Changes in Student Conception About Water Dissolves Various Types of Substances Through POE Strategies assisted KIT Experiment Properties of Water

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Abstract: As a result of interaction with various everyday phenomena, students often have alternative conceptions that are not in accordance with scientific conceptions. One of the concepts in the theme of water is water dissolving various substances. This study aims to identify changes in elementary school students' conception of the concept. This research uses descriptive method. The study involved 16 fifth graders at one of the schools in the city of Bandung. Students obtain a POE (Predict-Observe-Explain) learning strategy assisted by KIT to experiment with the properties of water. The research instruments included prediction questions (answered by students before the experiment), observation questions (answered by students after observing the experiment, and six-tier diagnostic tests (answered after receiving a scientific explanation from the teacher). The collected data were processed quantitatively to describe the conception of the students The results showed that the experimental observation activities and teacher explanations could increase the number of students who understood the scientific conception of the concept that water dissolved various substances, indicating that the POE assisted learning strategy of KIT experiments properties of water can improve mastery of concepts.

Keywords: POE strategy, KIT experiment the properties of water, water dissolves various substances

1. Introduction

Learning science in elementary schools is an important provision for students to study science at the next level of education [1]. Therefore, understanding the science of students in elementary schools needs to be in accordance with the opinions of scientists (scientific). Scientific understanding of student science will make it easier for them to learn the next scientific conceptions at a higher level. On the contrary, the understanding of science that is not scientific (misconceptions) that they experience in elementary school will make it difficult for them to learn scientific concepts at a higher level.

2. Related Works/Literature Review

Previous research reveals that students come to science classes by bringing existing ideas about the world that are different from accepted scientific ideas [2]. Students come to school with their own concepts about scientific phenomena [3] Furthermore, these concepts and ideas are held firm and resistant to change [4]. Understanding the concept of science brought by students comes from various sources that they receive from parents, society, culture and experiences of daily life they find related to something scientific. Thus it can be said that students come to school with alternative conceptions related to the natural world that are very resistant to change and greatly affect new learning [5]. This is according to the view of constructivism expressed by Widodo (2007) concluded that there are 3 principles: 1) Knowledge is human construction, 2) Knowledge is social construction, 3) Knowledge is tentative [6]. Research on the conception of students in teaching and learning activities as one of the interesting things. Over the past three decades researchers have revealed that for students and teachers who play a role in teaching and learning is something that is very central in educational research, because it shows that it is impossible for students to come to science classes without carrying out pre-instructional science [7]. Alternative conception is one of the initial conceptualities that students have at the time of pre-instructional science or before learning about the correct principles of science. The alternative conception is not able to provide an accurate explanation of science so that this can lead to misconceptions of science experienced by students. Because they develop these misconceptions by using common sense to explain scientific phenomena [8]

This research will show various students' conceptions of water can dissolve various substances. This concept is one of the phenomena that is close to students in everyday life, but in reality learning practices receive less attention. Because the teacher only gives concepts that only follow the terms in the text of reading books without conducting experiments by presenting phenomena directly to students. So that there are difficulties for students in understanding the concept of liquid solubility as well as the ability to think and solve problems that are less trained which is actually very necessary in human life. In a previous study on the solubility of substances by Ebenezer, J. & Erickson the process of dissolving sugar in water showed a lot of misconceptions [9]. One effort to help implement the scientific conception of the properties of water, then practicum learning is one way to provide understanding, practice thinking skills, and able to solve scientific problems regarding the nature of water phenomena can dissolve various substances. Practical based learning with the help of KIT experiments the properties of water to be a good alternative learning for students to develop skills, the ability to think critically and creatively in analyzing and applying concepts and principles to be more meaningful [10]. Because practicum-based learning using the experimental KIT tool can provide an experience of observing each incident in a scientific concept they learn. Then for the strategies used in order to investigate the students' conception by using POE (Predict-Observe-Explain). The POE strategy can provide opportunities for students to change and reconstruct their previous conceptions that are inconsistent or contradictions between observation and prediction [11]. With the use of POE can show a picture of the students' initial conception before the practicum treatment that will be given or is called a prediction, then students observe the predictions they have determined through the practicum and the last student gives an explanation after observing students get the results obtained in accordance with predictions or no. So that through this method is able to train the ability to think, and solve various problems related to science. This study aims to identify students' conception using POE (Predict-Observe-Explain) strategy through KIT assisted practicum experiment tools of water properties regarding the concept of water can dissolve various substances.

