CERTIFICATE

Ref: 26/UN34.13/TU/2021

This is to certify that

Antonius Tri Priantoro

has participated in

The 8th International Conference on Research, Implementation, and Education of Mathematics and Science
organized by Faculty of Mathematics and Natural Sciences, Universitas Negeri Yogyakarta
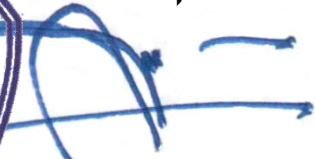on August, 27th– 28th, 2021

as a

Presenter

with the paper entitled :

Identification of Biological Learning Challenges and Strategies During the Emergency Response of The Covid-19 Pandemic

Yogyakarta, August 28th, 2021

Dean,

Prof. Dr. Ariswan, M.Si.
NIP.195909141988031003

Conference Chair,

Nur Aeni Ariyanti, M.P., M.Agr., Ph.D.
NIP. 198201272008122002

Booklet

8th ICRIEMS

The 8th International Conference on Research, Implementation, and Education of Mathematics and Science

"Transforming Science Literacy into A New Normal Digital World to Achieve Sustainable Development Goals"

August 27 - 28, 2021

- Mathematics & Mathematics Education
- Physics & Physics Education
- ✔ Biology & Biology Education
- Chemistry & Chemistry Education
- Natural Science Education & STEM

Faculty of Mathematics & Natural Sciences
Yogyakarta State University

WELCOME MESSAGE

Dear participants,

We are pleased to welcome you to the International Conference on Research, Implementation and Education of Mathematics and Sciences (ICRIEMS) 2021 in Yogyakarta Indonesia on August 27-28, 2021. The event was held at Universitas Negeri Yogyakarta (UNY) through virtual conferences due to the COVID-19 pandemic.

Universitas Negeri Yogyakarta is one of the qualified education state universities in Indonesia. There are seven faculties and one graduate program in UNY. This seminar is organized by the Faculty of Mathematics and Natural Sciences.

The theme of the conference is *"Transforming Science Literacy into A New Normal Digital World to Achieve Sustainable Development Goals".* The conference is expected to facilitate exchange of experiences on research and study in field of Mathematics, Sciences and Education. It is our hope that you will have well spent discussion as well as strengthening your network in this conference.

Hopefully, this book will provide you the guidance that you need during the conference. We genially welcome you to this conference.

Committe of 8th ICRIEMS 2021

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FOREWORDS
CHAIRMAN OF THE ORGANIZING COMMITTEE OF 8th ICRIEMS 2021

Assalamu'alaikum warahmatullahi wabarakatuh
May peace and God's blessing be upon you all

Dear respected speakers and participants on behalf of the Organizing Committee, we would like to extend our warmest welcome to the virtual conference of ICRIEMS 2021.

The 8th International Conference on Research, Implementation, and Education of Mathematics and Science (ICRIEMS) organized by the Faculty of Mathematics and Science, Universitas Negeri Yogyakarta, Indonesia is held today on August, 26–27, 2021. The theme of the 8th ICRIEMS is **"Transforming Science Literacy into A New Normal Digital World to Achieve Sustainable Development Goals".** A topic that is rapidly gaining traction in the field of mathematics, chemistry, physics, biology, mathematics education, chemistry education, physics education, biology education, and science education to address the challenges of the post-COVID era, or known as the new normal. The literacy knowledge in science (and education), gained from this conference, hopefully, is expected to help the community and government to overcome the impact of the pandemic, to adapt the new life forms, and transform it towards achieving sustainable development goals.

In addition, a conference is an event where prominent practitioners, researchers, students, and educators from all around the world are joining together to share their latest research and exchange ~~their~~ ideas. The conference will be a good ~~place~~ chance to promote or maintain not only national but also international collaboration and network among academics, researchers, and educators. This conference has accepted 96 papers from Indonesia, Malaysia, and Thailand. There are approximately 80 selected papers that will be published by AIP Publisher under the Scopus Index, while the rest of the papers will be published on Regular ICRIEMS Proceeding.

We owe special thanks to our keynote and invited speakers:
Keynote speakers:
1. Prof. Dr. Vincentas Lamanauskas – Vilnius University Šialiai Academy, Institute of Education, Lithuania
2. Dr. Ir. W. T. van Horssen – Electrical Engineering, Mathematics, and Computer Science, Delft Institute of Applied Mathematics
3. Dr. Syarif Riyadi – Energi Academy Indonesia (ECADIN)
4. Prof. Dr. Paidi – Faculty of Mathematics and Natural Sciences, Universitas Negeri Yogyakarta, Indonesia

Invited speakers:
1. Dr. Sri Wahyuni, S. Pd., M.Pd. – Universitas Jember, Indonesia
2. dr. Dian Kesuma Pramudya Nurputra, Ph.D., M.Sc., Sp.A – Faculty of Medicine, Public Health and Nursing, Gadjah Mada University

Last but not least, we would like to express our deepest appreciation and gratitude to all presenters and participants who have been actively involved in this conference. We also thank our reviewers for their invaluable comments and suggestions. We wish you have a productive conference and hope you enjoy your time at 8th ICRIEMS 2021

Wassalamu'alaikum warahmatullahi wabarakatuh.
Yogyakarta, August 26th, 2021

Nur Aeni Ariyanti, Ph.D

FOREWORDS BY RECTOR OF UNIVERSITAS NEGERI YOGYAKARTA

Assalamualaikum warahmatulahi wabarakatuh
Bismillahirahmanirahim,

The honorable; all vice rectors, deans, heads of institutions, board members of Universitas Negeri Yogyakarta, especially Dean of Faculty of Mathematics and Natural Sciences and the committees.

Our distinguished guest, keynote speakers and invited speakers, and dear all participants, ladies and gentlemen.

It's an honor for me, to welcome you, to Universitas Negeri Yogyakarta, especially on joining, the 8th International Conference, on Research, Implementation, and Education of Mathematics and Science.

On behalf of Universitas Negeri Yogyakarta, **I would like to welcome you**, in this amazing event. **I hope, all of you enjoy, and have a wonderful experience** in this academic meeting**.**
 "Transforming Science Literacy, into A New Normal Digital World, to Achieve Sustainable Development Goals" is **our challenge and opportunity** to be more creative and innovative in the development of Science and Technology.

Once again, thank you for participating and organizing this conference
Wassalamualaikum warahmatulahi wabarakatuh

Yogyakarta, 23 August 2021
Rector of UNY

Sumaryanto

VIRTUAL CONFERENCE PROGRAM
THE 8th INTERNATIONAL CONFERENCE ON RESEARCH, IMPLEMENTATION & EDUCATION
OF MATHEMATICS AND SCIENCES (ICRIEMS) 2021
27-28 August 2021, Faculty of Mathematics and Natural Sciences,
UNIVERSITAS NEGERI YOGYAKARTA, INDONESIA

Friday, August 27, 2021

No	Time*	Program
1	08.30 - 09.00	Registration
2	09.00 - 09.30	Opening
		1. National Anthem
		2. Welcome Speech : Chairman of ICRIEMS 2021
		3. Opening Conference by Rector of UNY
3	09.30 - 11.00	Keynote Speech #1 : Prof. Dr. Paidi, M. Si. (Faculty of Mathematics and Natural Sciences, UNY)
4	11.00 – 13.00	Break
5	13.00 - 14.15	Keynote Speech #2 Dr. Syarif Riyadi (Energy Academy Indonesia (ECADIN), Supply Chain Defectivity Expert in Semiconductor Industry)
6	14.15 - 15.30	Keynote speech #3: Prof. Dr. Vincentas Lamanauskas (Vilnius University Siauliai Academy, Institute of Education, Lithuania)
7	15.30 - 16.45	Keynote speech #4: Dr. Ir. W.T. Van Horssen (Electrical Engineering, Mathematics and Computer Science Delft Institute of Applied Mathematics)
8	16.45 – 17.00	Closing of Day 1

Saturday, August 28, 2021

No	Time*	Program
1	08.00 - 08.15	Opening
2	08.15 - 09.45	Invited speakers #1 Dr. Dian Kesuma Pramudya Nurputra, Ph. D., M. Sc., Sp. A (Faculty of Medicine, Public Health, and Nursing, UGM)
3	09.15 - 10.15	Invited speakers #2 Dr. Sri Wahyuni, S. Pd., M. Pd. (Universitas Jember, Indonesia)
4	11.15 - 12.30	Break
5	12.30 - 15.30	Parallel Sessions
6	15.30 - 16.00	Closing Best presenter award

* Time is set in Western Indonesian Time (WIB)

LIST OF PARALLEL SPEAKERS

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Room : BIOLOGI
Moderator: Dr. Anggi Tyas Pratama

	Author(s)	Title
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B 2 **12.45-13.00**	Tutiek Rahayu	Determinant of Obesity in Female Adolescents of Yogyakarta Region
B 3 **13.00-13.15**	Ngadikun, Kuncoro Asih nugroho	A New Biomarker of Colorectal Cancer Patient After Chemotherapy
B 4 **13.15-13.30**	Desy Ayu Retnawidyaningrum	The Inventory Of Moss At The Nglanggeran Ancient Volcano Area, Gunung Kidul, Yogyakarta.
B 5 **13.30-13.45**	Tri Yahya Budiarso	Isolation and Biochemical Characterization of Enterobacter cloacae Isolates from Ready-to-eat Foods Using API 20E
B 6 **13.45-14.00**	Charis Amarantini, Vinsa Cantya Prakasita, Chrismelan Julianto Pesoa	The Sensitivity Profile of Lactic Acid Bacterial Isolate Antibiotics with Biopreservative Potential
B 7 **14.00-14.15**	Aditia Pramuda Sunandar	Evaluation of Inhibitory Activity of Salak Peel Extract and Lotion Formula on Trichophyton mentagrophytes
B 8 **14.15-14.30**	Paramita Cahyaningrum Kuswandi, Tutiek Rahayu	Pedigree Analysis Of Obesity In Families Of Young Women In Yogyakarta

LIST OF PARALLEL SPEAKERS

BIOLOGY EDUCATION - DAY 2 (August 28, 2021)
Room : BIO EDU
Moderator: Rizqa Devi Anaziva, M.Pd.

