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Parallel Session (October 16th - 17th, 2020) **Meeting ID: 982 138 8843 Passcode: icst** **Time : 14.00-17.00 & 08.30-11.30 WITA** **Moderator : Sabri., Ph.D/Amirullah Abduh, Ph.D** **Host / HP : Mauliadi Ramli / 085242550937**		
No	**Presenter**	**Title**
1	Sandi Rais	Steady State Simulation of a CO2 Heat pump system for Water Heating
2	Witono Hardi	The Behavior of Square Crash Box in Various Cross-Section Subjected yy High-Velocity Impact https://youtu.be/SRQn0t5yQBg
3	M Muslimin	Cross-sectional texture of sago fiber due to liquid smoke treatment https://www.youtube.com/watch?v=HaoROgK6LWo
4	Cipto	Reducing Emissions CO, CO2, and HC, on Vehicles with Gasoline Fuel
5	Klemens A. Rahangmetan	Effect of Holding Time and Cooling Media on Heat Treatment Process to Gear Motor Indopart Hardness
6	Hariyanto	Exergy Modeling of Monocrystalline Silicon Solar Cells with Spectral Irradiation Variations
7	H Muzakki	Gating System Measuring of Sandcasting
8	R M Yusron	Investigation of Involute Profile Error on Spur Gear Processed using Wire EDM
9	W Findiastuti	Comparative assessment of green ball-manufacturing alternatives using Green Productivity Index (GPI)
10	Hairil Budiarto	Design and Development of Fuzzy Logic Control Systems on Bottled Drinking Water Pressing Equipment
11	Sri Wahyuni	Mobile robot painted dashed lines as road markings
12	Faikul umam	Design of Fuzzy Sugeno Controller for Anti-Roll Stabilizer Using Flywheel
13	R S Hidayatullah	The Effectiveness of Using Variations in Fuel Against Engine Performance 4 Steps 100 CC with Compression Ratio 8:1
14	D Riandadari	Design of Work System for Reducing Pollution and Forest Fire Smoke
15	Warju	The Effectiveness of Using Heaters on Mufflers to Reduce Exhaust Emissions from Spark Ignition Engines
16	Achmad Fajar Lasttanto	Design and Analysis Robot Puzzle For Capacity 0.5 Kg

17	A Lutfi	Gamification for Learning Media: Learning Chemistry with Games Based on Smartphone https://youtu.be/0-gHbdSD9xA https://drive.google.com/file/d/1NQYlUmoWLLZ3M_aD51WhE-q9lYhQniDd/view?usp=sharing (PPT)
18	Martini	The use of information technology to improve student's deep understanding of matter and energy https://youtu.be/4z3eZPcosFQ https://drive.google.com/file/d/1hXvHflwEZS2aXtULgC54KP3x0VSweM-r/view?usp=sharing (ppt)
19	Raharjo	Analysis of the Weakness to The Implementation of Online Learning During the Covid-19 Pandemic In the City of Surabaya, Indonesia
20	S Indana	The development of integrated textbook cooperative learning model to improve learning outcomes and practice literation skills
21	W B Sabtiawan	Blended Learning for Undergraduate Students: Validity, Practicality, and Effectivity https://www.youtube.com/watch?v=gBnLTctLXI8 (video) https://drive.google.com/file/d/17Tgn6HOeXAnqws36UWdAVdZsWZP7a0RT/view?usp=sharing (ppt)
22	Supriadi Torro	A Comparative Study of ICT and Conventional Teaching Roles in Boat Class of Coastal Areas
23	L Rosdiana'	The Effectiveness of The Animation Video Learning Earth's Layer Media to Improve Students' Concept Understanding https://drive.google.com/file/d/1kpMt4po_wPIINqOHBnb1E98XEnCWdZef/view?usp=sharing
24	Dwi koranto	Characteristics and practicality of problem-based project learning to improve process and product performances of prospective physics teachers
25	Suyono	The Claims Statements from Viral Videos for Instrument Development to Assess Argumentation Thinking Skills https://drive.google.com/file/d/1mZEncSO6yQu4vemSBAJDP0w-qMUM-eAt/view?usp=sharing (ppt)
26	Rindu Puspita Wibawa	E-readiness Measurement in the Virtual Application Learning https://youtu.be/9u8nW0JSH0A
27	Hasni	Development of Smart Character Education through Learning "Higt-Touch And Higt-Tech" (School Studies in Makassar City)
28	SC Wibawa	MiCa ver. 2.0: Mirrorless Camera gamification for students Base on Features as Distance Learning Tools