3. Material & Methodology

a. Data

Data was collected with a sample of 16 fifth grade students from one elementary school in the city of Bandung. Students' conceptions are explored through the application of POE strategies where there are student worksheets that they must fill. The first is when pre-instructional science or before practicum to see how students predict about a phenomenon, before the teacher explains in advance about the experiment that will be conducted verbally. After the prediction activity is complete, then the students are given science instruction through a science practicum assisted by KIT, an experimental tool for the properties of water guided by the teacher with students observing and observing phenomena about water can dissolve various substances. After students make observations and observations with the help of KIT, then students are given back a worksheet that aims to show the results of observations and observations that have been done so that they can find out whether the observations are in accordance with predictions or not, and asked to provide an explanation of the phenomenon. illustrate it by making an image. Furthermore, the students are given six-tier questions to show students' conceptions so that they can be obtained whether they are able to have a scientific conception accurately after the learning process is carried out.

b. Method

This research method is a descriptive analysis the result of some conception collected in quantitative data that aims to show students' conceptions of the properties of water about the concept of water can dissolve various substances. In addition, this study obtains information from various conceptual students so that it can show the extent to which students have a good scientific background through the answers they have raised from the questions given by researchers. To obtain information about students' conceptions, researchers provide several conceptual science criteria for students which are further categorized as follows:

TABLE 1.

Category	Explanation of categories
Fully Correct	Complete and correct explanation that can be accepted scientifically
Partly Correct	A correct but scientifically incomplete explanation as expected
Misconception	Explanations that have scientifically wrong statements
No Explanation	There is no explanation given by students, whether right or wrong

(Keles & Demirel 2010) [12]

4. Results and Discussion

a. Result

In this section, the results obtained through descriptive analysis of data collected through prediction questions to evaluation questions using a six-tier test. Before the teacher gives a prediction question sheet to students, he gives a verbal explanation about the phenomenon of water can dissolve various kinds of substances that indicate water can function as a solvent. Water trial KIT tools and materials are provided by the teacher to support the research that will be conducted. The explanation starts verbally conveying about the phenomena of 3 test tubes, each filled with a different solution of 2 ml (approximately 20 drops). For test tube A filled with tap water / well, tube B is filled with mineral water, and test tube C is filled with salt water. Furthermore, the three test tubes were burned through a spiritus burner alternately. From the teacher's explanation, students were asked to predict which test tubes had residues after burning.

Test Tube A
Tap water

Test Tube B
Mineral water

Test Tube C
Salt water

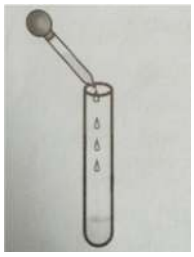
The prediction questions (Predict) given to students are obtained as follows:

TABLE 2.

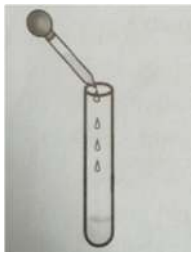
Calssification	Student Prediction	Student	Reason
Partly Correct	The residue is only in the test tube containing water	A	Because there are materials that blend with the water / other ingredients
Misconception	There is a residue in the tube containing tap water	C, D, E, F	because the three heated test tubes contain liquid
	There is no residue in the test tube	B,G,H,I,J,K,L,M,N,O	Because after the three test tubes are heated by fire spirits, the water will run out and there is no residue
No eksplanation	There are residues in the three test tubes	P	-