	Author(s)	Title
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BE 2 **12.45-13.00**	Triatmanto	The Potential Of Moss Diversity At The Nglanggeran Ancient Volcano Area, Gunung Kidul, Yogyakarta, For Biology Learning Resources
BE 3 **13.00-13.15**	Nurul Azizah	The Effectiveness of Blended Learning with Problem Based Learning-Group Investigation (PBL-GI) Model on Students' Critical Thinking and Problem-Solving Ability in Senior High School
BE 4 **13.15-13.30**	Aini Sahira	Implementation of the 7E Learning Cycle with Mind Mapping Based on Blended Learning to Improve Students' Concept Understanding
BE 5 **13.30-13.45**	Kintan Limiansi	Self-Efficacy in Online Learning during The Covid-19 Pandemic: Modification and Implementation Instrument for Biology Education Department Students
BE 6 **13.45-14.00**	Vinasti Fatonah	Literature Review: Evaluation of Learning Success by Implementing Curriculum 2013
BE 7 **14.00-14.15**	Zuchdiawati Luthfi Utami	The Antecedents and Consequences of Personal Reputation: An Agenda for Future Research
BE 8 **14.15-14.30**	Wiwi Rahayu Ningsih	STEM-Based Chemistry Learning in a Vocational Context: a Study of Students' Chemical Literacy
BE 9 **14.30-14.45**	Rika Istiqomah	Development of STEAM-Based Student Worksheets to Improve Students' Creative Thinking Skills in The Eleventh Grade
BE 10 **14.45 – 15.00**	Farid Kuswantoro	Report on Bali Botanic Garden Seed Bank education program
BE 11 **15.00 -15.15**	Antonius Tri Priantoro	Identification of Biological Learning Challenges and Strategies During the Emergency Response of The Covid-19 Pandemic
BE 12 **15.15-15.30**	Theophile Niyonsaba	Disparity in Knowledge, Information Sources, and Attitude on COVID-19 as a Socio-Scientific Issue among Biology Students: A Case of Rohero Campus Students in Bujumbura

KEYNOTE SPEAKERS' ABSTRACTS

Keynote Speaker #1

Reorientation of Biology Teaching and Learning Process in the New Normal Era

Paidi Hw.
Biology Education Department, State University of Yogyakarta

The Covid-19 pandemic has been going on for more than a year and a half, however there are still many students who have difficulties in online learning especially in learning biology. Students have problems in mastering biological subject matter, following procedures, and gaining scientific process skills. They even difficult to learn together and consult their learning difficulties.

Teachers' difficulties in preparing and organizing the biological learning objects and activities in the era of Pandemic Covid-19 is very likely affecting students' success in improving their scientific skills. Biology teachers need to be assisted in reorienting the form of teaching and learning activities that allow students to develop all domains of their competence. Hence, biology teachers need to be supported to discover feasible and relevant various objects and learning activities.

Biology education experts suggest that the use of objects from surrounding environment, ICT-based media, simulations, procedural knowledges available on the internet become biological learning objects. These objects are very feasible to be used for biology learning activities in observation, measurement, classification, and other scientific processes. These are also relevant for individual project activities and simple experiments. Biology teachers are then challenged to reorient how to design and manage biology teaching and learning activities using the objects and activities through blended learning in order to help students developing their knowledge and scientific skills.

Keywords: scientific skills, blended learning.

KEYNOTE SPEAKERS' ABSTRACTS

Keynote Speaker #2

Semiconductor: the Building Blocks of Digital World

Syarif Riyadi
Co-founder Energy Academy Indonesia

Digital technology is a signature of modern life, notably in the pandemic era. Digitalization facilitates a more efficient, productive, and sustainable life. More importantly, in the energy sector, next to decarbonization and decentralization, digitalization plays an important role. The current digital world could be realized by the advances in semiconductor technology. Common knowledge on semiconductor materials and manufacturing will be described in the talk. Next to that, applications & developments of semiconductor chips will also be explained.

KEYNOTE SPEAKERS' ABSTRACTS

Keynote Speaker #3

ONLINE/DISTANCE LECTURES IN UNIVERSITY STUDIES: ISSUES THAT MATTERS

Vincentas Lamanauskas
Vilnius University Šiauliai Academy, Lithuania
E-mail: vincentas.lamanauskas@sa.vu.lt

It is obvious that with the development of the internet and related technologies, the attitude towards teaching and learning, and studies has radically changed. The main principle of distance learning and/or university studies is the use of virtual space for the interaction of teachers and students (lecturers and students).

The process of distance learning and its evaluation during the COVID-19 pandemic is a particularly relevant object of scientific research. Analysing the accumulated experience, we can not only evaluate the situation of distance learning in Lithuanian higher institutions during the pandemic, but also by analysing the challenges posed by distance learning and opening new opportunities, to look for the directions for improving distance learning.

We are talking about distance learning (lectures in the broadest sense) in the pandemic situation. The study process prior to the Covid-19 pandemic proceeded in a usual way (face-to-face study mode). Due to the pandemic, study activities were adapted to remote modality, conducting lectures at a distance. Obviously, as in other parts of the world, this was done to guarantee the continuity of studies. For this, it was inevitably necessary to adapt the study modules in a short period of time, which were initially transferred personally to the distance learning practice. It is completely understandable that there is a fundamental difference between the already well-established form of distance learning and the pandemic transition to emergency remote study modality. Conventional distance modality has its own organisational form, certain conditions of implementation and peculiarities, which is undoubtedly much more professional than the implementation of distance learning in the conditions of the pandemic applying certain improvisation (without proper preparation – both students and lecturers).

In January-February 2021, a qualitative study was conducted, in which 158 students from three Lithuanian universities participated. Most of the respondents were students of social and humanitarian study programmes. Qualitative data obtained on the basis of open-ended questions were analysed using the method of quantitative content analysis, i.e., semantic subcategories and categories according to two main variables were distinguished: similarities between regular and distance lectures, and the positive and negative aspects of distance lectures.

It was found that certain similarities were characteristic of regular and distance lectures, and the positive aspects significantly outweighed the negative ones. While learning difficulty is the most important factor leading to a frustrating learning experience, fatigue has been found as the main cause of the stressful learning experience (Gorghiu et al., 2021). It can be stated that distance lectures have obvious advantages. Convenience of studying has been highlighted as a key advantage because students have better possibilities to combine studies

with work and personal needs; also, distance learning has led to financial savings, which is always relevant for students. Students value the flexibility of the studies i.e., notice lecturers' work and efforts ensuring the smoothness of the study process. Undoubtedly, certain shortcomings of distance lectures have been highlighted. It turned out that students feel the deterioration of physical and mental health, the negative effects of distance lectures on mental health are noticeable; spending a lot of time at computer screens, of course, also worsens physical health. Distance learning has deprived students of the opportunity to realise their social needs – students feel a lack of communication, have no possibilities to socialise, or these are very poor (Lamanauskas & Makarskaitė-Petkevičienė).

References

Gorghiu, G., Lamanauskas, V., Makarskaitė-Petkevičienė, Manea, V. I., & Pribeanu, C. (2021). Frustration and stress in the online education of university students from Lithuania and Romania. In *The 17th International Scientific Conference eLearning and Software for Education* (Bucharest, April 22-23, 2021). https://proceedings.elseconference.eu/index.php?r=site/index&year=2021&index=papers&vol=38&paper=b8389832c76665cfde47d4c4f55d93ae

Lamanauskas, V., & Makarskaitė-Petkevičienė, R. (2021). Distance lectures in university studies: Advantages, disadvantages, improvement. *Contemporary Educational Technology (CEDTECH)*, *13*(3), Article ep309. https://doi.org/10.30935/cedtech/10887

KEYNOTE SPEAKERS' ABSTRACTS

Keynote Speaker #4

On perturbation methods and its applicability in the engineering sciences

Wim T. van Horssen

Mathematics plays an important role in studying all kinds of engineering problems. In this presentation several perturbation methods and applications in engineering will be discussed. Special attention will be paid to the development of perturbation methods for those engineering problems which we studied in the last 20 years as well as recently. Our long-term research collaboration with scientists and PhD students from Indonesia, and their recent and active role in this research cooperation will be explained and illustrated

INVITED SPEAKERS' ABSTRACTS

Invited Speaker #1

Utilizing Evidence-Based-Medicine (EBM) Paradigm in the Digital WorldDuring COVID-19 Pandemic;

From Combating Fake News into Development of Artificial Intelligence

Dian Kesumapramudya Nurputra

Division of Neurology, Department of PediatricsGraduate Program of
Clinical Medicine Science
Faculty of Medicine, Public Health and Nursing, Universitas Gadjah Mada

COVID-19 pandemic since 2020 change most of our way of life. Increase of information, activities, and resources in our daily life through digital world are overwhelming. Health information and data, which areextensively widespread and highly regarded during this pandemic era, are important to be carefully read,interpreted and used so that benefits and usefulness are gained more than risks. Evidence-Based- Medicine (EBM) approach has been used for long in the medical field as proven tools to select and implement valid medical information into form of treatment or policy. However, such technique is well- trained only in some clinicians, scientists, and less known in most non-medical groups. As the result, less literacy on the health information is widely found in grass root, influencers, even in the level of policy maker, resulting in un-appropriate and slow decision, policy, attitudes and communication in handling thepandemic. Thus, in this era of fast digital information, implementation of a simplified EBM paradigm on medical data collection and transforming it into valid, easy-to-understand digital data may have potentialrole, leading into useful application for many purposes, eg. hoax filter in social media, health service, case management, research, big data building, statistical report, policy making and even artificial intelligent data base. GeNose C19 is an example of innovation utilizing artificial intelligent recognition for COVID-19detection on the basis of breath samples data, which were collected fast and massively using EBM approach.

INVITED SPEAKERS' ABSTRACTS

Invited Speaker #2

The Development of Articulate Storyline as Learning Media in Improving Students Critical Thinking Skills in Kepler's Laws Course

Sri Wahyuni[1*], Zainur Rasyid Ridlo[1], Dwi Nova Rina[1] [1]Departement of Science Education, University of Jember, Indonesia *Corresponding email: sriwahyuni.fkip@unej.ac.id

The purpose of this study was to develop a valid, practical, and effective articulate storyline as learning media. It could facilitate students' understanding of abstract material, or learning materials that could not be presented in class, to improve the critical thinking skills of junior high school students. Critical thinking is a process of the ability to solve problems based on good judgment and experiences in accordance with existing facts. Articulate storyline is an application that can insert files in images, graphics, sound, links, and videos in learning media. The research development design used was a ADDIE model which consists of five stages which include analysis, design, development, implementation, and evaluation. This study showed that the average validity test was 85.9% which very valid category. The results of practicality showed 85% with very practical achievement criteria. The effectiveness of articulate storyline based on N-gain (Normalized Gain) was 0.72 indicating high criteria. Based on the results of the validity, practicality, and effectiveness tests, it could be concluded that articulate storyline was appropriate to be used as one of the online teaching materials for junior high school students during the covid 19 pandemic.

Keywords : Articulate Storyline, Critical Thinking, Kepler's Law

PARALLEL SESSION – BIOLOGY

B1

The Identification of Plankton at Sundak Beach, Gunung Kidul, D.I. Yogyakarta

Yunita Fera Rahmawati [1, a)], Arum Surya Pratiwi[1,b)], An Nisa Kurniasari[1,c)], Muhammad Insan Fathin[1,d)], Abdullah Nashih Amin[1,e)]

[1]*Department of Biology Education, Yogyakarta State University, Indonesia*

[a)]*yunita.fr@uny.ac.id*
[a)]*arumsurya.2018@student.uny.ac.id*
[c)]*annisa.2018@student.uny.ac.id*
[d)]*muhammadinsan.2018@student.uny.ac.id*
[e)]*abdullah0675.2018@student.uny.ac.id*

Abstract. The presence of the plankton can be used as an indicator of clean water. It is because plankton could only live in clean waters. The species abundance of the plankton that can be found in the area is a main diet for other organisms, but it is also a major producer because of its ability to photosynthesise. One of the ecosystems where plankton could be found is in the marine ecosystem. Plankton can be found in the intertidal zone of the beach. This research was conducted during March 2021 at Sundak Beach, Gunungkidul, DI Yogyakarta. This study aims to identify plankton in the coastal area of Sundak Beach. Three stations were randomly selected based on distances, namely 5, 10 and 15 meters from the shoreline. Each station was carried out three times. Sampling used a plankton net with a diameter of 30 cm filtering 25 liters and observed under a microscope with a magnification of 400. Furthermore, plankton samples were identified in the microscopic laboratory, FMIPA UNY. From the sampling location, 6 classes of phytoplankton were found (Bacillariophyceae, Trebuxiophyceae, Chlorophyceae, Dinophyceae, Fragilariophyceae, Mediophyceae) and 2 classes of zooplankton (Hexanauplia and Monogononta). This research is a preliminary study to provide basic data that will be continued for further research.

