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Is SiPOERT an Innovative Learning? Implementation and Identification of Students' Conception on Simple Harmonic Motion

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Abstract

The purpose of this research is to identify students' conception of simple harmonic motion by implementing SiPOERT (Simulation in Predict Observe Explain with Refutational Text). The research method used is mixed methods with an embedded mixed methods research design. The research instrument used consisted of diagnostic test questions in the format of four-tier Simple Harmonic Motion, Refutational Texts Student Worksheets, and learning implementation observation sheets. The sample in this study consisted of 32 students in XI class in one of the public high schools in Central Java. The analysis of this study uses delta M, the implementation of learning is shown in the form of a percentage, and the change in conception is analyzed based on the results of the pre-test and post-test. The results showed that students' misconceptions decreased by 16.4% from the pretest of 65.9% to 49.5% in the post-test. There was a change in the level of conception, by 42% in the Accepted Change (AC) category, 41% in the Not Change (NC) category, and 17% in the Unaccepted Change (UC) category.

Keywords: simple harmonic motion, misconceptions, refutational texts, POE strategy

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1. Introduction

The quality of the conception possessed by students greatly affects their ability to solve physics problems (Su & Yeh, 2014) Various concepts for the scientific explanation of various phenomena are included in one branch of science, namely physics. Therefore, in achieving the objectives of physics lessons, the level of conception of students is one of the important factors for students to have.

Based on *Permendikbud* Number 21 of 2016, after studying physics subjects, students are expected to have several competencies related to physics concepts and their applications. Based on this we can see that the concept is one of the most important things that students need to solve problems and design simple projects and use them. In physics, understanding concepts are very important (Ozkan & Sezgin Selcuk, 2015), therefore after participating in learning, the concepts possessed by students must be scientific concepts.

Several previous studies have shown that when taking physics lessons, students already have the initial concepts based on their daily experiences (Ozkan & Selcuk, 2016). However, most of these students have initial concepts that are not in accordance with scientific concepts. This situation is referred to by various terms such as misconceptions, alternative conceptions, concepts, initial frameworks, conceptual difficulties,

and others (Gurel et al., 2015; Yürük & Eroğlu, 2016). Misconceptions are quite often found in physics learning, including in several concepts such as Optical Geometry (Kaltakci-Gurel et al., 2017), Fluids (Purwanto et al., 2018; Samsudin et al., 2018), Force and Motion(Bayraktar, 2009; Liu & Fang, 2016; Narjaikaew, 2013); and Simple Harmonic Motion (Somroob & Wattanakasiwich, 2017; Sugara et al., 2016).

Phenomena in everyday life are closely related to the concept of Simple Harmonic Motion. A good understanding of the concept of simple harmonic motion can be used as a basis for studying the motions of different objects that are disturbed from their equilibrium positions, macroscopic wave phenomena, and quantum phenomena. Given the importance of simple harmonic motion in daily life, the concept must be fully understood by minimizing misconceptions.

Based on the results of the preliminary study, it was found that there was a misconception of Simple Harmonic Motion material among students in one of the senior high schools in Serang, Banten. A total of 32 students of class XI were given a diagnostic test instrument in the four-tier format of Simple Harmonic Motion with open-ended questions. The four-tier open-ended diagnostic test is a diagnostic test instrument in a four-tier format to identify students' misconceptions about the material with the third tier an open question regarding the reasons for choosing the answer in the first tier. The results of the preliminary study show that there are problems with the concept of Simple Harmonic Motion material experienced by students as shown in Table 1.

Table 1. Percentage of Conception Level in Preliminary Study

Conception Level	Percentage (%)
SU	8.6
PP	2.5
PN	29.4
NU	7.1
MC	46.2
NC	6.1

Based on the results of the preliminary study conducted by the author, it was found that the highest level of conception was MC (Misconception) at 46.2%, followed by PN (partial negative) at 29.4%, SU (Sound Understanding) at 8.6%, NU (No Understanding) 7.1%, and the lowest level of conception is NC (No Coding) 6.1%. This lowest percentage is one of the limitations of the study, namely controlling students' psychological factors so that there are still students in the No Coding category. This is as mentioned by (Dewi et al., 2021; Samsudin et al., 2016) who state that psychological factors are one of the factors that become limitations in research.

