PROCEEDINGS

International Conference On Science Education (ICoSEd#3 2021)

" Education for Sustainable Development 2030 : The Impact, Challenges and Strategies in Science Education "

FMIPA UNIVERSITAS NEGERI YOGYAKARTA
2022

ISBN : 978-623-98805-0-7

PROCEEDINGS OF THE 3rd INTERNATIONAL CONFERENCE ON SCIENCE EDUCATION(3rd ICOSED)

Education for Sustainable Development (ESD) 2030: The Impacts, Challenges, and Strategies in Science Education

Yogyakarta, 6 November 2021

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Published by:
FMIPA Universitas Negeri Yogyakarta
Karangmalang, Yogyakarta 55281
Tel. (0274)550227, Fax. (0274)548203

ISBN : 978-623-98805-0-7

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Preface

This proceedings is the regular edition (non-Scopus-indexed) of the conference proceedings of the 3rd international conference on science education (3rd ICOSED) held by the Faculty of Mathematics and Science, Yogyakarta State University, Indonesia on 6 November 2021 at Yogyakarta State University. All papers in this proceeding were obtained from a selection process by a team of reviewers and had already been presented in the conference. Some selected papers from the conference were compiled under separate proceedings and published by AIP Publishing indexed Scopus.

The theme of this 3rd ICOSED is '*Education for Sustainable Development (ESD) 2030: The Impacts, Challenges, and Strategies in Science Education'*. We owe special thanks to our keynote speakers: 1. Prof. Alipaşa Ayas, Ph.D (Graduate School of Education, Science Education, Bilkent University, Turkey), 2. Gillian Kidman (Maths Science & Technology, Monash University, Australia), 3. Prof. Hiroki Fujii, Ph.D (Graduate School of Education, Faculty of Education, Okayama University, Japan), 4. Prof. Dr.Phil. Ari Widodo, M.Ed (Biology Education Department UPI, Bandung). We owe special thanks to our invited speakers: Prof Dr Anna Permanasari (Science Education Department, Universitas Pakuan, Bogor), Dr.Sarwanto (Science Education Department, Universitas Negeri Sebelas Maret, Surakarta), Dr.Munzil (Science Education Department, Universitas Negeri Malang), Dr.Agus Ramdani (Science Education Department, Universitas Mataram), Dr.Sri Wahyuni (Science Education Department, Universitas Negeri Jember), Dr.Antuni Wiyarsi (Chemistry Education Department, Universitas Negeri Yogyakarta).

Hopefully, this proceeding may contribute in disseminating research results and studies in the field of mathematics, sciences and education such that they are accessible by many people and useful for the development of our civilization.

Yogyakarta, January 2022

Editorial Team

Forewords from the Chairperson of the Committee

Assalamu'alaikum warahmatullahi wabarakatuh
May peace and blessings be upon you all
The honourable, the Rector of Universitas Negeri Yogyakarta, Prof.Dr. Sumaryanto, M.Kes., AIFO
The honourable, the Dean of Faculty of Mathematics and Natural Science, Prof.Dr.Ariswan
The honourable, our Keynote speakers (Prof. Alipaşa Ayas, Gillian Kidman, Prof. Hiroki Fujii, Ph.D, Prof. Dr.Phil. Ari Widodo) and the invited speakers (Prof Dr Anna Permanasari, Dr.Sarwanto, Dr.Munzil, Dr.Agus Ramdani, Dr.Sri Wahyuni, Dr.Antuni Wiyarsi)
Distinguished guests, ladies and gentlemen

Dear our respected speakers and participants
On the behalf of the Organizing Committee 3rd ICoSEd 2021, we would like to extend our warmest welcome to Yogyakarta.
Today on 6th November 2021, The 3rd International Conference on Science Education (ICoSEd) is conducted based on collaboration two institutions, Indonesian Science Educators Association namely Perkumpulan Pendidik IPA Indonesia (PPII) and Faculty of Mathematics and natural science, Universitas Negeri Yogyakarta, Indonesia. The theme for this conference is "Education for Sustainable Development 2030: The Impacts, Challenges, and Strategies in Science Education". The theme will encompass the field of science education to promote creative, resilience, and sustainable communities in facing global challenges.

This conference is followed by notable/prominent practitioners, researchers, educators and students from science education worldwide to share their latest research interest and exchange their initiatives. There are slightly over 100 papers which were accepted in ICoSEd website. The selected papers will be published by AIP Publisher under Scopus Index and the rest will be published on Indonesian Journals under Shinta index and Regular ICoSEd Proceedings.

We owe special thanks to our keynote speakers: 1. Prof. Alipaşa Ayas, Ph.D (Graduate School of Education, Science Education, Bilkent University, Turkey), 2. Gillian Kidman (Maths Science & Technology, Monash University, Australia), 3. Prof. Hiroki Fujii, Ph.D (Graduate School of Education, Faculty of Education, Okayama University, Japan), 4. Prof. Dr.Phil. Ari Widodo, M.Ed (Biology Education Department UPI, Bandung). We owe special thanks to our invited speakers: Prof Dr Anna Permanasari (Science Education Department, Universitas Pakuan, Bogor), Dr.Sarwanto (Science Education Department, Universitas Negeri Sebelas Maret, Surakarta), Dr.Munzil (Science Education Department, Universitas Negeri Malang), Dr.Agus Ramdani (Science Education Department, Universitas Mataram), Dr.Sri Wahyuni (Science Education Department, Universitas Negeri Jember), Dr.Antuni Wiyarsi (Chemistry Education Department, Universitas Negeri Yogyakarta).

Furthermore, we want to express our gratitude to our reviewers for invaluable comments and suggestions. We address very big appreciation and many thanks to all presenters and participants who have been willing to voluntary participate and actively involved in this conference. Last but not least, we address many thanks to all ICoSEd committee members who have devoted their thoughts and energy for ICoSEd.

We hope that this conference will be a good place to promote and maintain national and international collaboration and networking among academicians, researchers and educators.

Also, we hope that this conference can strengthen the collaboration between the association PPII and FMIPA UNY. Finally, we hope that all presenters and participants will enjoy join in this conference and follow the schedule tidely!
For information, you can update the progress the proceedings from our website. So please kindly check it regularly!
For any inquiries, please contact the committee via WhatsApp.
Thank You. Please enjoy your day.

Wassalamu'alaikum warahmatullahi wabarakatuh.

Chairperson of the committee,
Dr.Asri Widowati

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Building Character through Science Learning in the Covid-19 Pandemic Era

Elizabeth Emma Widyaningsih

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Abstract. Based on the results of the evaluation and survey of distance learning, it turned out that there was a decrease in the students' characters, including religious, independence, honesty, discipline, and integrity of the students. Therefore, it remains the responsibility of all teachers to build character through the learning carried out. This study used a pre-experimental design method with a sample of 135 students of class IX A, B, C, D SMP Negeri 1 Yogyakarta. The aims of this research were (1) to develop a way to cultivate the positive character of students in science learning; (2) to increase the awareness of students by being actively involved in Distance Learning (PJJ). The research results indicated that positive characters and activeness in learning could be achieved during science learning from the introduction and core activities to closing, designed in the right lesson plan with various methods used. The research results showed that how to develop a way to cultivate the positive character of students in science learning and increase students' awareness by being actively involved in learning. The integration of character education in the science learning process starts from the the lesson plans, implementation to evaluation. Distance learning requires teachers to be more creative in finding ways and methods to the students. A variety of method would make the students more interested to the learning process and became an active as participants. Therefore, this research is declared to be successful. Although from a cognitive perspective, 75% of learning completeness has not been achieved. From the data, it could also be concluded that the more students who were actively present in learning, the higher number they could reach the standard minimum. Although character cultivation can still be done during distance learning, the learning process carried out during the pandemic provides a lesson through classroom learning activities are more effective than online. Interaction is a process of social, cultural, ethical and moral maturation, and this can only be obtained from social interaction in the area of education

INTRODUCTION

COVID-19 (Corona virus disease 2019), by the world health organization (WHO) was declared an international pandemic that forced the world to enter a new world order, including the world of education. The physical distancing policy makes students have to study at home. Parents are confused about having to accompany their children in learning, teachers are also required to hurry to learn to overcome this challenge.

The teacher is an agent of change who must be willing to change from a safe situation to a completely new one. Competency achievement targets must still be completed, so teachers must try and think creatively and innovatively to deliver distance learning. This condition can be regarded as a challenge and an opportunity for teachers to carry out their professional competencies to continue learning and processing. It seems that teachers no longer have the opportunity to dodge that the current era of education is influenced by the industrial revolution 4.0.

Distance learning can be carried out well using digital technology in learning known as the cyber system. This digital technology is able to make the learning process take place continuously without the limits of space and time. To keep pace with the fast pace of the world of technology, the quality of teachers must be improved so that they are able to teach material with an application approach using Information Technology in the teaching and learning process.

The circular letter of the Minister of Education and Culture Number 4 of 2020 concerning Learning from Home through Distance Learning, one of which mentions providing a meaningful learning experience for students, without the need to be burdened with demands to complete all grades and graduation curriculum achievements; and also provides a variety of learning activities and assignments to learn from home taking into account the gap in access/learning facilities. With the Circular of the Minister of Education and Culture, learning from home (BDR) which has been carried out from March 23, 2020 until now requires the author to think about ways so that students continue to get meaningful learning.

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Learning carried out in semester 2 of the 2019/2020 school year will be used as evaluation material for learning in 2020/2021. Several evaluations were carried out, namely that emergency learning in semester 2 of 2019/2020 was mostly not yet real learning but was only an assignment. Character education has also not been fully implemented, including the character of discipline, responsibility, never giving up, and being independent.

During the Covid-19 pandemic, the character of students will appear. The characters that appear here are the character of discipline, responsibility, honesty, independence which is very visible from how students participate in distance learning activities.

According to the Language Center of the Ministry of National Education, character is innate, heart, soul, personality, character, behavior, personality, character, temperament, character. Character is the disposition of a relatively stable person, who upholds key ethical values such as respect/respect, responsibility, honesty, fairness, and caring (Afrizon, 2012). Why do characters need to be built? Martin Luther King once said that intelligence plus character is the goal of true education.

Character strength will be formed if support and encouragement from the surrounding environment, including family, school, and community. Character education through schools is not merely learning knowledge, but more than the cultivation of morals, ethical values, aesthetics, noble character. Billy Graham is known for his statement that when we lose our wealth, we lose nothing. When we lose health, we lose something. When we lose character, we lose everything.

According to RI Law No. 20 of 2003 article 3 states that National Education functions to develop and assist the character and civilization of a dignified nation in educating the nation. Aiming at developing potential, students become human beings who believe in God Almighty, have noble character, are healthy, knowledgeable, capable, creative, independence and become democratic and responsible citizens. Character education has identified 18 values based from religion, Pancasila, culture, and national education goals. Those values include religious, honest, tolerance, discipline, hard work, creative, independent, democratic, curiosity, national spirit, the love of the earth and water, appreciate achievements, friendly / communicative, love peace, love to read, care for the environment, care about social, and responsibility.

Khusniati (2012) states that the integration of character education in the learning process starts from the planning, implementation, and evaluation stages of learning. One approach used to introduce character education is a contextual approach. During distance learning has problems occur, including the lack of student attendance at G-meet, lack of student initiative to ask questions, students whose names appear in G-meet but are not present, late to collect assignments, and teachers cannot see their activities. Based on observations during the distance learning process, it can be concluded that the character behavior of students is still low. The objectives of this study were to (1) develop a way to cultivate the positive character of students in science learning; (2) increase students' awareness by being actively involved in learning.

METHOD

The method used in this study was a pre-experimental design used to examine the positive characters of students, and daily tests to determine the success of student learning in the cognitive domain. According to Arikunto (2013: 124) researchers only conducted one-time treatment which was thought to have had an effect, then a post-test was held. This research design is formulated in the Learning Implementation Plan which includes learning objectives from the positive realm, and involving student's positive character. Learning divides into three parts, namely, introduction, core activities and closing. The population used in this study was class IX students of SMP Negeri 1 Yogyakarta in the academic year 2020/2021. The technique of determining the sample is through purposive sampling technique.

RESULTS AND DISCUSSION

The lesson plans used are Blended Learning with a Flipped Classroom approach, a Problem based Learning (PBL) and a Direct Learning (DL) model. The learning steps were introduction, core activity and closing. The steps taken refer to the scientific approach and character cultivation. The characters that emerge were discipline, love to read, social care and responsibility.

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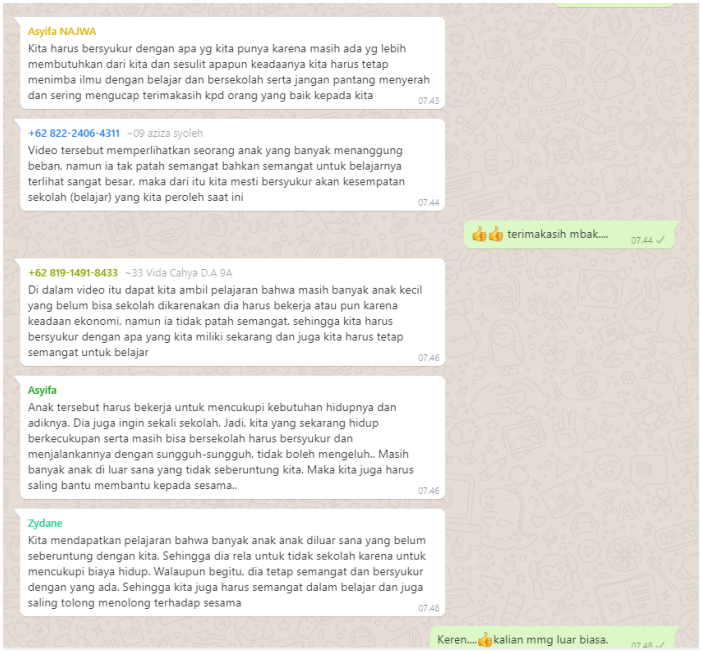
Introduction

At the beginning of the lesson, the teacher starts the lesson by opening the class group WhatsApp, then the teacher asks the students to fill out the attendance list in the form of a form. In addition to attendance, the teacher asks students to write down the good deeds they did in the morning and write down the literacy they read in the morning. The characters that are builted are discipline, love to read, social care and responsibility.

The lesson started by asking one of the people to lead the prayer, this is one way to instil a religious character. After praying, the teacher sent via wag. This short video would teach students about the character of hard work, social care, independence, honesty, responsibility. Then the teacher asked the students to listen and write down what they learned from the story.



Student 1

We have to be grateful with what we have, because there are many people who still need our help. Even though we face many obstacles and problem in out life, we have to be strong. For the people who help us, we need to be grateful and say ‘thank you’ to them.

Student 2

From the video, we learnt about a boy who really struggles about his life. He lives in poverty, yet he has a big motivation and dream to study, and become a better person. We have to be grateful that we still have a chance to study at school.

FIGURE 1. Student responses

Core Activities

Science learning activities are a means to instil character in students, both through material and during the learning process. Cultivation of character through the material studied. Natural Science is a science that the more we learn, the more we praise God for His great power. In addition to delivering the material, the teacher also instils a religious character, namely gratitude to God for His greatness and always fosters a curious character. Cultivation of the character through the learning process. The learning process included:

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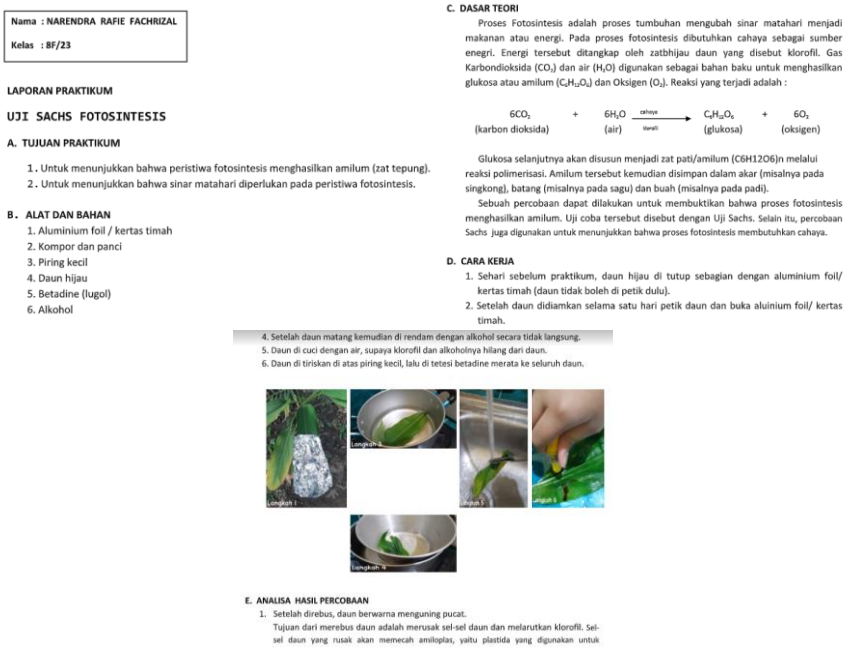
Discussion

Discussions in large groups were carried out using Google classroom or wag. Meanwhile, to monitor the activity and cooperation of students, a small wag is made, with the teacher as the members. With this small group wag, the teacher could see the character of the students and instil character. The characters in question were cooperation, responsibility, curiosity, independence, creativity, hard work, honesty, and communication.

The activeness of students in learning was also shown by active interaction in the exercises carried out, by using a jam board, students could write down their answers using sticky notes.

Even during the pandemic, students could still do practical work at home. This practicum used existing equipment at home. Practical results made in the form of a report book. The characters that are built here were discipline, independence, responsibility, honesty and curiosity.



Nama : NARENDRA RAFIE FACHRIZAL
Kelas : 8F/23

LAPORAN PRAKTIKUM

UJI SACHS FOTOSINTESIS

A. TUJUAN PRAKTIKUM

1. Untuk menunjukkan bahwa peristiwa fotosintesis menghasilkan amilum (zat tepung).
2. Untuk menunjukkan bahwa sinar matahari diperlukan pada peristiwa fotosintesis.

B. ALAT DAN BAHAN

1. Aluminium foil / kertas timah
2. Kompor dan panci
3. Piring kecil
4. Daun hijau
5. Betadine (lugol)
6. Alkohol

C. DASAR TEORI

Proses Fotosintesis adalah proses tumbuhan mengubah sinar matahari menjadi makanan atau energi. Pada proses fotosintesis dibutuhkan cahaya sebagai sumber enegri. Energi tersebut ditangkap oleh zatbhijau daun yang disebut klorofil. Gas Karbondioksida (CO_2) dan air (H_2O) digunakan sebagai bahan baku untuk menghasilkan glukosa atau amilum ($C_6H_{12}O_6$) dan Oksigen (O_2). Reaksi yang terjadi adalah :

$6CO_2$ (karbon dioksida) + $6H_2O$ (air) $\xrightarrow[\text{klorofil}]{\text{cahaya}}$ $C_6H_{12}O_6$ (glukosa) + $6O_2$ (oksigen)

Glukosa selanjutnya akan disusun menjadi zat pati/amilum (C6H12O6)n melalui reaksi polimerisasi. Amilum tersebut kemudian disimpan dalam akar (misalnya pada singkong), batang (misalnya pada sagu) dan buah (misalnya pada padi).

Sebuah percobaan dapat dilakukan untuk membuktikan bahwa proses fotosintesis menghasilkan amilum. Uji coba tersebut disebut dengan Uji Sachs. Selain itu, percobaan Sachs juga digunakan untuk menunjukkan bahwa proses fotosintesis membutuhkan cahaya.

D. CARA KERJA

1. Sehari sebelum praktikum, daun hijau di tutup sebagian dengan aluminium foil/ kertas timah (daun tidak boleh di petik dulu).
2. Setelah daun didiamkan selama satu hari petik daun dan buka aluinium foil/ kertas timah.
4. Setelah daun matang kemudian di rendam dengan alkohol secara tidak langsung.
5. Daun di cuci dengan air, supaya klorofil dan alkoholnya hilang dari daun.
6. Daun di tiriskan di atas piring kecil, lalu di tetesi betadine merata ke seluruh daun.

E. ANALISA HASIL PERCOBAAN

1. Setelah direbus, daun berwarna menguning pucat.
   Tujuan dari merebus daun adalah merusak sel-sel daun dan melarutkan klorofil. Sel-sel daun yang rusak akan memecah amiloplas, yaitu plastida yang digunakan untuk

FIGURE 2. Practicum carried out at home

Demonstration

In science learning, knowledge constructively should be carried out with practicum, making the students experience it for themselves. However, because of the pandemic situation, it was done by demonstrating an experiment. The demonstration was made into a video and uploaded on YouTube.