B2

Determinant of Obeity in Female Adolescents of Yogyakarta Region

Tutiek Rahayu[1, a)], Tri Harjana[1, b)], and Kartika Ratna Pertiwi[1, c)]

Author Affiliations
[1]*Biology Education Department, Universitas Negeri Yogyakarta, Jalan Colombo No 1 Karangmalang Caturtunggal Depok Sleman Yogyakarta Indonesia 55281*

Author Emails
[a)] tutiek_rahayu@uny.ac.id
[b)]tri_harjana@uny.ac.id
[c)]kartika.pertiwi@uny.ac.id

Abstract. This study aimed to determine the consumption pattern and the relationship between macronutrient consumption and nutritional status in obese adolescent girls as well as the contribution of macronutrient consumption, anthropometric measures at birth and parental *body mass index* (BMI) to obesity in adolescent girls. This survey study targeted obese adolescent girl population in Yogyakarta region. Samples were taken using purposive sampling technique with criteria such as age (18-24 y.o.), obese (BMI≥18), healthy and not on a diet. Dependent variables were obesity in adolescent girl, and independent variables were macronutrient consumption patterns, anthropometric measures (birth weight) and parental BMI. The questionnaires were adapted from the Indonesian Ministry of Health's Nutri Survey application, including recall diet instrument and observation sheet to record eating habits, anthropometric measurement, and parental history. There were 36 subjects enrolled in this study with an average age, weight, height, and BMI of 20,5 y.o., 158cm, 73,4 and 29,34, respectively. Overall, the subjects' ratio of macronutrient consumption pattern is proportional, and their intake of carbohydrate, protein and fat was in accordance with the concept of balanced nutrition. In this study, we found there is no relationship between macronutrient consumption pattern and BMI in obese adolescent girls. Also, the contribution of macronutrient consumption patterns, birth weight, and parental BMI to obese female adolescent was quite small, showing the numbers of 0.0020, 1.2740, and 0.0780, respectively. Among those three parameters, birth weight appeared to be the most determinant of obesity in adolescent girls of Yogyakarta region. Keywords: obesity, female, weight, nutrition, BMI

B 3

A New Biomarker of Colorectal Cancer Patient After Chemotherapy

Ngadikun[1, a)], Untung Widodo[2], Agus Barmawi[3], Ahmad Hamim Sadewa[1], Kuncoro Asih Nugroho[4], Metamalik Pasala[1]

Author Affiliations
[1]*Department of Biochemistry, Faculty of Medicine Gadjah Mada University, Sleman District, Special Region of Yogyakarta, 55281, Republic of Indonesia.*
[2]*Department of Anesthesia and Intensive Care, Faculty of Medicine Gadjah Mada University, Sleman District, Special Region of Yogyakarta, 55281, Republic of Indonesia.*
[3]*Department of Surgery, Faculty of Medicine Gadjah Mada University, Sleman District, Special Region of Yogyakarta, 55281, Republic of Indonesia.*
[4]*Department of Physics Education, Faculty of Mathematics and Natural Sciences Yogyakarta State University, Sleman District, Special Region of Yogyakarta, 55281, Republic of Indonesia.*

[a)] Corresponding author: ngadikun.1960@ugm.ac.id

Abstract. Colorectal cancer (CRC) is the third most common cancer in men and the second in women worldwide. To determine a biomarker for CRC, a new spectrophotometric method has been being developed. This study aims to investigate the pattern of EDTA-blood absorbance in CRC patients. One ml blood was collected from 52 subjects by venipuncture, which then drawn into EDTA tubes for spectrophotometry analysis. The differences of the parameters of EDTA-blood absorbance between two groups based on energetics of non-biological systems (ENBS) and energetics of biological systems (EBS) approach were tested by the t-test. The statistical significance of $p<0.01$ was used to evaluate the difference. The receiver operating characteristic (ROC) curves were applied to evaluate the effect of biomarkers on absorbance pattern. The t-test results indicate that the significant difference was observed between CRC patients and healthy controls only in parameter-1 of six parameters based on the ENBS approach. However, there were significant differences in all parameters based on the EBS approach. It was concluded that parameters of the pattern of EDTA-blood absorbance based on the EBS approach can be used to identify new biomarkers of CRC.

B4

The Inventory Of Moss At The Nglanggeran Ancient Volcano Area, Gunung Kidul, Yogyakarta.

Desy Ayu Retnawidyaningrum[1,a)], Emi Wulandari[2,b)] ; Triatmanto[3,c)]

1,2 Student of Biology Education Study Program, Faculty of Mathematics and Natural Sciences, Yogyakarta State University;
3 Lecturer of Biology Education Study Program, Faculty of Mathematics and Natural Sciences, Yogyakarta State University

[a)]*desyayu.2017@student.uny.ac.id*
[b)]*emiwulandari.2017@student.uny.ac.id*
[c)]*triatmanto@uny.ac.id*

Abstract. This paper aims to describe the results of the identification and inventory of moss species at the Nglanggeran Ancient Volcano area, Patuk, Gunungkidul. This research is an observational qualitative research by collecting and identifying all mosses found at the Nglanggeran Ancient Volcano (AV) area. The sampling technique is the explore method, following the tracking path in the Nglanggeran AV, by taking in/accidental sampling. Every moss found was identified and photo-documented. Then the samples were taken for microscopic observation of its taxonomic features in the laboratory. Microscopic observations were carried out on the laboratory of the Department of Biology Education, Faculty of Mathematics and Sciences, Yogyakarta State University. The research was conducted from March to May 2021. The results indicate that there are 23 species of mosses. From those species, there are 2 species of Marchantiopsida, 2 species of Jungermanniopsida, 1 species of Anthocerotopsida, and 18 species of Bryopsida. In addition, there were 9 types of mosses identified up to the genus level and 14 types of mosses identified up to the species level.
Keywords: *Moss Inventory, Nglanggeran Ancient Volcano*

B5

Isolation and Biochemical Characterization of *Enterobacter cloacae* Isolates from Ready-to-eat Foods Using API 20E

Tri Yahya Budiarso[1,a)], Charis Amarantini [1,b)], Ratih Restiani [1,c)], Putri Karina Sitanggang [2,d)], Eunike Marganingrum Andriani Samodra [2,e)], Aditya Virany Mamoto [2,f)], Yesica Puteri [2,g)], Virgin Kindangen [2,h)], Angelia Wattimury [2,i)], and Intan Puteri Yokebeth [2,j)]

[1]Faculty of Biotechnology, Universitas Kristen Duta Wacana Yogyakarta, Indonesia

[2]Undergraduate Faculty of Biotechnology, Universitas Kristen Duta Wacana Yogyakarta, Indonesia

[a)]*Corresponding author : yahya@staff.ukdw.ac.id*
[b)]*charis@staff.ukdw.ac.id*, [c)]*ratih.restiani@staff.ukdw.ac.id*, [d)]*sitanggangputri12@gmail.com*,
[e)]eunikeandriani0708@gmail.com, [f)]*adityamamoto@gmail.com*, [g)]yesicaputeri9@gmail.com,
[h)]virginkindangen@gmail.com, [i)]angelia.wattimury@yahoo.com, [j)]intanputri_ip68@yahoo.com

Abstract. Ready-to-eat foods have become a global concern because they are a source of income for low and middle-income people. Also, they constitute the main food for students and lower to middle-level workers. However, a lack of knowledge about good food processing practices results in microbial contamination that interferes with human health. *Enterobacter Cloacae* is one of the most common bacterial contaminants found in ready-to-eat foods in many countries. Therefore, the purpose of this research is to isolate and biochemically identify *E. cloacae* using the API 20E kit on ready-to-eat foods in Yogyakarta city and its surroundings. Subsequently, 115 samples of 10 types of food were collected from various locations for isolation and identification of the contaminant. The results showed that 7 foods were found to be contaminated, with processed egg products having the highest contamination level at 40%. This was followed by various snacks and packaged dairy products at 30% each, then skewered meatballs, and other processed food products, at 20% and 10%, respectively. Meanwhile, dumplings, potato products, and assorted iced drinks were not contaminated by the bacteria.

B6

The Sensitivity Profile of Lactic Acid Bacterial Isolate Antibiotics with Biopreservative Potential

Charis Amarantini[1, a)], Vinsa Cantya Prakasita[1, b)], Chrismelan Julia Pesoa[2, c)], Gracia Baquita Brundi Sarmento Madeira[2, d)] and Viona Ch Salakory[2, e)]

[1]*Biology Department Faculty of Biotechnology Universitas Kristen Duta Wacana jl dr Wahidin Sudirohusodo 5-25 Yogyakarta Indonesia. 55224*
[2]*Undergraduate Program Biology Department Faculty of Biotechnology Universitas Kristen Duta Wacana jl dr Wahidin Sudirohusodo 5-25 Yogyakarta Indonesia. 55224*

[a)] *Corresponding author: charis@staff.ukdw.ac.id*
[b)] *vinsa.cantya.p@staff.ukdw.ac.id*, [c)] *pesoagogali24@gmail.com*, [d)] *graciabaquitasarmad@gmail.com*, [e)] *vionasalakory@gmail.com*

Abstract. Lactic acid bacteria (LAB) that are to be utilized as probiotic or biopreservative need to be declared free of antibiotic resistance to avoid the transfer of resistance genes to opportunistic pathogens in the intestine. For safety reasons, it is important to know the antibiotic resistance profile of LAB isolates, with biopreservative potential. The sensitivity test of LAB isolates was carried out was on the antibiotics based on the Bauer Kurby disk method. The inhibition zones were expressed as S (sensitive), I (intermediate), and R (resistant) based on the Clinical Laboratory Standards Institute Performance Standards for Antimicrobial Disk Susceptibility (CLSI, 2017). Furthermore, antibiotic-resistant gene was detected based on the PCR method using primers and procedures for gentamicin [Aac (6')-aph(2") 220 bp; Aph(3')-IIIa 292 bp; Ant(6)597 bp], vancomycin [VanE 513 bp; VanX 454 bp], and trimethoprim [dfrA 474 bp; dfrD 175 bp]. The results showed that the tested LAB isolates were multiresistant to antibiotics and resistant to gentamicin and amikacin. In addition, a LAB isolate of peda fish (strain Pr4.3L) was resistant to the antibiotics gentamicin and trimethoprim, nevertheless, sensitivity to vancomycin was detected to possess the target amplicon of the vanX gene (454 bp). Others have no target amplicon towards gentamicin, vancomycin, and trimethoprim. Therefore, related to the safety of using LAB as a biopreservative, appropriate tests are still needed to identify the presence of antibiotic resistance gene that is horizontally transfered to other microorganisms.

