. The results of the evaluation were measured using frequency and weighted mean. The learning module was also evaluated and validated by selected secondary school science teachers on a scheduled and appointment basis.

Results and Discussion

The present study primarily aims to devise an instructional tool to discuss selected projectile motion concepts. *Projectile Horizontal and Vertical Component of Motion Independence Demonstrator* was the designed and developed instructional tool to aid instruction in Physics, discussing two projectile motion concepts, namely horizontal and vertical motion and projectile at an angle. The instructional tool was consisted of five main features as shown in Figure 1. The main feature of the instructional tool is to show the independence between the horizontal and vertical component of motion. Magnetic mechanism allows a magnet of the ball to demonstrate the independence of the projectile's horizontal and vertical component of motion. It was made using the concept of a simple electrical circuit. A positive electrical charge wire that was attached to a battery goes through the switch at the back of the frame, then it was coiled to an iron screw to create a magnetic mechanism.

The positive charge electrical wire was connected to a trigger at the tip of the first slide, allowing it to cut the power supply when the ball passes through it. When the ball having horizontal motion was launched, it should demonstrate that it would reach the ground at the same time as the ball having a vertical motion only.

A user manual prepared by researchers was developed along with the instructional tool to help students and teachers to use the instructional tool and avoid the risk of accidentally damaging the developed instructional tool, thereby reducing repair costs and avoiding unnecessary repairs. The user manual's contents are information regarding the background of the instructional tool, how to set up the instructional tool, troubleshooting and maintenance, and safety measures of using the instructional tool.

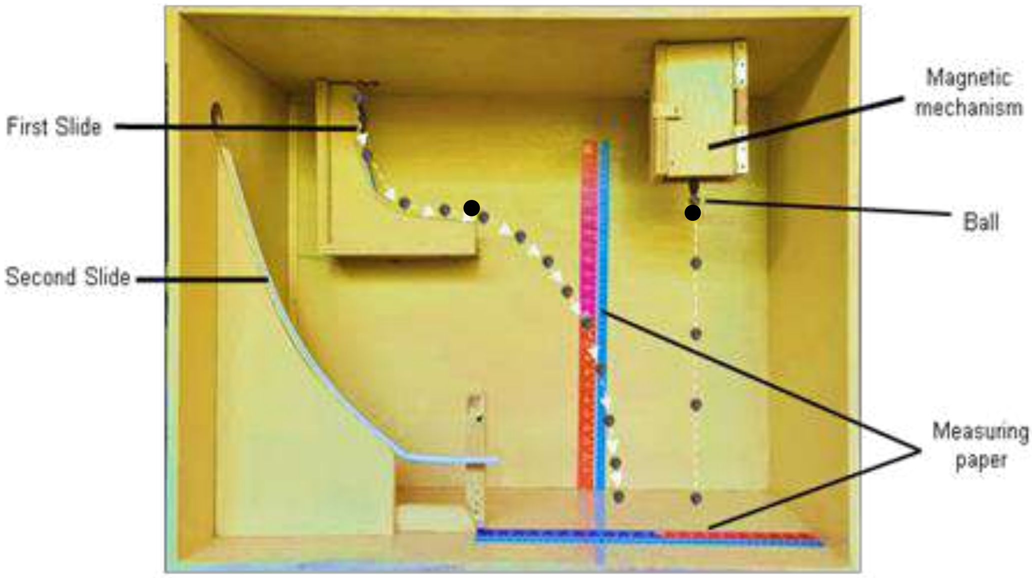

Figure 1. *Projectile Horizontal and Vertical Component of Motion Independence Demonstrator*

The instructional tool was examined carefully on three (3) factors using a likert-scale type of instrument ranging from 1 to 4 where 4 being Very Satisfactory (VS); 3 - Satisfactory (S); 2 - Poor; and 1 – Not Satisfactory. Table 1 beneath suggests the precis of evaluation by the respondents at the instructional tool. In the design factor of the instructional device, the overall score was 3.86, defined as "very satisfactory". In termsof the instructional quality factor of the tool, an average rating of 3.75 was obtained having a description of "very satisfactory".

Lastly, on the cost-benefit, the overall rating is 3.80 with a description of "very satisfactory". Henceforth, the grand mean on evaluation of the respondents to the instructional tool is 3.80 and has a description of "very satisfactory". The overall evaluation indicates that the respondents evaluated the instructional tool is effective for use in teaching physics concepts in Projectile Motion in public and private secondary and tertiary institutions.

Table 1. *Summary of expert's evaluation on the instructional tool*

Factors	Average Mean	Description
Design	3.86	Very Satisfactory
Instructional Quality	3.75	Very Satisfactory
Cost-Benefit	3.80	Very Satisfactory
Grand Mean	3.80	Very Satisfactory

The learning modules were also developed to complement the instructional tool as shown in Figure 2. The learning modules consist of two developed parts: Module 1 deals with "Motion in Two Dimensions: Horizontal and Vertical Motion" and Module 2 with "Motion in Two Dimensions: Projectile at an Angle". The lessons included in the learning module have been designed to fit within the framework of the science curriculum and the standards and Most Essential Learning Competencies (MELCs) in the K-12 science curriculum required by the Department of Education, particularly in the 9th grade. The content of module 1 was discussion on the independence of horizontal and vertical projectile motion while module 2 covers the relationship between the angle of projection and the height and range of the projected ball.

Figure 2. *Front Cover of the Learning Module 1 and 2*

Also, the Department of Education (DepEd) of the Philippines' 4-point evaluation rating sheet for print resources was used to evaluate the crafted module with two (2) as the lowest rating on very few criteria and four (4) as the highest rating in most of the criteria. Table 2 below shows the summary of the overall evaluation of the respondents on the crafted learning module. The results were as follows: the average mean for the content is 3.89; for the format, the average mean is 3.82; the presentation and organization criterion, the average mean is 3.89; and, on the accuracy, and up-to-datedness of information in the learning module, the average mean score is 3.83, all described as "very satisfactory". The grand mean of the respondent's evaluation of the learning module was 3.86 and got an overall rating description of "very satisfactory".

Table 2. *Summary of experts' evaluation on the learning module*

Factors	Average Mean	Description
Content	3.89	Very Satisfactory
Format	3.82	Very Satisfactory
Presentation and Organization	3.89	Very Satisfactory
Accuracy and Up-to-Datedness	3.83	Very Satisfactory
Grand Mean	3.86	Very Satisfactory

For further development of the instructional tool, recommendations drawn from the evaluators are considered. The recommendations of the evaluators on the improvement of the instructional tool includes incorporating other necessary materials, proper labelling of measurements in the tool, maximizing the background, modification of instructional tool's size, changing the colors of the background and metal ball, and modification of the materials used. For the utilisation of the instructional tool, the evaluators recommended confirming the user-friendliness of the instructional tool and including proper storage for the metal ball. The recommendations of the evaluators on the dissemination of the instructional tool includes creating video tutorials on the tool's development, securing DOST approval, proposing usage of the instructional tool in public school, and subjecting to second evaluation of the improved instructional tool On the other hand, the recommendations drawn from the evaluators on the improvement of the learning modules include adding more learning activities and providing key-to-correction of the learning module. It was found out that there were no recommendations from the evaluators on the utilisation and dissemination of the learning modules.

Conclusions

In conclusion, the developed instructional tool and user manual in teaching projectile motion concepts is completed and ready to be utilised for teaching. Furthermore, it met all the prescribed requirements set by the Department of Education for developing improvised instructional materials and is able to show the independence of motion of the projectile in its horizontal and vertical axis. On the other hand, the crafted learning module met all the minimum requirements set by the Department of Education for developing printed materials to be utilised in teaching projectile motion, particularly the independence of the horizontal and vertical component of motion. The recommendations of the evaluators on the improvement, utilisation, and dissemination of instructional tool and learning module were found varied and can be easily adapted for improvement of the tool.

References

[1] R. Ambag, Teaching science in the Philippines: Why (and how) we can do better, (2018). URL: https://www.flipscience.ph/news/features-news/features/teaching-science-philippines/

[2] Department of Education, PISA 2018: National Report of the Philippines, (2018).

URL: https://www.deped.gov.ph/wp-content/uploads/2019/12/PISA-2018-Philippine-National-Report.pdf

[3] P.S. Oh and S.J. Oh, What teachers of science need to know about models: An overview, International Journal of Science Education, 33(8), 1109-1130 (International Journal of Science Education, 2011).

[4] D.F. Treagust, G. Chittleborough, & T.L. Mamila, Student's understanding of the

[5] M. McCloskey, Intuitive physics, *Scientific american*, *248*(4), 122-131 (1983),

role of scientific models in learning science (International journal of science education, 2002), 4(4), 357-368.

[6] D. Halliday, R. Resnick, & J. Walker, Fundamentals of Physics. Problem supplement to accompany (2001). URL: https://www.webassign.net/ebooks/hrw10demo/toc.html?page=4.4

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The Effectiveness of The Rose (Reconnection of Science and English) Module in The Achievement of Science and English Competencies

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Abstract

DepEd's Basic Education – Learning Continuity Plan (BE-LCP) as described in DO. No. 12, s. 2020 called for measures that will bring education equitably to all its learners. The researchers saw the merging of Science and English into one learning material using a content-based instruction approach as an apt response to this call. Therefore, the ROSE (Reconnection of Science and English) Module was crafted. This experimental mixed-methods design action research sought to (1) determine the perceptions of the Grade 10 students on the ROSE (Reconnection of Science and English) Module in terms of (a) content, (b) activities, (c) the merged/integrated module as a whole; (2) determine if there was a significant difference between the students' pre and post-test results using the ROSE Module; and (3) identify how had the ROSE Module helped students achieved DepEd's Most Essential Learning Competencies (MELCs) in Science and English subjects. A survey questionnaire was used to find answers to objectives 1 and 3, while a diagnostic test was utilised as the instrument for objective 2. After two quarters of using the ROSE module, data on the pre and post-test results during the first and second quarters revealed a significant difference in the Grade 10 students' scores. Survey responses also showed that the respondents agreed to the Module's (a) content, (b) activities, and (c) merging/integration. Finally, despite the difficulties, confusion, and many other challenges, most of the respondents agreed that the ROSE module taught them academic skills such as writing and thinking as well as life skills such as responsibility, time consciousness, patience, perseverance, industry, and self-reliance.

Keywords: BE-LCP; CBI; modular print learning; ROSE Modules; Science and English competencies

Introduction

The current Covid-19 pandemic ushered in a new era worldwide, requiring almost all sectors from health, economy, transport, and even education to embrace the new normal. This era proved to be a challenging change to follow. Still, as the Department of Education braced for this life-changing turn in the academic field, it encouraged everyone to "ensure learning continuity through the K to 12 learning adjustments, alignment of learning materials, deployment of multiple delivery modalities, …" which was one of the principles highlighted in its Department Order No. 12, series of 2020 or the "Adoption of the Basic Education Learning Continuity Plan (BE-LCP) for School Year 2020-2021 in Light of the Covid-19 Public Health Emergency."