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FIGURE 3. Learning videos

For practicums that require special equipment, the teacher demonstrated in front of the camera which is the G-meet application. Students could read the data, so students could make reports. With demonstrations, the characters to be conveyed are curiosity, unyielding, disciplined, honest and creative.

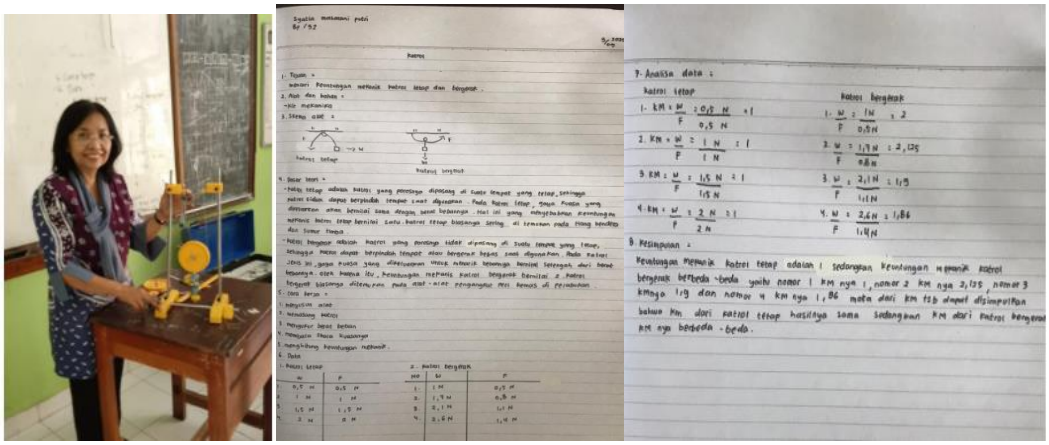

FIGURE 4. Demonstration for retrieving data

Assignment

For group assignments, students were asked to make presentations and present through Google meet. The built characters were cooperation, discipline, responsibility, creativity, love to read, hard work and communicative.

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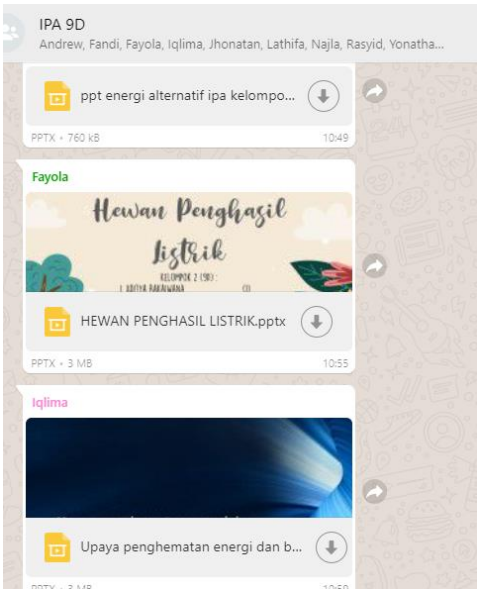

FIGURE 5. Presentation material of students' work

Products

One of the tasks given was to make learning videos according to the interests and abilities of students and upload them on YouTube. With this individual assignment, and leading students' interest in IT which is applied in science material, the characters that would be built in students were creative, hardworking and independent, love to read, love to learn and never give up.

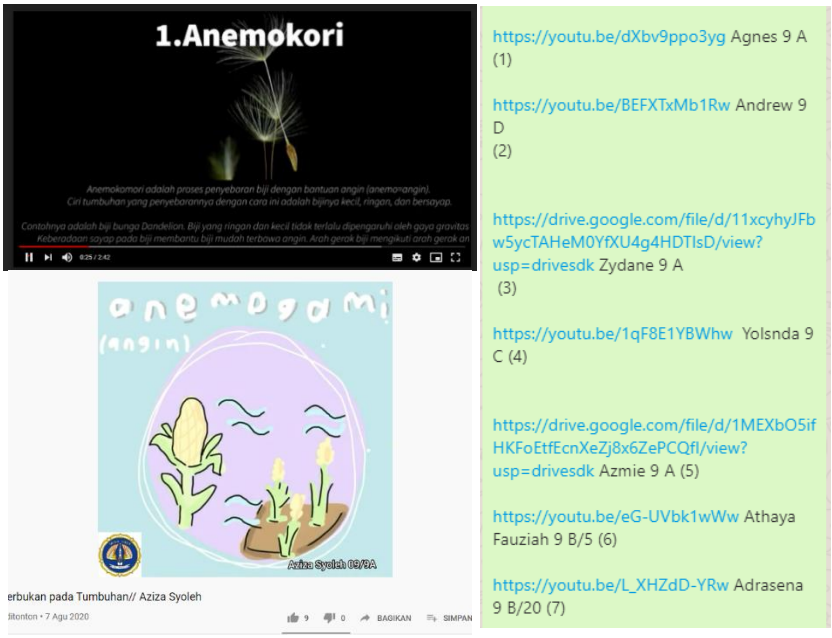

FIGURE 6. Student work

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Evaluation

Evaluation conducted as feedback on learning success. The evaluation carried out is an assessment of knowledge, attitudes and skills. The results of the assessment could be seen as follows:

TABEL 1. Completeness, Daily Test Average, and Attendance

Class	Completeness	Daily Test Average	Attendance
A	60%	72	85%
B	70%	72	83%
C	71%	75	94%
D	61%	69	77%

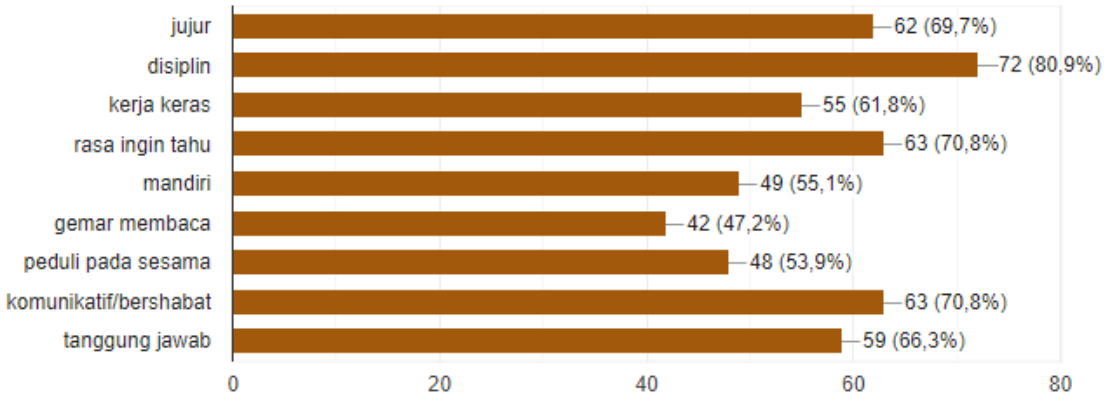

FIGURE 11. Character in Science

Character education is something that students must always grow in themselves both within the school environment, family, and in the community. Character education is defined as education that build and develops the noble character of learners so that they have the noble character, apply and practice in their lives whether in the family, as members of the community and citizens (Wibowo, 2012).

Distance learning is not an obstacle to build character in students. The integration of character education in the science learning process starts from the lesson plans, implementation to evaluation. From the data, it could also be concluded that the more active students are present in learning, the higher number of students who reached the standard minimum score, as shown in the class IX C. Distance learning requires teachers to be more creative in finding ways and methods to the students. A variety of method would make the students more interested to the learning process and became an active as participants and not only as listeners.

To increase the number of active students in the lesson, the school also provides a place, facilities and infrastructure, namely an ICT laboratory for students who cannot take distance learning at home due to the lack of infrastructure. In addition, the government has assisted in the form of internet data.

From the questionnaire it is resulted 89 responses from years IX students. Most students agree that Character education is needed to be collaborated in every subject. 70 students or 78.7% declare that character education is also collaborated in science subject. About 79.8% declare that by learning science students are reminded to always thansk to God for having the existed nature, we live in, related to religious. The religious character is given at the start of learning by praying and also during learning the teacher always reminds that everything comes from the greatness of God and we must be grateful. The other character collaborated in Science subject are 69.7% honesty; Honesty is a difficult thing to identify because of the teachers limited capability and facilities; 80.9% discipline is measured from being on time to attend lessons, always being present during lessons, being on time to collect assignments; 61.8% hard work during science lessons is shown from persistency in carrying out practicum and making practicum reports, ; 70.8% The curiosity is shown by the number of questions appeared during science lessons; 55.1% independence is shown from the ability of students to do the tasks given individually; 47.2% from the questionnaire, it was found that

ISBN: **978-623-98805-0-7**

the literacy culture of students was still very low; 53.9% empathy and 66.3% responsibility; empathy and responsibility given at the beginning of the lesson by short video. The short video would teach students about the character of hard work, empathy, independence, honesty, responsibility; 70.8% communicative, communication skills are very important in 21st century learning, so students must be able to communicate.

The standard score minimum of students is 70 (KKM). Attendance at learning during a pandemic is the number of students present divided by the total number. Of the four classes used as samples, data obtained that the completeness value of classes A and D was quite low, which was less than 70%. The average value of daily test for class D was less than 70. Meanwhile, the attendance of students in distance learning was an average of 84.75%. Many factors caused students to be unable to attend 100% during learning, including the lack of available facilities and infrastructure, such as the run out of Internet data, one cell phone was used for several people at home, and internet connection. Besides that, it was also due to the indiscipline of students to take part in learning. For attitude assessment, it was assessed from the activeness of students, the timeliness of collecting assignments, attendance at PJJ, and the daily attendance submitted. While the characters in the skill assessment included the ability to communicate and creativity in making assignments, including videos, PPT, and the practicum report.

CONCLUSION

Distance learning is not an obstacle to build character in students. The integration of character education in the science learning process started from the planning stage such as the lesson plans made by the teacher, implementation to learning evaluation. In addition to the results of cognitive assessments, more emphasized character strengthening, particularly at the time of introduction before learning, core activities and closing. Distance learning requires teachers to be more creative in finding ways and methods to the students. A variety of method would make the students more interested to the learning process and became an active as participants. The attendance of students in distance learning reached 84.75% or reached more than 75% of the target. Therefore, this study remains to be successful research. Although from a cognitive perspective, 75% learning completeness has not been achieved. During distance learning, the role of parents at home becomes more dominant in reminding children to be disciplined in following lessons. Hence there must be a good synergy between schools, parents and teachers to encourage generations through this pandemic era, while strengthening character. Conclusively, it produces Indonesian people with character following the goals and ideals of Indonesian Education. Although character cultivation can still be done during distance learning, the learning process carried out during the pandemic provides a lesson through classroom learning activities are more effective than online. Interaction is a process of social, cultural, ethical and moral maturation, and this can only be obtained from social interaction in the area of education.

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ISBN: **978-623-98805-0-7**

Impact of Natural Science Student Worksheet Based on Inquiry Pictorial Riddle to Improve Students Critical Thinking

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Abstract. Trends In International Mathematics and Science Study (TIMSS) show that students are often passive, only accept the material given by the teacher, do not take the initiative to ask questions, and do not seem to pay much attention to the learning activities carried out. Therefore, the school education system should focus on the design of memorizing concepts and improve students' thinking skills, especially higher-order thinking skills, namely critical thinking skills. This research uses a qualitative descriptive approach, and the type of research used is library research, namely collecting data or scientific papers related to the object of research or collecting data that is library in nature. The learning model applied is the pictorial riddle inquiry which can encourage students to increase the enthusiasm and scope of student initiative in learning, the activeness of students in groups to work together in formulating problems, to conclude the subject matter and the ability to interact with each other. The Inquiry Pictorial Riddle-based Student Worksheet is supposed to improve students' critical thinking skills.

INTRODUCTION

Education is a process that can grow, develop, mature, and change the order in oneself and others. Through education, a person can grow and develop naturally to carry out his duties as a human being. This will be the quality of life of the nation produced through quality education because education aims to create educated and skilled human beings for the present and the future.

Natural Sciences is the study of natural phenomena obtained through thinking, investigating, and discovering natural wonders. In achieving educational goals, Natural Sciences has included using scientific ideas and attitudes to study facts, concepts, theories, and activities or processes of unexplained natural phenomena. Thus, the need to continually update knowledge becomes a necessity [1]. Science is a product because it consists of a collection of knowledge in facts, concepts, principles, and laws about natural phenomena. Science is a process because it is a series of structured and systematic activities to discover concepts, regulations, and rules of natural wonders, including the ability to think, combine, and learn new ideas. Science is an attitude because it will shape students' personalities according to their values.

The decline in student performance in science education in Indonesia can be seen in the TIMSS evaluation program. Trends In International Mathematics and Science Study (TIMSS) is an international study of junior high school students mathematics and science achievement. According to the Trends In International Mathematics and Science Study (TIMSS) Survey scores in 2011, it was reported that among 42 participating countries, Indonesian junior high school students ranked 40th in the academic performance of science. Indonesia's national achievement score in the field of cognition, including knowledge, application, and reasoning, reached a score of 406 in the center of the TIMSS 500 scale [2]. This shows that students' ability in reasoning is still relatively low, and 45.7% of students experience reading errors, so they are wrong in giving answers [3].

The teaching and learning process is essentially a pattern of interaction between teachers and students and

ISBN: **978-623-98805-0-7**

between students and students in education. Students play an active role in finding knowledge, concepts, theories, and conclusions in the teaching and learning process, rather than trying to collect information or facts. To enable this process, the teacher must act as a teacher in teaching and learning activities so that students acquire knowledge and build knowledge for themselves and make students learn so that learning is not only teacher-centered[4]. Field facts based on the results of TIMSS research show that students are often passive, only accept the material given by the teacher, do not take the initiative to ask questions, and do not seem to pay much attention to the learning activities carried out. In addition, students have difficulty in making decisions and taking action on existing problems. This shows that the role of the teacher is still more significant than the role of students in science learning activities. The old teacher-centered learning paradigm is still widely practiced by teachers, and not much has been changed to a constructivist perspective that involves more students. Teachers have not updated conventional science learning methods and techniques, which science teachers usually do. Therefore, the school education system should focus on the design of memorizing concepts and improve students' thinking skills, especially higher-order thinking skills, namely critical thinking skills.

It seems that the ability to think critically is an interesting topic that is widely discussed in the world of education today [5]. In the 21st century, students are expected to be skilled to be able to solve every problem critically [6]. They are required to be able to think critically to solve problems with analytical power that considers various things related to logical and innovative reasons [7]. Learning that only memorizes theory is no longer relevant to current needs and circumstances. All aspects of life develop so that every human being must be able to think critically in dealing with dynamic situations.

In line with the results of Johnson's study, students who have adequate critical thinking skills have a high probability of being able to study problems systematically, face millions of challenges in an organized way, formulate innovative questions, and design solutions that are considered relatively new. A person needs to have critical thinking skills and need to learn them, because these skills are very useful and as a provision to face life now and in the future [8].

Critical thinking skills can make a person think rationally and logically in receiving information and systematically in solving problems. This means that critical thinking can improve analytical skills. In addition, critical thinking skills also increase a person's ability to tend to be creative. Someone who has critical thinking skills can take advantage of ideas or information, and look for additional relevant information so that they can evaluate and then modify to produce the best ideas. Critical thinking skills also function to reflect or self-evaluate the decisions that have been taken [9].

Critical thinking requires students to think at a higher level. In the learning process, if students are allowed to use higher-order thinking in each class, they will eventually use it to distinguish between truth and falsehood, appearance and reality, fact and opinion, knowledge and belief [10]. In other words, critical thinking skills provide the right direction for thinking and work and help determine relationships between things more accurately. Therefore, necessary thinking skills are needed when solving or finding solutions to problems and managing tasks. To become a habit, developing critical thinking skills involves integrating several skills: observation, understanding information from multiple angles, analysis, reasoning, judgment, decision making, and persuasion. The better the development of these abilities—given the habits that have been formed, the more capable we will be to overcome complex problems and achieve satisfying results.

To overcome the problems above, an effort is needed to increase students' motivation and activeness in learning. One of the efforts that can be used to overcome these problems is to use the inquiry learning model. The inquiry learning model is a learning model that can train students in critical and analytical thinking to seek and find the correct answers to the problems posed by the teacher. The teacher guides and provides instructions through procedures and questions during the learning process but does not provide solutions [11]. One type of inquiry learning model is a pictorial riddle. Pictorial riddle is a method or technique to develop student activities in small or large group discussions by presenting problems in illustrations. The pictorial riddle learning model can stimulate students to think critically about the issues raised in pictorial puzzles that can increase students' curiosity about the problems presented so that students are encouraged to learn more about these problems. Students can practice their thinking skills through riddles that the teacher has designed because students are directly involved in learning activities [12].

Based on the description above, a research is needed with the aim of being able to produce a product in the form of Student Worksheets that can improve students' critical thinking skills so that research is carried out with the title "Impact of Natural Science Student Worksheet Based on Inquiry Pictorial Riddle to Improve Students Critical

ISBN: **978-623-98805-0-7**

Thinking Ability".

METHOD

This research uses a qualitative descriptive approach, and the type of research used is library research, namely collecting data or scientific papers related to the object of research or collecting data that is library in nature. The stages that must be taken by the author in library research are as follows [13]:

1. Collect research materials.
   Because this research is library research, the material collected is in the form of information or empirical data sourced from books, journals, results of official and scientific research reports and other literature that supports the theme of this research.
2. Read library materials.
   Reading activities for research purposes is not a passive job. In reading the research material, the reader must dig deeply into the reading material that allows him to find new ideas related to the research title, namely Inquiry pictorial riddle, Worksheet, critical thinking skills.
3. Make research notes.
   The activity of recording research materials is very important because in the end all the material that has been read must be drawn to a conclusion in the form of a report.
4. Processing research notes.
   All materials that have been read are then processed or analyzed to obtain a conclusion drawn up in the form of a research report.

RESULTS AND DISCUSSION

This study analyzed several articles related to the development of inquiry-based pictorial riddle worksheets to improve critical thinking skills based on previous research and obtained the following results:

TABLE 1. List of Previous Research

No	Title of Research	Research and Conclusion
1	Pictorial Riddle Media Based on Inquiry Approach to Improve Critical Thinking Skills of High School Students	The results of the test analysis using the paired sample t-test conducted at the 4 schools showed a significance level of 0.00 < 0.05 which means that there is an average difference between the pre-test and post-test scores, thus indicating the use of pictorial riddle media based on an inquiry approach is effective in improving the critical thinking skills of high school students [14].
2	Development of Pictorial Riddle-Based Basic Physics Textbooks for Biology Education Students	Pictorial riddle-based basic physics textbooks for Biology education students were developed with quality with valid criteria with 0.92 and practically used by students and lecturers with scores of 87.1% and 88.5% and field test results with values of 92.3% and practically used in learning basic Physics for Biology Education students [9].
3	Application of Pictorial Riddle Model in Physics Learning to Improve Students' Critical Thinking Ability	Based on the data from the effectiveness calculation, it can be seen that the percentage of the effectiveness of each indicator of critical thinking ability in the control and experimental classes. There is a very significant difference that the effectiveness in the experimental class is very high compared to the control class, seen from each indicator. For the percentage results of each indicator of the pretest (pretest) in the control and experimental classes, all indicators get 0% results and when the final test (posttest) for the control class get the same results, namely 0%, because no student gets a

ISBN: **978-623-98805-0-7**

		score above the KKM or above the value of 60. However, for the experimental class that was given treatment by using the pictorial riddle learning model there was a very significant change after the final test (posttest) there were results, the percentage of the indicator providing a simple basic explanation was 93.87%, the percentage of the indicator formulating the answer is 87.76%, the percentage on the indicator of drawing conclusions according to the facts is 88.78%, the percentage on the indicator of ability to give reasons is 87.76% [15].
4	Analysis of the Critical Thinking Ability of Senior High School Students Using the Inquiry Pictorial Riddle Model	Analysis of students' critical thinking skills on colloidal material using the pictorial riddle inquiry model at SHS 12 Pekanbaru, it can be concluded that the overall achievement of the ability indicators. Students' critical thinking is classified into the good category with the acquisition of a percentage of 72.36% and can be developed optimally [16].
5	Development of Inquiry-Based Worksheet to Facilitate Critical Thinking Ability	The average score of the students' critical thinking ability test results is 70.60 with the highest score of 90 and the lowest score of 45. The minimum completeness criteria score at SMP Negeri 1 Tulang Bawang Udik is 67. Students who achieve the KKM score are only 20 people out of the total 29 people. This means that only 68.75% of students pass the KKM. So, inquiry-based worksheets to facilitate mathematical critical thinking skills are not effective in facilitating students' critical thinking skills [17].