B7

Evaluation of Inhibitory Activity of Salak Peel Extract and Lotion Formula on *Trichophyton mentagrophytes*

Aditia Pramudia Sunandar[1, a] Asmi Aris[1, b] Rahmanisa Laila Fitri[1, c]

1Universitas Negeri Yogyakarta, Jl. Colombo No. 1 Karangmalang, Yogyakarta, Indonesia. 55281.

[a] Corresponding author: aditiapramudia.2017@student.uny.ac.id
[b]asmiaris.2017@student.uny.ac.id
[c]rahmanisa3302fmipa2016@student.uny.ac.id

Abstract. *Tinea unguium* is a disease caused by fungus named *Trichophyton rubrum* and *Trichophyton mentagrophytes*. This disease may not cause mortality, but it is a clinically significant disorder that is naturally chronic and difficult to treat. The one of material that can be antifungal agent is salak peel. Salak peel has flavonoids compound that can be antifungal and antibacterial. The type of this research is a laboratory experimental research with factorial treatment. The result of experiment testing is both extracts and lotions of Salak (*Salacca zalacca*) peel can inhibit the growth of *T. mentagrophytes.* The biggest inhibition was found in 100% concentration extract in salak peel lotion with an average inhibition zone of 11.1284 mm and a maximum inhibition zone of 23.13 mm.

B8

Pedigree Analysis Of Obesity In Families Of Young Women In Yogyakarta

Paramita C. Kuswandi[1,a)], Tutiek Rahayu[1]

[1] Department of Biology Education, Faculty of Mathematics and Natural Science,
Yogyakarta State University, Indonesia
[a)] Corresponding author: paramita@uny.ac.id

Abstract. Obesity is a public health problem in the world. WHO estimates that 2.8 million people die from obesity and overweight. The prevalence of obesity in adults aged >18 years in Indonesia, especially in Yogyakarta has increased from 2007-2018. Genetic is one of the factors contributing to obesity and has been known to be related to obesity in families. The aim of this research was to analyze the inheritance pattern of obesity in families of young women in Yogyakarta. This study was an observational research with a cross sectional design and purposive sampling was also used as the sampling method. The participantss in this research were 36 obese young women aged 15-24 years with BMI ≥ 25 in Yogyakarta. BMI data of the young women families were also collected.BMI data from three generations of the participantss' families were obtained to analyze the inheritance pattern of obesity. This research was carried out from August 2020 - January 2021. Pedigree diagrams are used to analyze the obesity inheritance pattern based on BMI data from each families. Analysis was undertaken using hypothesis or assumptions for several modes of inheritance usually found for human traits. The results showed that the inheritance pattern of obesity in this research was 50% autosomal dominant and 44.44 % autosomal recessive. In conclusion, obesity in the families of young women in Yogyakarta follow an autosomal dominance and recessive inheritance pattern.

Keywords: *obesity, genetic, BMI, young women, family.*

PARALLEL SESSION – BIOLOGY EDUCATION

BE1

Development of Biology Practicum Guide Based On Android Application Using Adobe Flash Professional CS6 For Senior High School Level XI

Florentina Budi Ardiani[1, a)] and Antonius Tri Priantoro [1, b)]

[1] *Biology Education Study Program, Sanata Dharma University*
[a)] *Corresponding author: florentinabudi27@gmail.com*
[b)] *trie003@gmail.com*

Abstract. The balance of affective, psychomotor, and cognitive in K13 can be achieved through practicum. Needs analysis in 4 schools in DIY shows that Biology teachers are still using conventional practicum guides that have been made since several generations ago and have not been updated for various reasons so that media updates are needed to facilitate the implementation of practicum and understanding the material. This study aims to develop and determine the quality of the Android-based Biology practicum guide product made using Adobe Flash Professional CS6. This study uses research and development methods with 5 steps, namely (1) potential and problems, (2) data collection, (3) product design, (4) product validation, and (5) product improvement. The initial product is in the form of a 24 MB apk file consisting of an introductory menu, rules, introduction to laboratory equipment, practicum guides, bibliography, and profiles. Application products can be installed on Android OS smartphones at least version 5. Users also need to install Adobe Air as the product installer. This product was assessed by 4 validators, namely media experts, material experts, and 2 high school biology teachers in DIY with an average validation score of 3.7. The results of this score fall into the "very good" category and deserve to be tested after improvements based on validator comments and suggestions which include menu additions, language writing, image changes, transition animations, title design, and page switching consistency.

Keywords: research and development, android application, biology practicum guide for class XI SMA

BE2

The Potential Of Moss Diversity At The Nglanggeran Ancient Volcano Area, Gunung Kidul, Yogyakarta, For Biology Learning Resources

Triatmanto [1,a] Desy Ayu Retnawidyaningrum[2,b]; Emi Wulandari[3,c]

[1]*Lecturer of Biology Education Study Program, Faculty of Mathematics and Natural Sciences, Yogyakarta State University*
[2,3] *Student of Biology Education Study Program, Faculty of Mathematics and Natural Sciences, Yogyakarta State University;*

[a]triatmanto@uny.ac.id
[b]desyayu.2017@student.uny.ac.id
[c]emiwulandari.2017@student.uny.ac.id

Abstract. This article aims to describe the potential of moss diversity in the area of Ancient Volcanoes (AV) Nglanggeran, Patuk, Gunungkidul, as biology learning resources. This article is a study of the results of research on the inventory of moss species in Ngalnggeran AV, Patuk, Gunungkidul, Yogyakarta by Desy Ayu Retnawidyaningrum; Emi Wulandari, and Triatmanto. This study is a logical analysis based on the findings of scientific processes and products in the research, related to the demands of Basic Competencies in the 2013 high school/MA level curriculum, as well as the structure of biology according to BSCS. The study was carried out by 1). Identification of scientific products and processes contained in the research, 2) selection of science processes and products based on the curricular needs of Biology subjects and/or courses. 3) Structuring processes and products of science based on the unanimity of the concept, and 4) supplementation of processes and scientific products that have not been found/found in research. The results of the study show that research has the potential as a source of learning at the SMA/MA level at KD 3.1 on Biology and Scientific Methods; KD 3.2 and 4.2 on Biodiversity; KD 3.3 and 4.3 on the Principles and Basics of Classification, KD 3.8. and 4.8 regarding the grouping of plants into Divisio, and KD 3.10 & 4.10 regarding ecosystem components and their interactions.

Keywords: Diversity of mosses, Nglanggeran AV, biological learning resources,

BE 3

The Effectiveness of Blended Learning with Problem Based Learning-Group Investigation (PBL-GI) Model on Students' Critical Thinking and Problem-Solving Ability in Senior High School

N. Azizah[1, a] and S. Aloysius[2]

[1]Master of Biology Education, Faculty of Mathematics and Natural Sciences, Universitas Negeri Yogyakarta, Indonesia
[2]Departement of Biology Education, Faculty of Mathematics and Natural Sciences, Universitas Negeri Yogyakarta, Indonesia
Author Emails

[a] Corresponding author: nurulazizah.2019@student.uny.ac.id

Abstract. This research aims at investigating the effectiveness of blended Learning with Problem Based Learning-Group Investigation (PBL-GI) model on students' critical thinking and problem-solving ability in the biology learning. The research adopted a quasi-experimental design notably pretest-posttest nonequivalent control group design. Population of the research included 107 student of grade X MIPA of the State Senior High School 1 of Pajangan. The population was taken by using target population and 70 students were determined as the sample by using random sampling technique. Data collection techniques used were the method to see the result of students' critical thinking and problem-solving ability and correlation between the critical thinking and problem-solving ability. This research adopted critical thinking and problem-solving tests that were administered before and after the learning process took place. The instrument to measure critical thinking and problem-solving ability tests was a test consisting of 10 items. The instrument was initially validated the expert lecture (*expert judgment*) to obtain its content validity and empiric validity. Subsequently, empirical validity and instrument reliability were done by using *Alpha Cronbach*. The normality test employed was *Kolmogorov-Smirnov* test and the homogeneity test used was the *homogeneity test of data variance*. Hypothesis testing the data of critical thinking skill dan problem solving were analyzed by using *independent sample t-test* at the significance level of (α) = 0,05. Next, correlation between the critical thinking and problem-solving ability were analyzed by using *Pearson Correlation* at the significance level of (α)=0,05 and Pearson correlation value>r table then it is said that there is a correlation/relationship. The result of the study are: (1) this study suggests that blended learning with PBL-GI model was effective in developing the students' critical thinking because the result showed the significance value of 0,012 < 0,05 and students' problem-solving ability showed the significance value of 0.036<0,05; (2) there is positive correlation/relationship between critical thinking and problem-solving ability because the result showed the significance value of 0.004<0.05 and Pearson Correlation value>r table (0.480>0.3610).

BE4

Implementation of the 7E Learning Cycle with Mind Mapping Based on Blended Learning to Improve Students' Concept Understanding

Aini Sahira[1, a)] and Heru Nurcahyo[2, b)]

[1]*Master of Biology Education Study Program, Faculty of Mathematics and Natural Science, Yogyakarta State University, Yogyakarta 55281, Indonesia*

[2] *Biology Department, Faculty of Mathematics and Natural Science, Yogyakarta State University, Jl. Colombo No. 1, Yogyakarta 55281, Indonesia*

[a)] Corresponding author: *ainisahira.2019@student.uny.ac.id*
[b)]*heru_nurcahyo@uny.ac.id*

Abstract. The purpose of this study was to determine the increase in the ability to understand concepts after the implementation of learning with the 7E learning cycle with mind mapping based on blended learning on the nervous system material. The experimental class is XI IPA 1 and the control class is XI IPA 2. The design of this research is True Experimental Design type pretest-posttest control group design. The instrument consists of a conceptual understanding test. The data of this study were collected through a multiple-choice test consisting of 15 pre-test and post-test items. The data obtained were analyzed descriptively and used N-gain to determine the increase in student's conceptual understanding. The results showed that the understanding of students' concepts in learning the 7E learning cycle model with mind mapping based on blended learning was better than 5M learning with an N-gain value of 0.46 in the medium category.

BE5

Self-Efficacy in Online Learning during The Covid-19 Pandemic: Modification and Implementation Instrument for Biology Education Department Students

Kintan Limiansi[1,a)], Anggi Tias Pratama [2,b)], Rizqa Devi Anazifa [3,b)]

Author Affiliations

[1]*Biology Education Study Program, Faculty of Mathematics and Sciences, Yogyakarta State University, Yogyakarta, Indonesia*

[2]*Biology Education Study Program, Faculty of Mathematics and Sciences, Yogyakarta State University, Yogyakarta, Indonesia*

[3]*Biology Education Study Program, Faculty of Mathematics and Sciences, Yogyakarta State University, Yogyakarta, Indonesia*

Author Emails

[a)] *Corresponding author:* kintan.limiansi@uny.ac.id

[b)]anggitias@uny.ac.id

[c)]rizqa1992@uny.ac.id

Abstract. This study aims to modify the online learning self-efficacy scale (OLSES) developed by Zimmerman and Kulikowich (2016) and apply it to see the self-efficacy profile of students of the Department of Biology Education, Yogyakarta State University in online learning during the Covid-19 pandemic. This research approach is quantitative with a survey method conducted by giving OLSES questionnaires to 84 students from the Department of Biology Education. The OLSES instrument consists of 19 valid questions (Pearson Product Moment value of all items > .215; $p < .05$) and reliable (Cronbach's Alpha value .902) to be used as a self-efficacy scale in online learning. The results showed that 1 item had a median value of 3, item about the use of online libraries, but the other median items were 4 and 5, that is indicating a high self-efficacy profile of students majoring in biology education. Inferential analysis shows that students' self-efficacy online learning during the Covid-19 pandemic is not influenced by gender (p-value is .989), grade level (p-value is .756), and student study programs (p-value is .725).