The use of information technology to improve student's deep understanding of matter and energy

The use of information technology to improve student's deep understanding of matter and energy

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Abstract. Advances in information technology make it easy to get a lot of information from internet. Therefore, teachers must facilitate learning that encourages students to increase their deep understanding with the use of information technology. Through the implementation of the PDCA model, which consists of Plan, Do, Check, and Act, students gradually search for information on the topic of material change. The topic which consists of three sub topics, namely: (1) the composition; (2) the electricity; and (3) the magnetism. The subjects in this study were 20 students from the superior class of S1 Science Education. The implementation of the PDCA model is designed as follows, (1) the planning stage, students are given the task of finding information by internet about the sub topics that become their assignments. Students read and understand it; (2) the doing stage, students are asked to describe what is read, and formulate questions from the information read; (3) the checking stage, students re-examine the questions formulated; and (4) the action stage, students look for information to answer the questions in the previous stage. The study was conducted in two cycles. The results were obtained that there was an increase in students' deep understanding of all sub topics.

1. Introduction

To be able to enter a superior class, students must go through a selection process. Aspects selected include: achievement index, Test of English Proficiency (TEP) scores, superior class selection test scores, and interview scores. With this selection process, excellent students have greater potential compared to regular classes. For this potential to increase, learning must be designed by increasing in-depth understanding, by getting used to asking 5W1H questions and answering them. The higher the level of questions that are formulated, the greater the student's effort to answer the question, so the deeper the student's understanding, or a deeper understanding will be formed. In this study the habit of asking questions is designed by implementing the PDCA model (plan, do, check, and act). The formulation of the problem in this study is: "how to improve students' deep understanding with the implementation of the PDCA model?"

In the PDCA model, there are four stages, namely: plan-do-check-act cycle (Figure 1). The cycle has no end, so the PDCA should be repeated and repeated for continuous improvement. These stages are illustrated in Figure 1, below:

Figure 1 PDCA Model courtesy of The W. Edwards Deming Institute [1].

In this learning that is improved is a deep understanding of students. To increase deep understanding, we must pay attention to the potential students have. The potential is the ability and strength possessed by someone, both physical and mental, which allows it to be developed if it is supported by adequate training and facilities [2]. The potential can be called the hidden power or ability possessed by someone who can be optimized [3]. Through deep learning, students are intrinsically interested and try to understand what they are learning. An in-depth approach to learning has been described as a way for students to understand content in full by linking and compiling ideas, and searching for the underlying principles [4], [5]. Definition of deep learning is examining new facts and ideas critically, and tying them into existing cognitive structures and making numerous links between ideas [6], [7], [8], [9].

To optimize students' in-depth understanding in superior classes, a PDCA (plan-do-check-act) learning model is applied. Through PDCA, students are trained: read and understand readings; formulating questions, checking questions; and describe the answers to the questions formulated earlier. Characteristics of the teaching method, how students perceive the teaching context, and student factors play a role. Many of these factors are intertwined and how they relate to each other and differ across different student centered learning environments. [10], [5].
To have a deep understanding means being able to put together pieces of information and use them to understand something (for example solving problems, writing new ideas, and so on). Table 1 below shows you a few things you can do if you have a deep understanding. Compare with understanding the "surface" of a topic.

Table 1 Description of some actions associated with deep understanding (https://www.polyu.edu.hk/obe/students/files/deep.pdf)

Factual recall	Listing a pieces of information in unrelated manner. This is not deep understanding!
Contrast	Show the important difference between things.
Compare	Show how things are alike or not alike
Explain	Give the meaning of a topic clearly.
Relate	Show that the ideas are connected to each other.
Analyze	Examine in detail the elements of a topic and how they relate to each other.
Apply	Make use of specific knowledge or concepts to solve a problem.
Reflect	Show new understaning of something by studying past experience.
Generalize	Draw a general conclusion fro a number of facts.
Recommend	Suggest what is a appropriate to do base on a critical evaluation of available information.
Hypothesize	Propose an idea which can be used as a starting point for further study.

Theorize	Form general principles of an art or science

2. Method

This study uses a class action research design (action research classroom), by implementing the PDCA model (plan, do, check, and act), in the Matter and Energy course. As the subject in this study were students of Science Education, class of 2017 U a number of 20 students.