Misconceptions can be corrected by structuring the initial conception known as the conceptual change process (Samsudin et al., 2015, 2017). There are several studies that investigate the effect of the conceptual change approach on misconceptions and initial conceptions in physics learning (Cepni et al., 2012; Yürük & Eroğlu, 2016). The results show that the conceptual change approach is effective in changing the conception and improving the students' initial conceptions. The Predict-Observe-Explain (POE) strategy is one of the learning strategies based on a conceptual change approach.

However, POE learning has weaknesses including the difficulty of writing an explanation at the explain stage and the difficult to give reasons for the explanation and students are less sure of the explanation at the explain

stage that has been written (Acar Sesen & Tarhan, 2013). Therefore, to cover the weaknesses of the POE learning model, the researchers used alternative reading texts called Refutational Texts (RT). RT is a text that contains explanations that can activate prior knowledge with new conceptions together and then integrates it with the information contained in the text RT is a text designed to state misconceptions, then explicitly refuted then give an explanation that can be accepted scientifically as a logical sense (Broughton et al., 2010).

Refutational text will be more interesting if it is combined with images, animations, and simulations. However, until now researchers see that there are still few simulations related to simple harmonic motion material, one of which is the phet simulation. Researchers see that the simulation can still be developed to be more varied and improve the level of conception of students. In the phet simulation, the researcher saw that there was still a lack of variations in various types of pendulums and also the lack of a pendulum mass variable. Therefore, the researcher will make a simple harmonic motion simulation to be included in refutational texts.

Based on the background of the problem above, the authors intend to research the POE learning model, refutational texts with simulations, and identification of students' conceptions with the title "Implementation of POE Strategies Assisted by Refutational Texts with Simple Harmonic Motion-Simulation (SHM-S) to identify Student Conception on Simple Harmonic Motion Material".

This study aims to identify students' conceptions of the Simple Harmonic Motion material and the effect of the POE strategy on students' conceptions. To be able to achieve the research objectives, the research questions were formulated as follows, 1) How is the implementation of refutational Texts assisted POE strategy learning with Simple Harmonic Motion-Simulation (SHM-S) on Simple Harmonic Motion material?; 2) How is the effect of applying POE strategy learning assisted by refutational Texts with Simple Harmonic Motion-Simulation (SHM-S) on Simple Harmonic Motion material?; 3) What is the conceptual profile of Simple Harmonic Motion material for high school students based on the level of conception after applying refutational Texts-assisted POE strategy learning with Simple Harmonic Motion-Simulation (SHM-S) Simple Harmonic Motion?; 4) How to change the concept of Simple Harmonic Motion material for high school students after applying refutational Texts-assisted POE strategy learning with Simple Harmonic Motion-Simulation (SHM-S)?. The contribution of this research to the development of physics education practice includes complementing previous research and obtaining information about the effect of POE strategies assisted by Refutational Text with simulation applications on changing students' conceptions of Simple Harmonic Motion material.

2. Method

The research method used is mixed methods or mixed research methods. Mixed research methods involve collecting quantitative and qualitative data, combining two forms of data, and using different designs (Fassinger & Morrow, 2013). Quantitative research methods are used to determine the effectiveness of the application of POE strategies assisted by interactive media refutational Texts with SMH-S applications, while qualitative methods are used to determine the process of changing conceptions.

The research design used is embedded mixed methods. Embedded mixed methods design combines quantitative and qualitative

research methods simultaneously. The research process with embedded mixed methods design is depicted in Figure 1.

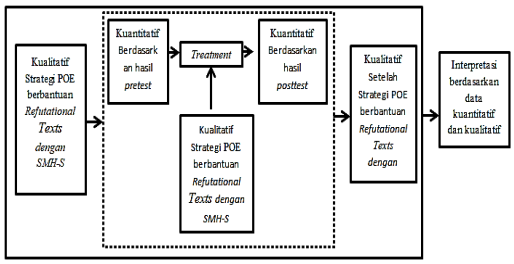

Figure 1. Embedded Mixed Methods Design

In Figure 1, it can be seen that quantitative data were obtained based on test results for pre-test and post-test. Qualitative data were obtained at the beginning of the study, namely the design of the learning process including lesson plans and interactive media refutational texts and SMH-S applications, the learning process based on student answers on interactive media refutational text, the process of changing the conception after the learning process was also used as qualitative data analysis.