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BE6

The Development of Angiosperm Anatomical Atlas as Laboratory Identification Reference in Plant Tissue Structure and Function for Senior High School Students Grade XIth

Vinasti Fatonah[1, a)], Ratnawati [1, b)]

[1]*Yogyakarta State University, Colombo Street 1, Karang Malang, Caturtunggal, Depok, Sleman, Yogyakarta, 55281, Indonesia.*

[a)] Corresponding author: vinasti.fth@gmail.com
[b)] ratnawati_bio@uny.ac.id

Abstract. This study aims to determine the feasibility of the Angiosperm Anatomical Atlas as the identification guidelines in laboratory activity of structures and functions of plant tissues for grade 11 of high school based on the result of experts' assessments and readability tests of biology teachers and students. This study is a Research and Development (R&D) research with ADDIE (Analysis, Design, Development, Implementation, Evaluation) as the model (Robert Maribe Branch, 2009) which is limited to the stage of ADD (Analysis, Design, Development). The subjects of the research are one material expert, one media expert, two high school biology teachers, and 30 Natural Science students of XIIth. The research object is the prototype of the Angiosperm Anatomical Atlas. The data collection was done using assessment instruments for a material expert, a media expert, biology teachers, and also students. The result of the study was analyzed qualitatively. The result of the study showed that all the Atlas assessment indicator which suitable with
the standard of BSNP have been fulfilled. Thus, it is concluded that Atlas has fulfilled the assessment indicator and feasible to be used as the learning media of laboratory activity.

BE7

Improvement of Critical Thinking Skills through Implementation of Problem-solving Model in Biology

Zuchdiawati Luthfi Utami[a] and Heru Nurcahyo

Departement of Biology Education, Faculty of Mathematics and Sciences, Universitas Negeri Yogyakarta, Yogyakarta 55281, Indonesia

[a] *Corresponding author: zuchdia.utami@gmail.com*

Abstract. Nowadays, 21st century education required university students to have higher-order thinking skill, such as critical thinking. One of the effort to improve students' critical thinking skills, is by implementing problem-solving model in Biology courses. This study aims to describe the difference in students' critical thinking skills using problem solving model and classical model (lecture method). This study used quasi-experimental with Pretest-Posttest Nonequivalent Control Group Design. The population of this study was the second-year biology education study program students of Yogyakarta State University, Indonesia. The samples were drawn by a probability sampling technique. The research subject were two classes of second-year biology education study program students on 2019/2020 academic year at Yogyakarta State University (YSU), Indonesia. The number of students in the control and experimental class were 28 students, respectively. Students in the control class were taught by a classical model (lecture method), while students in the experimental class were taught by a Problem-solving model. The data on students' critical thinking skills were collected by test. The data were analyzed using ANCOVA and the percentage average of N-gain score. The result of this study showed that there were significant differences ($p<0,05$) in students' critical thinking skills taught with Problem-solving (73%, high category) and classical model (lecture method) (48%, moderate category). It proves that problem solving model is able to improve students' thinking skills effectively.

BE8

PHOTOSYNTHESIS AND LEVELS OF Pb (*Syzygium oleana*) IN YOGYAKARTA AS BIOLOGY SOURCES

Wiwi Rahayu Ningsih[1,a)], I Gusti Putu Suryadarama[2,b)] and Risanti Dhaniaputri[3,c)]

[1]*Graduate Programme of Biology Education, Faculty of Mathematics and Natural Sciences, Universitas Negeri Yogyakarta, Indonesia*
[2]*Biology Education Departement, Faculty of Mathematics and Natural Sciences, Universitas Negeri Yogyakarta, Indonesia*
[3]*Biology Education Departement, Faculty of Mathematics and Natural Sciences, Universitas Ahmad Dahlan, Indonesia*
[a)] *wiwirahayu20@gmail.com*

Abstrack. Yogyakarta Special Region has a high level of plant diversity, and needs to be optimized as a learning resource. The purpose of this study is to analyze the rate of photosynthesis and pb content on red shoot leaves as a source of learning on biological material about high school metabolism class XII. Biology requires a reference to teach metabolic materials based on the influence of internal and external factors. This research was conducted in Cik Di Tiro Street Area of Yogyakarta. Design research using exploration. The results of exploration obtained differences in the rate of photosynthesis and content of Pb. The rate of photosynthesis and absorption of Pb on red shoot leaves is lower than in green because it is influenced by internal and external factors. This research can reveal the potential of plant diversity in the Special Region of Yogyakarta and analyzed the potential of learning resources. The process and results of this study have the potential to be a source of learning biology high school class XII on metabolism materials that refer to the 2013 curriculum.
Keywords: photosynthesis, Pb content, red shoots, learning resources

BE 9

The Effectiveness of The VAK (Visualization, Auditory, and Kinesthetic) Learning Model on Motivation and Learning Outcomes of Biology on the Reproductive System

Rika Istiqomah[1, a)] and I Gusti Putu Suryadarma[2, b)]

[1]*Graduate Programme of Biology Education, Faculty of Mathematics and Natural Sciences, Universitas Negeri Yogyakarta, Indonesia*
[2]*Biology Education Department, Faculty of Mathematics and Natural Sciences, Universitas Negeri Yogyakarta, Indonesia*

[a)] rika.istiqomah96@gmail.com

Abstract. This This research aims to find out the effectiveness of the VAK (Visualization, Auditory, and Kinesthetic) learning model on: (1) student's learning motivation, and (2) student's cognitive learning outcomes. This research is a quantitative research using a quasi-experimental design. Data analysis, both motivational data and learning outcomes data, uses statistical test of the Mann-Whitney U Test. The results show that: (1) The VAK (Visualization, Auditory, and Kinesthetic) learning model influences student's learning motivation. It is indicated by the results of the Mann-Whitney U Test with a significance of 0,00; (2) The VAK (Visualization, Auditory, and Kinesthetic) learning model influences student's cognitive learning outcomes. It is indicated by the results of the Mann-Whitney U Test with a significance of 0,00.

Keywords: VAK models, Motivation, and Learning Outcomes

BE 10

Report on Bali Botanic Garden Seed Bank Education Program

Farid Kuswantoro[1, 2,a)] and Dewi Lestari[1,3,b)]

Author Affiliations
[1]*Reaserch Center for Plant Conservation and Botanic Garden, Indonesian Institute of Sciences*
[2]*Bali Botanic Garden, Indonesian Institute of Sciences, Candikuning, Tabanan, Bali-Indonesia*
[3]*Purwodadi Botanic Garden, Indonesian Institute of Sciences, Jl. Raya Surabaya - Malang Km. 65, Pasuruan, East Java-Indonesia.*

Author Emails
[a)]*Corresponding author: faridkuswantoro@ymail.com*
[b)]*itisme.dewi@gmail.com*

Abstract. Since its initiation, the Bali Botanic Garden (BBG) Seed Bank as an *ex-situ* conservation facility is conducted seed conservation and research programs. BBG Seed Bank also engages with education programs as a part and to support the botanic garden roles in biodiversity education. This study aims to review BBG Seed Bank participation in botanic education and discuss the challenges and opportunities that need to be addressed in the future. During this study available data regarding BBG Seed Bank education program is sourced and descriptively analyzed. Resulted data shows that BBG Seed Bank is already engaged in numerous botanic education programs both for the academic and general public. However, improvement to overcome challenges such as the lack of staff quality and quantity, the limited facilities, various backgrounds of participants is essential to improve the education program. Digital and social media platforms should be utilized more intensively by the seed bank to enable its educational program to reach a wider audience.

BE 11

Identification of Biological Learning Challenges and Strategies During the Emergency Response of The Covid-19 Pandemic

Antonius Tri Priantoro[1]*; Ika Yuli Listyarini[1]; Luisa Diana Handoyo[1]; Retno Herrani Setyati Catarina[1]
[1]PS Pendidikan Biologi, FKIP, USD

trie003@usd.ac.id

Abstract. Quality education will be achieved if it is supported by a quality learning process. Therefore, teachers must understand teaching and learning strategies by implementing different teaching and learning strategies in different situations and conditions. During the Covid-19 pandemic period, it directly impacted the education system in Indonesia so that the learning process had to be done online (school from home), face-to-face classes had to turn into online classes with indirect interaction between teachers and students. This study aims to determine the challenges faced by the teachers and the learning strategies taken by the Biology / Science teachers in conducting online learning. The research was conducted through an online survey with SMP and SMA teachers in various provinces in Indonesia as respondents.

The results showed that the challenges (difficulties) faced by science / biology teachers in science / biology learning in the emergency response situation of Covid-19 were different for each region and school, but were generally related to the availability of a stable internet network signal, resources for internet access (mobile phones and or laptops), the ability to use information and communication technology facilities (ICT, hardware and software), and school support (WiFi, trainings, and online learning facilities). Difficulties especially faced by teachers who have not fulfilled the availability of internet network access and the ability to use ICT facilities are relatively low, and lack of school support. Meanwhile teachers who could access the internet network well and had the ability to use ICT facilities and also received school support did not experience difficulties.

The learning strategies applied by science / biology teachers in teaching science / biology material in the Covid-19 emergency response situation were to modify the form of learning synchronously using video conferencing (Zoom, Google meet), WAG, discussion forums at LMS, Google Classroom and asyncronus with assignment submission via WAG, email, LMS, Google Classroom. In the learning process, the teacher used various media such as PPT, video, virtual lab and independent practicum with the equipment and materials around the students. In the evaluation process, many teachers used written test techniques using google forms, email, or online quizzes such as Quizziz. The things that were considered by the teacher in determining strategies for teaching science / biology in the emergency response situation of Covid-19 were the condition of students, ease of access, practicality, flexibility, effectiveness and conditions of internet connection as well as data / quota usage capacity.

Keywords: learning strategy, biology, e-learning, covid-19 pandemic

BE 12

Disparity in Knowledge, Information Sources, and Attitude on COVID-19 as a Socio-Scientific Issue among Biology Students: A Case of Rohero Campus Students in Bujumbura

Theophile Niyonsaba[1, a)] and Paidi [2, b)]

Authors Affiliations
Graduate School, Department of Biology Education,
Yogyakarta State University
Jl. Colombo Yogyakarta No.1, Karang Malang, Caturtunggal, Kec. Depok, Kabupaten Sleman, Daerah Istimewa Yogyakarta 55281

Author Emails
[a)] *Corresponding author: theosmatata@gmail.com*
[b)] *paidi@uny.ac.id*

Abstract- Public awareness of countries' leaders, and adherence to the hygienic measures plagued by the new pandemic play a major role in managing a crisis of this magnitude which is largely affected by knowledge, attitude, and information sources in young science students. Hence, the current study aimed to assess disparity in knowledge and attitude about COVID-19 at Rohero Campus in Burundi and determine where they sourced their information and compare between them based on their academic years. Using validated, structured instruments, the online questionnaire was conducted in March in which 416 (412 Biochemistry and four Biology) students voluntarily participated in data collection. Sociodemographic characteristics and source of information were also recorded. Students aged 21-25 years (55 %) were the major number of participants. Overall, over 85% showed good knowledge about the disease and the main source of their information was the internet and social media over 80% and mass media over 91%. Those in the second year had a higher number of participants and scored higher in very construct compared to other students from the first, third and fourth year. In conclusion, Biology students at the Rohero campus demonstrated adequate knowledge and possessed good attitudes toward the prevention and spreading of the pandemic.