The same DepEd Order underscored two other equally important principles under which the BE-LCP stands, including "be sensitive to equity considerations and concerns, and endeavour to address them the best we can;", and "link and bridge the BE-LCP to DepEd's pivot to quality and into the future of education, under the framework of

Sulong Edukalidad and Futures Thinking in Education."

DO No. 12, s. 2020 also laid down its Most Essential Learning Competencies (MELCs) in all curriculum areas, which is DepEd's "emergency measure to allow instruction amid challenging circumstances to focus on the essential learning and ease the requirements for adapting classroom-based learning resource for distance learning."

Due to the need to ensure that flexible learning opportunities are provided to the students and that academic requirements are eased without prejudice to the standards set in the MELCs in this time of the pandemic, the researchers conceptualised an integrative approach to the development of learning module in Science and English subjects. The concept arose from the approach called Content-based Instruction (CBI), where the focus is not primarily on the language itself but instead on what is being taught through the language (Bilash, 2009). In the CBI approach, a student learns the language by using it to learn some other new content. In like manner, the researchers will craft one module which focuses on Science 10 concepts using the skills in the English language.

Numerous research have proved that the CBI approach is an effective means of teaching not only the language but also the content. For one, Curtain (1995) and Met (1991) as cited by the Center for Advanced Research on Language Acquisition (CARLA, 2019), found that "CBI lends itself to the incorporation of a variety of thinking skills, and learning strategies which lead to rich language development, e.g., information gathering skills—absorbing, questioning; organising skills—categorising, comparing, representing; analysing skills—identifying main ideas, identifying attributes and components, identifying relationships, patterns; generating skills—inferring, predicting, estimating." In another study, Hull (2018) reported that CBI was a popular method in a language class since it targeted competencies not only in the language but also in the achievement of content knowledge in various subjects. Meanwhile, a study on the use of CBI in teaching and reading in Nepal (Adhikary, 2020) proved this method's effectiveness.

Added to the research-driven rationale behind the fusion of Science and English learning, the researchers also recognise the need among its students for a module that will not seem to be academically demanding (although it teaches them all the skills highlighted in DepEd's MELCs) while learning both content and language. Furthermore, the process will also ease away much of the financial constraints on the school as it will reprint only one module for both the two subjects mentioned, a move which is also desired in this time of economic downturn.

This action research study investigated the effectiveness of an integrated module in Science and English 10 subjects called ROSE (Reconnection of Science and English) Module, which was utilised during the pandemic in Tinago National High School for the school year 2020-2021.

The study aimed to answer the following specific research questions:

a. What are the perceptions of the Grade 10 students on the ROSE (Reconnection of Science and English) Module in terms of (a) content, (b) activities, (c) the merged/integrated module as a whole?

b. Is there any significant difference between the students' pre and post-test results using the ROSE Module?

c. How has the ROSE Module helped students achieve DepEd's Most Essential Learning Competencies (MELCs) in Science and English subjects?

Methodology

The study used the experimental method, and all the Grade 10 classes using the ROSE Module were the respondents for twelve (12) weeks or two (2) grading periods. A mixed qualitative and quantitative approach was used in the treatment of data.

To address ethical concerns, parents' and students' consent were solicited. All personal information from the respondents were treated with utmost confidentiality to conform to Republic Act 10173 or the Data Privacy Act of 2012. No names of the respondent were mentioned in the transcript of the survey and other discussions throughout the research to safeguard the identity of the respondents.

Participants and Other Sources of Data and Information

This study involved approximately 36 students from each of the eight (8) sections in Grade 10 or around 289 students in total, enrolled during the SY 2020-2021 in Tinago National High School, Junior High School Department. 90% of those students comprised the total population of the grade 10 level, and this was seen as a good representative of the population for the researchers to make conclusions.

For the survey, 75 respondents from the four classes who answered the survey questionnaire were randomly chosen by the researchers which aimed to triangulate the data derived from the pre and post-test results. The 75 respondents or an average of 19 students from each class also represented the population.

Innivation

The study used the ROSE (Reconnection of Science and English) Module as the innovation and intervention to assist the Grade 10 students in learning Science and English subjects.

First, the researchers taught Science and English 10 subjects respectively, downloaded DepEd Order No. 12, s. 2020 and located the Most Essential Learning Competencies (MELCs) in the subjects mentioned. From these competencies, they brainstormed the possible merging of topics (content) and skills. Then, learning activities with all Science texts were crafted with a diagnostic test to ensure that students' learning is gauged before and after the module utilisation. The module was then submitted for quality assurance at the school level and ready for reproduction and utilisation.

All students in the Grade 10 mentioned above utilised the module during the first and second quarters of 2020-2021. Although they used only one module, each subject area was still autonomous in assessing and grading the output produced from the module. For instance, in assessing an essay about what a student should do when earthquakes happen, the Science teacher just investigated the content presented in the essay. In contrast, the English teacher just focused on the essay's mechanics, organisation, and style. The researchers believed that this approach decreased the students' cognitive load and even led to better performance, as the CBI approach has proved in previous research.

Data Gathering

A researcher-made Diagnostic Test in Science and English was utilised to measure the students' skills in both subject areas before and after using the ROSE Module.

A survey questionnaire for selected students from each section was also used to determine the students' perceptions of the ROSE (Reconnecting of Science and English) Module in terms of (a) content, (b) activities, and (c) the merged/integrated module. Responses to these components derived from a five-point Likert Scale form with a distinct set of arbitrary descriptions which ranged from strongly agree to strongly disagree.

Data Analysis Techniques

Data from the Diagnostic Test and responses to the survey questionnaire were interpreted quantitatively. The researchers used the IBM SPSS Statistics to compute for the Mean, Standard Deviation, and t-test. For the students' responses to the survey questionnaire, a five-point Likert Scale was utilised and ordered from high to low frequency for their corresponding interpretation. Meanwhile, on the respondents' comments and suggestions, emerging themes were identified and interpreted.

Results and Discussion

On The Students' Perceptions of The ROSE Module in terms of (a) Content, (b) Activities, (c) The Merged/Integrated Module as a Whole

Tables 1 to 3 showed the survey results conducted among the four randomly chosen sections to answer the questionnaire regarding their perceptions of the ROSE Module. The survey had a five-point Likert scale option with the following arbitrary descriptions: 4.21 – 5.00 (Strongly Agree), 3.41 – 4.20 (Agree), 2.61 – 3.40 (Neutral), 1.81 – 2.60 (Disagree), and 1.00 – 1.80 (Strongly Disagree).

Table 1 below showed the results of the students' perceptions in terms of content. The questions focused on the relevance of literary texts with the English competencies, Science topics vis-à-vis content, and sufficiency of lesson discussion.

Table 1. *Students' Perceptions of the ROSE Module in terms of Content*

Section	Average	Interpretation
Magwayen	3.55	Agree
Lakambakod	3.06	Neutral
Bathala	3.69	Agree
Amihan	3.74	Agree
Average	3.51	Agree

The results generally favour the content of the ROSE Module which were evidenced by the overall average of 3.51 (agree).

Table 2 showed the respondents' perceptions of activities and included lesson relevance, reliability, and validity questions. The results posted an average of 3.77, which was also interpreted as "agree."

Table 2. *Students' Perceptions of the ROSE Module in terms of Activities*

Section	Average	Interpretation
Magwayen	3.76	Agree
Lakambakod	3.22	Neutral
Bathala	4.14	Agree
Amihan	3.97	Agree
Average	3.77	Agree

Meanwhile, Table 3 showed the students' perceptions of the merged/integrated module and contained questions about unity between lesson content and activities, clarity of instructions, the transition from easy to more complicated lessons, typeface readability, clarity of layout, and illustrations. Like the other two previous indicators, the results above showed that the students agreed with the overall merged or integrated module.

Table 3. *Students' Perceptions of the ROSE Module in terms of Merged/Integrated Module as a Whole*

Section	Average	Interpretation
Magwayen	3.80	Agree
Lakambakod	3.17	Neutral
Bathala	3.76	Agree
Amihan	3.90	Agree
Average	3.66	Agree

The preceding data revealed that CBI has indeed achieved its purpose to target both the content of the lesson in Science and the language competences in English. It was worth nothing that in merging content with language competences, several T's of the CBI approach (which according to Stoller and Grabe (1997) were the means to develop a coherent content-based curriculum) were evident: Themes, Texts, Topics, Tasks, and Transitions. Moreover, based on the data gathered, the students were generally in agreement with how the content, activities (or tasks), and transitions were merged.

On the significant difference between the students' pre and post-test results using the ROSE Module

Table 4 showed the pre and post-test results in Science and English during the first quarter. The results showed that the students had a higher post-test score (M=14.65), (SD=4.68) than pre-test score (Mean=11.10), (SD=5.44) during the first quarter administration of the test on the ROSE Module for Science and English.

Table 5 showed the t-test of Science and English tests during the first quarter. A paired samples t-test found this significant difference ***t (293) = -10.87, p<0.001***.

Table 4. *Pre and Post-test Results in Science and English during Quarter 1*

		Mean	N	Std. Deviation	Std. Error Mean
Science and English tests (Quarter 1)	Pre test	11.10	294	5.44	0.32
	Post test	14.65	294	4.68	0.27

Table 5. *Paired Samples t-test of Science and English during Quarter 1*

		Paired Differences							Significance	
		Mean	Std. Deviation	Std. Error Mean	Interval of the Difference		t	df	Significance	
					Lower	Upper			One-sided	Two-sided
Science and English tests (Quarter 1)	Pre-test-Post test	-3.55	5.61	0.33	-4.20	-2.91	-10.87	293	0.00	0.00

Meanwhile, Table 6 showed the results of the pre and post-test for Science and English during the second quarter.

Table 6. *Pre and Post-test Results in Science and English during Quarter 2*

		Mean	N	Std. Deviation	Std. Error Mean
Science	Pre test	10.88	307	5.70	0.33
	Post test	17.07	307	6.27	0.36
English	Pre test	5.23	268	3.46	0.21
	Post test	8.90	268	4.54	0.28

Results showed that the students had a higher post-test score (M=17.07), (SD=6.27) than the pre-test score (Mean=10.88), (SD=5.70) during the second quarter administration of the test on the ROSE Module for Science 10.

Similarly, in English 10, results showed that the students posted a higher post-test score (M=8.90), (SD=4.54) than the pre-test score (M=5.23), (SD=3.46) during the second quarter.

Meanwhile, the following Table 7 showed the t-test on the pre and post-test of Science and English during the second quarter.

The paired samples t-test for Science found this difference to be significant ***t (306) = -22.43, p<0.001,*** while the same significant difference was found with the paired samples t-test for English ***t (267) = -11.36, p<0.001***.