Participants in the study were students of class XI science in a high school in Banjarnegara, Central Java, totaling 32 students. The population of the research is students who are in class XI IPA in a senior high school in Banjarnegara, Central Java. The sample consisted of 32 students (10 male students and 22 female students, with an age range of 15-16 years). The sample gets learning by using the POE strategy assisted by interactive media refutational Texts with the simple Harmonic Motion SMH-S application. The sample was selected using a cluster random sampling technique, which is a random sample selection because the population is divided into groups (Taherdoost, 2018). In this study, the population consisted of six groups which were then selected at random.

After obtaining the data on the results of the student's answers on the pretest and posttest using the four-tier diagnostic test instrument of Simple Harmonic Motion. Then coding is done to facilitate data processing and analysis. This coding is done to get information about the levels of students' conceptions. The coding technique is carried out based on Table 2.

Table 2. Level Conception

Tier	Category																
	SU	PP					PN						MC		NU		NC
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1	C	C	C	C	C	C	C	C	I	I	I	I	I	I	I	I	IA
2	S	N S	S	N S	S	N S	S	N S	S	N S	S	N S	S	N S	S	N S	
3	C	C	C	C	I	I	I	I	C	C	C	C	I	I	I	I	
4	S	S	N S	N S	S	S	N S	N S	S	S	N S	N S	S	S	N S	N S	

(Aminudin et al., 2019)

Based on Table 2, SU, PP, PN, MC, NU, and NC are conception level categories, while for Correct (C), Incorrect (I), Sure (S), Not Sure (NS), and Incomplete Answer (IA). Each of the six levels of conception has a score of conceptions and misconceptions. The scores for the conception category at SU, PP, PN, NU, and MC were 4, 3, 1, 0,

and 0 respectively. While the scores for the misconception category at SU, PP, PN, NU, and MC were 0, 0, and 1 respectively. , 3, 4. Scores are empty in the No Coding (NC) category to identify the possible score obtained. After coding and scoring, the data is processed and then the results are analyzed.

Based on the results of the category of students' conceptions in the pre-test and post-test, it can be determined the level of decline in the misconceptions found in students. The decrease in the number of misconceptions can be calculated by the following formula.

$$\Delta M = \frac{\%M_{pre} - \%M_{post}}{\%M_{pre} - \%M_{ideal}} \quad \dots (1)$$

Description:

ΔM = Decrease in the number of students with misconceptions

M_{pre} = Number of students who have misconceptions in the pretest

M_{post} = Number of students who have misconceptions in the

M_{ideal} = The minimum number of students who have misconceptions = 0

The formulation of the reduction in the number of students with misconceptions above is based on the adaptation of the inverse of the normalized gain value formulated by (Hake, 2002). The criteria for determining the level of decline in the number of students who experience misconceptions are shown in Table 3. (Sanyoto et al., 2016).

Tabel 1. Criteria for the Effectiveness of Reducing the Number of Misconceptions

Range < Δ M >	Effectiveness Criteria Decrease the number of students who have misconceptions
$0.7 \leq \Delta M < 1$	High
$0.3 \leq \Delta M \leq 0.7$	Medium
$0 < \Delta M \leq 0.3$	Low

3. Result and Discussion

a. The Effect of Implementing POE Strategy Assisted by Refutational Texts with Simple Harmonic Motion-Simulation in Changing Students' Misconceptions on Simple Harmonic Motion Material

Before processing the data, each level of conception is scored first. At this stage, scoring is done by using a misconception score for each level of conception. The score is Sound Understanding (SU) given a score of '0' because students can answer correctly in the first tier, and third tier, and belief in the second tier of confidence. For Partial Positive (PP) a score of '0' is given because students answered correctly in the first tier and third tier, but they are still not sure at one level of confidence. Partial Negative (PN) is given a score of '1' because students can answer correctly in the first tier or third tier. Not Understanding (NU) is given a score of '3' because students cannot answer correctly in the first tier and fourth tier. For Misconception (MC) a score of '4' is given because students answered incorrectly in the first and third tiers but had a certain level of confidence in their answers. And No Coding (NC) is not given a score because students do not answer in one or more tiers.