This inquiry method developed from the idea of John Dewey, who is famous for the "Problem Solving Method". Problem-solving steps are carried out with an approach considered quite scientific in investigating to obtain discovery. Starting from formulating problems, hypotheses, collecting data, testing ideas with data and drawing conclusions, it will guide students to always use a scientific approach and think objectively in solving problems [18]. The inquiry learning model is effective in improving students' thinking skills. However, the implementation of this model still has some problems. The problem is that the initial learning process does not attract students' interest, and in describing a problem, they still use analogue images [19]. Therefore, we need a technique that can attract students' interest to improve students' critical thinking skills in solving problems. The technique that will be used in this research is the pictorial riddle technique.

Pictorial riddle is a method for developing student activities in large and small group discussions, presenting problems in the form of illustrations. A riddle is usually a picture, either on a blackboard or a poster board, then the teacher asks questions related to the riddle [12]. This method aims to teach students the learning process and explain specific phenomena. The aim is to help students develop their subjects and develop the intellectual skills necessary to ask questions and find answers based on their curiosity.

The syntax for inquiry learning based on the Pictorial Riddle method is as follows:

1. Problem presentation. Students are invited to solve problems in the form of events that give rise to puzzles, and the problem is presented in the form of pictures
2. Identify problems in groups from the given problems
3. Conducting experiments and data collection
4. Observing the riddle (picture) that contains the problem
5. Students discuss in groups the results of the experiment
6. Students write a report on the results of the experiment

ISBN: **978-623-98805-0-7**

7. Students communicate the results of the experiment and conduct questions and answers
8. The teacher guides the students to draw conclusions [20]

Student Worksheets are media to activate students, help students find and develop concepts, train students to find and develop concepts, train students to find ideas, become an alternative way of presenting subject matter that emphasizes student activity, and can motivate students [21]. Through worksheets, teachers have the opportunity to encourage students to be more actively involved with the material discussed [22].

Teaching and learning activities in the classroom using worksheet learning media are equipped with riddles that can help students understand the problem, and some questions can guide students to find answers. In the inquiry process, the teacher allows students through teaching questions so that questions in the form of riddles guide students in groups, then proceed with the discussion. In discussion activities, students are faced with several opinions. Indirectly, students are trained to think about how they defend their idea. According to the theory of Jerome Bruner which states that some of the advantages of inquiry are encouraging students to think and work on their initiative, increasing students' understanding of concepts and ideas, helping to use memory, and placing students in new learning situations. The riddle given is in the form of a picture of the given problem. Riddles in the form of images can stimulate students' thinking power. Even more so, after observing the riddle and answering guiding questions, students are invited to discuss the problems presented. Learning directly from the given issues will make it easier for students to understand concepts and provide broad opportunities to explore themselves through the learning activities carried out [12]. Learning to use critical thinking skills, students are taught to change their mindset from guessing to logical guessing and from connecting concepts to capturing principles. Critical thinking is a new thing for students who are not used to using various learning models. Critical thinking, which is complex thinking, is different from normal thinking patterns that are often done by students so that it cannot be obtained automatically. Continuous practice is needed so that the critical thinking process can be realized [23].

The learning process is said to be effective if students meet the achievement of competency standards set by the school. The achievement of student competence is manifested in the mastery of knowledge reflected in the habits of thinking and working. The learning process must be student-centered and oriented. All the potential in students is developed to achieve a level of competence following the needs of job requirements. Based on the description above, it can be seen that the application of this type of inquiry-based pictorial riddle learning media affects increasing students' scientific competence. This can be seen in the spirit and scope of student initiative in learning, the activeness of students in groups to work together in formulating problems, to conclude the subject matter and the ability to interact with each other. Pictorial riddles can encourage students to be active and think critically [12].

Some advantages of applying pictorial riddles include increasing understanding of concepts, increasing students' activeness in learning, improving students' memory and analytical power, and enriching and deepening the material being studied to last a long time. The shortcomings of pictorial riddle learning include students who are accustomed to learning by only receiving information from the teacher, and it will be difficult if they are required to think for themselves; teachers are required to change their teaching style, which was initially as a giver or presenter of information, to become a facilitator, motivator, and mentor of students in learning; problem-solving can be mechanistic, formal, and boring [24].

References in the field of science have shown the effectiveness of Pictorial Riddle media based on an approach to improve students' critical thinking skills, according to research conducted by Indrawati, I Ketut Mahardika, Supeno, which showed that inquiry-based pictorial riddle media was effective in improving critical thinking skills of high school students. This statement is evidenced by the results of research showing an increase in the average value of necessary thinking skills through post-test scores from the four schools studied. In addition, the paired sample t-test analysis results showed a significant level of 0.00 <0.05, which means H0 is rejected, and H1 is accepted, which means that there is an average difference between the pretest and post-test scores [14].

ISBN: **978-623-98805-0-7**

CONCLUSION

Based on this explanation, the learning model applied is the pictorial riddle inquiry which can encourage students to increase the enthusiasm and scope of student initiative in learning, the activeness of students in groups to work together in formulating problems, to conclude the subject matter and the ability to interact with each other. It is concluded that a natural science student worksheet based on an inquiry pictorial riddle approach has the potential to impact students critical thinking skill.

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ISBN: **978-623-98805-0-7**

Development of a Mobile-Based Learning System (SPBM) to Support the Optimization of Independent Learning and Improve Understanding of Science Concepts at Junior High School

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Abstract. Learning using media is able to make students more aroused by their curiosity. From the results of observations, it was found that students did not understand the concepts in science lessons, namely the material of light and optical instruments because students were less interested in their learning. This study aims to produce the development of a mobile-based learning system (SPBM) on light materials and optical devices intended for valid VIII grade junior high school students who are also suitable for use. The research model used in this research and development is from Alessi & Trollip. The results of media validation get 89.1 percent, material validation gets 100 percent, students' readability test results get 88.8 percent. Therefore the media is declared very feasible to be used as learning media.

INTRODUCTION

In the current era of the technological revolution, children need to be encouraged to be ready to acquire lifelong knowledge and skills in the 21st century (Ejikeme & Okpala, 2017). Thus, integrating technology in learning becomes a must for teachers. Technology-assisted learning will make it easier for teachers to realize more effective, efficient learning and improve students' understanding in the learning process. These technological advances provide benefits for teachers both in terms of teaching and learning processes. Teachers have the opportunity to innovate, models, methods, media and ways of teaching in the classroom. Technological advances have a very significant effect on increasing information that is easily accessible by students in helping them understand the learning material provided so that students are expected to become "smart thinkers" in analyzing literature critically and being able to apply it in life. Learning that uses technology assistance in learning has various benefits for students ranging from involvement, comfort, convenience, achievement and satisfaction (Morris, Lambe, Ciccone, & Swinnerton, 2016). One technology that almost everyone has is mobile technology. Mobile technology has entered every activity carried out by students or the community. The use of mobile has developed so that the functions of mobile technology are increasingly effectively utilized by everyone. Mobile technology that can be accessed anytime and anywhere. Mobile technology has also entered the realm of education, where the use of mobile technology can develop various ways of learning for students both at school, at home and in the community, interacting with others, sharing information and views, absorbing information from various sources, improve students' conceptual understanding, and students' academic achievement in the learning process (Han & Shin, 2016; Schmid & Petko, 2019; Williams, et.al, 2018).

The use of mobile technology in science learning will also increase students' technological literacy as a form of skill development in the 21st century. Technological literacy is the ability of students to access, choose and use technology appropriately in the learning process. Technological literacy is seen as very important considering the increasingly rapid technological developments (Retnowati, Jerusalem, & Sugiyarto, 2019). Technological developments will affect students' technological literacy in learning. Especially during the Corona Virus Disease 2019 (Covid-19) pandemic where face-to-face learning cannot be carried out so students and teachers are required to be able to carry out technology-based learning (e-learning). Digital learning is also carried out by almost all countries

ISBN: **978-623-98805-0-7**

both in Asia and Europe (Goldschmidt, 2020). Like Nepal (Subedi, Nayaju, Subedi, Shah, & Shah, 2020) also implementing e-learning is the right choice to ensure the continuity of education and the learning process for students during the covid-19 pandemic (Almaiah, Al-Khasawneh, & Althunibat, 2020). Technological literacy is the ability to use technology effectively in completing the required learning tasks (Davies, 2011).

Rapid technological developments will require students to have good technological literacy skills. Therefore, students' literacy skills must be maintained to help achieve learning goals. Students' technological literacy skills will lead students to have the ability to adopt, adapt, find and evaluate technology that can be used to achieve learning objectives (Hansen, 2003). The results showed that 96% of students had an Android type cellphone and the rest did not have an Android. This means that the use of mobile technology in learning will be very possible if used. The results of the questionnaire distributed through the form to junior high school science teachers explained that teachers teach science concepts only with books and student worksheets that are owned by students and then provide exercises based on these books. During the pandemic, teachers are faced with online learning so that teachers must be able to select suitable media to use in online learning so that learning will be more meaningful and improve students' understanding of concepts. Previous research conducted by Cahyana, Paristiowati, Savitri, & Hasyrin, (2017) found that the use of mobile applications in chemistry learning has a positive impact on improving student learning outcomes. Reinforced by research conducted by Mabruri, Ahmadi, & Suminar (2019) that mobile media in physics learning can also affect student learning outcomes. Budke, Parchmann, & Beeken (2019) also found that mobile applications applied in chemistry learning had a positive impact in increasing motivation, self-concept understanding, asking and students' comfort in learning chemistry. Science learning is also classified as science which contains facts, concepts, principles, laws and theories.

Science learning is also learning that is not only concrete but also abstract. Abstract learning materials cannot be taught directly because students cannot see or display it in real terms so that students will find it difficult to understand the theory when explained (Karina, Irawan, & Hindrasti, 2020). One of the abstract science learning materials is solar eclipse and lunar eclipse material. The material for solar and lunar eclipses is material that explains the process of solar eclipses and lunar eclipses in nature and the impact of the phenomenon of solar and lunar eclipses on life on earth. The process of the occurrence of solar and lunar eclipses cannot be seen with the naked eye by students, so to teach these concepts the teacher must have media that can help students understand the concept of solar and lunar eclipses. Mobile technology-based media is very suitable to be used during the COVID-19 pandemic to support students' understanding of concepts. Some of the existing applications related to the solar system are the solar scope system and PhET. The solar system scope application contains explanations related to the elements in the solar system such as planets, meteors, stars and much more.

In accessing deeper knowledge related to this solar system, it is necessary to upgrade the scope application of the solar system by making payments to the application. This means that everyone will not be able to further access this application if they do not make a payment. However, the solar system scope application contains 3D animation so it is very interesting if it becomes a learning medium for students. While the PhET application is a virtual lab application that can be done on the PhET web itself. Especially for the solar system material in the PhET application itself, it only explains how the orbit, speed, mass, and direction of motion of the earth, moon and sun. So that students better understand how the trajectory of the sun, moon and earth in the solar system. Students can also enlarge and reduce the mass or speed of the moon and earth around the sun and can also change the direction of rotation of the moon, earth and sun in their evolution. Learning through PhET can also increase students' motivation and conceptual understanding in understanding rotation and revolution.

METHOD

This research is a type of development research with the research and development model used in this study referring to the ADDIE model (Analysis, Design, Development, Implementation, and Evaluation). the phases are mutually integrated and synergized among each other (Aldoobie, 2015; Molenda, 2015). This study uses a one-group pretest-posttest design. This design uses the pretest as the determination of the research class (Fraenkel, Wallen, & Hyun, 2012).

ISBN: **978-623-98805-0-7**

RESULTS AND DISCUSSION

Design Stage Results

In the development of a mobile-based learning system (SPBM) researchers make designs that are displayed on applications and web applications. At this stage the researcher makes a media feature design referring to several sides. One of the sides is the storyboard. In this application, several features of a mobile-based learning system will be displayed. Storyboard is a picture of learning media in which there are learning options that can be selected from the icons in the application. In addition, storyboards are also a guide in the mobile-based learning process. The following is an example of a storyboard made in a mobile learning system:

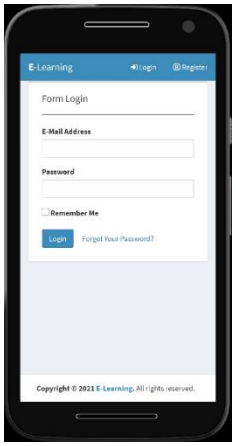

FIGURE 1. Storyboard login display

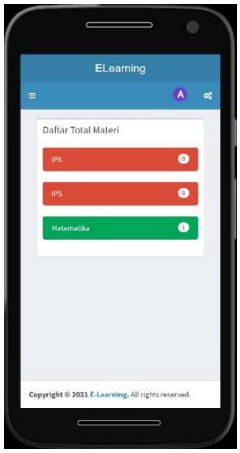

FIGURE 2. Storyboard Menu Display

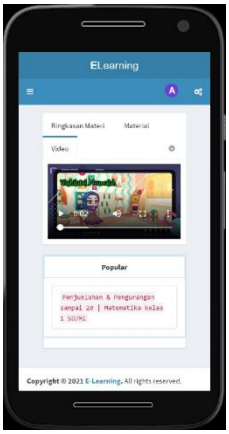

FIGURE 3. Storyboard Menu Display

FIGURE 4. Storyboard Menu Display

Presentation of the Results Discussion

The product developed is the development of a mobile-based learning system (SPBM) with light materials and optical devices. In the material there are several things related to matter, namely the nature of light, the formation of images in the lense mirror and the sense of sight of humans and insects. In addition, there are optical tools that are often encountered everyday. In this science lesson, the material that is the teaching material that is reviewed is in

ISBN: **978-623-98805-0-7**

accordance with basic competence 2.12 in the 2013 curriculum for class VIII SMP. Later in this product, the basic learning objectives will be described which aims to make students learn independent and so that students can understand science lessons with material concepts about light and optical devices. Students using the Mobile-based Learning System Development (SPBM) product are expected to be able to master the material that is a science subject for junior high school students.

The good influence by students in using Mobile-based learning system development (SPBM) in generating student grades makes this product feasible to use (Ramadhani, et al., 2016).

Learning motivation and learning independence of students can be influenced by whether or not the learning media used by educators are interesting, curiosity and curiosity can trigger learning and make it easier for students to understand teaching materials (Fanny, 2013). Learning media containing material can be used by teachers when in conditions like this, when remote online learning becomes a learning season for all levels due to the new order of the COVID-19 pandemic conditions. With this distance learning system, students are expected to be able to understand questions with independent learning and students understand the material from teaching materials. Development of a Mobile-based Learning System (SPBM). The feasibility test is carried out in two steps, namely the Alpha test and Beta test. Alpha test is product validation by media experts and material experts. Beta test is a readability test conducted by class VIII SMP students who have taken light materials and optical instruments. The results of the calculation of media development that have been carried out are presented in Graph 1.2

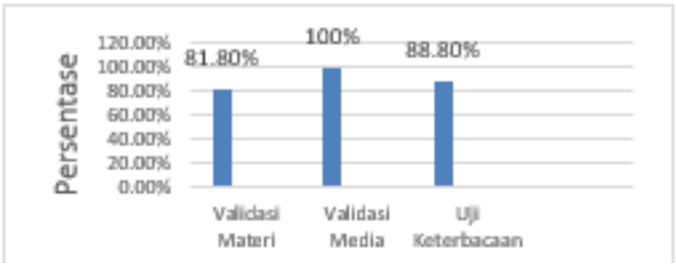

FIGURE 5. Media development calculation results

From the results of the calculations that have been carried out, the learning media is in the very valid category in terms of material, media, and readability test, so it can be said that the learning media is very feasible to use. This learning media can support students to understand the imaginary concept of light material and optical devices with state visualization microscopy of the concepts studied. Visualization can be done by presenting images, animated videos and audio. Presentation of material on learning media through images and animated videos. These images can help students interpret visualization through a two-dimensional display. Pictures can explain definitions that cannot be explained by text and summarize complex texts (Yudianto, A. 2017).

Through pictures can help students understand the text through visual symbols making it easier to understand the material and foster interest in learning (Sadiman, A., 2006). Animated video is an illustration of an event that cannot be sensed directly or abstractly. Through animation can help visualize an invisible state. Animation on media presents the formation of images on mirrors, lenses, the human eye, and other optical devices. With the help of animation, it can display movements and microscopic shapes that cannot be observed by the senses so that they can provide new experiences to students so as to increase students' learning motivation (Hasanah & Lukman, 2015). The exercises contained in this learning media can be used during the evaluation to measure students' conceptual understanding through the material that has been studied. The exercise displays direct feedback to students in the form of a work score that is displayed when the user has finished working on all the questions. Feedback from the evaluation is in the form of grades and there is information in the form of awards that can make students more motivated to learn (Kuswanto & Radiansah, 2017).

CONCLUSION

From the results of the development of a mobile-based learning system (SPBM) obtained a valid percentage of 89.1% so that it can be declared very valid and can be tested for feasibility. While the results of the validation of the material obtained the percentage of validity of 100% so that it can be declared very valid and can be tested for

ISBN: **978-623-98805-0-7**

feasibility. The readability test was carried out by grade VIII junior high school students. The results of the readability test by 15 grade VIII junior high school students obtained a fit and proper percentage of 88.8% with the percentage stated that this application was very suitable for use and became student learning independently. In addition, in this study the features can be developed further and increase the number of questions as an exercise and evaluation of student learning.

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ISBN: **978-623-98805-0-7**

How Local Potential-Based Contextual Learning Improve Students' Scientific Literacy?

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Abstract. Indonesia is a country that is rich in local wisdom. In the field of education, local wisdom has been widely used as an object of research to determine its effect on students' learning abilities. This literature review article aims to explain how local wisdom-based learning can improve students' scientific literacy skills. The results of the synthesis of important factors that improve scientific literacy skills through the integration of local potentials in learning are obtained from the results of relevant research that raises the local potential of Indonesia. The results of this literature review study found that the important factors that lead to an increase in students' scientific literacy skills through the integration of local potential are: a). Local potential can be implemented with a constructivist approach. b). Involving students' mental processes, c). Oriented to problem-based learning and scientific evidence, d). Related to the readiness to behave in environmental care.

INTRODUCTION

The rapid development of science in the 21st century requires that Humans work hard to adapt to all aspects of life. In times of climate change, worldwide diseases, and the question of sustainable energy, scientific literacy has never been more important (Kähler, Hahn, & Köller, 2020). The relevance of science has increased enormously in the last years. The world is changing rapidly due to scientific and technological progress, which can be seen in environmental. Challenges or technological innovations, and scientific literacy (SL) is necessary to understand and deal with these changes (OECD, 2019: 99-101). However, the low level of scientific literacy causes students to be less responsive to developments and problems that exist around the environment, especially those related to natural phenomena, local advantages, and problems in the surrounding environment. Therefore, it is necessary to develop a strategy to improve scientific literacy, one of which is by utilizing a learning model based on local advantages.

An effective way to improve students' scientific literacy skills can be found through educational research, one of the things that is widely used as an object of research to find ways to improve students' scientific literacy skills is the utilization of local potential. It has also indeed been instructed by the Indonesian government through the Law of the Republic of Indonesia no. 20 of 2003 concerning the National Education System in Chapter X article 36 paragraph (3) point d which requires every school to apply the local potential-based education model found in each region as a means to better introduce students to their environment, so that they have skills that are in accordance with the local potential of their region. Indonesia is a country rich in potentials, cultures and natural resources in each region. The potentials of the region in Indonesia is abundant, including the local potential associated with the entrepreneurial world (home industry) (Dewi, Suryadarma, Wilujeng, & Wahyuningsih, 2017).

The integration of local potential into science learning needs to be directed towards the achievement of students' learning outcome which is, in line with the nature of science, whole and complete, namely, students' possession of science knowledge, skills, and scientific attitude and ability to apply science knowledge in daily life so that it could leads to them becoming individuals with scientific literacy. In achievement of scientific literacy, learners from Indonesia at presentare still left far behind those from other countries (Wilujeng, Kun, & Suryadarma, 2017). Project

ISBN: **978-623-98805-0-7**

activity assisted by local potential based teaching materials have a profound effect on scientific literacy skills of the students (Hernawati, Amin, Al Muhdhar, & Indriwati, 2019).