Table 7. *Paired Samples t-test of Science and English during Quarter 2*

		Paired Differences							Significance	
		Mean	Std. Deviation	Std. Error Mean	Interval of the Difference		t	df	Significance	
					Lower	Upper			One-sided	Two-sided
Science	Pre-test-Post test	-6.19	4.84	0.28	-6.74	-5.65	-22.43	306	0.00	0.00
English	Pre-test-Post test	-3.67	5.29	0.32	-4.31	-3.04	-11.36	267	0.00	0.00

It could be noted that the grades of combined Science and English in Quarter 2 were 8.25 for the pre-test and 13.26 for the post-test. These results were lower than in Quarter 1. The discrepancy can be attributed to the fact that most of the topics during the first quarter are easier than those of the second quarter. For instance, in Science, Quarter 1 topics were mainly about Plate Tectonics; meanwhile in English, language skills mostly focused on using information from news texts in everyday life, appraising the narrative elements, and determining the effects of textual aids. On the other hand, more challenging content was presented in Science during the second quarter, including electromagnetic waves; while for English, competencies revolved around observing the language of research, identifying parts and features of argumentative essays, and formulating statements of opinion and assertion.

The above results reveal that generally, CBI can indeed improve the learners' general knowledge of the topic while at the same time give them opportunities to practice their communicative language skills, including reading and writing. This agrees with the study of Hull (2018) who reported that in the CBI approach, learners were first provided with an overview of the topic, then they were tasked to perform various activities that would make them practice their proficiency in the target language through the engagement with subject matter.

On How the ROSE Module Helped Students Achieve DepEd's Most Essential Learning Competencies (MELCs) in Science and English Subjects

Table 8 below showed the survey results among the respondents who were given the open-ended question "What can you say about the integrated module in Science and English?"

Table 8 reflected that the students generally had difficulty and confusion in using the ROSE module due to their limited vocabulary and the absence of one who could assist them in their studies. Some appreciated the module because it enabled them to get much knowledge from the learning material, while the others said that it was easier to have one module which covered two subjects.

Table 9 below showed the transcribed responses on what the respondents thought were the advantages of the ROSE Module.

The responses revealed that students found it easier to have the two subjects in one module because the lessons were clear and understandable, and it enabled them to go back and review past lessons. Furthermore, it also promoted their academic writing and thinking skills as well as positive values like responsibility, time consciousness, patience, perseverance, industry, and self-reliance.

Table 8. *Transcribed Responses on What the Respondents Can Say about the Integrated Module in Science and English*

Summary of transcribed responses	General Themes
Generally difficult	Complex and confusing due to the students' limited vocabulary and unavailability of someone who can assist them in their studies.
Difficult yet challenging	Much knowledge can be derived from the module.
Generally confusing	Easier to have two subjects in 1 module.
Confusing due to unfamiliar words/limited vocabulary of students	
Confusing because it's combined	
Much knowledge derived from the module	
Difficult and easy at the same time	
It enabled them to learn	
Easier to have two subjects in 1 module	

Table 9. *Transcribed responses on what the respondents think are the advantages of the ROSE Module*

Summary of transcribed responses	General Themes
Easier to have two subjects in one module	Easier to have two subjects in 1 module.
Able to get knowledge despite the pandemic	Still gained knowledge despite the health crisis.
Helped gain additional knowledge	Promoted development of writing skills, thinking skills.
Improved writing skills	Learned the values of responsibility, time consciousness, patience, perseverance, industry, and self-reliance.
Improved thinking skills	Lessons are clear and understandable.
Developed responsibility and time consciousness	Enabled students to go back and review previous lessons.
Clear and understandable lessons	
Students can still go back and re-read lessons	
Learned patience, perseverance, industry, self-reliance	
Learned to work on one's own	

Table 10 showed the disadvantages of the ROSE module as perceived by the respondents. Most disadvantages noted by the students in using the module including the difficulties in understanding the lessons because of having a limited vocabulary, unclear pictures, and no one to assist them in answering. Some also mentioned about having many household chores, which also led to their difficulty in answering the modules. By having just one module, the respondents commented that the lessons seemed compressed; meanwhile, the others said that by combining the two subjects, it looked like there was a lot to be done. On the other hand, some mentioned that by combining the two, they could not distinguish between Science and English.

Table 10. *Transcribed Responses on What The Respondents Think are The Disadvantages of The ROSE Module*

Summary of transcribed responses	General Themes
Lessons were compressed	Lessons were compressed.
Difficulty understanding some parts of the module	Lessons seemed like it's a lot/a handful.
No emphasis on each separate subject	No more emphasis on each separate subject; can't distinguish which is Science or English.
The module seems to cover a lot of topics	Difficulties are due to limited vocabulary, unclear pictures.
Difficulty due to limited vocabulary	Difficulties are due to the absence of someone who can assist them in answering.
Some pictures are unclear	Difficulties are due to household chores.
Difficulty due to unavailability of someone who can assist in answering the module	
Lack of focus due to various household chores	
Unsure about what subject to focus on	

Table 11 below showed how the ROSE module helped the respondents in learning the Science and English subjects. First, the students noted that ROSE Module made them learned two subjects in one module, making answering the activities more manageable.

It also facilitated their understanding on unfamiliar words, grammar, and thinking skills which led to the realisation that Science and English are not that difficult. Furthermore, they learned new knowledge through the module during the pandemic.

Table 11. *Transcribed Responses on How The ROSE Module Helped Them in Learning Science and English*

Summary of transcribed responses	General Themes
It made answering the activities easier	It made answering the activities more manageable.
I learned to understand and read properly	It facilitated understanding of unfamiliar words, grammar, thinking skills.
I learned patience in understanding unfamiliar words	It led to discovering new knowledge despite the pandemic.
I gained additional knowledge	It led to the realization that Science and English are not that difficult.
I learned despite the pandemic	It made them learn two subjects in just one module.
The realization that Science and English are not that difficult	
It improved my English, and I gained additional knowledge	
I learned especially grammar	
I learned the two subjects in one module	
I get to hone my skills in thinking/understanding	

The succeeding table below focused on the respondents' comments on the ROSE Module. It was noted that the respondents freely wrote down their comments about the module they used for the first and second quarters. Their comments derived from the difficulties they experienced in answering the module due to vocabulary. Some of them reflected that they had a tough time balancing between answering the module and doing house chores.

Moreover, there were many essays to be written. Despite some difficulties, they expressed that they were able to manage the answers, and it was easy to have two subjects in one module. Their responsibility and self-reliance were also developed by answering the module on their own.

Table 12. *Transcribed Responses of The Respondents' Comments on the ROSE Module*

Summary of transcribed responses	General Themes
Easy to answer but too many essays	It was easy to answer, but it has too many essays to write.
No problem encountered	Some parts were difficult to understand due to reasons like limited vocabulary.
Difficulty answering some parts of the module	Lessons were tough but managed through them all.
Tough lessons but manageable	Answering the module taught them responsibility, self-reliance.
I learned how to be a responsible student	The module is sound, and they're contented with it.
Difficult to understand; did not learn anything	It was easy to have two subjects in one module.
Learned how to study on one's own	The modular approach gave them a tough time balancing between studies and working for the family.
Asked the help of others for complex topics	
Module is good	
Contented with the module	
Difficulty in using the English language	
I had difficulties but was able to manage	
I had a tough time balancing between studies and working	
Easier to understand with one module for two subjects	
Appreciates the two subjects in one module approach	

Table 13 below showed the general suggestions culled from the respondents' answers. The suggestions ranged on opposite extremes: some recommended the approach while the others preferred the separate subjects of Science and English. Other recommendations focused on visual aspects of the module such as having clear pictures, using simple vocabulary, and more explanations and examples that geared to facilitate their understanding. There was also one who suggested having more space for their answers.

Table 13. *Transcribed Responses to the Respondents' Suggestions on the ROSE Module*

Summary of transcribed responses	General Themes
Recommends this approach	The approach is recommended.
Suggests clear pictures, so it's easy to understand	Make images clear to facilitate better understanding.
Some lessons need explanations and a lot of examples	Give more explanations and examples, especially for complex topics.
Better if Science and English are separate	Use simple vocabulary.
Suggests more straightforward vocabulary facilitate understanding	Have more space for students' answers.
Suggests explanations/discussions	The approach is NOT recommended.
Suggests more space for answers	

The statistics on the pre and post-test of the learners showed that the ROSE Module was indeed effective in achieving the competencies in Science and English, evidenced by the significant difference in both subjects during the first and second quarters when the module was implemented among the Grade 10 learners.

This was affirmed by the results of the survey questionnaire in which the respondents also agreed with the ROSE module in terms of content, activities, and integration of the two subjects.

In the survey responses, the respondents' answers to the questions reflected both positive and negative feedback. A closer look at some of the responses revealed that they seemed to be generally talking about the "modules" as a whole during the time of pandemic and not just the ROSE Module. In fact, they had much difficulty in accomplishing the module because they were doing house chores or had no one who could assist them in answering the questions.

Some answers were specific only to the ROSE Module, for example, the difficulty in distinguishing which lesson was for Science and English. Since the lessons were merged, the learners could not determine the activities for the separate subjects.

Conclusion

The concept of the ROSE Module is anchored on Content-based Instruction (CBI), an approach which focuses on the topic or the subject matter. In CBI, students learn about the topic using "a language they are trying to learn rather than their native language, as a tool for developing knowledge and linguistic ability in the target language" (teachingenglish.org.uk). CBI is considered to be a more natural way of developing language ability, as it bears a resemblance to the way we learn our first language. With CBI, students fulfil a real language purpose: to know about Science concepts and translate that learning to activities such as writing essays, creating infographics, or writing outlines.

Based on the students' perceptions of the ROSE Modules, the data shows that the respondents perceive the ROSE Module’s content, activities, and subject merging or integration as something agreeable to them.

From the significant difference between the students' pre and post-test results using the ROSE Module, the data gathered show that in both Science and English subjects, there is a significant difference between their pre and post-test scores during the first and second quarter periods. Moreover, the difference is higher during the first quarter than the second quarter.

According to how the ROSE Module helps students achieve DepEd's Most Essential Learning Competencies (MELCs) in Science and English subjects, the results show that the learners believe the ROSE Modules have both advantages and disadvantages, and it have been instrumental in helping them learn the two subject areas. They also give their comments and suggestions on how the module can still be improved for Grade 10 students in the succeeding years.

Recommendations

It is understandable that students experienced confusion or felt that there was no focus on their language learning. CBI is not explicitly focused on language learning; instead, it uses language to learn about content, which is entirely new to them. To address this difficulty, it is recommended that measures be done by the researchers to address this confusion among the students, and this include the following: (1) orientation of students on the ROSE module and the underlying principle behind the merging of Science and English subjects; (2) making language more straightforward to promote better understanding among the learners; and (3) inclusion of lesson enhancers such as short video lessons explaining the complex topics.

Further research on the utilisation of CBI is also recommended especially in the Philippine setting to better shed light on the relevance of this approach to the country's educational setup. This is especially true in the secondary level of both Junior and Senior High School (Grades 7 through 10 and 11 through 12), as English instruction is used for most of the subject areas including Mathematics, Science, English, Music-Arts-Physical Education-Health (MAPEH), and Technology and Livelihood Education (TLE).

Finally, regarding the innovations on modules that will be crafted using the CBI approach, it is also suggested that besides the students, teachers can contribute in evaluating the content, activities, and the merged module as a whole.