This is done for delta-M <ΔM> calculations to determine the effect of applying POE assisted by Refutational Texts with Simple Harmonic Motion-Simulation in learning by looking at the decrease in the number of misconceptions <ΔM> in the experimental class as shown in Table 5.

Table 5. Recapitulation of Pretest, Post-test, and delta-M <Δ M>

Students	Pretest Score	Post-test Score	<ΔM>	Interpretation
S1	45	37	0.73	High
S2	39	30	0.50	Medium
S3	40	33	0.47	Medium
S4	45	35	0.77	High
S5	39	32	0.44	Medium
S6	42	26	0.73	High
S7	26	25	0.04	Low
S8	41	25	0.70	Medium
S9	30	24	0.25	Low
S10	35	28	0.35	Medium
S11	35	31	0.24	Low
S12	40	29	0.58	Medium
S13	45	35	0.77	High
S14	36	28	0.40	Medium
S15	44	31	0.76	High
S16	36	20	0.57	Medium
S17	42	30	0.67	Medium
S18	38	20	0.64	Medium
S19	38	34	0.29	Low
S20	39	29	0.53	Medium
S21	41	31	0.59	Medium
S22	35	30	0.28	Low
S23	42	29	0.68	Medium
S24	28	21	0.26	Low
S25	35	25	0.43	Medium
S26	40	30	0.56	Medium
S27	39	25	0.61	Medium
S28	31	26	0.23	Low
S29	31	26	0.23	Low
S30	30	21	0.33	Medium
S31	28	13	0.43	Medium
S32	39	24	0.63	Medium
	Average		**0.49**	**Medium**

Description: S = Student; <ΔM> = Value ΔM (Decreasing the Quantity of Misconceptions)

Based on the results of data processing in Table 5, it was obtained that the mean value <ΔM> = 0.49. These values are in table 3. The interpretation of the table above is included in the "medium" category. This means that POE learning assisted by Refuta-

tional Texts with Simple Harmonic Motion-Simulation is quite influential in reducing the number of students who experience misconceptions. These findings are in line with several other studies that the use of POE strategies can help students to change conceptions and improve students mental models (Berek et al., 2016; Kibirige et al., 2014; Samsudin et al., 2017)

b. Profile of the Conception of Simple Harmonic Motion for Students

The data obtained from the student answer sheets (the results of the pretest and post-test) were processed in the form of a percentage of the student worksheet profiles. The percentage of students' worksheets based on the results of the pretest is shown in Table 6, while the results of the post-test are shown in Table 7.

Table 6. Percentage of Students' Conception Level based on pretest results

Question Number	Percentage of Students' Conception Based on Pretest Results (%)					
	●	◐	◑	◒	○	◌
Q1	3.2	0	61.3	37.5	0	0
Q2	12.9	3.2	9.7	59.4	12.9	0
Q3	0	3.2	0	84.4	9.7	0
Q4	6.5	6.5	0	78.1	9.7	0
Q5	0.0	0	9.7	81.3	6.5	0
Q6	0.0	0	12.9	68.8	16.1	0
Q7	9.7	0	9.7	75.0	6.5	0
Q8	19.4	0	19.4	59.4	3.2	0
Q9	6.5	3.2	12.9	71.0	6.5	0
Q10	0	0	35.5	53.1	9.7	0
Q11	3.2	0	25.8	62.5	6.5	0
Q12	3.2	0	19.4	59.4	16.1	0
Average	**5.4**	**1.3**	**18.0**	**65.9**	**8.6**	**0**

Notes: ● = *Sound Understanding*; ◑ = *Partial Positive*; ◐ = *Partial Negative*, ◒ = *Misconception*; ○ = *No Understanding*; ◌ = *No Coding*; Q = Question Number;

Based on Table 6. obtained information about the variation of student worksheets from the results of the pretest for each question. Table 6. shows the existence of misconceptions with the highest percentage that dominates in the experimental class based on the results of the pretest. The percentage is 65.9%. As for the LK Sound Understanding, the percentage is 5.4%. This shows that the misconceptions experienced by students before learning POE are still very large, and only a small part of them understand the concept well.