Learning that integrates local potential is contextual-based learning. Local potential-based learning, of course, is learning that involves students with real objects that can be observed. Contextual Teaching and Learning (CTL) is learning that builds student knowledge based on actual learning experiences in everyday life [6]. Contextual learning is rooted in a constructivist approach (Brown, 1998: 25). CTL according is a learning approach that emphasizes the full involvement of students so that they can connect the material they learn with real-life situations so as to encourage students to be able to apply it in real life (Sanjaya, 2008). On that basis, the learning environment is a factor that determines the quality of student learning outcomes. This encourages educators to choose the right learning environment or context design that combines various forms of real experience through local potential-based learning towards the learning outcomes desired by students.

Based on some of the research results that have been presented, it is stated that local potential-based learning can improve scientific literacy, therefore in this literature review article we will discuss how local potential-based learning can improve students' scientific literacy.

METHOD

This literature review analyzes relevant articles and focuses on local potential-based learning in improving scientific literacy skills. The articles used in this literature review are articles obtained using the Google Scholar database. The articles reviewed are articles related to Indonesia's local potential published in the last ten years. The stages in reviewing this article are as follows: 1). Articles are selected based on relevant titles. In this case, 53 corresponding articles were obtained. 2). Articles were selected based on abstracts, so from 53 selected articles, it was reduced to 25 articles. 3). Articles were selected based on the content of the article as a whole, so that the article became 8 articles that were reviewed in detail.

RESULTS AND DISCUSSION

Based on the results of the analysis of articles on local potential and scientific literacy, all research articles analyzed showed that the integration of local potential in learning activities tended to increase scientific literacy skills although with varying increases. There are many variables affect the level of scientific literacy of students such as individual intelligence, speaking ability, social level, educational qualifications, and family background (Heath, et.al, 2014). As for the results of research on the effect of local potential integrated science learning on students' scientific literacy are summarized in Table 1.

TABLE 1. The Effect of Local Potential Integrated Science Learning on Students' Scientific Literacy

Articles	Local Potential Type	Scientific Literacy
1	Vegetables on the slopes of Merapi Cepogo, Boyolali	Improving students' scientific literacy skills
2	Slopes of Mount Kelud, Kediri Regency	Suitable to improve the ability of students' science literacy either theoretically or empirically
3	Salt of Ungaran Region, Pringapus District, Semarang Regency	LKS can improve scientific literacy in the content aspect in the high category, the context aspect of the students in the high category and the science process aspect in the medium category.
4	Traditional game	The application of the module has a moderate effect on scientific literacy skills
5	Salt hydrolysis	Student Worksheets can improve students' scientific literacy skills in aspects of content, context, and aspects of the student's science process
6	Sokaraja batik	Improving scientific literacy, especially in the process aspect which is included in the high category.
7	Dragon fruit cultivation in Palaan village, Malang	LKS is effective for improving students' scientific literacy skills (including medium category)
8	Wetlands of South Kalimantan	Can significantly improve students' scientific literacy overall

ISBN: **978-623-98805-0-7**

Based on the results of the study of several articles above, it can be ascertained that other main factors that lead to an increase in students' scientific literacy skills are related to the integration of local potential in science learning, namely: 1) Local Potential-Based Learning Implemented with a Constructivist Approach. 2) Involving Mental Process. 3) Oriented to Problem-Based and Evidence-Based Learning Scientific. 4) Local Potential Related to Readiness to Care for the Environment

Local Potential-Based Learning Implemented with a Constructivist Approach

One of the main factors that lead to increased scientific literacy skills through the integration of local potentials in learning is because local potential-based learning is implemented with a constructivist approach. According to constructivism theory, students will build their knowledge through what they experience in everyday life [6]. The constructivist approach is able to stimulate students to be responsive to developments and problems that exist around the environment, especially those related to natural phenomena, regional local potentials, and problems in the surrounding environment (Nofiana & Julianto, 2018). The learning activities that use a constructivist approach lead students to build new knowledge based on the identification of previously owned knowledge. This is also in accordance with a statement which says that identifying, analyzing, and connecting environmental issues is a factor that can improve scientific literacy skills (Marks & Eilks, 2009).

Involving Mental Process

Local potential-based learning automatically involves mental processes. This is based on the analysis of Nofiana's research (2018). The results of Nofiana's research (2018) which developed integrated teaching materials of local potential of Sokaraja batik on environmental pollution materials showed that after learning based on local potential, aspects of the science process increased the most significantly compared to aspects of science content and aspects of the context of science. The scientific process aspect refers to the mental processes involved when answering a question or solving a problem, such as identifying and interpreting evidence and explaining conclusions. This includes knowing the types of questions that science can and cannot answer, recognizing what evidence is needed in a scientific investigation, and recognizing conclusions that are in accordance with the existing evidence. The results of this study are in line with the results of a research regarding the application of student worksheet designs containing ethnoscience of salt hydrolysis material to improve students' scientific literacy. Implementation of Student Worksheets containing ethnoscience of salt hydrolysis material developed can improve students' scientific literacy skills in aspects of content, context, and aspects of the student's science process. Local wisdom-based learning has great potential to give birth to students who are capable and succeeded in growing the ability to think logically, creatively, able to solve problems, be critical, master technology and be adaptive to changes and developments in the modern world (Ariningtyas, Wardani, & Mahatmanti, 2017).

Oriented to Problem-Based and Evidence-Based Learning Scientific

A study of the effect of Problem based learning model integrated local potential of Boyolali vegetables shows that there is an effect of PBL model based on local potential on increasing students' scientific literacy skills (Putri, Sudarisman, & Ramli, 2014). The highest average aspect in the experimental class is the aspect of "using scientific evidence", while the lowest aspect is "identifying scientific issues". The high aspect of using scientific evidence in the experimental class is supported by learning using Problem-Based Learning in the third, fourth, and fifth stages. The third stage of the PBL model is independent and group investigation. At this stage, students try to gather information from various sources, as well as as much evidence as possible to find solutions to the problems they encounter. This activity can train students to interpret scientific evidence and identify the evidence behind the reasons for drawing conclusions. This is also consistent with another research which states that research-based teaching and learning (investigation) has a much more positive impact on science and has the potential to increase scientific literacy (Woods-McConney, et.al, 2013).

The fourth stage of PBL is developing and presenting the work. Stage 4 of PBL students must be able to explain to friends and teachers that the answer they choose is the best solution, and ensure that the reasons for their conclusions are able to prove what they understand. Students should also explain the advantages and disadvantages of the decisions they believe in (Savery, 2006). These learning activities are certainly very supportive of increasing students' scientific

ISBN: **978-623-98805-0-7**

literacy skills. The fifth stage of the PBL model is evaluating the problem solving process. In line with the other research that states PBL can train students to become critical, flexible, and reflective thinkers, who can use the knowledge they have to make important decisions (Hmelo-Silver, 2004). In addition, a research which tested the differences between the local potential-based Problem-Based Learning model and the conventional model on scientific literacy and readiness to behave in environmental care showed that the scientific literacy of students who were treated with the local potential-based Problem-Based Learning model was better. than students who were given the conventional model (Yanuarsari, Ramli, & Fatmawati, 2014).

Local Potential Related to Readiness to Care for the Environment

a research that conducted for the development of learning tools (SSP) based on local advantages of peat land in South Kalimantan showing that the gain score on environmental awareness was low, while the science literacy score of students who were categorized as moderate in the experimental class and low in the control class (Syaban & Wilujeng, 2016). Although the gain score did not increase significantly, it can be seen that the readiness to care for the environment and scientific literacy can increase through the integration of local potential in learning. From the results of these studies, it can be concluded that local potential-based learning tends to increase students' environmental awareness.

Environmental concern is an attitude that reflects actions or efforts in solving problems. The other research is research on the application of problem solving model integration and STAD (PROSTAD) based on local potential in human and environmental materials to improve the scientific literacy skills of 10th graders of SMAN 1 Cepogo. The local potential in this case is vegetables because it is one of the local potentials of the Cepogo area. The conclusion of the study is that the application of the integration of Problem Solving and STAD (PROSTAD) models based on local potential on Human and Environmental materials can improve the scientific literacy skills of students of SMAN 1 Cepogo (Utami, Sudarisman, & Prayitno, 2015).

In addition, the other research is developing and utilizes student electronic supplement books based on the local potential of the Simalungun coffee plantation in an effort to improve scientific literacy in environmental contexts and students' environmental care attitudes. The results of this study indicate that there is an increase in students' scientific literacy skills in the context of the environment as evidenced by the N-Gain value of the experimental group which is higher than the control group, and the environmental care attitude of the experimental group is higher than the control group. These results indicate that the student electronic supplement book based on the local potential of the Simalungun coffee plantation can be used as an additional textbook in the learning process (Sinurat, 2020).

Recommendations for Effective Learning Design Improving Scientific Literacy Skills

Based on the findings from the results of a literature review related to factors that have a positive influence on increasing students' scientific literacy skills, it can be formulated a local potential-based learning design that may be very effective in improving scientific literacy skills. Learning design is a systematic development of teaching that involves learning theories to ensure good quality of learning (Sagala, 2005: 15). The suggested learning designs are learning designs that use a constructivist approach, learning that prioritizes students' mental processes, learning based on real problems and scientific evidence, and learning that emphasizes students' concern for the surrounding environment. Thus, this learning design can be the basis for developing learning models, or learning tools.

CONCLUSION

The factors that cause the increase in students' scientific literacy skills through the integration of local potential are (a) local potential implemented with a constructivist approach, (b) involving mental processes, (c.) oriented to problem-based learning and scientific evidence, (d) related to readiness to behave in environmental care.

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ISBN: **978-623-98805-0-7**

Scientific Approach in Developing Curiosity Attitude for Elementary School Students during the Covid-19 Pandemic

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Abstract. Curiosity is an attitude that is needed by students in the 21st century. However, this attitude does not just appear but needs to be developed from an early age, especially through the learning process. An alternative solution that can be used to develop curiosity is through a scientific approach. This study aims to explore a scientific approach in developing the curiosity of elementary school students during the covid-19 pandemic. This research was mixed-method research that integrated qualitative and quantitative data to support data on increasing curiosity when implementing a scientific approach. Data collection techniques were carried out through observation and documentation activities. Data analysis techniques were carried out by analyzing existing data which was supported by quantitative data to increase curiosity. The data were described and discussed as the results of the study. The results of this study indicated that a scientific approach could developed the curiosity of elementary school students during the covid-19 pandemic. Implication of this study was the scientific approach can be used as an alternative to developing the curiosity of sixth-grade elementary school students during the covid-19 pandemic.

INTRODUCTION

Education is an effort made to shape students into better human beings by the national goals of education. Each factor in the implementation of education must support each other to achieve the educational goals that have been set. The purpose of Indonesian education is to create modern students, characterized by the values of Pancasila. At the elementary school education level, currently implementing the 2013 curriculum is following the objectives of character education in Indonesia, namely the focus on affective, cognitive, and psychomotor development.

In elementary school thematic learning, there are several learning contents, one of which is science learning. In science subjects at the elementary school level, it encourages students to be able to become a generation that has a scientific attitude in life in their environment. The science material presented tends to invite students to understand the material coherently according to the rules of scientific thinking, starting from identifying the problems found to concluding. Teachers are also required to be creative and innovative so that the science material presented will be easily understood and understood by students (Mujakir, 2015). Learning that contains science should also be oriented to student activities that emphasize science skills through observing, assessing, researching, analyzing, and clarifying

ISBN: **978-623-98805-0-7**

based on observational data (Sulthon, 2016). All students have internal factors such as curiosity that can spur students to be more active in the learning process carried out.

Curiosity is an attitude possessed by students and must be developed in the learning process in elementary schools, especially in science learning. Curiosity can encourage students to explore or get more complex information. This attitude must be possessed by students to face various challenges that will exist in the future (Winarni, 2019). Given the importance of this attitude, this attitude of curiosity must still be developed even in the online learning process. The scientific approach is one approach that can be used to develop an attitude of curiosity in students. Scientific learning activities in integrated thematic learning are carried out through the process of observing, asking, trying, associating, and communicating. This scientific approach is believed to be able to develop the curiosity of elementary school students during the online learning period during the covid-19 pandemic. This is also supported by research conducted by Prasetyo (2017) which explains that there is an influence between the application of the scientific approach to the character of students' curiosity. This study aims to explore the implementation of a scientific approach in developing the curiosity of elementary school students during the Covid-19 pandemic.

As study material, here is a literature review related to the scientific approach, curiosity, elementary science learning, and learning during the COVID-19 pandemic. A scientific approach is a scientific approach recommended by the government to be implemented in the 2013 curriculum following the Minister of Education and Culture Number 22 of 2016. This approach consists of five stages, namely observing, asking, trying, reasoning, and communicating. Specifically, these activities can be seen in Table 1.

TABLE 1. The stages activities of the scientific approach

No	Indicator	Sub Indicator
1	Observing	Students observe the object of study that is well studied
2	Asking	Students asking things that have not been understood related to the material being studied
3	Trying	Students conduct experiments according to the object of study being studied
4	Reasoning	Reasoning Students make reasoning from the results of experiments that have been carried out
5	Communicating	Students are able to communicate the results of experiments that have been carried out to the general public

Harlow (1953), Berlyne (1954), and Dember (1956) originated the Drive theory. They considered curiosity to be an unpleasant experience of "uncertainty" triggered by "the presentation of new or unusual stimuli (e.g., objects, pictures) elicit approach behavior and sustained attention" (Litman, 2005). Curious behavior has the aim of restoring cognitive and perceptual coherence. Curiosity is one of the 18 characters that need to be developed by students. Curiosity is attitudes and actions that always seek to find out more deeply and widely from something they have learned, seen, and heard (Hasan et al, 2010: 9-10). Silmi and Kusmarni (2017) argue that curiosity is a natural emotion that exists in humans where there is a desire to investigate and find out more about something they are learning. Curiosity will make students continue to find out about what they don't know, by finding out students will get a lot of new information and knowledge and add to the insights they have.

Suriasumantri (in Puspitasari, Santoso, & Muchsini, 2015) this curiosity is used as the starting point of knowledge possessed by humans. Curiosity occurs because students think that something learned is something new that must be known to answer their ignorance. To increase curiosity, it can be done with literacy activities which are expected to develop character. Abidin, Mulyati, Yunansah, & Sari (2018: 1) reveal that literacy is defined as the ability to use language and images in rich and diverse forms to read, write, listen, speak, see, present, and think critically about ideas.

Daryanto and Darmiatun (2013: 131) argue that the indicators of curiosity include asking teachers and friends about the subject matter; asking something about a natural phenomenon that has just happened; asking the teacher about something heard on the radio or television; and asking about various events that are read from the print media. Furthermore, Kurniawan (2013: 149) explains that the indicators of student curiosity in class are creating a class atmosphere that invites curiosity; demonstrate the ability to think critically, logically, and creatively; demonstrate listening, speaking, reading and writing skills; open their minds to new things, or things they learn; always ask a lot of questions; read various types of literature to explore their world; do not accept learning as something boring and interesting; look and understand when learning feels fun.

ISBN: **978-623-98805-0-7**

Hasan et al (2010: 34) states that the indicators of the attitude of curiosity include asking or reading sources outside of textbooks about material related to the lesson; reading or discussing natural phenomena that have just occurred; asking about some natural, social, cultural, economic, political, technological events that have just been heard; asking about something related to the subject matter or outside the classroom.

Based on the explanation above, the indicators of curiosity referred to in this study are as follows.

TABLE 2. Curiosity Indicator

No	Indicator	Sub Indicator
1	Ask the teacher and friends about the subject matter	a. Ask the teacher about the material or experimental steps that you don't understand b. Questioning the findings of other groups
2	Enthusiastically looking for answers	a. Read various learning resources related to the material being studied b. Answering questions posed by teachers or friends
3	Attention to the object being observed a.	a. Pay attention to the teacher's explanation of the object being observed b. Using the senses to observe the object/event that is being observed seriously
4	Enthusiasm in the scientific process	a. Carry out data collection activities seriously. b. Do data processing seriously c. Shows interest in the results of the experiment

METHOD

This research used is mixed-method research that uses qualitative and quantitative data collection methods. This study was explored the application of a scientific approach in developing the curiosity attitude of elementary school students during the covid-19 pandemic with supporting data for the development of the curiosity attitude aspect.

This research was carried out at SDN Kajar Wonosari, Gunungkidul in the online learning process for science subjects class VI for the academic year 2021/2022. The participants of this study were sixth-grade students of SDN Kajar Wonosari, with a total of 19 students, consisting of 12 female students and 9 male students.

Data collection techniques were carried out through observation and documentation techniques. Observations in this study were carried out using a five-scale observation guideline as a research instrument. This study uses the observation of the implementation of a scientific approach and increasing students' curiosity in learning science for grade VI elementary school. While this documentation technique is used to collect data related to research on science learning activities for grade VI elementary school that applies a scientific approach.

The data analysis technique in this study used descriptive qualitative data analysis techniques and quantitative data. Observers observe the activities of teachers and students during learning activities following the steps in the scientific approach. The data obtained were then analyzed in narrative form and made temporary conclusions regarding the implementation of teacher activities following the steps in Miles Hubberman's qualitative data analysis, namely data collection, data reduction, data displays, and drawing conclusion. For quantitative data, it is calculated to measure the increase in the aspect of curiosity attitude. The phases of data analysis are presented in Figure 1.

ISBN: **978-623-98805-0-7**

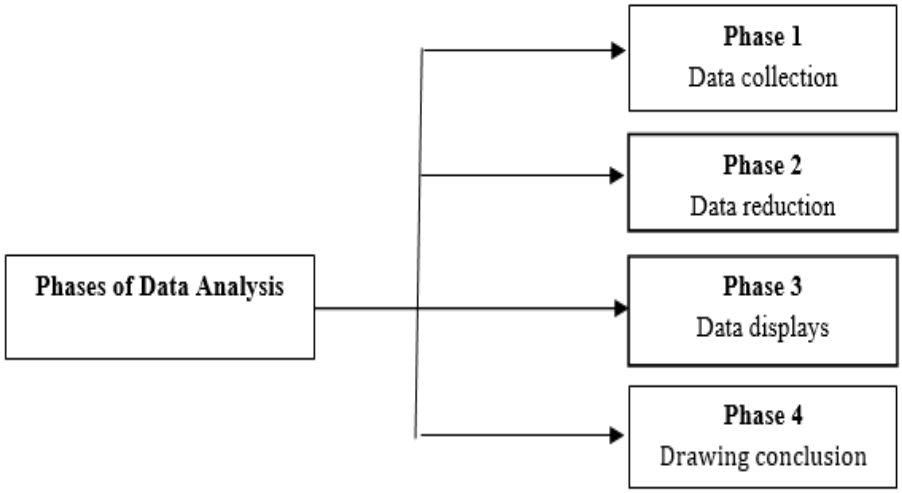

FIGURE 1. Phases of the data analysis

RESULTS AND DISCUSSION

Learning activities in elementary schools during the Covid-19 pandemic are carried out online (on the network). The implementation of learning goes by adjusting the conditions in the field. Various obstacles must be overcome so that learning continues as it should and the learning objectives can be achieved. Online learning requires students to study alone at home and still with parental supervision. With the assistance of parents who always help students during learning, some students become lazy in learning and only rely on their parents when getting assignments. This causes the curiosity of students to be reduced. Curiosity is an important attitude for students to have. This needs to be developed in the learning process at elementary school age.

This research was conducted on sixth-grade students of SDN Kajar Wonosari in the 2021/2022 academic year. This study uses a mixed-method, namely qualitative and quantitative by analyzing a single variable, namely student curiosity. Respondents in this study were all students of class VI, totaling 19 students, consisting of 12 female students and 7 male students. This research is a population study because the number of samples is less than 100. Data collection techniques used are observation and documentation.

This study aims to analyze students' curiosity in science subjects using a scientific approach. This scientific approach has 5 learning steps, namely: observing, asking questions, trying experiment, reasoning (associating), and communicating. Observation of learning activities before implementing the scientific approach was carried out on Tuesday, September 7, 2021. From a total of 19 students, 15 students were present face-to-face at Google meet, while 2 other students attended via WhatsApp Group, and 2 others were absent. After greeting students by asking how they were doing and suggestions to keep progressing and conveying apperception, the teacher conveyed the objectives of science learning to students, namely identifying how living things adapt to their environment. The teacher asks students to be enthusiastic about taking online classes and always provides opportunities for students to ask questions to the teacher. On this day the teacher explained to students about science material how to identify the way living things with their environment through the lecture method on Google meet, while students through WhatsApp Group will be sent a video. Students listen carefully to the teacher's explanation. After listening to the teacher's explanation, students have the opportunity to ask questions about what they don't know.