References

Adhikary, R. P. (2020). Effectiveness of content-based instruction in teaching reading. *Theory and Practice in Language Studies*, Vol. 10, No. 5, pp. 510-519, May 2020. http://dx.doi.org/10.17507/tpls.1005.04

Bilash, O. (2009). *Content-based Instruction*. Available: https://sites.educ.ualberta.ca/staff/olenka.bilash/Best%20of%20Bilash/content

British Council. (2021). Content-based instruction. Available: https://www.teachingenglish.org.uk/article/content-based-instruction

Center for Advanced Research on Language Acquisition (CARLA). (2019). *Content-based Second Language Instruction*. Available: http://carla.umn.edu/cobaltt/CBI.html

DepEd Order No. 12, series 2020. *Adoption of the Basic Education Learning Continuity Plan (BE-LCP) for School Year 2020-2021 in Light of the COVID19 Public Health Emergency*. Department of Education.

Hull, T. (2018). Content-based instruction: A communicative approach for the EFL classroom. *PUPIL: International Journal of Teaching, Education and Learning.* 2(3),63-77. Available: https://dx.doi.org/10.20319/pijtel.2018.23.6377

Stoller, F. L.& Grabe, W. (1997). A 6T's Approach to Content-Based Instruction. Available: https://carla.umn.edu/cobaltt/modules/curriculum/stoller_grabe1997/6ts.pdf

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Improving Student's Conceptual Understanding and Metacognitive Strategies through Quantum Learning Model with Concept Map Techniques

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Abstract

Nowadays, we commonly find students' low interest toward science learning, students' low understanding of science concept, and low impact of learning process toward students' thinking skills. This study aims to identify the improvement of students' conceptual understanding and metacognitive when applying quantum learning model with mind mapping at learning process. This study also describes the metacognitive strategies in quantum learning model using mind map. A mixed methodology was used in this study. The results show that students who studied using quantum learning model with mind mapping have higher conceptual understanding and metacognitive improvement. The steps in the quantum learning model can improve students' metacognitive strategies. The result provide suggestion to other teachers to alternatively use quantum learning model with mind mapping to improved students' conceptual understanding and metacognitive.

Keywords: conceptual understanding; mind mapping; quantum learning, metacognitive strategies

Introduction

The understanding of students' concepts in a Junior High School in Sragen Regency of science subjects is still weak. This is indicated by students' learning outcomes that have not been encouraging. According to Gardner as quoted by Santyasa (2014) understanding is a mental process of adaptation and transformation of knowledge. There are several reference indicators in the process of understanding concepts, namely: interpreting, giving examples, classifying, summarising, guessing, comparing, and explaining.

Low learning outcomes also indicate the ability of students to control the learning process is still low. According to Risnanosanti (2008) a person's ability to control the learning process is called metacognitive ability. According to Livingston (1997) metacognition includes a knowledge component and a strategy component. Metacognitive strategies include planning, monitoring, and evaluation. The application of metacognitive strategies will control one's learning process in order to make effective learning.

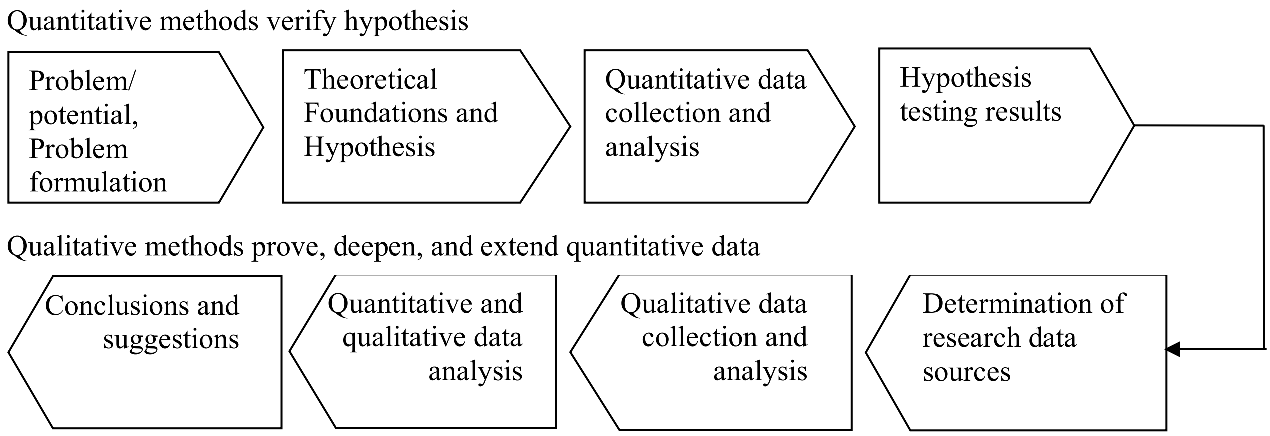
Responding to the abovementioned challenges, quantum learning model can be one of models implemented to improve learning process. Main principle of quantum learning is to bring students' world into our world and bring our world into students' (de Porter, et al, 2005). This principle requires the need for a teacher to enter the students' world as an early step of learning activity. In addition, quantum learning has two main concepts, namely accelerated learning and learning facilitation (de Porter, et al, 2005). The quantum learning model can be implemented in various ways. One of suggestions in implementing quantum learning is to use a concept map. A concept map is a visual presentation of the connection of concepts and the hierarchical organization of concepts (Santrock, 2008). Concept maps provide an overview of the concepts in the subject matter to ensure students can understand the concept as a whole. Learning activity using quantum learning combined with concept maps is carried out through sequential learning steps (syntax). The syntax for learning the quantum learning model with a concept map is described in Table 1.

Table 1. *Syntax of quantum learning model with concept map*

No	Phase	Teacher activities	Student activities
1	Grow	Interact with students, motivate students by conveying AMBAK (what is the benefit for me).	Passionate about participating in learning activities.
2	Experience	Bring experience to students, invites investigations.	Experience yourself, conduct investigations, gather information.
3	Name	Give definitions and keywords, link, provide reinforcement using a concept map.	Define, understand information, relate information using concept maps
4	Demonstrate	Demonstrate, guide students.	Demonstrate, practice.
5	Repeat	Direct students to repeat the material.	Repeat the material learned, convey.
6	Celebrate	Give reward	Celebrate success.

Methodology

The research was conducted using mixed methods research. The design used is Explanatory Sequential Design. The steps in this study are illustrated in Picture 1 (Sugiyono, 2013)



Picture 1. *Chart of research development procedures.*

to the first step is to find that students' understanding of concepts and metacognitive strategies is low. Theoretical basis is determined in the form of conducting a literature review on quantum learning, concept maps, understanding concepts, and metacognitive strategies. The study proposed a hypothesis that there is a difference in improvement of concepts understanding and a difference in improvement of metacognitive strategies between quantum learning and concept maps compared to conventional learning. Conventional learning means learning process which do not use any specific learning model or syntax, method, and media. It only consists of opening, main session, and closing.

The collected data is students' understanding concepts based on test result and students' metacognitive strategies with questionnaires before and after treatment. The hypothesis test was carried out using a non-equivalent control group design by giving different treatment between the experimental group and the control group.

The source of qualitative data was determined by taking five students each from the experimental group and the control group. The qualitative data was collected through interviews. After the data was collected, quantitative and qualitative data analysis was carried out by confirming the results of quantitative data analysis with the results of qualitative data analysis. The data analysis result becomes reference for the study conclusion and suggestion provided for further improvement.

The subject of this study is students from class VIII B and VIII C of SMP Negeri 3 Sragen for the academic year of 2014/2015. There were 33 students from each class. Class VIII B students were the experimental group while class VIII C students were the control group. The variables used are independent variables and dependent variables. The independent variable is the use of a quantum learning model with a concept map technique and the dependent variable is an understanding of concepts and metacognitive strategies.

Data Collection Techniques and Instruments

Data was collected by using test, interview, and questionnaire techniques. Data collection instruments are divided into three stages, namely preliminary studies, expert validation, and implementation. The preliminary study used an interview guide instrument about learning support facilities and about barriers to learning activity. Expert validation uses validation sheets for learning tools, teaching materials, concept understanding tests, metacognitive strategy questionnaires, and interview guidelines for metacognitive strategies. The implementation uses a concept understanding test, a metacognitive strategy questionnaire, and a metacognitive strategy interview guide.

Instrument Validity and Reliability

Content validities were tested by asking for expert judgment (science education lecturers) and empirical method of validity. Based on both validity test, the valid concept understanding test instrument are 35 out of 45 items. For the metacognitive strategy questionnaire, 30 out of 35 statement items are valid. The reliability of the concept understanding test instrument was tested using the Kuder Richardson 20 formula. The reliability of the metacognitive strategy questionnaire was tested using the Cronbach's Alfa formula.

The validity test of qualitative data is carried out by triangulation method which uses different data collection techniques based on the same data source (Sugiyono, 2010). The data obtained from the questionnaire was compared with the data from the interviews.

Data analysis technique

Quantitative data in the form of data on increasing students' understanding of concepts and metacognitive strategies were analysed by inferential statistics using

Microsoft Excel For Windows 2007. The analytical techniques used are as follows.

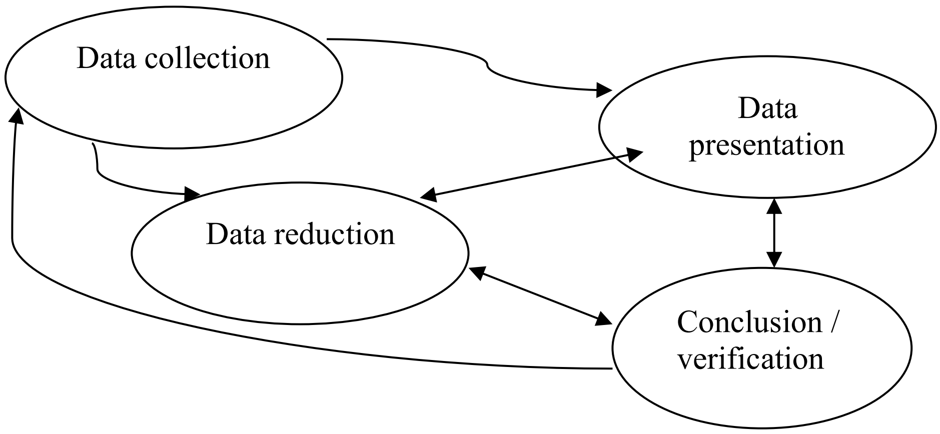
Normality test

The normality test was carried out because the use of parametric inferential statistics required the data to be analysed to be normally distributed. For normality test used chi squared test (χ^2). If the value of χ^2count is smaller than χ^2 table, then the data is normally distributed. From the normality test results, it shows that the data is normally distributed. Afterwards, the t test was carried out.

Paired sample t test

The t test is used to test the alternative hypothesis (Ha) to prove that there is a difference in improvement of concepts understanding and a difference in improvement of metacognitive strategies between quantum learning and concept maps compared to conventional learning. Ha is accepted if the value of t count is greater than t table.