Keywords: coronavirus, knowledge, awareness, attitude, information source, Biology students

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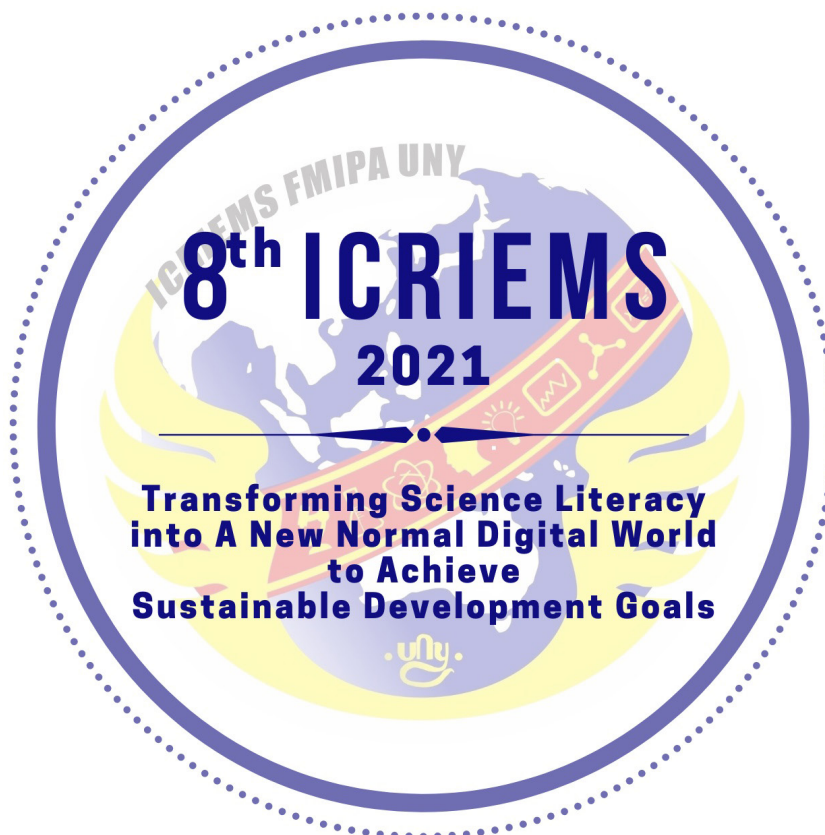
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Identification of Biological Learning Challenges and Strategies During the Emergency Response of The Covid-19 Pandemic

Antonius Tri Priantoro[a], Ika Yuli Listyarini, Luisa Diana Handoyo and Retno Herrani Setyati Catarina

PS Pendidikan Biologi, FKIP, Universitas Sanata Dharma

[a] Corresponding author: trie003@usd.ac.id

Abstract: Quality education will be achieved if it is supported by a quality learning process. Therefore, teachers must understand teaching and learning strategies by implementing different teaching and learning strategies in different situations and conditions. During the Covid-19 pandemic period, it directly impacted the education system in Indonesia so that the learning process had to be done online (school from home), face-to-face classes had to turn into online classes with indirect interaction between teachers and students. This study aims to determine the challenges faced by the teachers and the learning strategies taken by the Biology / Science teachers in conducting online learning. The research was conducted through an online survey with SMP and SMA teachers in various provinces in Indonesia as respondents.

The results showed that the challenges (difficulties) faced by science / biology teachers in science / biology learning in the emergency response situation of Covid-19 were different for each region and school, but were generally related to the availability of a stable internet network signal, resources for internet access (mobile phones and or laptops), the ability to use information and communication technology facilities (ICT, hardware and software), and school support (WiFi, trainings, and online learning facilities). Difficulties especially faced by teachers who have not fulfilled the availability of internet network access and the ability to use ICT facilities are relatively low, and lack of school support. Meanwhile teachers who could access the internet network well and had the ability to use ICT facilities and also received school support did not experience difficulties.

The learning strategies applied by science / biology teachers in teaching science / biology material in the Covid-19 emergency response situation were to modify the form of learning synchronously using video conferencing (Zoom, Google meet), WAG, discussion forums at LMS, Google Classroom and asyncronus with assignment submission via WAG, email, LMS, Google Classroom. In the learning process, the teacher used various media such as PPT, video, virtual lab and independent practicum with the equipment and materials around the students. In the evaluation process, many teachers used written test techniques using google forms, email, or online quizzes such as Quizziz. The things that were considered by the teacher in determining strategies for teaching science / biology in the emergency response situation of Covid-19 were the condition of students, ease of access, practicality, flexibility, effectiveness and conditions of internet connection as well as data / quota usage capacity.

INTRODUCTION

Background and Problems

Corona Virus Disease 19 (Covid-19) has become a world pandemic and has caused many changes in all areas of life for the world community. In response to the pandemic, the World Health Organization (WHO) published an international standard protocol for handling the Covid-19 virus outbreak, which includes the practice of self-isolation, physical distancing restrictions, personal hygiene, especially hands, and the use of masks. In this regard, the Government of Indonesia adopted the WHO international standard protocol which was adapted to the conditions of the Indonesian people through Perpu No. 1 Year 2020, Presidential Decree No. 11 of 2020, and Government

Regulation No. 21 of 2020. The Government Regulation contains 9 policies related to safeguarding the economic sector and one policy related to Large-Scale Social Restrictions (PSBB). Other policies include school and work holidays, restrictions on religious activities, and restrictions on activities in public places.

In his speech, the President of the Republic of Indonesia Joko Widodo urged people to start working from home, worship from home and learn from home. Responding to the president's appeal, various companies and offices as well as government and private agencies implemented the Work from Home (WFH) program. In the field of education, the Minister of Education and Culture issued Circular Number 36962 / MPK.A / HK / 2020 which recommends that all teaching and learning activities both at schools and college campuses use online or online methods as an effort to prevent development and development. the spread of Coronavirus disease (Covid-19). With the issuance of this circular, schools began to implement a home learning system, known as School from Home (SFH).

The application of the online learning from home (SFH) system / e-learning during the Covid-19 pandemic brought challenges and even difficulties for teachers, students and parents. Most schools and stakeholders do not yet have readiness to implement the online learning system. In science / biology learning, teachers face obstacles that are not easy to overcome immediately. This is because the science / biology learning material has characteristics that are very close to nature and everyday life, in which there are also practicum or observation activities. This will bring its own challenges for science and biology teachers. How will they teach Science / Biology material through online learning?

Purpose and Benefits

Based on the problems mentioned above, we conducted a survey to identify the challenges and strategies that science / biology teachers undertook during the Covid-19 emergency response. With this research, it is hoped that the difficulties and challenges faced by science / biology teachers in learning online systems can be seen during the Covid-19 pandemic. Identification of challenges and difficulties faced as well as learning strategies, creative ideas, good practices in science / biology learning with an online system from science / biology teachers can be a source of information and inspiration for other teachers experiencing similar difficulties. In addition, the common challenges and difficulties faced can generate a sense of enthusiasm to remain optimistic and arouse the creativity of science / biology teachers and teachers of other subjects. With the identification of challenges, difficulties and strategies in online learning, it is hoped that it can become input for schools in managing and determining policies related to learning in schools during the Covid-19 pandemic. For the Biology education study program, it can be used as input in preparing Biology teacher candidates who can be responsive to developments in information technology and remain productive, creative and adaptive in all conditions.

Literature Review

The implementation of SFH learning is carried out through online or on-line learning using internet facilities. This learning is more widely known as e-learning, which is the effect of technological transformation, especially the internet. Through e-learning, users can learn and obtain information, both through synchronous and asynchronous methodologies, to get information quickly and up to date in a productive environment (Oye, Salleh, & Iahad, 2012). E-learning was first introduced by the University of Illinois using a computer-assisted instruction system and a computer called PLATO. Then e-learning continued to develop in the 1990s with the emergence of the era of Computer-Based Training (CBT) where at that time e-learning applications began to appear that were operated on computers or also in the form of CD-ROM packages. The material is presented in written and multimedia form. Then in 1997 the Learning Management System (LMS) which was connected to the internet began to develop and is currently experiencing rapid development (Aunurrahman, 2019). The development of computer technology with internet access has brought big changes to the learning process where access to literature, books, and information can be reached very easily so as to facilitate the learning process.

Soekartawi, et.al. (2002) stated that "E-learning is a generic term of all technologically supported learning using an array of teaching and learning tools as phone bridging, audio and videotape, teleconferencing, satellite transmissions, and the more recognized web-based training or computer aided instruction. also commonly referres to as online course ". This means that e-learning is a general term for all technology-supported learning that uses a variety of teaching and learning tools as a link, such as telephone, audio and video recording, teleconferencing,

satellite transmission, and web-based training or online courses. More specifically, Rosenberg (2001) emphasizes the use of internet technology in e-learning to deliver a series of solutions that can enhance knowledge and skills. More clearly, Dong (2001) concluded that e-learning is an asynchronous learning activity through electronic computer devices connected to the internet, where students try to obtain learning materials that suit their needs (Kamarga, 2001).

There is a difference between traditional learning and e-learning. The difference lies in physical contact and the role of the teacher. In a "traditional" class, there is an encounter between the teacher and students at a certain time and place and the teacher is more of a learning center where the teacher is tasked with transferring knowledge to students, whereas in e-learning classes there is a physical separation that is not bound by time and place. and learning centers are students where students are required to be more independent and responsible for the learning process (Aunurrahman 2019; Elyas, 2018).

Aunurrahman (2019) provides the characteristics of e-learning, as follows: (1) E-learning is a form of learning that emphasizes the delivery of information, communication, education and online training; (2) E-learning provides a set of tools that can enrich the value of traditional learning so that it can answer the challenges of global development; (3) E-learning does not mean replacing the classical learning system that is practiced, but strengthening the learning model through enrichment of information about the substance and developing educational technology; (4) The learning capacity varies greatly, depending on the content and means of conveying information or learning messages and learning styles.

E-learning learning activities place more emphasis on online communication. However, this should not negate the pedagogical elements of learning. In e-learning, there are 2 terms, namely asynchronous and synchronous. Asynchronous is a form of e-learning where participants can develop ideas or information without being tied between one participant and another at the same time, for example in the form of using email, blogs, wikis, and discussion boards. Conversely, synchronous requires that participants spend the same time in exchanging ideas and information, for example, face to face discussions, online sessions, virtual classrooms or meetings. Several pedagogical approaches that can be applied in e-learning are as follows (Aunurrahman, 2019): (1) Instructional design. In this approach, learning focuses more on a curriculum that is developed with an emphasis on group education or individual teachers; (2) Social constructivist. This approach emphasizes activities carried out in discussion forums, blogs, wikis, and online collaborative activities; (3) Laurillard's conversational model, is a form of pedagogical approach that focuses on the use of direct discussion forms widely; (4) Cognitive perspective, focuses on the cognitive development process through learning activities; (5) Emotional perspective, more focused on developing emotional dimensions of learning such as motivation, engagement, game models, and others; (6) Behavior perspective, focuses on skills and behaviors that result from the learning process. Learning models in this form include role playing and its application in real activities in the field; (7) Contextual perspective, focused on structuring instrumental and social environmental factors that can encourage the learning process.