The table above is a prediction of students about the phenomenon of water can dissolve various substances. From the results obtained in the table shows that student A gives an almost correct answer. Because it provides reasons that approach the concept scientifically. However, from the predictive answer option that he submitted, it was still incomplete, stating "Residue is only found in test tubes containing water". The reaction tube described by the researchers all contained water but the three test tubes each had different types of water, so the answer to the prediction was still incomplete because which water did he mean whether salt water, or tap water or water mineral? Therefore, the researcher gives a category of "partially correct" for student A because the predictive answers are still incomplete even though the explanation is close to the scientific concept. Then the students' prediction answers are mostly included in the misconception category, they are students B, C, D, E, F, G, H, I, J, K, L, M, N, O. In this category, students are more likely propose a prediction "there are no residues in the three test tubes" after heating, because they assume that the water in the three test tubes evaporates and nothing remains. This is based on the student's experience of water can evaporate when heated, if the water is heated continuously then the water will not run out. In accordance with the view of constructivism which states that students' initial knowledge plays an important role when they learn about a thing that has something to do with what they already know [6]. The initial knowledge brought by these students will deliver concepts that are not scientifically appropriate to the phenomena of science they find. Because every phenomenon of science obtained through everyday experience without proper scientific instruction can enable students to use common sense in interpreting the phenomenon of science so that it is very susceptible to experience scientific misconceptions. Then the last one is a student, P student who does not give an explanation of the prediction he has stated. The student gives a prediction but does not give a reason why "there are residues in the three test tubes". Therefore P students are included in the "No explanation" category. In this classification, students may not be able to understand the phenomenon described. Students in this category are able to write reasons but that have nothing to do with phenomena or empty the prediction answers.

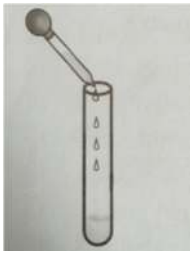
After seeing various predictions as well as students' reasons about the phenomenon, the teacher then provides learning through practicum assisted by KIT to experiment with the properties of water with the tools and materials provided by the teacher. The practice here aims to enable students to make observations and observations directly to prove whether their observations are in accordance with predictions. The following practicum process is carried out through 3 different test tubes containing liquid.



The reaction tube (a) is filled with 2mL of Tap water



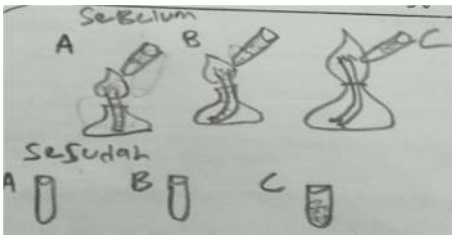
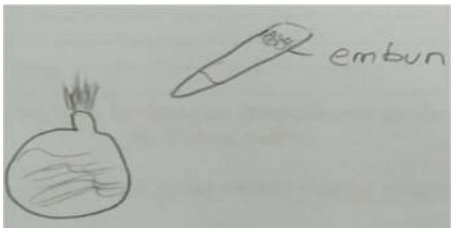
The raection tube (b) filled 2mL Mineral water



The raection tube (b) filled 2mL Salt water

The heating process of each tube (a), (b), and (c)

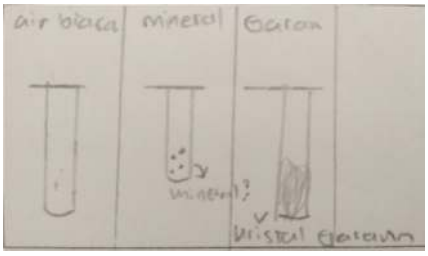
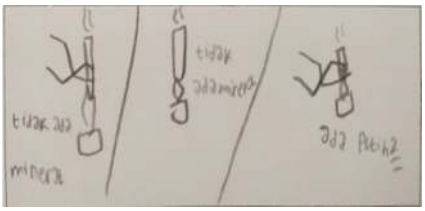
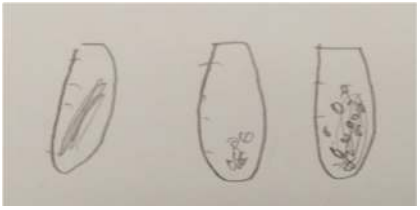
Through the KIT, an experimental tool for the properties of water, students observe (Observe) phenomena which are simulated by the teacher so that the results of his observations are written by answering a number of questions to prove the students' predictions presented earlier. The following sheets of observations and student explanations are accompanied by illustrations.