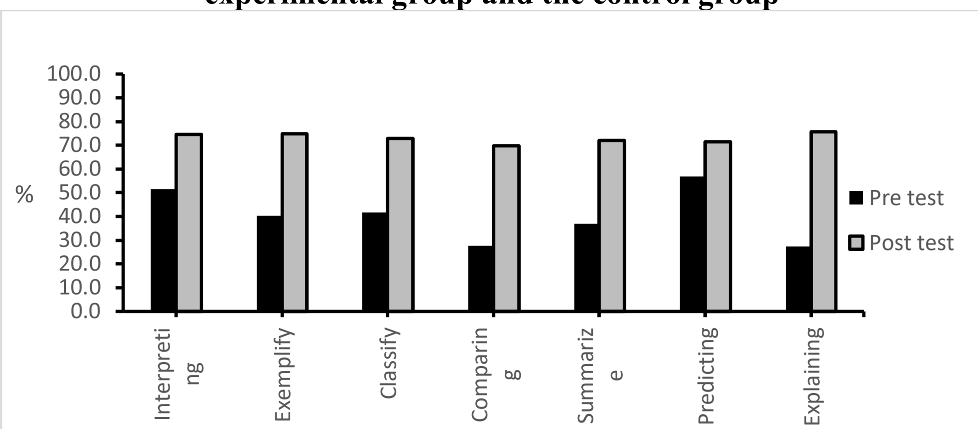
To analyse the qualitative data, an interactive model from Miles and Huberman is used as shown in Picture 2 (Sugiyono, 2010).



Picture 2. *Components of data analysis.*

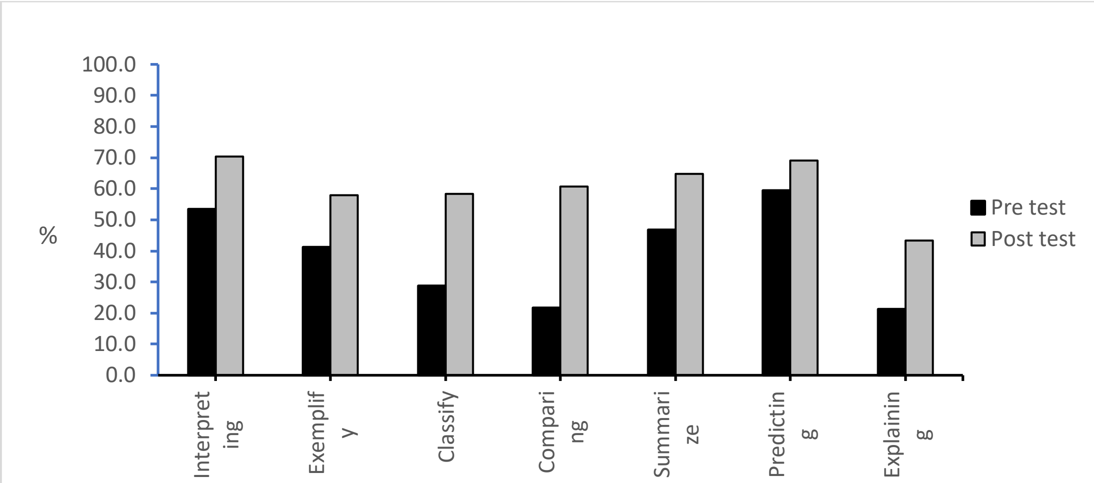
Qualitative data from this study is a description of students' metacognitive strategies consisting of planning, information management, monitoring understanding, minimising errors, and evaluating. The collected data was then reduced. Afterwards, the data was presented. The step after presenting the data was drawing conclusions and verification.

Findings and Discussion Comparison of increasing understanding of the concept of the experimental group and the control group



Picture 3. *Pre-test and post-test scores for understanding the concept of the experimental group*

In the pre-test experimental group, the average concept understanding result was 40.7%. Explaining had the lowest points with 27.3%, while the highest is predicting (57.0%). From the post test, the average concept understanding result was 72.9%. Comparing became the lowest indicator with 69.7%, while the highest indicator is explaining with 75.8%.



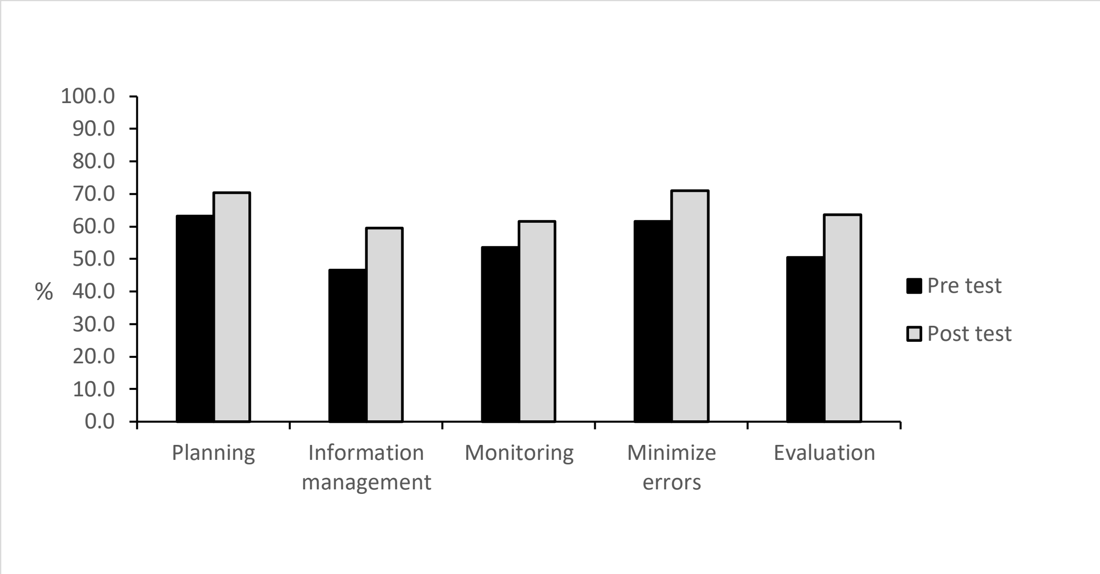
Picture 4. *Pre-test and post-test scores for understanding the concept of the control group*

For the control group, from the pre-test, the average concept understanding result was 39.8%. The lowest indicator was explaining with 21.2%, while the highest was interpreting with 53.3%. From the post test, the average concept understanding result was 61.6%. The lowest indicator was explaining with 33.3% while the highest is interpreting with 70.3%. Based on the t test, it was obtained that the t count = 4.51 and at dk = 32 with a significance level of 5%, it was obtained t table = 2.04. Since the t count > t table, Ho1 is rejected and Ha1 is accepted. It means there is a difference in improvement of concepts understanding and a difference in improvement of metacognitive strategies between quantum learning and concept maps compared to conventional learning.

The increase in understanding of concepts in the experimental group was generally higher than in the control group. In the experimental group, the students' conceptual understanding was better. Students were able to answer questions about the subject matter discussed. Students were able to explain the meaning of motion, give examples of motion, and classify the types of motion according to the group. Students explained motion through natural steps, gave examples of motion through demonstration steps, and classified motion accordance with concept maps.

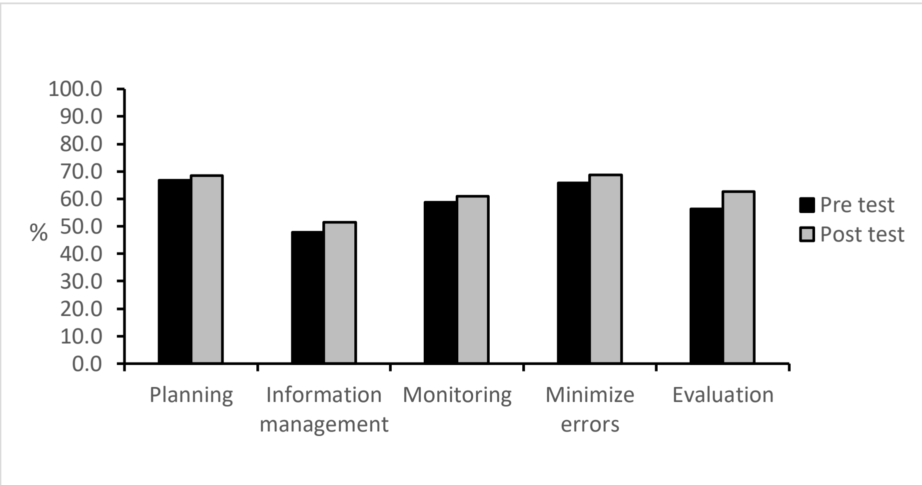
The difference in improvement of concept understanding that occurs was relevant to Kusno's and Purwanto's finding (2011) which states that quantum learning is effective and provides better learning outcomes compared to conventional learning. Increased understanding of concepts in the experimental group was also relevant to the findings of Suryani, et al (2014) which states that students' knowledge, attitudes, and preparatory actions for earthquakes can be increased through learning the quantum teaching model. In addition, increased understanding of concepts was also relevant to the findings of Riswanto and Putra (2012), which identify the use of effective mind mapping strategies to improve students' writing skills.

Comparison of the improvement of metacognitive strategies in the experimental group and the control group.



Picture 5. *Pre-test and post-test scores of the experimental group's metacognitive strategies*

In the experimental group, from the pre-test, the average metacognitive strategy result was 54.7%. The lowest aspect was information management with 46.7%, while the highest was planning with 63.3%. From the post-test, the average metacognitive strategy result was 64.6%. The lowest aspect was information management, which is 59.6%, while the highest was minimising errors with 71.0%.



Picture 6. *Pre-test and post-test scores of the control group's metacognitive strategies*

In the control group, from the pre-test, the average metacognitive strategy result was 58.3%. The lowest aspect was information management with 47.9%, while the highest was planning with 66.7%. From the post test, the average metacognitive strategy result was 61.4%. The lowest aspect was information management with 51.5%, while the highest was minimising errors with 68.8%. Based on the t test, it was obtained that the t count = 3.28 and at dk = 32 with a significance level of 5%, it was obtained t table = 2.04. Since t count > t table, Ho2 is rejected and Ha2 is accepted. It means there is a difference in the improvement of students' metacognitive strategies between those produced by quantum learning models and concept maps compared to conventional learning.

The improvement in metacognitive strategies in the experimental group was generally higher than that in the control group, despite there were aspects with small improvement difference. The small difference is due to the relatively short study time. The result shows that the students have carried out planning, monitoring, and correcting errors. Students prepared what is needed to learn, tried to understand the learning objectives, and sought help when they found difficulties with the subject matter. Students sought help if they found difficulties when they asked questions to the teacher or other students about the subject matter of motion that was not understood.

The improvement of metacognitive strategies was relevant to idea of Rosenzweig, et al (2011) which states that teaching students' metacognitive strategies that can help them succeed in doing assignments is something important. Sastrawati (2011) states that teachers need to pay attention to the metacognitive strategy factors that students have, along with the components that influence their emergence. Students with low metacognitive strategies need more attention in order to have higher metacognitive strategies.