After accommodating all students' questions, the teacher then responded to the questions asked by students and provided learning materials for animal and plant adaptation through power points. Students listen to the teacher's explanation regarding the adaptation material. The questions if made in Table 3.

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TABLE 3. Student Questions before Using the Scientific Approach

No	Indicator	Sub Indicator
1	Rofi	Miss, do all animals adapt?
2	Roccoli	Miss, how do cats adapt?

Based on these data, only two students asked questions. The data above shows that students' curiosity is still low with a percentage of 70%. Based on the results of observations, the attitude of curiosity that has been carried out on Tuesday, September 7, 2021, results can be presented in Table 4.

TABLE 4. The Observation Result of Curiosity before using the Scientific Approach

No	Creativity Indicator	Mean
1	Ask the teacher about material or experimental steps that have not been understood	3,5
2	Questioning the findings of other groups	3,4
3	Reading various learning resources related to the material being studied	3,5
4	Answering questions posed by teachers or friends	3,4
5	Paying attention to the teacher's explanation of the object being observed	3,8
6	Using the senses to observe the object/event being observed seriously	3,6
7	Carry out data collection activities seriously	3,5
8	Doing data processing earnestly	3,4
9	Shows interest in experimental results	3,4
	Total Mean	**3,5**

Observation of learning activities while using a scientific approach was carried out on Tuesday, September 14, 2021, and Wednesday, September 15, 2021. The second observation of the number of students was 19 children, 15 students were present face-to-face at Google meet, while 2 other students attended via WhatsApp Group and 2 others were absent. After greeting students by asking how they were doing and suggestions to keep progressing and conveying apperception, the teacher conveyed the objectives of science learning to students, namely identifying how living things adapt to their environment. The teacher asks students to be enthusiastic about taking online classes and always provides opportunities for students to ask questions to the teacher. Specific learning activities can be seen in Figure 2.

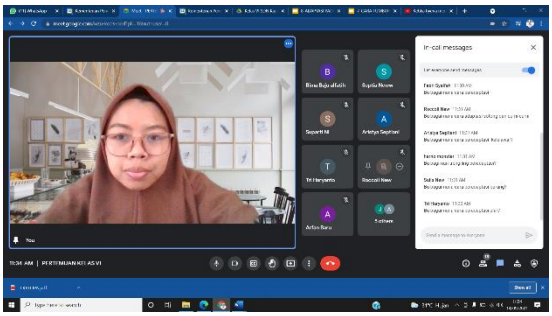

FIGURE 2. The learning process using Google meet

The first stage in the scientific approach is observing (observing). The teacher shows a video on how the pangolin animal adapts in defending itself from enemy attacks. Students observe and pay attention to the video given by the teacher. After watching the video, students are allowed to convey their ideas regarding the video. 6 students asked through the chat column, while there was 1 student who asked via WhatsApp Group. The questions asked by students were about how other animals besides pangolins adapt to the environment and how to complete the worksheets. After accommodating all students' questions, the teacher then responded to the questions asked by students and provided learning materials for animal and plant adaptation through power points. Students listen to the teacher's explanation regarding the adaptation material. The questions if made in Table 5.

ISBN: **978-623-98805-0-7**

TABLE 5. Student Questions After Using the Scientific Approach

No	Nama	Questions
1	Febri Syarifah	Miss, how do animals adapt?
2	Roccoli	Miss, how are cuttlefish and squid adapted?
3	Ariestya Septiani	Miss, how do bats adapt?
4	Rosalia	Miss, how do pangolins adapt?
5	Alya	Miss, how do you adapt birds?
6	Sheilla	Miss, how do you adapt snakes?
7	Zea	How do pangolins adapt?
8	Tama	Miss, who are the members of my group?
9	Anissa	Miss, I want to ask my group, Riko and Piyu, don't you?

The third stage is the stage of experiment. The teacher explains to the students related to the next task. Students are divided into several small groups. Each group consists of 3-4 students with a distance of the house close to each other. Each group was asked to observe and identify plants and animals around the house. After observing plants and animals, students analyze how they adapt. The teacher distributes which contains instructions for doing assignments and a list of tables that must be completed.

The next stage is reasoning or associating. Through group activities, students will have joint discussions to determine what plants and animals will be analyzed and how these plants and animals adapt to the environment. At this stage, students do it at home with teacher supervision through WhatsApp Group discussions. At this stage, 2 students from different groups asked the teacher several stages that were not clear through WhatsApp group discussions. For the trying and reasoning stage, students carry out these activities in their respective homes while still being monitored by the teacher through WhatsApp online discussions. Each group sends photos documenting student activities while conducting discussions at their respective homes.

The second observation activity was held on Wednesday, September 15, 2021. 10 students attended face-to-face, while the rest were present via WhatsApp Group. The activities carried out were presenting the results of student discussions related to the identification of plants and animals and how to adapt them. Each group is given about 5-10 minutes to present the results. The group representatives read what plants and animals were observed and how they were adapted. Meanwhile, the other groups listen and write down the questions they want to convey to the presenting group. The presentation was carried out to the last group. However, there was one group that did not attend the virtual face-to-face class so the presentation was replaced by sending a video/sound recording to the teacher. The learning activity ends by conveying the conclusions of the material that has been studied today. The teacher appreciates the work, enthusiasm and curiosity in the learning process. Based on these data and explanations, the following data can be obtained.

TABLE 6. The Observing Curiosity Result Before Using the Scientific Approach

No	Creativity Indicator	Mean
1	Ask the teacher about the material or experimental steps that you don't understand	3.9
2	Questioning the findings of other groups	3.7
3	Read various learning resources related to the material being studied	4.0
4	Answering questions posed by teachers or friends	3.8
5	Pay attention to the teacher's explanation of the object being observed	4.1
6	Using the senses to observe the object/event that is being observed seriously	4.0
7	Carry out data collection activities seriously	4.1
8	Do data processing seriously	4.2
9	Shows interest in the results of the experiment	4.0
	Total Mean	**4.0**

Based on the data above, the percentage is calculated and obtained a percentage of 80%. The science learning model with a scientific approach that is carried out according to stages has been proven to increase students' curiosity during the covid-19 pandemic. Even though the implementation is online, teachers can still maintain students' curiosity

ISBN: **978-623-98805-0-7**

in science learning by using a scientific approach. Students are very enthusiastic when asking questions related to learning materials. Some students also asked about the steps in a simple science experiment process.

Based on the data obtained from the observational analysis, there is an increase in the average result, namely from the average value before using the scientific approach of 3.5 to 4.0 after using the scientific approach. From the initial presentation of 70% increased to 80%. From these data, it can be said that the application of this scientific approach can be used to develop the curiosity of sixth-grade elementary school students in science subjects.

Based on the explanation above, it can be concluded that the scientific approach can develop students' curiosity. The learning process is carried out by implementing five stages, namely observing, asking, trying, reasoning, and communicating activities. A scientific approach is an approach that is carried out in learning that aims the learning process can be matched with a scientific process, therefore the 2013 curriculum mandates the essence of the scientific approach in learning. The scientific approach is believed to be the beginning of the development and development of attitudes, knowledge, and skills of students. . The learning process using a scientific approach is directed so that students can formulate problems by actively asking questions, not just solving problems by answering. The learning process is expected to be directed to train analytical thinking where students are taught how to make decisions, not mechanistic thinking, namely by listening and memorizing alone (Majid, 2014: 23).

A scientific approach is a learning approach that focuses on skillfully gaining new knowledge with scientifically-based detailed steps. The concept of scientific learning can also be said as a learning process that guides students to be able to solve problems through scientific steps with careful planning, data collection, and data analysis to produce a conclusion. Kurniawan (2013: 56) argues that the scientific approach has the following characteristics, they are student-centered, involves science process skills in constructing concepts, laws, or principles, involves potential cognitive processes in stimulating intellectual development, especially higher-level thinking skills. students' height, and can develop students' character. By applying this scientific approach, students can develop character, improve students' thinking skills, and can solve every problem they face, and have high learning outcomes.

Learning objectives using a scientific approach consists of to improve intellectual abilities, especially students' higher-order thinking skills; to form students' ability to solve a problem systematically; the creation of learning conditions in which students feel that learning is a necessity; obtaining high learning outcomes; to train students in communicating ideas, especially in writing scientific articles; to develop students' character (Hosnan, 2014: 13)

The principles of the scientific approach in learning activities consist of student-centered learning; learning forms student's self-concept; learning to avoid verbalism; learning provides opportunities for students to assimilate and accommodate concepts, laws, and principles; learning encourages the improvement of students' thinking skills; learning increases students' learning motivation and teacher's teaching motivation; provide opportunities for students to practice communication skills; there is a validation process for concepts, laws, and principles that students construct in their cognitive structures (Hosnan, 2014: 31).

CONCLUSION

Based on the results and discussion, it can be obtained results that show that using a scientific approach in elementary science learning can increase students' curiosity. This is evidenced by an increase in the average presentation of observation scores related to student curiosity from 3.5 to 4.0 so that the presentation of values increased from 70% to 80%. Based on these results, it can be concluded that the application of the science learning model with a scientific approach can be used as an alternative to developing the curiosity of sixth-grade elementary school students during the covid-19 pandemic. Based on these conclusions, it is suggested that the scientific approach can be used as an alternative to developing the curiosity of sixth-grade elementary school students during the covid-19 pandemic.

ACKNOWLEDGMENTS

Acknowledgments are conveyed to the basic education study program of the UST Yogyakarta postgraduate directorate who has facilitated the implementation of research and publication of the results of this research.

ISBN: **978-623-98805-0-7**

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ISBN: **978-623-98805-0-7**

International Student Mobility between Southeast Asia and EU: Case of Indonesia, Vietnam, and Malaysia

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Abstract. The international mobility of students from one part of the world to another has been ongoing for centuries. Due to socioeconomic reasons, it has been observed that students in developing nations generally move to study in institutions located in developed nations. After completion of their studies, some of these students stay back to pursue their careers in host nations, while others return to their homelands. In contrast, there are relatively fewer students coming from developed nations to pursue their studies in developing nations, causing an unbalanced student mobility. In recent years, Science Technology, and Innovation (STI) dialogue and exchange between Asia and Europe has been consistently emphasized in the various ASEM Summits and Ministerial Meetings. Within the ambit of this co-operation, balanced mobility forms one of the core topics (the others being Lifelong Learning and Vocational training, University-industry Cooperation and Quality Assurance) for educational cooperation. In this study, we empirically investigate the inward and outward mobility of students from three Southeast Asian (SEA) nations, viz. Indonesia, Malaysia and Vietnam. Our study found stark unbalanced mobility, especially in regard to students coming from EU nations and those from these three nations going to EU nations. There were many more students going to EU nations from SEA nations than students coming from the EU to SEA nations for studies. Some barriers and solutions have been discussed to mitigate this trend.

INTRODUCTION

The ASEM dialog addresses political, economic and social issues to embolden cooperation between Asia and Europe and incorporates equal partnership and mutual respect between member nations [1]. These meetings have emphasized Science, Technology, and Innovation (STI) as an important area for bi-regional co-operation. The ASEM education process is well within the purview of this dialog. As initiated categorically during the ASEM Ministers meeting (ASEMME3) in Copenhagen in 2011 and then re-emphasized during ASEMME4 in Kuala Lumpur in 2013, balanced mobility is one of the four core topics for cooperation between Asia and Europe in the field of education. The other three topics are Lifelong Learning and Vocational Training, University-industry Cooperation and Quality Assurance. Although each of these topics is categorized distinctly, they in fact complement each other. For example, better quality assurance and recognition would improve the flow of students and staff between Asia and Europe.

Mobility here refers to the flow of students and staff between one region of the world and another. In the past, primarily due to socioeconomic reasons, this flow has been more from a developing or less developed region of the world to developed regions of the world. For this reason, in the past, the flow of students has been more from Asia to Europe rather than the other way round. However, in recent times, the growth in the GDP of several countries in Asia, more stress on English as a medium of instruction together with other factors, such as the opening of the economy in some major nations of Asia (such as China), has resulted in some nations (i.e., China, South Korea and Malaysia) obtaining an increased influx of foreign students. Nonetheless, it is observed that the majority of these students are from either neighboring nations of these countries or from the Middle East region or Africa. In short, most of these foreign students coming to Asian countries are non-Europeans. This has led to a kind of 'imbalance' – there are still several times more students going from Asia to Europe than students coming from Europe into Asia. Asia is turning out to be a 'net exporter' of foreign students, and Europe is a 'net importer' of foreign students. ASEM education minister meetings have realized that to strengthen educational cooperation, there is a great need to first mitigate this imbalance.

ISBN: **978-623-98805-0-7**

Although mobility can be categorized in several ways and at several levels, essentially, they involve two main types – long-term mobility and short-term mobility. In the case of 'long-term' mobility, the students may either choose to go to a foreign country with a plan to settle in that country after the completion of studies or may choose to return to his country. In the former case, the student makes a now popular case of 'brain drain', and in the latter, the main issue would be the case of degree recognition back in his or her country. Another type of mobility is 'short-term' mobility, where the students undergo one or two semesters of their degree course or a summer course in a foreign country. In this case, the main issue would be the transfer of course credits so that they are absorbed in the main course back home.

Europe has always been an attractive destination for students. A survey conducted by QS (www.topuniversities.com), a UK agency that also brings out its respected ranking of world universities, found that out of the 10 top destinations of students' choice of education, there were 5 from Europe and none from Asia. Additionally, while interest in the US and UK has declined, interest in most top European destination countries has increased since 2009. The results of this survey show that Asia would have to work even harder now to attract students to its shores.

The purpose of this study is to investigate the international student mobility trends of three SEA nations – Vietnam, Indonesia and Malaysia – and empirically investigate whether a mobility imbalance exists in these three nations. All three SEA nations are dynamic and rapidly developing countries in southeast Asia. Hence, an analysis of these three nations would serve as a good proxy of the overall SEA nations-EU student mobility scenario. SEA is a vast, diverse region with massive economic disparities and development gaps; thus, international student flows vary immensely. The region is home to both the richest and poorest nations in the world. The remaining part of the paper delineates data harvested, analysis done and based on the results we then proceed with our discussions and final concluding thoughts

METHOD

The data on student mobility are harvested (see table 1) between August and September 2021 from the UNESCO website [2] of the 3 southeast Asian nations, namely, Indonesia, Vietnam and Malaysia.

TABLE 1: Format for raw data extracted

Inward or Outward (separate tables)					
Malaysia		**Indonesia**		**Vietnam**	
Country	Students	Country	Students	Country	Students
<name of country>	<number of students>	<name of country>	<number of students>	<name of country>	<number of students>

We then perform a descriptive analysis in MS-Excel and further carry out network visualization of the data once affiliation-based relationship data are constructed. For our calculations, we use the top 10 countries associated with each SEA nation (Indonesia, Malaysia and Vietnam) for both inward and outward mobility. A network is an association of two or more entities (also known as a 'node') joined together through some form of relationship [3]. The relationship in a network is depicted with a line (also known as an 'edge') between the entities. The thickness of the lines depicts how strong the relationship is between the nodes (see figure 1). In our study, a thicker line would simply mean more students go to that country.

ISBN: **978-623-98805-0-7**

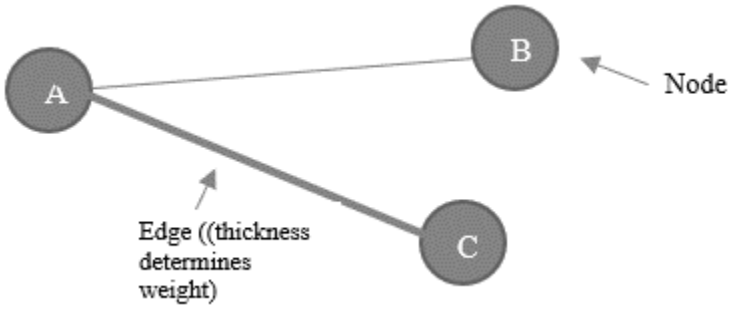

FIGURE 1. A network demonstration

Only one graph metric is calculated, the 'degree'. A 'degree' is the number of direct connections a node has with other nodes [4]. No other graph metrics are calculated, as they are not within the scope of this study. NodeXL software [5, 6] is used for network visualization.

RESULTS AND DISCUSSION

Among the three nations studied here, only Malaysia has so-called balanced student mobility in regard to overall inward and outward mobility, taking all students into consideration. Of the total number of mobile students abroad, Malaysia hosted more inbound students (see Table 2). In contrast, both Indonesia and Vietnam sent students abroad several times more than they hosted them in their institutions within their home countries (see Table 2)

TABLE 2. Students sent abroad, and students hosted. Stats: uis.unesco.org

	Vietnam	**Malaysia**	**Indonesia**
Students abroad			
Total number of mobile students abroad	108,527	61,904	49,900
(% of total mobile students)	1.9	1.1	0.9
Outbound mobility ratio	...	4.8	0.6
Students hosted			
Total number of mobile students hosted	7,250	81,953	7,677
(% of total mobile students)	0.1	1.5	0.1
Inbound mobility rate	0.4	6.7	0.1

Malaysia received the maximum number of inward students from China (see table 3). Several students from Indonesia, Bangladesh, Yemen and other nations also came to undergo their tertiary education here. Malaysia has been home to high-quality institutions where courses are taught in English. In addition, the relatively high standard and moderate cost of living together make Malaysia a favored destination in Southeast Asia. Both Malaysia and Indonesia share a mutual association, with Indonesia receiving its high number of inward students from Malaysia and Malaysia also receiving its second highest number of students from Indonesia. Both nations are ethnic Malay nations and situated geographical proximity with each other, and other similarities (such as maritime tropical climate) make students of these two nations choose institutions of their liking in the other nation. Vietnam is located in mainland southeast Asia, and similar student dynamics are found. Geographical proximity playing a role here too. Students from

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nearby nations, Laos PDR and Cambodia, choose Vietnam as their destination. Over the years, Vietnam has economically progressed very well in comparison to its neighbors, especially Cambodia and Laos, and this is seen with students preferring to go to Vietnam.

However, what was interesting was the fact that no EU member nations, with the exception of France, were among the top 10 nations sending their students to these three SEA countries. Even France, which has had long colonial ties with Vietnam, had only 36 students in total sent to Vietnam.

The social network visualization graph (see Figure 2) displays an interconnection between these three southeast Asian nations' inward international student destinations. The lines also display the number of students each nation is receiving. The width of the lines depicts the strong connection a nation has with the other in regard to inward student movement.