This is in line with other studies that students have difficulty understanding the concept of Simple Harmonic Motion so they do not have a good understanding of the concept (Nugraha et al., 2019; Somroob & Wattanakasiwich, 2017; Sugara et al., 2016).

Table 7. Percentage of Students' Conception Level based on Post-Test results

Question Number	Percentage of Students' Conception Based on Post-test Results (%)					
	●	◑	◑	●	○	○
Q1	59.4	3.1	28.1	9.4	0.0	0.0
Q2	25.0	6.3	34.4	34.4	0.0	0.0
Q3	6.3	0	6.3	75	0.0	0.0
Q4	9.4	9.4	15.6	65.6	6.3	0.0
Q5	9.4	0.0	15.6	71.9	9.4	0.0
Q6	3.1	6.3	25.0	65.6	0.0	0.0
Q7	15.6	3.1	28.1	50.0	3.1	0.0
Q8	31.3	0.0	31.3	34.4	3.1	0.0
Q9	15.6	3.1	6.3	68.8	6.3	0.0
Q10	6.3	3.1	18.8	50.0	3.1	0.0
Q11	21.9	3.1	40.6	46.9	3.1	0.0
Q12	53.1	3.1	21.9	18.8	3.1	0.0
Average	**21.4**	**3.4**	**22.7**	**49.5**	**3.1**	**0.0**

Notes: ● = *Sound Understanding*; ◑ = *Partial Positive*; ◑ = *Partial Negative*, ● = *Misconception*; ○ = *No Understanding*; ○ = *No Coding*; Q = Question Number;

Based on Table 7, information about the variation of student worksheets was obtained from the post-test results for each question. However, Table 7 shows that there is a difference in the average percentage for each LK based on the post-test results. The highest average percentage of LK based on post-test results was in the Misconception category as well, which was 49.5%, while for the Sound Understanding category it was 21.4%. Based on the results of the pretest and post-test, this shows that after POE learning there was a decrease in the level of conception of Misconception by 16.4%, and an increase in the level of conception of Sound Understanding by 16%.

These findings are in line with several other studies that the use of POE strategies can help students to change conceptions and improve students mental models (Berek et al., 2016; Kibirige et al., 2014; Samsudin et al., 2017)

c. Profile of the Conceptual Concept of Style in Students Before the Application of POE assisted by Refutational Texts with Simple Harmonic Motion - Simulation in Learning

After obtaining information about the percentage of students misconceptions on the Simple Harmonic Motion material based on the results of the pretest, an analysis was carried out to determine the part of the misconceptions detected in students. Part of the students' misconceptions about the Simple Harmonic Motion material is shown in Table 8.

Table 8. Part of the students' misconceptions about the Simple Harmonic Motion

Code	Misconceptions
M1	Students assume that the period of vibration is inversely proportional to the length of the string on the pendulum
M2	Students assume that when the pendulum is there there is a maximum deviation, then the velocity and acceleration are zero.
M3	Students assume that the period of the pendulum is influenced by the mass of the object that is swinging
M4	Students misinterpret the general form of the representation of one vibration into a mathematical form.
M5	Students assume that if the period is larger, the particles will travel through the vibration time faster.
M6	Students assume that the displacement affects the period of the spring-mass system.
M7	Students assume that the direction of velocity is opposite to the direction of the spring force
M8	Students assume that the acceleration of the spring is in the direction of the deviation of the spring.
M9	Students assume that the total spring constant is inversely proportional to the frequency of the spring.
M10	Students assume that the total energy of the spring is proportional to the magnitude of its amplitude.
M11	Students assume that the greater the spring constant, the greater the value of the increase in the length of the spring
M12	Students assume that the greater the spring constant, the greater the period of vibration.