Elyas (2018) states that e-learning has several benefits, namely in terms of flexibility in time and place; the occurrence of independent learning; as well as cost savings, for example in terms of transportation costs, management administration costs, instructor fees, and provision of infrastructure. In addition, the use of the internet in open and distance education is known to have several benefits, such as the availability of e-moderating facilities where lecturers and students can communicate easily through internet facilities without being limited by distance, place, and time; lecturers and students can use structured and scheduled teaching materials or study instructions via the internet; students can study or review teaching materials anytime and anywhere; students can search for additional information via the internet; students and lecturers can conduct discussions via the internet and can be followed by a large number of participants; changing the role of students from being passive to being active; and relatively more efficient (Elangoan, 1999; Soekartawi, 2002; Mulvihil, 1997; and Utarini, 1997 in Elyas, 2018).

Although previously mentioned that e-learning has many benefits, e-learning also has drawbacks. Bullen (2001) and Beam (1997) in Yazdi (2012) suggest that there are several weaknesses in e-learning, namely (1) lack of interaction between teachers and students or even between students themselves. This lack of interaction can slow down the formation of values in the teaching and learning process; (2) The tendency to ignore academic or social aspects and vice versa encourage the growth of business / commercial aspects; (3) The teaching and learning process tends towards training rather than education; (4) Changing the role of teachers from previously mastering conventional learning techniques, now also required to know learning techniques that use ICT; (5) Students who do not have high learning motivation tend to fail; (6) Not all places have internet facilities available; (7) Lack of personnel who know and have internet skills; and (8) Lack of mastery of computer languages.

In e-learning there are 3 categories, namely adjunct, mixed / blended, and fully online. The Adjunct model is face-to-face (traditional) learning supported by an online delivery system as enrichment. The existence of an online submission system is an addition. For example, to support learning in class, a teacher / lecturer assigns students / students to search for information from the internet, use computers and LCD projectors and multimedia in the classroom, etc.

The Mixed / blended model is placing the online delivery system as an inseparable part of the overall learning process. This means that both the face-to-face process and online learning form a complete whole. Unlike the adjunct model which only puts an online submission system as an extra.

Fully Online Model, where all learning interactions and delivery of learning materials occur fully online. There is no face-to-face (traditional) learning at all. For example, learning materials in the form of videos are uploaded and received via the internet, or learning is linked via hyperlinks to other sources in the form of text or images. The main feature of this model is the occurrence of collaborative learning online (Chaeruman, 2017).

There have been many studies on the implementation of e-learning learning. Hanum (2013) evaluated the implementation of e-learning at SMK Telkom Sandhy Putra Purwokerto. At the SMK, e-learning was developed using a Moodle-based LMS. From the results of data analysis, it was concluded that the implementation of e-learning learning at SMK Telkom Sandhy Putra Purwokerto was not fully effective.

Palennari et al. (2018) in their research used Moodle learning media with blended learning which is integrated with the discovery learning model on human reproduction material that is learned online. The results of a limited-scale trial conducted in class XI IPA at SMAN 2 Makassar showed that the practice of Moodle integrated online learning media obtained a score of 70.20 by students in the practical category, and a score of 89.94 by the teacher in the very practical category. The advantages of Moodle-based learning are simplicity and flexibility in the sense of being flexible in choosing a time and place to study, except for doing online quizzes which are generally given a time limit for processing.

Related to the use of virtual laboratories, Adi & Iqbal (2011), Adit (2020) show that virtual laboratories significantly increase ($p = 0.0$) student learning motivation which includes attention, relevance, confidence, and satisfaction (ARCS). In another lesson, Hayat (2020) uses quizizz for the assessment of material in the scope of biology to improve student learning outcomes in class C.6 SMA 7 Banjarmasin. By using multiple choice questions and descriptions, the results of the study showed that in the initial conditions the percentage of students completing was 48% while in the final condition the students who completed were 68% so that there was an increase in completeness by 20%. Students are happy and motivated about the scope of biology learning by holding online quizzes using quizizz in learning. Susanti (2019) examines the correlation and effectiveness of using google classroom in Biology learning at SMA Charis Malang. The results showed that the effectiveness of using google classroom on student cognitive learning outcomes was 10.7% and the rest was influenced by other variables.

In order for online learning / e-learning to run well and achieve the expected learning objectives, the teacher must carry out a learning design. There are several things that must be done by the teacher, namely (1) identifying the content of learning material based on student needs, (2) determining learning objectives, (3) determining instructional strategies, (4) determining how to present the material, and (5) determining the strategy (Ghirardini, 2011). Hanum (2013) suggests 5 aspects of e-learning learning management, namely learning planning, material design and creation, learning delivery, media and learning interactivity, and evaluation of learning implementation. These five aspects will be a reference for researchers in identifying the strategies chosen by the teacher in implementing online learning in their class.

RESEARCH METHOD

This research is a survey research to identify the challenges and strategies taken by science / biology teachers in implementing online learning during the Covid-19 pandemic. The survey in this study used a cross-sectional design, where the researcher collected data at one point in time (Cresswell, 2015).

The subjects of this study were biology teachers at the high school level and biology science teachers at the junior high school level throughout Indonesia. The minimum sample size is calculated using the Slovin formula. The calculation is based on Human Resources data for Primary and Secondary Education, Ministry of Education and Culture, Center for Education and Culture Statistics Data 2016 (Pages 36, 40-41), where it is stated that the number of science teachers in Indonesia is 83,366 people and the number of Biology teachers throughout Indonesia, amounting to 17,206 people. From these data, it can be calculated that the total population of science and biology teachers throughout Indonesia is 100,572 people. This number is rounded down to 100,000 people to make it easier

to calculate the minimum sample size. The minimum sample size required in this study was calculated using the Slovin formula (Riduwan, 2005). Based on the Slovin formula, the required sample size is 100 people with a significant level of 10%.

The data in this study were collected through open and closed questionnaires to obtain data regarding the identification of challenges and learning strategies for Science / Biology during the Covid-19 pandemic. Therefore, the first step in this research is the development of a questionnaire. The questionnaire that has been created is then validated by 2 competent validators for it. After fulfilling the improvements suggested by the questionnaire validator, the questionnaire is packaged in the form of a google form to simplify and speed up the distribution of the questionnaire to respondents and facilitate the recapitulation of the questionnaire fields. Then the link for filling out the questionnaire is sent to the respondent. To refine the results, a Focused Group Interview (FGI) was conducted with teacher respondents selected by the researcher.

The closed questionnaire data were analyzed descriptively quantitatively. Open questionnaire data and FGI were analyzed descriptively qualitatively using the Miles and Huberman model which consists of 3 stages, namely data reduction, display data, and conclusion drawing/verification..

RESULTS AND DISCUSSION

Development of Research Instruments

The instrument in this study was a questionnaire consisting of 3 parts, namely (1) Identity, which consists of personal identity and work-related identity (8 questions), (2) Challenges of Online Biology Learning, which consists of supporting and inhibiting factors (15). statement), and (3) Online Biology Learning Management Strategy, which includes 5 aspects of learning, namely planning, designing and producing materials, delivering learning, media and learning interactivity and evaluation of learning implementation (20 statements). The questionnaire used is a mixed open and closed questionnaire. The initial design of the instrument can be seen in Appendix 1.

This research instrument through validation by 2 experts in the field of education, namely Dr. Marcellinus Andy Rudhito, S.Pd. and Dr. Hongki Julie, M.Sc. The instrument validation consisted of 11 statement items summarized in 3 aspects, namely the questionnaire format, language, and the contents of the questionnaire. The assessment of the validator is done by choosing a score according to the validator's observations. The assessment score in the instrument is in the form of a Likert scale consisting of 5 choices, namely 1 (very bad), 2 (not good), 3 (confusing, 4 (good), and 5 (very good). see rater agreement (Retnawati, 2016). The item validity index in the Aiken index follows the following formula:

V = (sum of s) / (n (c-1))
where:
V = rater agreement index
s = score determined by rater minus the lowest score in the category used
n = number of raters
c = number of categories that the rater can choose

The interpretation of the results of the calculation of the Aiken Index uses the following criteria: <0.4 = low validity; between 0.4 - 0.8 = moderate validity; and> 0.8 = high validity. The calculation of the Aiken Index for this research instrument is presented in Table 1. and the calculation of the Aiken coefficient value for the research instrument is presented in Table 2.

TABLE 1. Calculation of aiken index for research instrument validation

No. Item	Validator 1	Validator 2	s1	s2	Σs	V
1	5	5	4	4	8	1
2	5	5	4	4	8	1
3	5	4	4	3	7	0,875
4	4	4	3	3	6	0,75
5	4	4	3	3	6	0,75
6	4	4	3	3	6	0,75
7	5	4	4	3	7	0,875
8	5	4	4	3	7	0,875
9	5	5	4	4	8	1
10	4	4	3	3	6	0,75
11	4	4	3	3	6	0,75

TABLE 2. Results of the calculation of the Aiken coefficient of research instruments

Scale	Validator 1	Validator 2	s1	s2	Σs	V
Item 1-11	50	47	39	36	75	0,852

From Table 1 it is known that all items are in the valid or very valid category. Overall, based on the calculations in Table 4.2, the Aiken instrument coefficient is 0.852 which means that the research instrument is included in the high validity category. There are several inputs from the validator to the research instrument being developed.

The revised research instrument was then converted into a Google Form (GF) for easy distribution to respondents throughout Indonesia. The research instrument after the revision can be seen in attachment 2, while the GF can be accessed via the link https://bit.ly/KuisionerStrategiPembelajarnDaringCovid19.

Respondent Identity

The number of teachers who became respondents in this study amounted to 225 people, most of whom were women (177 people or 79%). Male respondents only amounted to 48 people or 21%. Respondents' ages varied, most of them were less than 30 years old (40%) followed by those between 41-50 years old (23%), while the age group of respondents between 30-40 years and more than 50 years was relatively the same (19% and 18 %). Most of the respondents' backgrounds are S1 (83%) and the rest are Masters (17%).

Regarding work as a teacher, most teach in SMA (56%) and in SMP (40%), and a small proportion teach in SMP-SMA (4%). Teachers who were respondents in this study came from 21 provinces in Indonesia, most of the respondents came from schools in DIY (26%), West Java (19%), and Central Java (14%), and East Java (9%). A small proportion (4% or less) come from schools in other provinces. Respondents' teaching experiences varied, which seems to be related to age variation. Most of them have 1-5 years of teaching experience (39%), followed by those with more than 20 years of experience (24%), 10-20 years (19%), 5-10 years (12%), and less than 1 years (7%). The identity of the respondents as a whole can be seen in Table 3.