TABLE 3. International student flows (inward and outward) from Indonesia, Vietnam, and Malaysia (based on the top 10 inward and outward source and destination countries, respectively, for Indonesia, Malaysia and Vietnam). Countries shown in bold are EU member countries. ^United Kingdom was member of the EU until Jan 2020. Calculation based on stats from: uis.unesco.org

OUTWARD MOBILITY						**INWARD MOBILITY**					
Destination Countries	Degree	Indonesia	Malaysia	Vietnam	Students Total	Source Countries	Degree	Indonesia	Malaysia	Vietnam	Students Total
Australia	3	12180	15653	16138	43971	China	3	515	11713	108	12336
United States	3	8452	8619	25596	42667	Indonesia	1		8440		8440
Japan	3	4187	2600	34276	41063	Bangladesh	1		6904		6904
United Kingdom	3	2986	14950	3468	21404	Lao PDR	1			6056	6056
Korea, Rep.	2	1006		7752	8758	Yemen	1		5680		5680
Malaysia	1	8440			8440	Nigeria	2		4661	22	4683
Germany	3	2419	1168	2773	6360	Pakistan	1		4649		4649
Canada	3	951	1099	2529	4579	India	2	947	2810		3757
France	1			4093	4093	Egypt	1		2342		2342
New Zealand	2		1854	1359	3213	Saudi Arabia	1		2149		2149
Finland	1			2440	2440	Iraq	1		2116		2116
Indonesia	1		1745		1745	Malaysia	1	1745			1745
Netherlands	1	1569			1569	Timor-Leste	2	1650		28	1678
Saudi Arabia	1	1453			1453	Thailand	2	996		25	1021
Ireland	1		1430		1430	Cambodia	1			612	612
India	1		1087		1087	Korea, Rep.	2	141		152	293
						Samoa	1	218			218
						Aruba	1	181			181
						Libya	1	110			110
						Japan	1	103			103
						France	1			36	36
						Myanmar	1			34	34
						Mozambique	1			32	32
Grand Total		43643	50205	100424	194272			6606	51464	7105	65175

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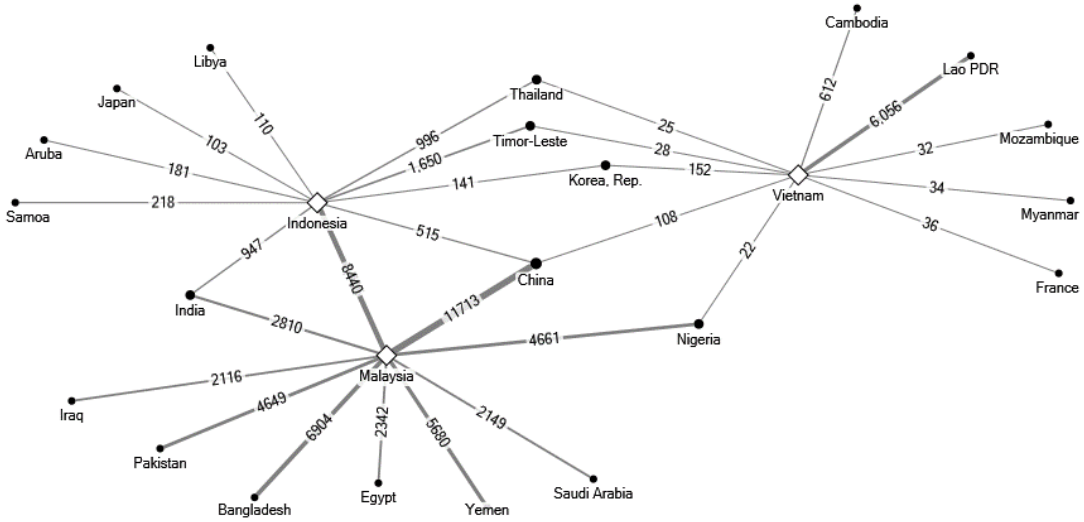

FIGURE 2. Network Visualization of inward student mobility in Indonesia, Vietnam, and Malaysia

In contrast to inward student mobility, where most of the students thronging to the three SEA nations were either from geographically close nations or non-Western nations, the outward movement gives a very different picture. The top 2 destination nations of all three Southeast Asian nations are all developed nations. While Australia is the most preferred nation for both Malaysia and Indonesia students, Japan is the most preferred nation for Vietnam. Although the UK is the second most preferred nation for Malaysia, it does not appear in the top 5 nations for either Indonesia or Vietnam. Malaysia was once a British colony, and this association is reflected in the high number of students preferring the UK as their study destination. Malaysians still rate a British degree high, as it gives them a competitive edge in the job market [7]. A similar association with their former colonial masters is evident in the other 2 SEA nation cases – Indonesia and Vietnam were Dutch and French colonies, respectively – and these are reflected in the number of students still preferring to go to these countries.

In 2020, UK exited the EU. However, since it has been part of the EU since 1973 until 2020, we would still mention it when discussing nations as members of the EU. In regard to EU member nations, Germany, the UK, France, the Netherlands and Finland are preferred destinations. While we saw only a handful of students coming from EU member nations to these 3 SEA nations, thousands of students are going to EU nations to pursue their tertiary education.

Network visualization (see figure 3) displays the interconnection of nations as students move to pursue their education. In contrast with the visualization of inward student mobility, the visualization of the network of outward student mobility displays dense interconnections between the top 10 nations to which students from each of these 3 southeast Asian nations go. This is since students from these 3 nations have many of the nations with similar preferences as destination countries for their tertiary education. ‘Degree’ reveals that the UK and Germany are the most preferred EU destinations of students from all three nations of SEA.

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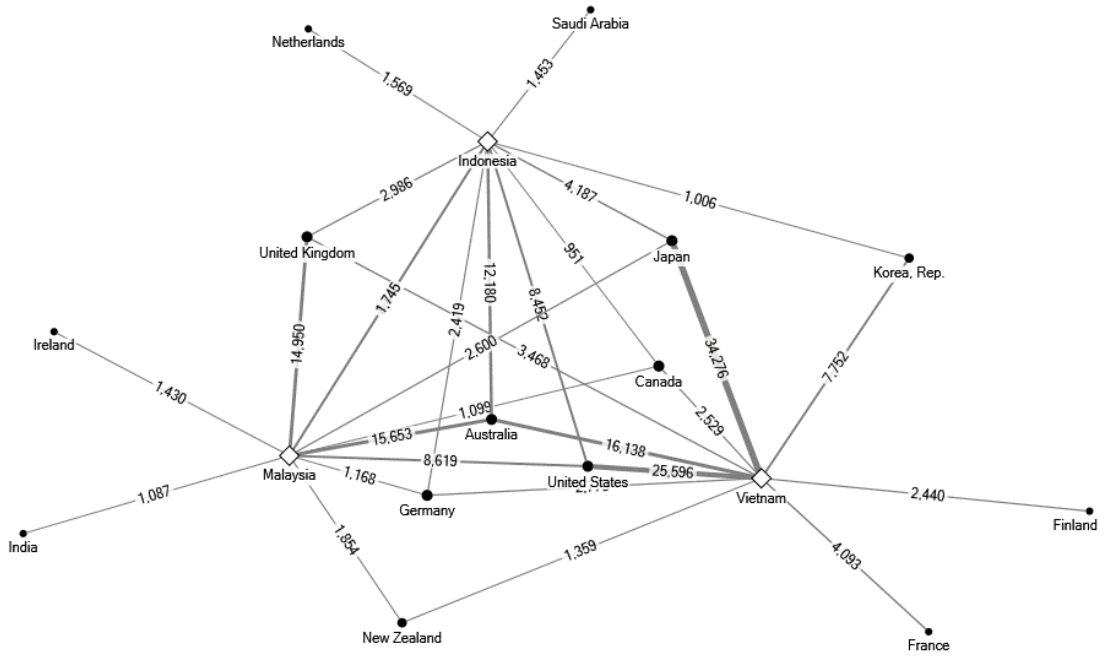

FIGURE 3. Network visualization of outward student mobility in Indonesia, Vietnam, and Malaysia

As is evident from the analysis, there are 37,296 students from these three SEA nations going to EU nations (including the UK) and just 36 students coming from EU nations to the three SEA nations. In short, the imbalance is stark – for every 1000 students going to EU, there is only 1 student coming to the 3 SEA nations.

Our analysis found a glaring imbalance in mobility between students seeking studies in Southeast Asia and Europe – far more students preferred to go to Europe than those from Europe willing to come to study in Southeast Asian countries. Here, we suggest some possible barriers that may hinder students from coming from Europe to SEA and how we could possibly mitigate these barriers if proper mechanisms are brought in place. There are several impediments to bringing European students to Asia.

Some of the major ones are funding, recognition and credit transfer and language. Funding is one of the biggest attractions for any foreign student. The Erasmus program in Europe has attracted thousands of students from outside Europe to come and study in different countries in Europe. There are few other scholarship programs, such as ASEM-DUO [8], that run fellowship schemes on a bilateral basis. Credit transfer issues are still a major deterrent for those from Europe desiring to pursue their higher education in SEA nations. Local programs are not porous enough to accommodate foreign earned credits. In regard to language, although English usage has increased in Asia, language incompatibility between Asia and Europe is another deterrent.

Following mitigation strategies needs further exploration:

- There is an immediate need to set national standards and guidelines for recognition and to elaborate a credit transfer mechanism. Something of the size and acceptability as the ECTS. The European Credit Transfer and Accumulation System or ECTS was developed by the European Commission within the purview of the Bologna Process to facilitate the transfer of academic credits for students desiring to pursue education at different European institutions. ECTS is a student-centered system based on the student workload and is generally determined in terms of the 'learning outcomes' and other competencies. Full academic recognition is essential for effective student mobility, where students could gain a degree by earning credits from different institutions even when the actual course content of the programs may differ. By providing easier recognition of qualifications and periods of study at different institutions, ECTS has not only successfully promoted the academic mobility of European students but has also been instrumental in making job-seekers move across Europe.

Over the last several years, there has been a concerted effort by governments and policy makers in Asia to develop an ECTS-equivalent system. Credit transfer systems such as ACTS (AUN-ASEAN Credit transfer system) and

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SEAMEO-RIHED are born out of such efforts for facilitating and harmonizing the credit systems of various institutions in Asia. Although these systems have had some degree of success, a vast majority of programs in Asian universities remain nonflexible (or rigid), thereby posing a large hindrance for student mobility not only for students within Asia but also for European students desiring to pursue part (one or two semesters) of their degree programs in Asia. Hence, there is a dire need to first have an effective credit transfer system that Asian institutions can easily adopt. Such an effort would attract more European students to Asia.

- Compatible academic cycles, shared quality assurance procedures, and provision for mutual qualification recognition are some of the ways for structural convergence. The ASEAN University Network could need to play a pivotal role here.
- To fund more joint study programs with English, for example, as common medium of language
- To provide accredited and attractive international short-term programs such as summer schools;
- To provide scholarships. ASEM-DUO is doing a very good work in this area. Additionally, there is a need to find an Asian version of ERASMUS MUNDUS and ERASMUS+.
- Other aspects, such as mitigating immigration restrictions, for example, making student Visa hassle-free
- Arranging education fairs to promote global education

CONCLUSION

A balanced mobility of students is very important for nations, and its benefit could be summarized in one word – Internationalization [9]. Internationalization brings diversity and improves the knowledge base. Are there other barriers? To find this more, investigation through surveys and interviews is needed to gather information from international students and other stakeholders.

As discussed earlier, course accreditation, credit transfers, language and funding are some of the factors that impede the mobility of students. However, even if these issues are completely addressed, the aim of balanced mobility cannot be fully realized unless we make Asia attractive for Europeans. Europe has in fact done this for a long time now. For example, programs such as ERASMUS [10] have been specifically formulated by European nations to make Europe more attractive for outsiders.

Another way that could make Asia attractive for European students is by offering short- and long-term courses that motivate students to come to Asia. Asia's rich history could be marketed in the form of research-based courses at the undergraduate, graduate and PhD levels. Therefore, students could be doing ethnographic studies on Orang Aslis in Malaysia, investigating the lifestyle of Komodos in Indonesia or getting to learn about kick-boxing in Thailand to studying traditional medicine in China, yoga and Ayurveda in India or understanding the lifestyles of settled American citizens in the Philippines.

In addition, short "travel courses" that explore the rich flora, fauna, ancient and new places of archaeological marvels could also be thought about. Such programs could promote Asia as a unique destination for students. Ideas, such as these, that make Asia attractive for Europeans could be further explored.

Once the visiting students have a taste of southeast asia, they could be potential candidates for long-term courses. In addition, there should be more dedicated institutes (one such institute is the Asia-Europe Institute in Malaysia, which was conceived and established under the ASEM process) in Southeast Asia that are dedicated to inviting students from Europe to pursue higher learning here. One such center could also serve as a nodal agency to lay down effective strategies for academic credit transfers between institutions, to government and other policy makers.

Hence, in conclusion, there is a need to formulate an 'international strategy' to embed mobility at the national level. If the issues of funding, quality assurance, recognition of courses and credit transfer are structurally addressed, we could see mitigation in the present imbalance in mobility. Among several others is people-to-people connectivity, which could promote ASEM connectivity. For this the work, the effort is required by both the continents - while Asia needs European students, it is equally important for Europe to direct their students to look toward Asia as a potential destination for part or full educational programs.

ACKNOWLEDGMENTS

The study is supported by Universiti Malaya, Kuala Lumpur, Malaysia, Project Number: GPF029A-2020.

ISBN: **978-623-98805-0-7**

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ISBN: **978-623-98805-0-7**

Work and Energy: How Relationship between Learning Style and Critical Thinking Skill through Hybrid Learning?

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Abstract. Critical thinking skill is one of the abilities that must be possessed by students in the 21st century. Students are currently not trained to always think critically which could be caused by the learning styles of the students themselves. The learning style here is a combination of a person's state of being able to absorb, be able to organize and be able to process information. This study aims to analysis the implementation and relationship of learning styles with critical thinking skills after the Hybrid Learning model is applied to the work and energy materials. The method used correlation analysis with product moment correlation. The sample of this research was the students of class X MIPA, totaling 16 students who were selected by using saturated sampling technique. The instruments used were a learning style questionnaire, Authentic Assessment Based on Teaching and Learning Trajectory) with Student Activity Sheet (AABTLT with SAS) and critical thinking skills test questions. The results showed that the average percentage of learning implementation using the Hybrid Learning model was 91% with a very effective category. The results of the hypothesis test using the product moment correlation test, then rcount (0.110) < rtable (0.497) or rcount less than rtable, so Ha is rejected and H0 is accepted. The results of this study can be concluded that there is no significant relationship between learning styles and critical thinking skills of students of class X MIPA on the matter of work and energy.

INTRODUCTION

Hybrid Learning or commonly called Blended learning is a learning process that unites various learning methods by combining virtual resources and physical contact. M.Finn defines the blended learning is integrates or hybrid learning on the programs in different formats to achieve to a common goal [1]. Heinze A in his research states that blended learning or hybrid learning is a mixed model of various learning strategies and methods of delivering the learning process which strategy is based on offline and online, especially online learning based on web/blog, without leaving face-to-face activities [2]. The hybrid learning model is a combination of face-to-face learning with online learning or e-learning. Thus, the combined purpose of this hybrid learning learning is to combine the nature of the learning model [3].

The use of the learning model can be applied by looking at the characteristics of students. This can be seen from the students' learning styles. De Porter explains that learning style is a combination of how a person can absorb, organize and process information [4]. An appropriate learning style is the key to student success in learning [5]. Hamzah in his research stated that "There are several categories/types of a person's learning style that we can know and observe that we might follow if we feel that we are suitable for such a learning style, including visual learning styles, auditory learning styles and kinesthetic learning styles" [6]. Visual learners are different from auditory learners who rely on the ability to hear. Meanwhile, kinesthetic students prefer to learn by being directly involved [7]. Recognizing one's own learning style does not necessarily make someone smarter, but knowing one's learning style will be able to determine a more effective way of learning [8].

ISBN: **978-623-98805-0-7**

H. Ennis' statement that critical thinking is a process in which one of the aims is to make a decision about what to believe and what to do in a learning process [9]. The term Focus is related to identifying the main focus or concern, Reason relating to identifying and assessing the acceptability of the reason, Inference relating to assessing the quality of conclusions with the assumption of reasons to be accepted, Situation relating to the situation carefully, Clarity relating to clarity then check to make sure the language is accurate and clear and Overview relating to double check or step back and see everything in its entirety [10]. Several critical thinking indicators, H. Ennis identified 12 critical thinking indicators, which is 1) Formulate questions; 2) Analyze arguments or questions, 3) Answering questions about an explanation or question, 4) Consider the credibility of a source; 5) Observing and considering an observation report; 6) Deduce and consider the results of the deduction; 7) Make and consider value decisions; 8) Induce and consider the results of induction; 9) Define terms and consider a definition; 10) Identify assumptions; 11) Define action; and 12) Interact with other people.

Nurbaeti's research states that students' learning styles have a close relationship with the achievement of the average value of students' critical thinking skills [11]. This makes it difficult to achieve educational goals, one of which is an indicator of critical thinking ability [12]. This is based on the theory that has been put forward by experts (especially Piaget), that critical thinking skills can already be applied to students at the junior high school level, because the age of students in junior high school (-+ 12-15 years) is included in the category of the formal operation stage [13].

Critical thinking skills can be trained through practice and patience in thinking process activities, so that students more easily understand concepts and materials that have a broad scope and affect higher student learning outcomes [14]. Nurbaeti in her research states the learning process goes well, the learning objectives will also be achieved [15]. Thus, when students are able to think critically, on the other hand, it can also improve student learning outcomes [16]. With the ability to think critically allows students to find the truth in the midst of events and information that occurs every day [17]. The roots of this hybrid learning research can be traced to information systems researchers, while information systems researchers have a very important role in drawing attention to the impact of technology to develop this education [18].

METHOD

The method used is the method of correlation analysis with research design based on the situation and conditions in the field [19]. The sample of this study was the students of class X MIPA in one of Madrasah Aliyah in Subang, totaling 16 students who were selected with saturated sampling technique, because the situation of COVID-19.

There are 3 stages in this research, namely the planning stage, the implementation stage and the final stage, the following data analysis techniques: implementation of learning analysis (using worksheet with AABTLT with SAS), learning style questionnaire sheet analysis (Likert Scale), and critical thinking ability test analysis. The relation between learning style and critical thinking ability using hypothesis test with Normality Test (Chi Square) and Hypothesis Testing with Product Moment Correlation).

RESULTS AND DISCUSSION

Implementation of hybrid learning

For the implementation of the hybrid learning model in online learning, using the WhatsApp Group application, Google Classroom, Google Form. Documentation of activities is presented from pictures 1 to pictures 2.

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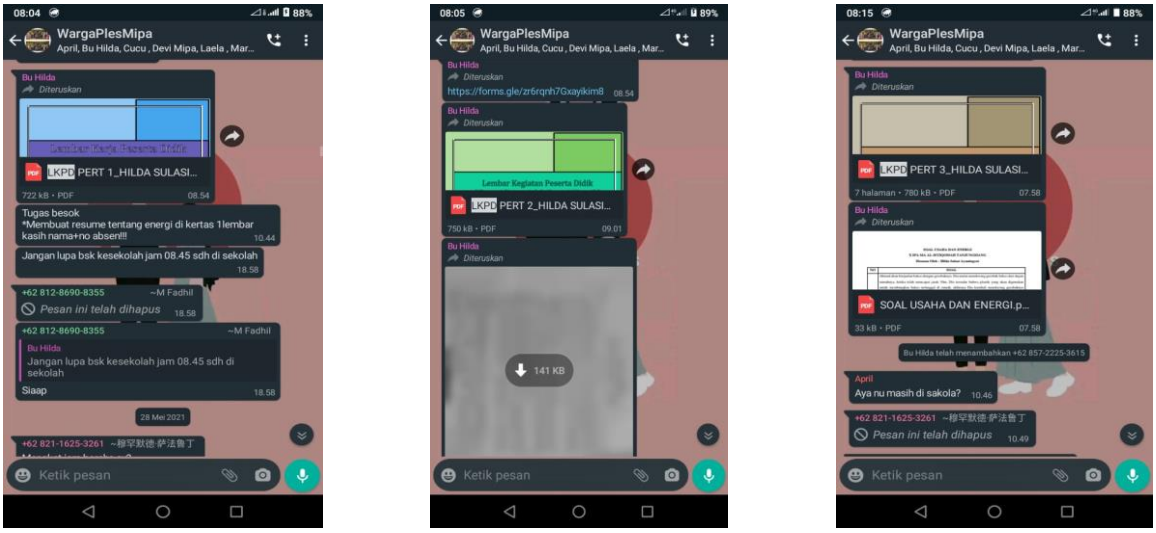

FIGURE 1. Distribution of worksheet and posttest

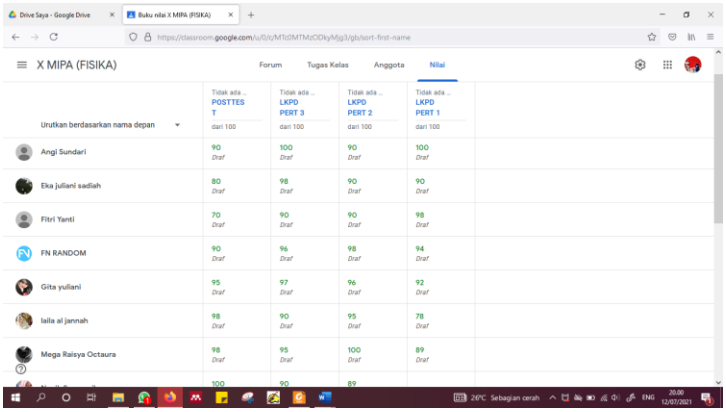

FIGURE 2. Assessment for worksheet and posttest

For the implementation of the Hybrid Learning model in offline learning, the documentation is in Figure 3.

FIGURE 3. Offline learning

Figure 3 shows offline learning activities for learning calligraphy activities. In the implementation of learning the number of questions is 8, for the stages of each question consist of 4, namely apperception, motivation, problems and asking, conclusions. All that stages was doing when online and offline learning.

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Grouping of learning styles and critical thinking skills

Student learning style test results are presented in the picture 4.

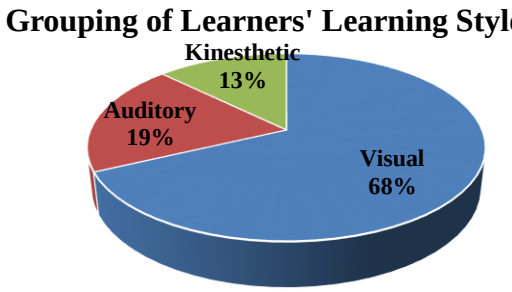

FIGURE 4. Diagram of the grouping of students' learning styles

Figure 4 shows that 68% of students tend to have a visual learning style, 19% of students tend to have an auditory learning style and 13% of students tend to have a kinesthetic learning style. After classifying students' learning styles, researchers will classify critical thinking scores based on learning styles.