Description: Q = question number

Table 8. shows the students' misconceptions about the Simple Harmonic Motion material based on the pretest activity using the four-tier diagnostic test instrument for Simple Harmonic Motion. The misconception part is made based on the dominance of the highest misconception part of the student's answers. The existence of misconceptions in the Simple Harmonic Motion material in students is in line with the findings of several researchers (Maulidina et al., 2019; Nugraha et al., 2019; Sugara et al., 2016; Tumanggor et al., 2020; Wardani, 2020) namely the existence of a misconception in the material of Simple Harmonic Motion.

d. Profile of the Conception of Style Concepts in Students After the Application of POE assisted by Refutational Texts with Simple Harmonic Motion - Simulation in Learning

The percentage of misconceptions after the learning is applied is presented in the form of a bar chart as shown in Figure 2.

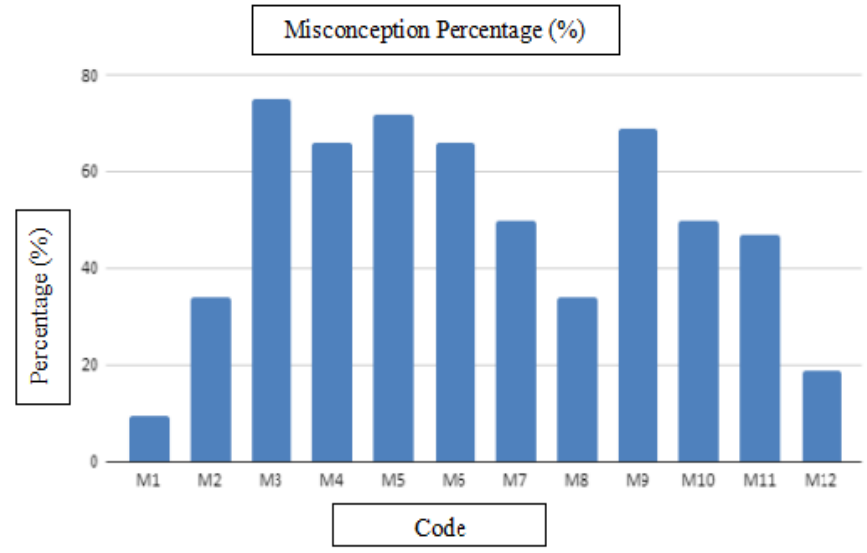

Figure 2. Percentage of Student's Misconception based on Pretest Results

The bar chart in Figure 2. shows the highest percentage of misconceptions in the experimental class is in the M3 question which is a question about the effect of the mass of the load on the vibration period, with a percentage of 75%. This illustrates the existence of the same misconception as the results of the pretest, but with a different number of students, namely 24 out of 32 students. This shows a decrease of 9.4% (considering the percentage of students misconceptions in question number 2 in the pretest is 84.4%.

e. Changing the Conception of Simple Harmonic Motion Material after the Application of POE assisted by Refutational Texts with the Simple Harmonic Motion-Simulation Application

The change in the average percentage of misconceptions in students is 16.4%. This indicates the effect of learning with POE assisted by Refutational Texts with Simple Harmonic Motion-Simulation Applications in reconstructing students' misconceptions in Simple Harmonic Motion material. This section will also discuss changing students' conceptions based on the category of changing conceptions. The results of the percentage values of the types of students' conceptions of change are shown in Table 9.

Table 2. Category Changes in Students' Conceptions

Misconception Code	*Accepted Change (AC) %*	*No Change (NC) %*	*Unaccepted Change (UC) %*
M1	78	13	9.4
M2	56	28	16
M3	25	69	6.3
M4	22	56	22
M5	19	56	25
M6	34	38	28
M7	38	44	19
M8	44	34	22
M9	31	56	13
M10	44	44	13
M11	47	28	25
M12	69	22	9.4
Average	**42**	**41**	**17**

Changes in the category of students' conceptions are categorized into 3 categories, namely Accepted Change (AC), No Change (NC), and Unaccepted Change (UC). After applying POE learning assisted by Refutational Texts with the Simple Harmonic Motion-Simulation (SMH-S) Simulation Application on the Simple Harmonic Motion material, the average change in conception in the AC category is 42%, the category does not change by 41%, and the changes that fall into the category NA by 17%.