Toit and Kotze (2009) states that metacognitive strategies can provide guidance in effective teaching and help students to learn effectively. For this reason, students' metacognitive strategies need to be improved effective learning activities and optimal results.

Description of the experimental group's metacognitive strategy

For the planning aspect, some excerpts of an interview obtained were as follows.

X : Do you try yourself to have enough time to study? Why?

Y : Yes I do, because if there is not enough time, I will not be able to complete the study.

X : Do you think about what it needs to learn before you start studying? Why?

Y : Yes I think, because if I do not prepare to study, I will not focus.

X : Do you set any specific goals before starting to study? Why?

Y : Yes I do, because if I don't know the purpose, I don't know the learning objectives.

From the interview, it is found that the student has some plans. The emergence of the planning aspect can be seen in the behaviour of students who spent time to study, tried to understand the learning objectives, and prepared what is needed to learn. Students spent time to study in order to learn about the information that has been delivered or will be delivered by the teacher thoroughly, understand the learning material, and can ask some questions well. Students tried to understand the learning objectives in order to understand the direction, purpose, and the results to be achieved from the learning activity. Students prepared what is needed to learn to be focused, comfortable, and perfect.

For the information management aspect, some excerpts of an interview with a subject was obtained as follows.

X : Do you pay more attention when you face important information? Why?

Y : Yes I do, in order it is to understand the important information conveyed.

X : Do you make your own examples to make the information more understandable? Why?

Y : Yes I do, because it is easier to understand example made by myself.

X: Do you ask yourself if what you read relates to what you have already known? Why?

Y : Yes I do, in order to understand the lesson, and help study.

Aspects of information management have grown in students. Students read slowly when encountering important information, elaborate on information by making their own examples, and relate new information to prior knowledge they already have. Students read slowly when they encounter important information in order to better know and understand the information presented. Students elaborate with make their own examples so that it is easy to understand and associate with making new things their selves. Students associate new information with their prior knowledge in order to deepen their understanding of new lessons, not to forget, and to learn more easily and quickly.

The monitoring aspect can be seen from some excerpts of an interview with a subject as follows:

X : Do you ask yourself periodically if you reach your goal, why?

Y : Yes I do, in order it is to know if I can do it or not, so I can study more.

X : Do you consider other ways to solve a problem before you answer, why?

Y : Yes I do, in order it is to implement the right strategy.

X : Do you review periodically to help understand important relationships, why?

Y : Yes I do, it is in order to forget, understand more that there is a relationship.

From the interview, it explains that the students carried out the monitoring aspect. Students were able to ask themselves whether they have achieved learning objectives, reviewed subject matter periodically, and considered various alternatives to solve a problem. Students asked themselves whether they have achieved the learning objectives in order to know if they have understood the lesson or not. It also shows that they were responsible for their learning. Students reviewed the subject matter periodically to make it easy to understand, easy to remember, and clearer. Monitoring aims to measure students' learning progress and improve the learning process carried out.

The aspect of minimising errors is shown by excerpts of an interview with a subject as follows.

X : Do you ask other students' help when you don't understand something? Why?

Y : Yes I do, if I don't understand, I have to ask, if I don't ask, I won't understand.

X : Do you change your strategy when you fail to understand? Why?

Y : Yes I do, because by using another method, I can understand.

X : Do you stop and go back through new information that is not clear? Why?

Y : Yes I do, because if I don't repeat it, I don't know, so that the information is clearer.

The interview shows that students made effort to reduce error. Students tried to ask for help from other students to understand the subject matter, change the strategies used, and repeat unclear subject matters. Students asked for help from other students to understand the subject matter to avoid mistakes and become faster to understand it. Students changed the strategies used to do the work faster and understand in other ways. Students repeated material that is not clear in order to quickly understand the knowledge and information.

The evaluation aspect is described by excerpts of an interview with a subject as follows.

X : After completing the test, do you know how well you did?

Y : Yes I do. I can be more enthusiastic for learning, and I can identify my own abilities.

X : Do you summarise what you have learned? Why?

Y : Yes I do, because I can understand what I have written. It is easier to work on it, and it is faster to learn.

X : Do you ask yourself if you have studied as much as you get immediately after completing the assignment? Why?

Y : Yes I do. It makes easier to learn and express opinions.

The evaluation aspect has grown in students. Students tried to find out the success of their learning, made a summary of the material studied, and assessed themselves against the learning activities that have been carried out. Students tried to find out the success of learning in order to get good grades, understand the lesson, and know their abilities. Students made a summary of the material studied in order to find out important things and save learning time. Through evaluation the progress achieved by a person in learning can be identified.

Conclusions and Suggestions

Based on the discussion of the results, from the research conducted, it is concluded that the increase in understanding of concepts produced by learning using the quantum learning model with concept maps is higher than the increase produced by conventional learning. Indicators in the process of understanding concepts that increased were interpreting, giving examples, classifying, summarising, guessing, comparing, and explaining.

The increase in metacognitive strategies produced by learning using the quantum learning model with concept maps is higher than the increase produced by conventional learning. The metacognitive strategies generated by implementing the quantum learning model with concept maps has emerged. It was depicted by students who have planned, managed information, minimised errors, monitored, and evaluated their learning.

Based on the conclusions, the suggestions that can be drawn is quantum learning models with concept maps can be used as an alternative for teachers to improve students' understanding of concepts and metacognitive strategies. In addition. Moreover, schools need to encourage teachers to carry out learning by applying a quantum learning model with concept maps.

References

de Porter, B., Reardon, M., dan Nourie, S.S. 2005. *Quantum Teaching:* Mempraktekkan *Quantum Learning* di Ruang-ruang Kelas. Bandung: Kaifa.

Kusno dan Purwanto, J. 2011. Effectiveness of Quantum Learning For Teaching Linear Program at The Muhammadiyah Senior High School of Purwokerto in Central Java,Indonesia. *EDUCARE:International Journal for Educational Studies Vol. 4 (1).*

Livingston, J.A. 1997. *Metacognition: An Overview.* http://www.gse.bufallo.edu/fas/shuel/cep564/Metacog.htm (downloaded July 16, 2005).

Risnanosanti. 2008. *Melatih Kemampuan Metakognitif Siswa dalam Pembelajaran Matematika.* http://www.eprints.uny.ac.id (downloaded February 21, 2014).

Riswanto dan Putra, P. P. 2012. The Use of Mind Mapping Strategy in the Teaching of Writing at SMAN 3 Bengkulu, Indonesia. *International Journal of Humanities and Social Science Vol. 2 (21).*

Rosenzweig, C., Krawec, J., dan Montague, M. 2011. Metacognitive Strategy Use of Eighth-Grade Students with and Without Learning Disabilities During Mathematical Problem Solving: A Think-Aloud Analysis. *Journal of Learning Disabilities Vol. 44 (6).*

Santrock, J.W. 2008. *Psikologi Pendidikan.* Jakarta: Kencana.

Santyasa, I.W. 2014. *Pengembangan Pemahaman Konsep Dan Kemampuan Pemecahan Masalah Fisika Bagi Siswa SMA Dengan Pemberdayaan Metode Perubahan Konseptual Berseting Investigasi Kelompok.* http://www.pasca.udhiksa.ac.id/ e-

journal/ index php (downloaded February 25, 2014).
Saraswati, E., Rusdi, M., dan Syamsurizal. 2011. Problem Based Learning, Strategi Metakognisi, dan Keterampilan Berpikir Tingkat Tinggi Siswa. *Tekno-Pedagogi Vol. 1 (2)*.
Sugiyono. 2010. *Metode Penelitian Pendidikan*. Bandung: Alfabeta.
Sugiyono. 2013. *Metode Penelitian Kombinasi*. Bandung: Alfabeta.
Suryani, I., Sari, S.A., Milfayetty, S., dan Dirhamsyah, M. 2014. Increasing Knowledge of The Earthquake Preparedness Through Quantum Teaching Model on State Primary School 19 Banda Aceh. *The International Journal of Social Sciences Vol. 19 (1).*
Toit, S.D. dan Kotze, G. 2009. Metacognitive Strategies in the Teaching and Learning of Mathematics. *Pythagoras Vol. 70 (12).*

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Difficulties of the Grade Four Pupils towards Accomplishing Experiment-Based Learning Performance Tasks in Science in the New Normal

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Abstract

This study determines the difficulties of the grade four pupils towards accomplishing experiment-based learning performance tasks in Science in Parsolingan Elementary School for the school year 2021-2022 with the new normal education. It employed a mixed method of quantitative-qualitative research design. In gathering the data, survey through a questionnaire was used. Arithmetic mean was used to treat the data gathered. Results showed that the greatest difficulty faced to the least were the Needed Materials (M= 3.79), Task Instructions (M=3.69), Completion Time (M=3.63), Home Environment (M=3.57), and Learning Support (M=3.30). These findings led to suggest that teachers shall consider seeking support from internal and external stakeholders for the provision of required materials for the experiment-based learning performance tasks in Science to help the grade four pupils in optimising the execution of experimental processes and skills needed.

Keywords: experiment-based; grade 4 pupils; performance tasks; Science

Introduction

The ongoing COVID-19 pandemic remains to pose a challenge in teaching, learning, and assessment needs of the pupils under the new normal education setting. With the school's continued adoption of distance learning mode of instruction, pupils keep learning using DepEd's self-learning modules (SLMs) through the online assistance of teachers, TV, and radio-based instructions and are evaluated based on their accomplished written works and performance tasks which form their quarterly grades.

Among the subjects in school, it is Science that requires experiment-based learning performance tasks. These are given as authentic assessment because they help teachers in improving the teaching and learning processes (Shalev et al., 2018). They are authentic assessment tools that measure higher-order thinking skills and data-driven instruction which optimise learning (Abbot & Wren, 2016). If these were done properly and accomplished on time, these experiment-based learning performance tasks are good indicators of authentic learning.

According to K to 12 Science Curriculum, Science learning centres are around these three domains: (1) comprehension and utilisation of empirical knowledge in the local and global settings whenever possible; (2) execution of experimental processes and skills: and (3) promotion and manifestation of a scientific way of thinking and behaviour. Thus, these are Science knowledge, Science skills, as well as Science attitudes and values that pupils must possess and master even in the new normal education setting.

In this case, pupils' understanding of Science is fulfilled efficiently when they perceive and figure out the scientific knowledge by themselves. Then, these pupils' close observation and experimentation spearhead the development of their scientific cognition, values, and competence. Hence, efforts to ensure that the pupils themselves are the ones carrying out the provided experiment-based learning performance tasks in Science this school year 2021-2022 are that they are completely accomplishing these tasks on time. Moreover, all the necessary materials for the experiment-based tasks are available at the pupils' home and must be given more attention.

Ideally, every pupil is capable to accomplish the experiment-based learning performance tasks because all of them are expected to fulfill the minimum basic competencies established by the DepEd in the Basic Education Learning Continuity Plan (BE-LCP) under DepEd Order No. 012, s. 2020 on Most Essential Learning Competencies (MELCs) to progress on the next grade level.