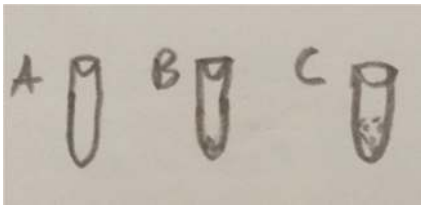
Student	Observation Result	Explanation	Student drawing
A, C, D, E, F, G, H, J, K, L, M, N, P	Test tube (a) no residue, Test tube (b) no residue, Test tube (c) there is residue or residue	So, the test tube (a), (b), and (c) each has been warmed up. Then the reaction tube (a) there is no residue, the test tube (b) there is no residue, but (c) there is residual foaming, or salt crystals or white salt	
B, I	Tap water, mineral water and heated salt water will evaporate		
O	The reaction tube (a) is nothing. The reaction tube (b) is nothing. The reaction tube (b) is nothing	Test tube (b) no residue. Test tube (b) no residue. Test tube (c) no residue	

The results above show that for students A, C, D, E, F, G, H, J, K, L, M, N, P have observations "after the three test tubes have warmed or burned, for the test tube (a) and (b) there is no residue, while the test tube (c) there is a residue that is marked in white on the bottom of the test tube ”even so, the students proposed diverse representations. If we look at student A revealing "the test tube (a) there is

no material left, tube (b) there is no material left" it represents salt as a material that forms white after the reaction tube (c) which contains heated salt. Then for student F, he revealed his observations "Well water and minerals if heated will boil out the smoke and burn nothing after being heated. Salt water when heated boils faster after being heated and remaining salt. From the observations made, he saw the three test tubes that were burned and boiled to look smoky so that the water in the test tube ran out. Interestingly, the student's answer was that he stated that salt water boiled faster than other water. However, the answer already represents an explanation or reason for the results of his observations. Furthermore, the student L stated "All water evaporates but the salt water leaves a kind of crystal" he observed all the water in the three test tubes evaporated, but what distinguishes them from the three is after heating or burning is seen in the test tube (c) leaving sort of crystal. He observed the test tube (c) there were remnants that formed like crystals attached to the walls of the test tube. Likewise with student M who has a similar explanation with student L, namely "The tube (a) is heated to run out. The heated tube (b) that occurs is run out too, but for a tube (c) heated the salt water becomes white crystals ", so he gives the statement that any salt water that is heated through the combustion will become crystalline. This gives an illustration that each student has a different representation for the phenomenon they find. In connection with this, the purpose of the explanation of students has the same opinion, namely "test tube (a) and (b) there is no residue, while the test tube (c) there is a residue". Then if we associate with their previous predictions there is only 1 student from the observations that correspond to his prediction, namely student A. Because the predictions he represents from the test tube (c) there are materials or materials that blend with water so that the material or material can be separated through burning. Then students B and I only give the answer "yawn" by not giving an explanation for the answer. And the last is student O by giving a statement that the three test tubes have no residue. The student did not explain again in full related to the answer he put forward.

After students make the observation process, they are given a six-tier question sheet which aims to explain (Explain) the concept of water can dissolve various substances. Conception analysis from predictions to observations through practicum until explanation of students' conception of the phenomenon is part of a series of POE strategies in this study. The results of the six-tier student answers collected again are then included in the table as follows.

Classificaion	Student	Answer	Explanation	Student drawing
Fully Correct	A		Because it has a boiling point that is bigger than pure water. So the salt, minerals and other substances in the test tube don't evaporate, so there is residue left behind or remnants.	
	J, H, K	There is a residue	Because it has other substances dissolved in the three test tubes containing salt water, mineral water, and tap water.	
Partly Correct	C, D, G, M, N		Because salt has a larger boiling point than mineral water, tap water, and pure water	

Misconception	E	There is residual heated water except mineral water	
	F	Because salt water and mineral water have residues	
	I	Because water has a sediment	
	P	Because there is a residue in the test tube	
	L	When the salt is heated, the water evaporates but the salt does not, the salt turns into a salt crystal	
	O	Well water has no residue	
No explanation	B		