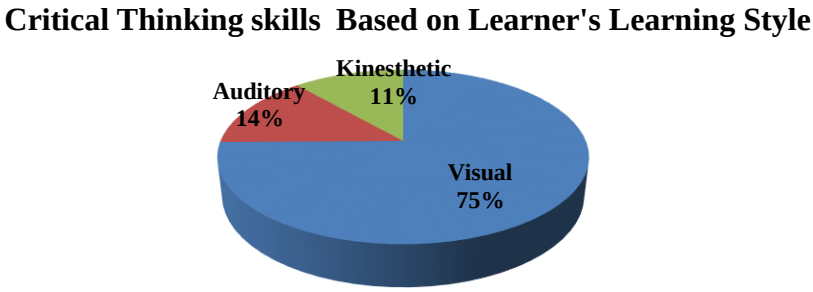

FIGURE 5. Diagram of student learning styles grouping

Figure 5 shows the percentage of students' critical thinking skills grouping based on learning styles. It shows that students' critical thinking skills as a whole can be categorized into 3 categories of learning styles with the following influence or percentage: visual learning style has the highest percentage in the implementation of critical thinking ability tests. students who get a percentage of 75% with a total of 11 students, for auditory learning style has a percentage of 14% with 3 students, and for kinesthetic learning style has a percentage of 11% with 2 participants. Overall, it can be concluded that most students have visual learning style categories so that the learning style in the classroom is more dominant in what they see or see than what they hear and do. Thus, the percentage value of the critical thinking ability test of students in the visual learning category is higher than the auditory and kinesthetic learning style category. Because basically every student has a different category of learning styles, but not all of them develop in a balanced way, but some dominate with their learning style category. This causes students to like learning that varies according to the category of learning styles they have. The diversity of categories of student learning styles requires a selection of suitable teaching strategies or teaching styles so that the strengths of students' learning styles develop properly. By involving visual, auditory, and kinesthetic aspects, it is expected to be able to increase students' learning activities [8].

Meanwhile, the percentage of critical thinking skills based on each indicator is presented in Figure 6.

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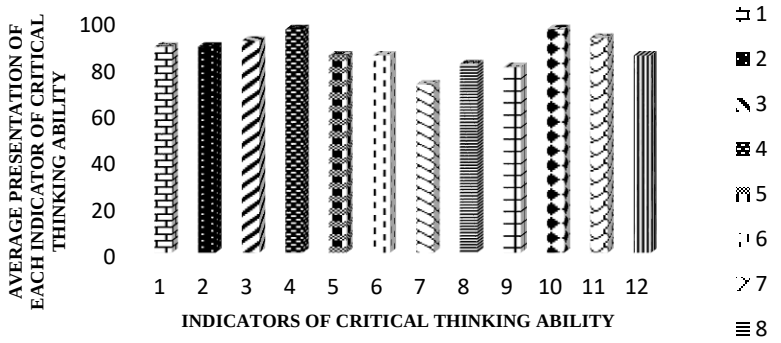

FIGURE 6. Average percentage of each indicator about critical thinking skills

Figure 6 shows that the average percentage of each indicator about students' critical thinking skills is very high, from 73-100%. The indicator about the critical thinking ability of students who have the highest score is the question indicator 4 considering the credibility of a source and indicator 10 identifying assumptions with a value of 96%. While the lowest is indicator 7 induces and considers the results of induction by 73%. The factors that have the greatest influence on the process of achieving student learning outcomes with critical thinking ability tests are intelligence and talent, critical thinking skills must be possessed by a student, because based on existing theory it can be concluded that critical thinking skills play an important role in regulating and controlling one's cognitive processes in learning and thinking, so that one's learning and thinking becomes more effective. and efficient [20].

The relationship between learning styles and critical thinking skills

Analysis for relationship between learning style and critical thinking skills are show in the Table 1 and Table 2.

TABLE 1. Normality test results learning style and critical thinking skills test

Criterion	Learning Styles	Critical Thinking Skills
Number of Students	16	16
Maximum Value	98	98
X Average	84	87
Chi-Square (Xcount)	2.7	11
Degrees of Freedom	5	5
Chi-Square (Xtable)	11.0705	11.0705
Information	normal distribution	normal distribution

Table 1 shows that the learning styles and critical thinking skills can be categorized as data that is normally distributed if the calculated chi-square value (Xcount) is smaller than the table chi-square value (Xtable). The value of Xcount (2.7) < Xtable (11.0705), thus the data of students is normally distributed. For critical thinking skills shows that the value of Xcount (11) < Xtable (11.0705), thus the critical thinking skills test data of students is normally distributed.

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TABLE 2. Hypothesis Testing Data Recapitulation.

Criterion	Value
r_{count}	0.110
r_{table}	0.497
Criteria	H_a is rejected, H_0 is accepted
Information	There is no significant relationship between learning styles and students' critical thinking skills

The data in table 2 shows the results of hypothesis testing conducted using Product Moment Correlation. Based on the results of data processing above, it can be concluded that Ha is rejected and H0 is accepted, meaning that there is no significant relationship between learning styles and students' critical thinking skills through a hybrid learning model on work and energy materials. The factors causing the absence of a significant relationship include the learning styles of the students themselves, because in order to provide the best way of learning for each individual, the learning style must be determined/known in advance by considering differences such as personality, perception, ability and intelligence [21]. Then another factor is the lack of development of students' critical thinking skills, because according to Lambertus the development of students' critical thinking skills can be strengthened through the application of student-centered learning, because students are given the freedom to build their own knowledge, discuss with friends, are free to express opinions, can accept or reject the opinion of friends and can formulate conclusions [22]. Another factor that causes the absence of a significant relationship between learning styles and students' critical thinking skills is because the results of processing critical thinking skills tests show various averages. The factors that have the greatest influence on the process of achieving student learning outcomes with critical thinking ability tests are intelligence and talent [20].

Competence in the achievement of critical thinking skills by students may therefore be influenced by the learning style preferences of each individual [20]. Critical thinking skills and learning styles of students are a major concern for educators because they affect the teaching methods used in their development in teaching in a learning classroom [21]. In this study, lack of information about the learning styles of students resulted in no significant relationship with students' critical thinking skills, so that further research should dig deeper into the categories of students' learning styles themselves in more detail in order to get maximum results. In addition to being seen and considered in terms of the personality of the students, it is also seen from the side of the perception of each student based on learning styles or experiences in learning to gain knowledge, then it should also be seen in terms of intelligence and children's ability to manage knowledge information better in order to get maximum results and knowing and considering the more detailed categories of learning styles of students. Then, the teaching of critical thinking must therefore focus on explicitly teaching its guiding principles, as well as putting the skill into practice through exercises that promote its use [23]. Because 21st schools and universities as well should prepare students for a different social life, a different economic world and a more demanding and skills-oriented workplace. It is the century of digital literacy, technological advances, multicultural societies, human mobility, global communication, social networking, innovations and creativity and inclusiveness. In other words, 21st century students need to develop the necessary 21st century skills [24].

CONCLUSION

The results of the study show that the learning process using the hybrid learning model, very effective category. Based on the calculation results from the learning style questionnaire, it shows that the category of learning styles is visual learning style. There is no significant relationship between learning styles and students' critical thinking skills through a hybrid learning model on work and energy materials. The factors causing the absence of a significant relationship include the learning styles of the students themselves, because in order to provide the best way of learning for each individual. But, based on the results of the calculation of the value of students' critical thinking abilities, it shows that students' critical thinking skills have a very good category and the percentage of each indicator about students' critical thinking skills has various values, but is still in the very high category, meaning that the value obtained by students in the critical thinking ability test of students is very good.

ISBN: **978-623-98805-0-7**

ACKNOWLEDGMENTS

Authors wishing to acknowledge to Departement of Physics Education Faculty of tarbiyah and teacher training and LP2M UIN Sunan Gunung Djati for support.

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ISBN: **978-623-98805-0-7**

Development of Science Teaching Aids to Improve Critical Thinking Abilities and Understanding Concepts to Students

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Abstract. This study aims to (1) produce the feasibility of windmill props and solar panels as learning media; (2) testing the effectiveness of windmills and solar panels in improving students' critical thinking skills; (3) testing the effectiveness of windmills and solar panels in improving students' conceptual understanding skills. The type of research is R & D with a sample of 17 students of class IX SMPIT Usamah. The analysis techniques carried out are Normality Test and n-gain score. The results of the research show: (1) that windmills and solar panels are produced in categories suitable for use as learning media; (2) props of windmills and solar panels are effective in improving students' critical thinking skills with an n-gain score of 86; (3) props of windmills and solar panels are quite effective in increasing the ability to understand concepts in students with an n-gain score of 61.

INTRODUCTION

A learning process in the field of Natural Sciences (IPA) is a learning process that is planned and neatly arranged to increase the potential in students, both in attitudes, knowledge and skills. In science learning at SMP/MTs, the revised 2013 curriculum requires higher reasoning [1]. With the 2013 revised curriculum in the science learning process, students are expected to have higher order thinking skills/critical thinking/HOTS (Higher *Order Thinking Skills)* which are needed by students to be applied in everyday life.

However, based on the results of the PISA (The Program for International Student Assessment*)* research focusing on science or science, in 2015, Indonesia received an average score of 403 and decreased in 2018 to 396, while the average score from the OECD (Organization for Economic Cooperation and Development) is 489 [2]. The PISA Item Test combines the problem-solving process with collaborative problem-solving competencies where students need to have higher-order thinking skills, namely at the stage of analyzing (C4), evaluating (C5) and creating (C6) to be able to answer the Test Items given by PISA [3].

This is not in accordance with learning science based on the revised 2013 curriculum where students can have high critical thinking skills. High-level thinking skills/critical thinking is an intellectual process by conceptualizing, applying, synthesizing and evaluating information obtained through observation, experience, reflection, thinking or communication as a basis for believing and taking an action [4].

The results of observations at SMPIT Usamah, in the learning process, educators dominate the learning process more than students who tend to be passive. Based on the results of interviews with science teachers, students tend to be sleepy, easily bored and not enthusiastic during the learning process. Student learning outcomes also tend to be lower (65) than the predetermined KKM value (77). This is due to the lack of understanding of concepts in students, resulting in students' misunderstanding of a concept. If the understanding of a concept is not mastered by students, it will be difficult for students to solve a problem that exists in the surrounding environment.

In the learning process, SMPIT Usamah teachers use learning media such as *power points*, videos, demonstrations, experiments and teaching aids. However, there are some materials that are classified as abstract but there is no appropriate learning media. One of these materials is Renewable Energy Sources. The material for renewable energy sources is delivered by the teacher using videos and *power points* where the use and selection of learning media is not in accordance with Dale's experience cone which reveals that by using media in the form of images, students will only understand the overall material presented by the teacher as much as 30% and by using videos, the material absorbed is only 50% of the total material delivered by the teacher [5].

ISBN: **978-623-98805-0-7**

Based on the results of observations and literature studies, the researchers then developed learning media products in the form of teaching aids to improve students' critical thinking and conceptual understanding concept understanding is defined as understanding the relationship between one concept and another so that it can be applied in solving problems [6].

The level of concept understanding when viewed from the indicators of concept understanding based on Bloom's Taxonomy analysis are: (1) interpreting; (2) exemplifying; (3) classifying; (4) summarizing;(5) inferring; (6) comparing; (7) explaining [7]. According to Enggen Paul Don Kauchack [8] critical thinking is the ability and tendency to make and assess conclusions based on evidence. Fisher [9] states critical thinking is a skillful activity that can be done better or vice versa and good critical thinking will meet various intellectual standards such as clarity of relevance and so on.

The indicators of critical ability according to RH Ennis quoted by Ika Rahmawati, et al [10] are classified into five, namely:

1. Provide a simple explanation (elementary clarification), including: focusing questions, analyzing arguments, asking and answering questions that require explanation or challenge.
2. Building basic skills (basic support), including: considering the credibility of sources and making observations.
3. Drawing conclusions (inferences), including: compiling and considering deductions preparing and considering inductions, making decisions and considering the results.
4. Provide further explanation (advanced clarification), including: identifying terms and considering definitions, identifying assumptions.
5. Setting strategies and tactics (strategies and tactics) includes: determining an action or interacting with other people.

Teaching aids are teaching aids that support the delivery of problems so that they can facilitate delivery in a short and effective time [11]. Meanwhile, according to Muhammad [12] says that teaching aids are concrete objects that are used to demonstrate and clarify the delivery of material to students. The purpose of using the props for; (1) clarify in the delivery of information conveyed by the teacher to students; (2) make it easier for students to understand and understand the material presented [13].

The functions or benefits of using teaching aids according to Suyanto [14] Students' interest in learning becomes great; (2) Students will find it easier to learn the material presented, especially when the teacher can present abstract concepts in learning in a concrete form; (3) Students will be aware of the relationship between teaching and objects around it or natural science and society.

The advantages of using teaching aids that are expressed by Muhammad [14] Helping to develop sensitivity to time, place and cause-effect relationships; (2) Clarify the meaning of the learning materials so that it is easier for students to understand the learning materials delivered; (3) Teaching methods become more varied so that students do not get bored easily.

According to Russefendi [15] the characteristics of teaching aids are durable, attractive shapes and colors, simple and easy to manage, the size is in accordance with the child's physical size, can present learning concepts (does not complicate understanding), in accordance with the mathematical concepts of learning, can clarify the concept of learning, it can be expected that students learn actively, and teaching aids can be used as a basis for the growth of abstract thinking concepts. Learning media is said to be feasible if it meets the aspects of validity, effectiveness and practicality or practicality [16].

Based on this description, the researcher plans to examine development of science teaching aids to improve critical thinking abilities and understanding concepts to students.

METHOD

The type of research used in this study is Research and Development (R&D) which is used to produce certain products and test the effectiveness of these products [16]. The researcher uses the Sugiyono methods has 10 stages which were then simplified due to time constraints into 4 stages: (1) Research and data collection stage; (2) planning and design stage; (3) product development phase and (4) validation and testing phase.

The research and data collection stages were carried out by conducting structured interviews with science teachers. The results of these interviews will be analyzed for planning the learning process and planning the learning media that will be used.

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The next stage is planning and design. The planning includes the design of learning as well as the design and design of learning media (props) which will be tested for the validity and effectiveness of the learning media. The researcher designs the teaching aids by sketching and analyzing the needs of the teaching aids. To support these teaching aids, the researchers also designed a instructional module for the use of teaching aids and Student Worksheets (LKPD).

The next stage is the product development stage. Researchers assemble the required components according to the planned design. Furthermore, the teaching aids are validated to determine the feasibility of the teaching aids. If it is said to be suitable for use, it will then be tested at a predetermined school.

The trial phase was carried out for data collection. In the learning process, the researcher uses the one-group pretest-posttest design to determine critical thinking skills and conceptual understanding before using teaching aids and critical thinking skills and conceptual understanding after using teaching aids with a test instrument in the form of pretest-posttest.

TABLE 1. Research design

Pretest	Treatment (X)	Posttest
O_1	X	O_2

The research was conducted at SMPIT Usamah Tegal from 3 February - 6 February 2021. In this research samples includes class IX students of SMPIT Usamah Tegal with 17 students. Researchers used the SMPIT Usamah School where the use of teaching aids was still very minimal. Based on the results of interviews with science teachers, poor understanding skills and underdeveloped critical thinking skills. This is shown from the results of obtaining scores below the Minimum Completeness Criteria (KKM), which is 70.

The data collected includes data: (1) produce the feasibility of windmill props and solar panels as learning media; (2) testing the effectiveness of windmills and solar panels in improving students' critical thinking skills; (3) testing the effectiveness of windmills and solar panels in improving students' conceptual understanding skills.

The data analysis techniques on the data collected are as follows.

1. Feasibility Results for Windmills and Solar Panels

   The data obtained will be analyzed using a rating scale with the results of the data in the form of quantitative data which is interpreted into qualitative data. The results of the answers to all items can be calculated using the formula [17].

$$\sum Criteria\ Score = hight\ score \times \sum indicator\ item \times \sum respondent \quad (1)$$

   The results of the calculation of the criteria score are interpreted in the form of percentages as follows.

$$Percentage\ (\%) = \frac{score\ \ obtain}{total\ \ score} \times 100 \quad (2)$$

   The results of the calculation of the criteria score are interpreted in the conclusion line in Table 2 [16] below.

TABLE 2. Range percentage and criteria score

Formula	Criteria Score
84%-100%	Excellent
68%-83.9%	Very Good
52%-67.9%	Good
36%-51.9%	Poor
≤ 35.9%	Very Poor

2. Normality test

   Normality test is used to find out distributed data normally or not. The normality test using the One Sample Kolmogorov Smirnov method has a higher normality level. As for decision making is as follows [18].

   a. Significant Level < 0.05 = Data is not normally distributed
   b. Significant Level > 0.05 = Data is normally distributed.

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3. Pretest-Posttest Results of Concept Understanding Ability
   The results of the pretest-posttest conducted by students on the concept understanding instrument will be analyzed and converted into scores. The score is then converted into a percentage using a formula.

$$NP = \frac{R}{SM} \times 100\% \quad (3)$$

   The results of the percentage sought are categorized as follows (Putri Diana et al, 2020, p.27) which are shown in Table 2.

TABLE 3. Percentage category of concept understanding ability

Percentage of Achievement (%)	Category
$66.6 < P \leq 100$	High
$33.3 < P \leq 66.6$	Medium
$0 < P \leq 33.3$	Low

4. Pretest-Posttest Results of Critical Thinking Skills
   The results of the pretest-posttest conducted by students on critical thinking instruments will be analyzed and converted into scores. The score is then converted into a percentage with the formula.

$$(\%) = \frac{total\ score}{score\ maximum} \quad (4)$$

   According to Setyowati (quoted by Wahyu Arini and Fikri Juliadi, 2018, p.7) the results of the percentage sought are categorized as follows.

TABLE 4. Percentage category of critical thinking ability

Percentage of Achievement (%)	Category
$80 < PK \leq 100$	Very High
$60 < PK \leq 80$	High
$40 < PK \leq 60$	Medium
$20 < PK \leq 40$	Low
$0 < PK \leq 20$	Very Low

5. N-Gain Score and Prerequisite Test
   After the data pretest-posttest obtained, then calculating a score of N-Gain using the following formula

$$N\text{–}Gain\ score = \frac{posttest\ score - pretest\ score}{score\ maximum - pretest\ score} \times 100 \quad (5)$$

   The result of the N-Gain calculation is interpreted with the following classification.

TABLE 5. Interpretation of n-gain

Percentage of Achievement (%)	Category
N-gain > 70	High
30 ≤ N-Gain ≤ 70	Medium
N-Gain ≤ 30	Low

Furthermore, the N-Gain score in the prerequisite test includes the normality test (Kolmogorov Smirnov). Decision making if the significant level <0.05, then the data is not normally distributed and if the significant level is > 0.05, then the data is normally distributed.

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6. Student Questionnaire Results

The results of the questionnaire data were then analyzed from all items using a formula.

$$\sum Criteria\ Score = hight\ score \times \sum indicator\ item \times \sum respondent \quad (6)$$

The results of the calculation of the criteria score are interpreted in the form of percentages as follows.

$$(\%) = \frac{total\ score}{score\ maximum} \quad (7)$$

The results of the calculation of the criteria score are interpreted in the conclusion line in Table 6 [16] below.

TABLE 6. Range percentage and criteria score

Formula	Criteria Score
84%-100%	Excellent
68%-83.9%	Very Good
52%-67.9%	Good
36%-51.9%	Poor
≤ 35.9%	Very Poor

RESULTS AND DISCUSSION

This study aims to (1) produce the feasibility of windmill props and solar panels as learning media; (2) testing the effectiveness of windmills and solar panels in improving students' critical thinking skills; (3) testing the effectiveness of windmills and solar panels in improving students' conceptual understanding skills.

Result of product development then an assessment by the validator from media experts and materials experts. Result of validator's assessment shows that product improvement is needed development. As for the corrective comments from media validators including: (1) tool mat display is not strong and unattractive; (2) props holder is not strong and color too conspicuous; (3) connecting cable made neater and better; (4) goal learning on the guide module synchronized with indicators; (5) student worksheet made more suitable for critical thinking.