However, there are many factors that contribute why the pupils do not perform the required minimum experiment-based learning performance tasks within the quarter. These unidentified problems of the pupils significantly influence their commitment to learning. Schendel & Tolmie (2017) as cited by Mangali G. et al. (2019) stressed that unaccomplished performance task was an indication of an unsuccessful performance due to its non-conformity to the assessment tool, while its incompleteness was a proof that the deep understanding of the subject matter was not attained. Unaccomplished performance tasks impede the progression of the lesson, disallows the teacher to measure real understanding, and deprive the pupils the chance to develop true understanding and creativity. Teaching and learning suffer happen when a pupil fails to accomplish a performance task because it leaves a teacher with no accurate measure of the level of understanding.

In Parsolingan Elementary School, the frequency count and percentage distribution of grade four pupils who accomplished the experiment-based learning performance tasks in Science were lower (frequency range: 14-19, percentage range: 33%-44%) and did not even reach 50% of the total number of pupils in class compared to the pupils who were unable to accomplish (frequency range: 24-27, percentage range: 56%-67%). These baseline data showed that the grade 4 pupils were struggling or were facing great difficulties in accomplishing the experiment-based learning performance tasks in Science because of a lot of factors.

Therefore, the researcher takes the initiative to delve on determining the difficulties of the grade four pupils towards accomplishing experiment-based learning performance tasks in Science in Parsolingan Elementary School for the school year 2021-2022 with the new normal education.

Methodology

The study utilised the mixed-method research design. The quantitative part of the study focused on the computed mean data about the difficulties of the grade four pupils towards accomplishing experiment-based learning performance tasks in Science in the new normal era in Parsolingan Elementary School using the survey questionnaire. The qualitative part of the study focused on the transcribed data from the direct responses of the pupils in the focus group discussion to contextualise the quantitative part and gave it a more detailed examination. The mixed method was then appropriate in this research since this method involved collecting, analysing, and integrating quantitative (survey) and qualitative (focus group) research.

Instrument

Survey through a questionnaire was used to gather the needed data. A questionnaire made by the researcher was used to determine the difficulties that pupils faced towards accomplishing experiment-based learning performance tasks in science in the new normal. The first part of the questionnaire was composed of twenty (20) statements wherein the five variables have four (4) items each. This part was scored through a five-point Likert Scale, depending on the frequency the respondents identified the difficulties faced towards accomplishing experiment-based learning performance tasks in science in the new normal. The second part of the questionnaire was comprised of five (5) open-ended questions to help contextualise the first part and gave it a more detailed response.

Results and Discussions

Difficulties faced by the grade four pupils in accomplishing experiment-based learning performance tasks in Science

This table presents and describes the computed mean data about the difficulties of the grade four pupils towards accomplishing experiment-based learning performance tasks in science in the new normal in Parsolingan Elementary School along with the following variables such as Tasks Instructions, Needed Materials, Completion Time, Home Environment, and Learning Support.

Table 1 showed the mean responses of the grade four pupils pertaining to each item under the variable Task Instructions which affected their accomplishment of the experiment-based learning performance tasks in Science in the new normal era. With a range of values from the least (3.53) to the highest (3.86) and a grand mean of 3.69, it showed that the mean responses in all items fall within the range of 3.50 – 4.49 which had the equivalent descriptive rating of *Agree*. This signifies that the grade four pupils perceive the tasks instructions as difficult to follow and to understand on their own especially when *“the instructions do not provide accurate or specific description of the experiment-based learning performance tasks to be accomplished.”* Their *Agree* responses in all items reveal that the experienced difficulty in the task instructions has a direct influence on their ability to complete the experiment-based learning performance tasks in Science because this affects their confidence, motivation, pacing of learning, and interest in starting and finishing the experiment-based learning performance tasks in Science.

Table 2 showed the mean responses of the grade four pupils pertaining to each item under the variable Needed Materials which affected their accomplishment of the experiment-based learning performance tasks in Science in the new normal. With a range of values from the least (3.63) to the highest (4.00) and a grand mean of 3.79, it showed that the mean responses in all items fall within the range of 3.50 – 4.49 which had the equivalent descriptive rating of *Agree*. This signifies that the grade four pupils perceive the needed materials to be unavailable, incomplete, costly, and too many to prepare by themselves especially when *“the required materials for the experiment-based learning performance tasks need to be bought and the family has no budget for those.”* Their *Agree* responses in all items reveal the current and real situation of the pupils in their homes wherein the basic needs, such as food and paying the bills are the top priority. While this factor (needed materials) may hinder their accomplishment of the experiment-based learning performance tasks in Science in the new normal, it can be seen as an opportunity to tap their resourcefulness trait wherein the use of alternative materials that are available and which correspond to the required materials for the experiment-based learning performance tasks can be tried as a viable option.

Table 3 showed the mean responses of the grade four pupils pertaining to each item under the variable Completion Time which affected their accomplishment of the experiment-based learning performance tasks in Science in the new normal. With a range of values from the least (3.49) to the highest (3.74) and a grand mean of 3.60, it showed that the mean responses range from *Neutral*

(2.50 – 3.49) to *Agree* (3.50 – 4.49). These signify that the grade four pupils perceive the completion time as too short and difficult for them to finish on time especially when there is *"Lack of well-managed time and these coincide with other tasks at home."* Their *Neutral* and *Agree* responses reveal their poor management of time due to procrastination and home distraction or the trouble in maintaining a schedule because they need to be the helpers at home especially in doing the household chores.

Table 4 showed the mean responses of the grade four pupils pertaining to each item under the variable Home Environment which affected their accomplishment of the experiment-based learning performance tasks in Science in the new normal. With a range of values from the least (3.42) to the highest (3.72) and a grand mean of 3.57, it showed that the mean responses range from *Neutral* (2.50 – 3.49) to *Agree* (3.50 – 4.49). These signify that the grade four pupils perceive the home environment as not conducive and had no sufficient space to move freely to accomplish the experiment-based learning performance tasks especially when *"The home lacks good arrangement and had a lot of distractions resulting to divided attention and inability to accomplish the experiment-based learning performance tasks."* Their *Neutral* and *Agree* responses reveal the lack of a designated space at home that diminishes too many distractions by family members, noise, chores, or television and that encourages focus or concentration on accomplishing the assigned experiment-based learning performance tasks in Science.

Table 5 showed the mean responses of the grade four pupils pertaining to each item under the variable Learning Support which affected their accomplishment of the experiment-based learning performance tasks in Science in the new normal. With a range of values from the least (3.19) to the highest (3.37) and a grand mean of 3.30, it showed that the mean responses in all items fell within the range of 2.50 – 3.49 which had the equivalent descriptive rating of *Neutral*. This signifies that the grade four pupils perceive the learning support as a way to peace and balance in accomplishing the experiment-based learning performance tasks in Science in the new normal. Their *Neutral* responses in all items reveal equal or fair amount of attention, guidance, assistance or help from parents or guardians when needed.

Table 6 showed the average of the mean responses of the grade four pupils pertaining to the five (5) variables that affected their accomplishment of the experiment-based learning performance tasks in Science in the new normal. The average mean responses were ranked from the smallest average to the biggest average to present the variables as difficulties that would hinder grade four pupil to accomplish experiment-based learning performance tasks in Science. From the greatest difficulty faced to the least are the Needed Materials (M= 3.79), Task Instructions (M=3.69), Completion Time (M=3.63), Home Environment (M=3.57), and Learning Support (M=3.30). The ranking shows that the Needed Materials is the greatest difficulty leading to unaccomplished experiment-based learning performance tasks in Science.

Table 1. *Difficulty Faced by Grade Four Pupils in the Task Instructions*

No.	Task Instructions	Mean	Interpretation
1	The instructions in the experiment-based learning performance tasks are difficult to understand.	3.72	Agree
2	The instructions do not provide accurate or specific description of the experiment-based learning performance tasks to be accomplished.	3.86	Agree
3	The instructions show no relevant samples to serve as guide in accomplishing the experiment-based learning performance tasks.	3.65	Agree
4	The step-by-step instructions in accomplishing the experiment-based learning performance tasks are hard to follow.	3.53	Agree
	Grand Mean	**3.69**	**Agree**

Table 2. *Difficulty Faced by Grade Four Pupils in the Needed Materials*

No.	Needed Materials	Mean	Interpretation
1	The needed materials for the experiment-based learning performance tasks are not available at home.	3.63	Agree
2	The materials needed for the experiment-based learning performance tasks that I have are incomplete.	3.72	Agree
3	The required materials for the experiment-based learning performance tasks need to be bought and the family has no budget for those.	4.00	Agree
4	The needed materials for the experiment-based learning performance tasks are too many to prepare.	3.81	Agree
	Grand Mean	**3.79**	**Agree**

Table 3. *Difficulty Faced by Grade Four Pupils in the Completion Time*

No.	Completion Time	Mean	Interpretation
1	The experiment-based learning performance tasks are difficult to finish on time	3.63	Agree
2	The time set to complete the experiment-based learning performance tasks are too short	3.49	Neutral
3	Lack of well-managed time to complete or accomplish the experiment-based learning performance tasks	3.74	Agree
4	The time to do the experiment-based learning performance tasks coincide with other tasks at home	3.65	Agree
	Grand Mean	**3.63**	**Agree**

Table 4. *Difficulty Faced by Grade Four Pupils in the Home Environment*

No.	Home Environment	Mean	Interpretation
1	Home environment is not conducive for doing the experiment-based learning performance tasks.	3.42	Neutral
2	The home had no sufficient space to move freely to accomplish the experiment-based learning performance tasks	3.44	Neutral
3	The home had a lot of distractions resulting to divided attention and inability to accomplish the experiment-based learning performance tasks	3.70	Agree
4	The home lacks good arrangement for successful accomplishment experiment-based learning performance tasks	3.72	Agree
	Grand Mean	**3.57**	**Agree**

Table 5. *Difficulty Faced by Grade Four Pupils in the Learning Support*

No.	Learning Support	Mean	Interpretation
1	Parents/guardians have no desire and no ability to teach or help in accomplishing the experiment-based learning performance tasks	3.19	Neutral
2	No further explanation and relevant samples received from teacher or parents/guardians in accomplishing the experiment-based learning performance tasks	3.37	Neutral
3	Poor guidance and assistance from parents/guardians in accomplishing the experiment-based learning performance tasks	3.30	Neutral
4	Lack of strict supervision from teacher or parents/guardians in accomplishing the experiment-based learning performance tasks	3.33	Neutral
	Grand Mean	**3.30**	**Neutral**

Table 6. *Ranking of Variables Based on the Average of Mean Responses in the Difficulties Faced by the Grade Four Pupils in Accomplishing Experiment-based Learning Performance Tasks in Science.*

Difficulties Faced by the Grade Four pupils in accomplishing experiment-based learning performance tasks in Science	Grand Mean	Interpretation
Learning Support	3.30	Neutral
Home Environment	3.57	Agree
Completion Time	3.63	Agree
Task Instructions	3.69	Agree
Needed Materials	3.79	Agree

Qualitative data from the direct responses in the focus group discussion were analysed to contextualise the quantitative findings and give them a more detailed examination.