Based on the table above, there are 4 students who fall into the completely correct category. In this category, there is student A who answers very fully. He explained the concept by explaining that "the boiling point of a salt solution is higher than a solution of mineral water and tap water" which was not explained by students J, H, K. But the answers from these 3 students were able to show a complete concept. Then then as much as, students in the category of misconception, 5 students included in the correct criteria in part and in the last 2 students included in the category of no explanation. Of the 6 students in the misconception category, student E revealed that "heated water has remnants except mineral water". This shows that mineral water does not have residues, even though mineral water is also dissolved water certain substances and minerals because tap water is well water that has been mixed by various substances that exist in certain environments, as well as bottled mineral water which has been mixed by various kinds of certain substances and minerals that will produce residues from substances and minerals that dissolve in the water after heating. It's just because of the limitations of our eyes to see residues which are minerals and dissolved substances in tap water and mineral water that are very unlikely to be seen by the naked eye. The same is true for O students, because he considers well water or tap water to have no residue whereas tap water is also water that has been dissolved by certain substances. For students I stated that water has sediment, while for types of pure water (aquades) will not have residues such as the type of water in the test tube (a), (b), and (c). And for students L states that "salt water turns into salt crystals". Then the next is the "partially correct" category. As many as 5 students who obtained this criterion were close to scientific conception. The category reveals that "because salt has a boiling point that is larger than mineral water, plumbing and pure". It is true that salt has a larger boiling point compared to the three waters, but the answer is still not scientifically complete because they do not provide a statement indicating the presence of certain substances and minerals in salt water, mineral water and tap water. For categories there is no explanation can be seen B and P students do not give any explanation and empty the answer, but they only illustrate their answers through an image.

After going through the process of predicting, observing, and explaining the phenomenon of water can dissolve substances, the number of students who have knowledge of the properties of water can be described through the table as follows.

Aspec	Knowledge	Predict	Observe	Explain
Phenomenon	Know	31,25%	87,5%	62,5%
	Do not know	68,75%	12,5%	37,5%
Explanation	Know	6,25%	81,25%	56,25%
	Do not Know	93,75%	18,75%	43,75%

Based on the table, it can be concluded that the results of the students' predictions regarding the phenomenon of water that can dissolve various substances are more likely that students do not know about the phenomenon by obtaining 68.75% of students, and those who know only 31.25%. For the explanation aspect, students who know only 6.25%, while the dominant students do not know 93.75%. This shows that students' initial knowledge of the phenomenon of water can dissolve substances is still little known by students because the more dominant answers to the predictions they submit are more contrary to the results of their observations so that they have not been able to explain the concept well. After going through observations by practicing a KIT assisted experiment on the properties of water, students who know become a lot that is equal to 87.5% compared to students who do not know that is 12.5%. Then from the explanation aspect, students who know as much as 81.25% and don't know as much as 18.75%. In connection with this, in terms of students 'observation / observation answers through the provision of practicum assisted by KIT experiments the properties of water can further enhance students' knowledge about whether there are residues from the 3 test tubes after heating. And the last answer is the explanation of students, for the aspect of the phenomenon is obtained 62.5% know and as many as 37.5% do not know. For the explanation aspect, as many as 56.25% knew while 43.25% did not know. This shows that after students make observations and conceptual explanations by the teacher, their knowledge of the properties of water can increase, both in terms of phenomena and explanations they are able to explain the concept of water phenomena can dissolve substances. Although there are some students who have a partially scientific concept, their answers can already be categorized according to the scientific conception.

5. Conclusion

Students bring initial knowledge into the classroom before they are given instructions by the teacher to get to know a concept is something that needs attention. Because the initial concept of students can influence the new concepts they get from the teacher able to be grown into concepts that are scientifically appropriate or may be contradictory. This research is a descriptive analysis using POE (Predict-Observe-Explain) strategy as a way to investigate student conception and through practicum assisted by KIT tools to experiment on the nature of water to help foster the ability to think critically and creatively in expressing scientific concepts in students. The concept studied is that about water can dissolve various kinds of substances with the help of KIT experiments the properties of water which are proven by experiment 3 test tubes filled by several different drops of water. In the results previously explained that students are able to foster a conception of the phenomenon of water can dissolve various substances starting with predictive answers. In the prediction ask about is there any residue or residue attached to the test tube after burning. After they made observations through the practicum assisted by the KIT tool, they tested the properties of water, they were able to grow new concepts even though the prediction answers they proposed were more likely to be incompatible with observations. Through KIT assisted lab experiments the nature of water, misconceptions that occur in a number of students can be minimized as evidenced by as many as 56.25% of students can explain the concept scientifically than before students are given practicum learning with the help of KIT the properties of water are only 6, 25% of students who know the concept of water can dissolve various substances. Therefore, through the POE (Predict, Observe, Explain) strategy assisted by KIT experiments the properties of water can change students' conceptions about the phenomenon of water can dissolve various substances.

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