Indicators of competency achievement in this course include: students can (1) explain about the composition of substances, electrical substances, and magnetism of substances; (2) identify changes in physics and chemical changes around them; (3) explain chemical changes or physical changes that can affect the composition of a substance, electricity, or magnetism of a substance; (4) describe the advantages and disadvantages of changing the composition of a substance, electrical substances, or magnetism of substances; (5) describe the relationship between matter and energy. To achieve this indicator, PDCA learning is carried out as follows,

1. Plan Phase

At this stage, students are divided into study groups consisting of 3-4 students/groups. The whole group was given the task of reading in accordance with the topics specified, including: composition, magnetism, and electricity.

2. Stage Do

From reading assignments, students are asked to describe what is read by formulating the question. The questions formulated are categorized as HOT (analyze, evaluate, or create).

3. Check Stage

At this stage, students re-check the questions that have been formulated. Each group of students can measure whether the questions they have produced are able to provide the widest possible information to other groups when entering the action stage. If not, the group is allowed to rearrange questions related to the topic of their assignment.

4. Act Stage

At this stage, students look for information to answer the questions they have formulated at the "do" and "check" stages, by developing presentation material related to the topic for which they are assigned. Here is one example of the presentation material made by the "composition" group in the first cycle.

Data collection techniques by observing worksheets and evaluating during presentations. Measurement of student understanding is seen from the ability to make questions and describe answers.

Data were analyzed by categorizing the ability to form questions and describe, as surface, superficial, or deep understanding.

3. Results and Discussion

In this study, the first activity observed was the ability to formulate questions. The level of understanding is determined from the description made for each question that is formulated. The results of implementing the PDCA model to increase understanding, in two cycles can be shown in Table 1 below:

Table 1 Level of understanding in cycle 1.

Sub Topic	Formulate the questions	Level of understanding
The composition	What is the composition of substances? What makes the composition of substances change? Why substances can change into a composition? What are the indicators of a substance undergoing a change in composition?	In the first question, the level of understanding is only on the surface, because students only define. but for the next three questions, students must understand the factors that can make the composition of a substance change, and explain the indicators of a

Sub Topic	Formulate the questions	Level of understanding
		substance undergoing a change in composition. The description of the answers to the last three questions shows an increase in student understanding, although it is still at a shallow level.
The magnetism	What is the meaning magnetism in substances? What are the uses of magnets? What are the characteristics of magnets? How to eliminate the magnetic properties?	Surface understanding, because what the students do is only give an understanding of magnetism of substances, describe the uses and characteristics of magnets. The fourth question is shallow, because the student explain how to eliminate the magnetic properties.
The electricity	What is the meaning electricity? What is the meaning electrical conductor? What is the meaning electrical semiconductor? What is the meaning insulator? Where does electricity come from? What is an electric current? How does electricity flow?	In the first four questions, the level of understanding is only on the surface, but when entering the last three questions, students must understand the origin of the electric current and explain how the current flows, so the level of understanding is shallow.

In cycle 1, some questions are more defined, so students only remember. Remembering is categorized into surface understanding. Surface understanding largely answers questions about what, when, where and who, especially explicit, and requires little understanding or action [11].

Surface knowledge in the form of information can be stored in books and computers, and the mind/brain. Most of our daily lives such as conversation, description, and even self-reflection can be considered as surface thinking and learning that create surface knowledge. Much of what is taught in schools is focused on awareness and memorization (surface knowledge) with an inadequate focus on understanding or meaning [11].

In order for students to develop presentation material that can provide broader information to their peers, the next question must have a higher category, for example: "why, or how". On the composition sub topic, students can describe things that can make the composition of substances change. Substances can change into a composition because there are chemical changes. Chemical change is a substance change can produce new substance by chemical characteristics with different original substances. it can change in the form of combining a number of substances or decomposition of a substance. Chemical changes can be identified with the following characteristics: the formation of gas; formation of sediment; color changes; and temperature changes. For this explanation is categorized as shallow understanding

On the magnetism sub topic, the student explain how to eliminate the magnetic properties by dropped or slammed, heating on the magnet, and alternating electric current (AC). On the electricity sub topic, the student explain how the current flows from the batery in a circuit gives energy to the electrons and pushes them arround a circuit, from the negative terminal of the cell, round the cirsuit and back to the positive terminal of the cell. The last two explanations are categorized as shallow understanding.