1. What kind of contribution which can succeed in the accomplishment of experiment-based learning performance tasks in Science in the new normal?

".. nang dahil din po kay Mama ko po,... kumpleto po ako sa mga tasks na pinapagawa.." Pupil 5

".. dahil kumpleto po yung mga gamit ko para sa experiment, ...nire-ready po namin

".. needed materials po, ...yun po yung nakatulong, ... kaya ko po nagawa yung mga learning performance tasks sa Science.." Pupil 38

".. sa akin naman po, dahil sa tulong po ni Mama, ...kaya po nakumpleto ko po yung mga experiment." Pupil 14

".. dahil po sa mga magulang ko po kaya po nakakapagpasa ako.." Pupil 18

ni Mama yung lahat ng mga kailangan sa performance tasks para magawa lahat at masagutan po lahat." Pupil 40

".. learning support po, ...andyan po si Mama para tulungan ako.." Pupil 36

".. needed materials po, ...kasi po kapag naihanda na po yun, madali na lang pong gawin yung mga tasks namin sa Science, ...hindi na po ako nahirapan.." Pupil 7

The responses of the pupils indicated that learning support and needed materials contributed highly to the successful

2. What kind of difficulties have you faced towards accomplishing experiment-based learning performance tasks in Science? and

3. Among those mentioned difficulties, which one hinders you in accomplishing the experiment-based learning performance tasks in Science? Why?

".. sa time lang po, ...hindi ko po siya nagagawa kaagad, ...marami pong ginagawa sa bahay, ...kaya late po akong nakakapagpass.." Pupil 42

".. sa needed materials sometimes po ako nahihirapan, ... lalo po kung wala kaming ganun sa bahay, ...kailangan pa pong bilhin.." Pupil 35

".. completion time po, ...kasi wala po minsan si Mommy ko po para po tulungan po ako.." Pupil 21

".. ako po hindi po kumpleto ng materials, ... nahirapan po ako dun sa last activity (changes happened in mixed solutions) kasi po kulang po yung materials ko." Pupil 20

3. What can you do to accomplish the experiment-based learning performance tasks in Science? or Who do you think can help you in accomplishing experiment-based learning performance tasks in Science? Why?

".. pagsusumikapan pong gawin yung mga experiment, ...magtatanong po sa inyo (teacher) kung kailangan." Pupil 40

".. magsisimula na pong gawin yung mga experiment, ...magpapatulong kapag kailangan po sa family member." Pupil 42

".. makinig po nang mabuti sa inyo (teacher) o sa magulang, ...magtatanong po kung paano, ...kapag hindi kayang gawin o sagutin." Pupil 18

".. gagawin yung best ko, ...makikinig nang mabuti, ...nae-explain naman po nang maayos.." Pupil 38

".. magfo-focus lang po sa mga tasks, ...kapag may hindi alam, dun po yung time para magtanong." Pupil 20

".. magiging ready po para matuto, ...ihahanda po yung sarili, ...pati po yung mga kailangang gamitin.." Pupil 7

".. makinig nang maayos kapag online class, ...para alam kung ano po talaga yung dapat na gagawin." Pupil 14

".. magpapatulong sa family, ...kapag hindi alam, ...kapag nahihirapan na." Pupil 5

".. magtatanong po kay Tita o kay Lola kapag hindi po alam.." Pupil 35

".. kapag wala po si Mama, kay ate po hihingi ng tulong.." Pupil 36

Every grade four pupil strived for a successful accomplishment of the experiment-based learning performance tasks in Science. Their responses reflected that they knew what to do and whom to approach to ask for help in order to complete all the

4. Is there anything else would you like to say or add about the difficulties you face in accomplishing experiment-based learning performance tasks in Science in the new normal?

".. mas maganda po kung face-to-face, ...para alam kung ano po talaga yung dapat na gagawin, ... maiintindihan po nang maayos.." Pupil 30

".. busy po yung mga parents, ... nagtratrabaho po, ...walang gagabay po." Pupil 21

".. walang sapat na pera pambili ng materials." Pupil 17

assigned experiment-based learning performance tasks. If only difficulties in accomplishing the experiment-based learning performance tasks in Science could be minimised, the execution of experimental processes and skills as well as the promotion and manifestation of scientific way of thinking and behaviour were easily achieved.

The grade four pupils emphasized from these responses that the difficulties they encountered were the challenge of communicating the performance tasks instructions during this time of teaching and learning in a remote online set-up, the problem for parents to provide this sort of hands-on assistance to them while working 8-to-4, and the lack of family budget to make the required materials available. These signify that plenty of considerations and strong online presence of the pupils are important to avoid the times of feeling helpless in accomplishing the tasks.

2. Proposed Action Plan to Address the Difficulties Faced by the Grade Four Pupils in Accomplishing Experiment-based Learning Performance Tasks in Science

This table presents the proposed action plan which will serve as a basis for undertaking appropriate measures and prioritising any initiative of improvement to enhance the Science teaching-learning-assessment delivery during the new normal.

Difficulties	**Objectives**	**Actions to be Taken**	**Persons Involved**	**Success Indicators**
Task Instructions The instructions do not provide accurate or specific description of the experiment-based learning performance tasks to be accomplished	Ensure that the grade four pupils understand the task instructions and are able to complete the experiment-based learning performance tasks easily	Create a Science Task Instruction Infographic that will clearly explain the steps of an experiment in digestible short words and with visual or picture format	Teachers, grade four pupils	The Science Task Instruction Infographic has helped the pupils 100% in understanding and following the instructions because the visuals explain clearly what the pupils have to do, how they have to do it, and when they have to complete the experiment-based learning performance tasks in Science, resulting to accomplishment of the experiment with 100% ease

Needed Materials The required materials for the experiment-based learning performance tasks need to be bought, while the family has no budget for it	Provide the grade four pupils with complete and free materials to be used for the accomplishment of experiment-based learning performance tasks in Science	Conduct "Gamit Mo, Sagot Ko: SciencEskwela Program" to raise complete experiment-based learning kits and distribute these to all grade four pupils especially to less fortunate pupils	Teachers, grade four pupils, Stakeholders	100% completion of the experiment-based learning performance tasks in Science because when the pupils have complete materials to be used for the experiment, they can engage with the assigned performance tasks more effectively and ultimately have more productive experiences
Completion Time Lack of well-managed time to complete or accomplish the experiment-based learning performance tasks	Improve the grade four pupils' skills in scheduling and planning the things they have to do and complete the experiment-based learning performance tasks in Science	Implement "Do Not Disturb" time slots on the grade four pupils' Master Schedule and block TV and computer time or cellphone game playing distractions during critical home learning sessions. Therefore, the experiment-based learning performance tasks can be completed on time	Teachers, grade four pupils, Parents	The Grade Four Pupils are becoming 100% better at managing their time because their implemented Master Schedule has helped them in eliminating distractions and allowing them to be more organised, confident, and focus on completing the experiment-based learning performance tasks ahead of the due dates
Home Environment The home lacks of good arrangement for successful accomplishment on experiment-based learning performance tasks	Make a conducive and dedicated learning space at home that can improve concentration and facilitate education, discovery, completion, and achievement	Parents and grade four pupils should set up a specific area at home designated for learning which creates a boundary for other family members in order to not disturb the pupils while studying	Teachers, grade four pupils, Parents	100% improved concentration and increased sense of willingness to do and complete all the experiment-based learning performance tasks in Science in their simple dedicated learning space at home. The area is quiet and void of any potential distractions and creates vibe at which the grade four pupils would feel as if they are actually studying in the classroom

Recommendations

Based on the findings of the study, the following recommendations which can increase efforts for actions and the interest of future researchers on parallel research study are hereby offered.

1. On account of the findings on Task Instructions difficulty that *"the instructions do not provide accurate or specific description of the experiment-based learning performance tasks to be accomplished,"* strategic intervention from the initiative of the teachers to modify and develop the parts of the experiment-based learning performance tasks in Science according to the needs and preferences of the pupils shall be done to assist or guide the grade four pupils in the successful completion of their experiment-based learning performance tasks in Science.

2. On account of the findings on Needed Materials difficulty that *"the required materials for the experiment-based learning performance tasks need to be bought and the family has no budget for those,"* teachers shall consider seeking support from internal and external stakeholders for the provision of required materials for the experiment-based learning performance tasks in Science to help the grade four pupils optimise their execution of experimental processes and skills needed.

3. On account of the findings on Completion Time difficulty that there is *"lack of well-managed time and these coincide with other tasks at home,"* teachers and parents shall work hand in hand in planning and providing an effective and efficient study schedule for the grade four pupils to develop better time management and improve their level of performance, not only in Science but also in all subjects at school.

4. On account of the findings on Home Environment difficulty that *"the home lacks good arrangement and had a lot of distractions resulting to divided attention and inability to accomplish the experiment-based learning performance tasks,"* teachers and parents shall work together, which may be talked on during Parent-Teacher meeting, in identifying, setting up, or creating a corner at home designated for the grade four pupils' learning space so that their individual learning and assessment process in the new normal setting become more effective and efficient.

5. The proposed action plan of this study could be modified and developed so that further solutions to the difficulties, challenges or problems that occur in terms of the learning processes and completion of experiment-based learning performance tasks of the grade four pupils in Science would be provided as relevant and valuable inputs. Moreover, it can alleviate their susceptibility to unaccomplished performance task.

References

Abbott, A. L., & Wren, D. G. (2016). Using performance task data to improve instruction. The Clearing House: A Journal of Educational Strategies, Issues, and Ideas, 89(1), 38-45.

DepEd Order No. 012, s. 2020**.** *Adoption of the Basic Education Learning Continuity Plan for School Year 2020-2021 in the Light of the COVID-19 Public Health Emergency.* Retrieved from https://www.deped.gov.ph/wp-content/uploads/2020/06/DO_s2020_012.pdf

K to 12 Science Curriculum Guide August 2016. Retrieved https://www.deped.gov.ph/wp-content/uploads/2019/01/Science-CG_with-tagged-sci-equipment_revised.pdf

Mangali G. et al., (2019). *Sequential Analysis of Problems Encountered by Students in Accomplishing Performance Tasks,* International Journal of Multidisciplinary Research and Publications (IJMRAP), Volume 2, Issue 1, pp. 58-67, 2019. Retrieved from https://www.researchgate.net/publication/334470122_

Sequential_Analysis_of_Problems_Encountered_by_Students_in_Accomplishing_Performance_Tasks

Shalev, N., Humphreys, G. & Demeyere, N. (2018). *Manipulating perceptual parameters in a continuous performance task. Behav Res* 50, 380–391. https://doi.org/10.3758/s13428-017-0877-7

Schendel, R. & Tolmie, R. (2017). *Beyond translation: adapting a performance-task-based assessment of critical thinking ability for use in Rwanda, Assessment & Evaluation in Higher Education*, 42:5, 673-689, DOI: 10.1080/02602938.2016.1177484

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