Beside of corrective comments from validators, Researchers make revisions according to comments and suggestions from validators. Tool mat replace the windmill display using wood *plywood* with a length of 40 cm x 16 cm and size 44 cm x 11.5 cm on the solar panel which is given a *cream* color with a the tip is lined with black. Sit as component base is replaced by using wood *plywood* and colored *cream* with the edges are lined with black. Participant learn to use props. The props container uses a large box strong and easy blue color.

Research on the development of windmill props and solar panels was analyzed from the aspect of the feasibility of the props, the aspect of the effectiveness of the use of the props and the practicality of the props. In the feasibility aspect, it is analyzed by looking for the overall score given by the media and material expert validators as well as the teacher's assessment. The results of the analysis of the media expert's assessment with an overall percentage of 93% in the very good category with a good decision to use in research. Furthermore, the assessment of the material expert with an overall percentage of 94% in the very good category with a Good decision to be used in research and the assessment of the science subject teacher with an overall percentage of 98% in the very good category.

Based on the overall results on the feasibility aspect, it shows that the props of windmills and solar panels are good for use in research. Props that have been tested for feasibility will produce valid and reliable data. This was conveyed by Riyanto [19] saying that the validation aspect is intended for examining an object which shows that the object has met the predetermined indicators. This statement is reinforced by Arikunto's opinion [17] where the validity test is used to show that the object meets the objectives to be achieved. If the validity results are met, the next step is to test the effectiveness of windmills and solar panels in improving the ability to understand concepts and try out the effectiveness of windmills and solar panels in improving critical thinking skills.

The effectiveness of using windmills and solar panels can be determined using *n-gain score* analysis. The result of obtaining the *n-gain score* on understanding the concept is 61 in the medium category.

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TABLE 7. N-Gain score concept understanding

Information	Score
N-Gain	61
Catagory	Medium

Based on the *n-gain score, it* shows that windmill props and concept understanding are quite effective in increasing concept understanding. The *n-gain* data *were* analyzed using the Normality Test with the results of the *pretest* data getting a Sig (2-tailed) value of 0.200 > 0.05 and the *posttest* data getting a Sig (2-tailed) value of 0.039 > 0.05. According to Rochmat [14] if the results are significant level > 0.05 then the data is normally distributed. So it can be concluded that the *pretest-posttest* data on the concept understanding instrument have data that are normally distributed.

The increase in the ability to understand concepts was shared with the results of 65% in the medium category and 87% in the high category.

TABLE 8. Results of percentage improvement in concept understanding ability

Information	Percentage (%)
Pretest	65
Posttest	87

The results of this acquisition are in accordance with Muhammad's statement [12] where one of the advantages of using teaching aids is that students understand the learning delivered by using teaching aids. According to Rudy and Hisbiyatul [13] said that teaching aids are used to make it easier for students to understand and understand the material presented. This is reinforced by the statement of Suyanto [19] which says that one of the benefits of teaching aids is that it is easy for students to learn the material presented, especially when the teacher can present abstract concepts in learning in concrete form.

Meanwhile, the results of the *n-gain score* on critical thinking instruments were 86 with the high category, meaning that the teaching aids used were effective in increasing the ability of students to understand concepts.

TABLE 9. *N-Gain score* critical thinking

Information	Score
N-Gain	86
Catagory	High

The n-gain data were analyzed using the Normality Test with the result that the pretest data got a Sig (2-tailed) value of 0.044 > 0.05 and the posttest data got a Sig (2-tailed) value of 0.025 > 0.05. According to Rochmat [20] if the results are significant level > 0.05 then the data is normally distributed. So, it can be concluded that the pretest-posttest data on critical thinking instruments have data that are normally distributed.

The increase in critical thinking skills was achieved by 60% in the medium category at the *pretest* and 90% in the very high category.

TABLE 10. Results of percentage improvement in critical thinking ability

Information	Percentage (%)
Pretest	60
Posttest	90

This result is in accordance with Sudjana's statement [14] which states that teaching aids have a function to enhance the quality of teaching and learning. By using teaching aids, students' critical thinking skills will increase, so that the quality of teaching and learning will increase. This is reinforced by the opinion of Muhammad [13] who says that teaching aids are able to develop sensitivity to time and place and are able to train students in problem solving.

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This is in accordance with Suyanto's statement [21] which says that the benefits of teaching aids are that it is easy for students to learn the material presented, especially when the teacher can present abstract concepts in learning in concrete form and it becomes easier for students to learn the material presented and students will be aware of the relationship between teaching and objects around it or natural science with society.

The practical aspect is determined based on the results of the assessment by the user, namely the students. The overall achievement result is 86% with a very good category which indicates that the windmill and solar panel teaching aids are easy to use and students understand the material obtained from the windmill and solar panel props. This is in accordance with the opinion of Alfiati, et al [16] where the level of practicality can be determined based on the results of the assessment of the level of ease of use of instructional media and materials delivered easily understood by learners.

Based on the feasibility aspect with the results of the windmill and solar panel props suitable for use, the effectiveness aspect with the effective results used in improving critical thinking skills and quite effective in improving the ability to understand concepts and practical aspects with a very good practicality level, it can be said that the teaching aids kincri wind has fulfilled all three aspects of learning media, where learning media is said to be feasible if it contains aspects of validity / feasibility, aspects of effectiveness and aspects of practicality [22].

CONCLUSION

Based on the results of research and discussion, it can be concluded that:

1. The props "Windmills and solar panels" are suitable for use in learning based on the results of the validity of science experts and teachers in order to improve students' critical thinking skills and conceptual understanding. The results are the percentage of media (93%), the percentage of material (94%) and science teachers (98%). The developed media is said to be VALID used in research.
2. The props of windmills and solar panels are said to be effectively used in learning to improve students' critical thinking skills with an n-gain score of 86%.
3. The props of windmills and solar panels are said to be quite effective in use in learning to improve students' conceptual understanding skills with an n-gain score of 61%.

ACKNOWLEDGMENTS

Alhamdulillahi rabil ‘alamin, the researcher expresses his highest gratitude to Allah subhanahu wa ta’ala for blessing, love, opportunity, health, and mercy to complete this undergraduate thesis. This undergraduate thesis entitled “Development of Windmills and Solar Panels in the Sub-Material of Renewable Energy Sources to Improve Critical Thinking Skills and Concept Understanding in Students” is submitted as the final requirement in accomplishing undergraduate degree at Science Education Study Program, Faculty of Math and Scince , Yogyakarta State University.

I am enormously grateful to my mother and my father for the endless love, pray, and support me. I am especially grateful to Professor Insih Wilujeng, M.Pd for his continuous encouragement, kindly advice throughout my study and I am thankful for examiner Sabar Nurohman, S.Pd.Si.,M.Pd and Widodo Setiyo Wibowo, S.Pd.Si.,M.Pd for kind advice and help. And then, i would like to express my deep gratitude to all staff of the Department who have helped me to get to this point.

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ISBN: **978-623-98805-0-7**

Analysis of Classroom Management Model in Learning Science: Case Study in Junior High School

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Abstract. Due to COVID-19 situation, the learning activity should be done by the online class. The online class needs appropriate classroom management to increase student's participation and achieve the goal of learning. The focus of this observation is to identify the model of classroom management that was used in science class activity. The data was collected by using direct observation with qualitative descriptive research method. The instrument used in conducting the observation is observation rubric that consists of 35 items. The observation was conducted in one of private Junior High School in Bandung city. The sample consisted of a science teacher and 23 students in Grade 7 Chieftain. The result of this observation is the classroom management model that used in this sample observation is Assertive Discipline.

INTRODUCTION

Due to COVID-19 situation, the learning activity should be done by online class to minimize the impact of this disease in daily life. The implementation of online class needs the uses of technology that can make learning more active, creative, innovative, fun and creates multi-interaction between teachers and students [1]. But the problem is the online class in formal school is not familiar for students, so they have to adapt to the situation of learning. Because of that, we need appropriate classroom management that implies in the online class learning to increase the participation of the students.

The important thing in an online classroom for junior high school is how to manage the class activity to be held well and interactive. Classroom management is a decision and procedure to maintain the class where the teaching and learning are conducted [2]. Classroom management refers to the skill of organization and presentation of lessons in several ways that make all students actively engaged in learning [3]. By implication it mean that classroom management refers to making attractive class activity, catching student's interest and understanding what is happening in the classroom. Classroom management can also be interpreted as a series of effort to work and process systematic activities in teaching and learning that represent more than preparing learning materials, facilities, and teaching aids, arrange the classroom layout, and arrange the time management, so learning can work well and the purpose of the curriculum can be achieved [4].

The aim of classroom management is to create an environment for academic learning such as the mastery of the concept that was already delivered, and the second creating an environment for social-emotional learning that belongs to the social skill of the student in societies [5]. The classroom management has principle as follows: warm and enthusiastic, has challenges, uses a variety of media, flexibility, and focusing on positive things [6].

Classroom management has many models that can imply in the class activity, those model will indicate the strategies of the teacher and students to achieve the goal of learning during the class activity. There are three well-established models of classroom management:

1. Models of Classroom Management

1.1 Assertive Discipline

Assertive discipline is a model developed by Lee Canter in the 1970s and then expanded based on Marlene Canter's work with children with behavioral problems. The assertive discipline approach is often characterized as

ISBN: **978-623-98805-0-7**

focusing primarily on rewards and punishments. This approach was developed to train teachers specifically to manage behavior in a classroom setting and is based on the idea that teachers have a right to teach in a well-managed classroom and students have the right to learn in a controlled environment.

In the assertive discipline model, teachers do not view students as adversaries. The structure of this model is this approach focuses more on how the teacher is in charge of managing the classroom environment. The teacher reacts to students' behavior assertively according to the predetermined agreements with students. There are four components of assertive discipline models: (1) consistent rules; (2) predetermined set of positive reinforcement as feedback for obeying the rules; (3) prearranged set of negative consequences as feedback if the rules are not followed; (4) plan to implement the models with students.

1.2 Logical Consequences

The logical consequences model is a model developed by Rudolf Dreikurs in 1968. This model is based on earlier work by German psychiatrist Alfred Adler and relies on the notion that students' misbehavior is an outgrowth of their unmet need. In this models, the focus is the fulfilment of students' social needs. If students' social needs are not fulfilled, students will start to misbehave and not following the structures. Unlike assertive discipline where the model of classroom management emphasizes the importance of teacher-imposed structure in the classroom, this model emphasizes more on how teachers assist students in fulfilling their needs.

1.3 Teacher Effectiveness Training

Teacher Effectiveness Training is a model of classroom management developed by Gordon in 1977. Similar to the Logical Consequences model, Teacher Effectiveness Training evolved from the field of psychology. This model conceptualizes effective management of a classroom as facilitating the shift of management responsibilities from teacher to students.

Contrary to the assertive discipline model, this model emphasizes more on teacher's role in classroom management and promotes ways that teacher can empower students to self-regulate their behavior through modelling and teaching students how to solve their own problems.

Based on the explanation about these models, the objective of this research is to identify the model of classroom management that is used in learning science in junior high school, with the main focus: (1) What type of classroom management model was used in the observation; (2) What is the impact of that model during the science class activity.

METHOD

Researchers collect the data using direct observation. Therefore, this research used qualitative descriptive research approach. Descriptive research is scientific research that describes events, phenomena or fact systematically dealing with a certain area or population. Tried to get deep data and information about the object by giving detailed data and information based on particular criteria [7]. Descriptive research aims to accurately and systematically describe a population, situation or phenomenon. The method in this research is case study research method that aims to investigate the process of classroom activity.

1. Participants

The model of sampling that used in this research is purposive sampling. The observation was conducted in one of private Junior High School in Bandung city. The sample consisted of a science teacher and 23 students in Grade 7 Chieftain.

2. Instrument

The instrument used in conducting the research is the observation rubric. The observation rubric consists of some aspects, which are student activity, teaching-learning process, teacher performance, and classroom management. The focus of this research is the classroom management aspect. This aspect consists of 35 items which are grouped into six sub-aspects of classroom management: managing classroom procedure (3 items), online classroom rules (10 items), managing students' behavior (5 items), organizing online classroom (2 items), special rubric for logical consequences (8 items), special rubric for teacher effectiveness training (7 items).

3. Procedure

In total, a science teacher and 23 students are observed by four observers. During the learning activities, the observers gather information from the teacher's behavior in managing the online classroom and collect the data towards the observation rubric. Since the approach used is descriptive research and the method is case study research, the observers find out the dominant model of classroom management using the result of the observation that was

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collected in the rubric. Although the teacher practices more than one model of classroom management, the most frequent actions can define a teacher's dominant model of classroom management.

RESULTS AND DISCUSSION

1. Result

The content of science that the classroom discuss is about global warming. Classroom procedure has been well conducted by the teacher. The class starts with the pre-learning activity. First, the teacher gives instruction to the class leader to lead the learning process, then the teacher checks the attendance of the student. The teacher used a learning cycle model by beginning the class to check the student's prior knowledge. Then the teacher introduced the students with new specific information and guided them to questioning and discussing which led to conclusion and concept development. Online classroom environment for both students and the teacher supports the learning activity. There are no obstacles or problems during the lesson.

The learning activity starts at 09.50 o'clock. All students of class 7 Chieftain wear school uniforms. Both students and the teacher joined the class on time. However, a rule such as maximum lateness is not applied to the class. Instead, students have to join the class by the time the teacher does a roll call. The teacher asked the student to turn on the camera during the learning activity. All students have a good connection, so they keep their camera on. Students usually mention the name before asking or answering questions, in accordance with the rules that the teacher has delivered before. All students are respectful both to the teacher or friend during the lesson by listening when somebody is speaking in conveying their opinion and quiet when the teacher is talking or delivering the material. Students also mute the microphone when the teacher delivers the material so that it makes the class have a conducive environment. So, based on what we observed during the lesson, students are already obeying all the online class rules.

The teacher manages students' behavior by expecting every student to work cooperatively as a classmate and as a teammate at all times. Unfortunately, during the observation research, there are no group activities that require teamwork. The teacher also expects every student to pay attention when the teacher gives instructions for an assignment or activity. This aspect was fulfilled since students carefully listen to the teacher's instruction when the teacher asks them to make a poster related to global warming. Students are also expected to follow the online classroom rules and to behave appropriately while in school and be courteous to everyone. It is clearly stated before, students are already obeying all the online class rules, but the polite behavior and the good manners of students in school cannot be observed since the observation is conducted virtually. In addition, the teacher manages students' behavior by giving them a reward in the form of an "additional score" to motivate students to have an active involvement in the class, such as asking or answering questions. The teacher also gives students a punishment if they are not obeying the class rules, for example, if students don't respond when the teacher checks their attendance, so it will be reputed as absent.

It has been found that the arrangement of the online classroom can support the learning activities, because the teacher together with all of the students is in the same room of the online platform, making an active interaction between each other. The platform that is used for the class is Google Meet, it is accessible for everyone, easy to use, secure, and contains useful features such as share screen and recording.

Related to the logical consequences, it has been resulted that in the beginning of the class, the teacher directly reputed students as absent if they don't respond when the teacher checks their attendance. After that, the teacher asks students to turn on the camera, but there are some students who turn off the camera without any permission. When the learning activity starts, the teacher leads students to discuss their prior knowledge regarding the topic which is global warming, although most students haven't read the material before. After that, the teacher explains the material using an E-book to attract students' attention. Then, the teacher asks students to watch a video related to the topic within 15 minutes, but there are some students who haven't finished when the time is over. Without considering the students who have utilized time effectively, the teacher directly gives additional time for students' who have ineffective time management.

During the teaching-learning process, when the teacher asks questions related to the topic, only several students who answer teacher's questions. Nevertheless, the teacher didn't try to reach the students who never give an opinion or idea, so the teacher can't ensure students' understanding. From this, we assume that there is no encouragement of efforts given by the teacher. In addition, when a student answers the teacher's question, the

ISBN: **978-623-98805-0-7**

teacher didn't ask the other students' opinion regarding their friend's idea. Generally, the teacher is not fostering the passive students to have an effort to be actively involved in the teaching-learning process.

Related to the teacher effectiveness training, it has been resulted that in the beginning of the class activity, students have extrinsically motivated because the teacher will give some reward and punishment so the students can't manage their own behaviour, also the initial activity don't state the students' problem to be discussed. The class is done by presentation of the teacher using teacher-centered instructions and didn't do group discussion. At the end of the class activity, there was QnA session to make sure if there was misconception of students.

2. Discussion

2.1 Assertive Discipline

From the observation we have done, we see some similarities between the model used in the classroom and the assertive discipline model. As has been stated above, the assertive discipline model has four important components: consistent rules, predetermined set of positive reinforcement as feedback for obeying the rules, prearranged set of negative consequences as feedback if the rules are not followed, and plan to implement the models with students [8]. These four components can be found in our observation result.

- Consistent and fair rules

The consistent rules applied in this classroom are:

(1) All students of grade 7 Chieftain wear school uniforms.
(2) Both students and the teacher joined the class on time.
(3) Students have to join the class by the time the teacher does a roll call.
(4) Both students and teacher have to turn on the camera during the learning activity. Unless they have a bad connection.
(5) Students have to mention the name before asking or answering questions
(6) Students have to be respectful both to the teacher or friend during the lesson.
(7) Students have to mute the microphone when the teacher delivers the material so that it makes the class have a conducive environment.

During our observation, the rules were delivered by the teacher by the time the class started.

- Predetermined set of positive reinforcement as feedback for obeying the rules.

  Predetermined set of positive reinforcement present as one of the aspects of classroom management. The teacher manages students' behavior by giving them a reward in the form of an "additional score" to motivate students to have an active involvement in the class, such as asking or answering questions.

- Prearranged set of negative consequences as feedback if the rules are not followed

  Prearranged set of negative consequences present in classroom management. The teacher gives students a punishment if they are not obeying the class rules, for example, if students don't respond when the teacher checks their attendance, so it will be reputed as absent.

- Plan to implement the models with students

  Students are involved in the planning of the implementation of the models.

2.2 Logical Consequences

As has been stated above, logical consequences model emphasizes more on how teachers assist students in fulfilling their needs. From the rubric we have arranged, the classroom management will belong to logical consequences classroom management model if it is fulfilled eight aspects, which are:

- Teacher asks students to remind their friends who are not join the online class yet
- Teacher requires students to ask permission if they can't attend the class or have connection issues
- Teacher guides students to recall their prior knowledge regarding the topic that will be discussed
- Teacher help students' to increase their attention in learning activities by using media
- Teacher makes sure that students utilize time effectively
- Teacher gives student an encouragement of efforts
- Teacher fosters students who are not actively involved in the teaching-learning process
- Teacher fosters students to respect others' opinion assertively

However, the result from the observation we have done shows that the classroom management in 7 Chieftain only fulfil 2 out of 8 aspects. The two aspects are Teacher guides students to recall their prior

ISBN: **978-623-98805-0-7**

knowledge regarding the topic that will be discussed and Teacher help students' to increase their attention in learning activities by using media.

2.3 Teacher Effectiveness Training

As has been stated above, teacher effectiveness training model emphasizes more on teacher's role in classroom management and promotes ways that teacher can empower students to self-regulate their behavior through modelling and teaching students how to solve their own problems. From the rubric we have arranged, the classroom management will belong to teacher effectiveness training classroom management model if it is fulfilled seven aspects, which are:

- Students is intrinsically motivated to be a good, without any obvious external reward
- The learning activity including the presentation by the instruction
- Student doing a group discussion in the learning activity
- The learning activity including individual sharing and skill building activities (Through QnA session)
- Using learner-centered instruction approach
- The learning activity started by identify student own problem and using win-win problem solving
- Student manage their own behavior

However, the result from the observation we have done shows that the classroom management in 7 Chieftain only fulfil 2 out of 7 aspects. The two aspects are the learning activity including the presentation by the instruction and The learning activity including individual sharing and skill building activities (Through QnA session).

CONCLUSION

According to the observation we have done in class 7 Chieftain, all aspects of assertive discipline model can be found in our observation result assertive discipline model, for Logical Consequences model only fulfil 2 out of 8 aspects, and for Teacher Effectiveness Training model only fulfil 2 out of 8 aspects. Then we came into conclusion that the science teaching-learning activity with topic Global Warming is using assertive discipline model as its classroom management model. Based on our observation, we assume that the implementation of this model increases the students' activeness during the class activity. However, we can't prove this assumption statistically because we're not able to do observation with the quantitative approach. A further study and observation are highly recommended to find out more about the impact of this model.

ACKNOWLEDGEMENTS

We would like to give our special thanks to Allah SWT, Mr Argit, the science teacher for 7 Chieftain SMP Tunas Unggul, Ms. Rismawati for helping us getting the permission to do observation, Mrs. Eliyawati and Mrs. Anna Permanasari for the guidance so we can finish this article.

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