Shallow knowledge is when you have information plus some understanding, meaning and sense-making. To understand is to make some level of meaning, with meaning typically relating to an

individual or organization and implying some level of action. To make meaning requires context [11]. Characteristic of deep learning is relating new and previous knowledge [6], [7], [8], [9].

Table 2 Level of understanding in cycle 2.

Sub Topic	Formulate the questions	Level of understanding
The composition	How can substances change in composition? Give three examples in your life for changes in the composition of substances! What is advantage and disadvantage from changes in substances composition?	Shallow understanding, because students can explain how substances can change in composition and give examples of changes in the composition of substances in everyday life. In the last question, students' understanding is deep because it can illustrate the advantages and disadvantages of changing the composition of substances.
The magnetism	Magnetic behavior is classified as paramagnetism, diamagnetism, and ferromagnetism. What distinguishes one from another? We know that magnets can conduct electricity, for example on bicycle dynamo. How can this be explained?	Deep understanding, because students explain differences in paramagnetism, diamagnetism, and ferromagnetism by being connected to the presence of free electrons in a metal. The description of the second question is also deep understanding. Students can explain the process of formation of electricity by magnets on a bicycle dynamo, a phenomenon called electro-magnetic induction.
The electricity	We know the terms conductor, semiconductor, and insulator. What is the difference between one and another? Can we convert conductors or semi-conductors into insulators? How do you change it?	Deep understanding, because students explain differences from conductor, semiconductor, and insulator using the term conduction band, valence band, forbidden energy gap.

In cycle 2, the question already requires students to give a deeper explanation. For example, students can explain how substances can change in composition because there are chemical changes. Chemical composition refers to the arrangement, type, and ratio of atoms in molecules of chemical substances. The chemical composition of a substance determines the properties of the substance. The students can give examples of changes in the composition of substances in everyday life, such as: the process of photosynthesis, fermentation, urea fertilizer. corrosion of iron, and combustion wood processing.

In magnetism, students explain the differences from paramagnetism, diamagnetism, and ferromagnetism by connecting to the presence of paired/unpaired electrons in metals. Paramagnetism refers to the magnetic state of an atom with one or more unpaired electron, for example: Aluminium (Al). The electron configuration for Al $1s^2 2s^2 2p^6 3s^2 3p^1$. Diamagnetic is matter that is unaffected by the magnet. Diamagnetic has no unpaired electrons, for example Zinc (Zn). The electron configuration for Zn $4s^2 3d^{10}$. Changes in electron configurations will cause changes in the magnetism of the substances.

In electricity, students explain differences from conductor, semiconductor, and insulator using the term conduction band, valence band, forbidden energy gap. Conduction band is defined as the

outermost shells of the atom in carry the electron ae free to move and thereby can carry electric current. Valance band is defined as the inner shells of the atoms in which the electrons are tightly bound to each other and can not move freely. They need additional energi to move freely. The energy gap present in between conduction band and valence band, is called forbidden energy gap.

In cycle 2, questions and answer descriptions show students' deep understanding. In-depth knowledge of students must develop understanding and meaning, integrate it, and be able to change the frame of reference as context. Developing in-depth knowledge is not an easy task. Gather relevant information and combine into several parts to build various patterns that must be taken when facing a new situation. In-depth knowledge usually provides the best solution for a problem. When someone has deep knowledge, the more learning they will build in the subconscious. In other words, in the area of focus, knowledge breeds knowledge. The more that is understood, the more that can be made and understood [11]

Personal development process that involves changes in perception and learning habits are complex [12], [13]. Learning is seen as a construction of knowledge and insight, taking knowledge, and gaining knowledge. For example, new knowledge must be accepted to solve specific questions, therefore, the practice of connecting between new knowledge and learners (building knowledge and insights) is necessary to increase this new sense of knowledge in the mind (taking knowledge through memorization and reproduction) [14], [15].

4. Conclusion

From the results of the study it can be concluded that to improve students' deep understanding, learning must facilitate students learning how to learn (learning to learn something), so students can develop ideas or creative ideas related to things that are learned. Through the habit of asking questions, students will try to find answers to these questions. The higher the level of difficulty of the questions that can be formulated, the greater the student's effort to answer the question, and the broader and in the student's understanding.

In accordance with the results of the implementation, suggestions that can be written here are the stages in the PDCA model implemented for individual assignments, so that each student can know their initial understanding and improvement. With students recognizing/knowing how much their understanding is, students will be motivated to develop it when learning facilitates them.

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