In the Accepted Change (AC) category, there is an increase in the level of conception from the pretest results to the post-test results. In the pretest, PD17 answered incorrectly with a level of confidence that the swing with a longer string will have a smaller vibration period.

A	Arin sampai pada hitungan ke-10, kemudian disusul Billy	Hubungan panjang tali dengan periode getaran berbanding terbalik, dimana ketika periodenya lebih besar maka partikel akan membutuhkan waktu yang lebih lama untuk mencapai satu getaran.

Figure 3. Answers from PD17 in the pretest four-tier test of Simple Harmonic Motion

While the post-test PD17 answered confidently that the swing with the shorter rope length will have a small vibration period. He replied that the relationship between the length of the rope swing and the period is directly proportional. After being investigated, it turns out that PD 17's answer has changed based on PD17's answer on Interactive Media Refutational Texts. The initial stage of PD17 answers the questions on "Predict" answers as shown in Figure 4.

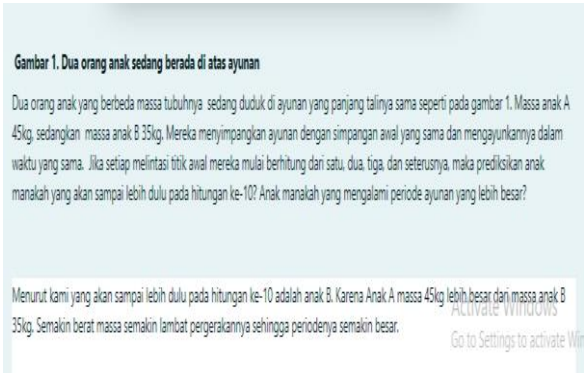

Figure 4. PD17 Prediction Answer on Interactive Media Refutational Text

These findings are in line with several other studies that the use of POE with refutational texts strategies could encourage students to be more understand of the abstract concept and reduce misconceptions because POE learning model requires the student to held direct observation towards the problems. (Ijirana & Wahyuni, 2019; Kurniawan et al., 2022; Tool, 2022)

4. Conclusion

Based on the findings of the analysis related to the implementation of the POE learning model assisted by Refutational Texts with the Simple Harmonic Motion-Simulation Application on the Simple Harmonic Motion material, the average percentage of implementation was 92.8% with a "very good" interpretation. Thus, it can be said that the implementation of POE assisted by Refutational Texts with the Simple Harmonic Motion-Simulation Application in learning is going very well.

The implementation of learning through the application of POE assisted by Refutational Texts with the Simple Harmonic Motion-Simulation Application affects reducing students' misconceptions. This is indicated by the acquisition of an average value of <ΔM> of 59.4%. The interpretation that dominates is the "medium" interpretation. This <ΔM> value indicates the effectiveness or influence of the application of a learning model used to reduce the number of misconceptions. Thus it can be said that the application of POE assisted by Refutational Texts with the Simple Harmonic Motion-Simulation Application has a considerable influence on reducing students' misconceptions about the concept of Simple Harmonic Motion material.

Based on the findings from the analysis of the student's level of conception profile, information on the misconception profile of the Simple Harmonic Motion material was obtained. The average percentage of misconceptions based on the results of the pretest in the experimental class is 65.9%. However, the average percentage of misconceptions based on the posttest results in the experimental class was 49.5%. Thus, it can be said that the average percentage of misconceptions based on the results of the pretest with the average percentage of

misconceptions on the post-test results decreased by 16.4%.

Based on the findings related to the student's misconception profile from the pretest and posttest results, information was obtained about changing students' misconceptions. The change in the percentage of misconceptions in the experimental class is 16.4%. In addition, the average percentage change in the conception level is 42% in the Accepted Change (AC) category, 41% in the Not Change (NC) category, and 17% in the Unaccepted Change category. This type of conceptual change tends to change the expected (become a better conception). Thus, it can be said that the application of POE is assisted by Refutational Texts with Simple Harmonic Motion-Simulation Applications on Simple Harmonic Motion material.

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