TABLE 3. Characteristics of respondents

No.	Aspect		Amount of Responden	
Personal Identity				
1	Age	Less than 30 year	90	40%
		30-40 year	43	19%
		41-50 year	51	23%
		More than 50 year	41	18%
2	Sex	Male	48	21%
		Female	177	79%
3	Education Background	S1	186	83%
		S2	39	17%
Personal Identity related occupation				
4	Level of student	SMP	91	40%
		SMA	127	56%
		SMP-SMA	7	3%
5	School Location (Province)	1. Banten	8	4%
		2. Bengkulu	2	1%
		3. DIY	59	26%
		4. DKI	16	7%
		5. Jabar	42	19%
		6. Jateng	31	14%
		7. Jatim	20	9%
		8. Kalbar	9	4%
		9. Kalsel	1	0%
		10. Kaltim	6	3%
		11. Kaltara	1	0%
		12. Bangka Belitung	1	0%
		13. Kepri	2	1%
		14. Lampung	6	3%
		15. NTT	8	4%
		16. Papua	1	0%
		17. Riau	1	0%
		18. Sulsel	3	1%
		19. Sumbar	2	1%
		20. Sumsel	4	2%
		21. Sumut	2	1%
6	Teaching Experience	Less than 1 year	15	7%
		1- 5 year	88	39%
		6-10 year	26	12%
		10-20 year	42	19%
		More than 20 year	54	24%

Challenges of Online Biology Learning

Description of the Questionnaire Response

During the Covid-19 emergency response the learning process must be carried out online at all levels of education from elementary, junior high, high school to college. As a new and must-do mode of learning, the implementation of online learning raises various difficulties and challenges. The following is a description of the challenges and difficulties faced by biology teachers in various SMP and SMA in 21 provinces in Indonesia that were identified based on the results of an online survey.

To access the internet, which is the main requirement for the online learning process to take place, most teachers have to rely on their personal quota (48.9%), others still have to use their personal quota even though the school has provided WiFi (47.6%), while teachers who can or simply using school WiFi only as much as 3.6%. From all respondents, as many as 225 teachers, most of them considered the internet network in their area to be quite helpful in implementing online learning (88%), but the rest (12%) still considered the internet network in their area to be unreliable.

In general, teachers have the ability in the field of ICT to develop online learning (91%), while a small proportion (91%) do not have this ability. However, only some (62%) have done online learning before the Covid-19 pandemic, while others (38%) have never done it. Thus, it can be said that online learning is new for some teachers.

Challenges or difficulties in implementing online learning are also related to school support. Most of the respondents (71%) have received internet quota subsidies to support online learning, while 29% of respondents stated that they had not or did not receive the subsidy. In addition, most respondents (71%) have also received training related to online learning techniques / strategies / models, while other respondents (29%) have not received any training. Most schools have provided additional support facilities for developing online learning (school LMS, for example Moodle, Google classroom, and others). This was stated by 81% of respondents, while 19% of respondents stated that their school did not provide this facility. Almost all schools (90%) have also provided internet access via WiFi in schools, while 10% of respondents stated that their schools did not provide WiFi.

Time allocation also seems to be a challenge for some respondents. As many as 5% of respondents indicated that they do not have the time to prepare and manage online learning in their class, while the majority (95%) have allocated their time well. For online learning preparation 177 respondents or 79% of respondents took longer to prepare for online learning compared to regular face-to-face learning, while 21% did not take any longer. Regarding the implementation of online learning according to face-to-face schedules, as many as 5% of respondents cannot do it, while other respondents (95%) have done it according to schedule. In terms of the flexibility of online learning time according to the time students have, 21% of respondents said they disagreed with this, while others (79%) agreed with that flexibility.

Supporting infrastructure was also a challenge for some respondents. A total of 23% of respondents do not have the hardware facilities (computers, laptops, tablets, or cellphones) to develop online learning in their classrooms. Regarding the condition of students, as many as 49% of respondents believe their students do not have a quota to access online learning. Even so, as many as 61% of respondents indicated that more than 75% of their students actively participate in online learning, while 9% of respondents stated that only 50% of students who actively participate in online learning in their classrooms. The overall survey results as described above can be found in Table 4.

Identification of Inhibiting and Supporting Factors

Based on the description of the recapitulation of the results of filling out the questionnaire challenges in online biology learning as mentioned above, it seems that at least 3 things are related to each other which are supporting factors for some respondents but also inhibiting factors for some other respondents.

a. Availability of internet network and the means to access it.

These two things are a unity of factors that cannot be separated for the implementation of online learning. The absence of an internet network signal determines the failure of online learning even though the supporting facilities are complete. Topographically isolated school location so that it has not been served by a Provider or is located in a blank area. Although the numbers are not many, some respondents (12%) have struggled to get a stable signal. If the signal is good or stable, then this is a very good supporting factor. Many things can be developed with the availability of internet signals and the means to access them, namely mobile phones, laptops and desktops. However, still around 23% of respondents do not have adequate facilities.

TABLE 4. Recapitulation of the results of filling out the challenges questionnaire in online biology learning
(Note: SS = Strongly Agree; S = Agree; TS = Disagree; and STS = Strongly Disagree).

No	Aspects	Statement	Number of Respondent Responces			
			STS	TS	S	SS
1	Internet network	Internet network used	Personal quota (110;49%), School WiFi (8;4%), private quota and school WiFi (107;47%)			
		The internet network in my area is quite helpful for me in implementing online learning	4	22	130	69
			2%	10%	58%	30%
2	IT skills	I have ICT skills to develop online learning	0	20	159	46
			0%	9%	71%	20%
		I have done online learning before the Covid-19 pandemic	12	75	103	35
			5%	33%	46%	16%
3	School support	Schools provide internet quota subsidies to support online learning	20	44	73	88
			9%	20%	32%	39%
		The school provides training for teachers related to online learning techniques / strategies / models	8	56	107	54
			4%	25%	48%	24%
		Schools provide additional support facilities for developing online learning (school LMS, for example, mooddle, google classroom, etc.)	2	41	98	84
			1%	18%	44%	37%
		Schools provide internet networks via wifi in schools	4	18	97	106
			2%	8%	43%	47%
4	Time allocation	I have time to prepare and manage online learning in my classroom	2	10	152	61
			1%	4%	68%	27%
		It took me longer to prepare for online learning compared to face-to-face learning	1	47	110	67
			0%	21%	49%	30%
		I do online learning according to a face-to-face schedule	5	47	112	61
			1%	4%	68%	27%
		Online learning time is flexible according to the time students have	1	47	110	67
			0%	21%	49%	30%
5	Supporting infrastructure	I have the hardware facilities (computer, laptop, tablet, or mobile phone) to develop online learning in my classroom	5	47	112	61
			2%	21%	50%	27%
		My students have a quota to access online learning	23	88	97	17
			10%	39%	43%	8%
6	Student participation	Student response / participation to online learning by teachers:				
		• Other reasons			2	(1%)
		• • less than 25% of students participate in online learning			8	(4%)
		• • only 25-50% of students participate in online learning			10	(4%)
		• • 50-75% of students actively participate in online learning			69	(31%)
		• • More than 75% of my students participate actively in online learning			92	(41%)
		• • All students actively participate in online learning			44	(20%)

If the internet network signal and the tools / gadgets to access are available, there is still another determining factor, namely the availability of quota. This is very crucial because there is no provider that eliminates the use of the internet network for a relatively long period of time. If the school does not subscribe, then a private quota is the only option so that learning can still be delivered by the teacher. On the one hand, the use of this personal quota can be burdensome for teachers' finances and depending on the location the signal is often unstable which makes learning activities not smooth. On the other hand, the use of personal quotas makes the implementation of learning more flexible in terms of the teacher's time and place because it allows teachers to work from home (WFH), as well as being able to adjust to the best time of the students in the class concerned. This last thing, of course, also depends on the availability of access facilities and internet network signal on the part of the students. If a school subscribes to an internet network which can then be accessed by teachers, then the availability of an internet network that is ready for use becomes more certain. Teachers can schedule learning activities according to face-to-face schedules as is usually done in offline learning activities. For activities like this the teacher has to work from the office / school (WFO). WiFi facilities are generally provided by existing schools.

b. Ability to use ICT facilities

Online learning is a new thing for most Indonesians including teachers, students and parents. This mode of learning has actually been started several years ago by several universities and has been implemented at least in a blended manner (a mixture of online and offline). Likewise, some of the respondent teachers (62%) from schools with good internet access have done online learning. At this time when the Covid-19 pandemic broke out, all teachers were required to do online learning amid all limitations including the availability of an internet network and infrastructure to access the internet network (as discussed in section a above), as well as the limited ability of some teachers to using ICT facilities. In online learning the ability to use ICT is a requirement so that the learning process can take place and the interaction of teachers, students, and learning resources occurs in various learning modes and strategies. This is important to do so that learning objectives can be achieved more effectively and efficiently even though it is done online.

The use of ICT facilities includes the use of various hardware devices such as cellphones, laptops, desktops, video cameras, audio recorders, viewers and others for internet access with various modes of connection, recording and displaying audio, photos and videos. In addition, the use of ICT facilities also includes the introduction and use of various software (software) to produce teaching materials and learning media for biology, as well as conducting online learning evaluations. The recapitulation of the questionnaires shows that 91% stated that they have the ability in the field of ICT to develop online learning. Thus only 9% still have to struggle to hone their abilities and skills in using ICT facilities.

c. School Support

The implementation of online learning during the Covid-19 pandemic cannot be left entirely to the ability of teachers alone to be able to access the internet network using their respective infrastructures and carry out online learning as far as they are aware. In order for the basic competency (KD) of learning that has been outlined to be achieved, the school should provide full support for what is needed for the implementation of online learning. If the problem is related to the availability of an internet network signal, then schools can provide WiFi so that teachers have access to a relatively stable internet network; and if the problem is that the teacher does not / do not have the means for internet access, then the school should be able to lend computer equipment at school or provide soft loans to purchase the facility. From the questionnaire filling, it can be seen that there are still 23% of respondents who do not have adequate equipment.

If the problem lies in the teacher's inability to use ICT infrastructures properly, the school should provide the necessary training or IHT. This really needs to be done so that teachers have the ability to carry out innovative online learning and attract students' attention to learn better. The achievement of this ability must be seen when the teacher implements it in the classroom (virtual) with students. Among the respondents in this study there were still 29% who had not received training from the school concerned.

Full school support becomes evident when the school provides additional support facilities for developing online learning (school LMS, for example Mooddle, Google Classroom, etc.) without limiting the use of other platforms. Schools that have provided things like this have achieved quite a lot, as indicated by 81% of respondents, so that there are still 18% of respondents / schools that struggle individually to choose the delivery mode in online learning.

The difficulties associated with the three things mentioned above generally occur in schools that are outside the area or city where the internet network signal is unstable. These conditions prevented teachers and students from prior to the Covid-19 pandemic using ICT facilities. When entering a pandemic period and online learning is a must, they are not or are not ready either individually or institution / school. Difficulties are especially faced by teachers who are not or are not accustomed to accessing the internet network due to the lack of signal and / or the relatively low ability to use ICT facilities, and lack of school support through the provision of WiFi networks, training for material preparation and online learning processes, and increasing use skills. ICT facilities, provision of virtual classes for online learning (Moodle, Google Classroom) and others needed by teachers.

School teachers who are in locations with affordable internet network signals are generally more ready and responsive to the need to carry out online learning because the use of ICT facilities is more frequent even though initially not many schools allowed the use of cellphones in the classroom. Teachers who can access the internet network smoothly and have the ability to use ICT facilities and receive school support do not experience difficulties. On the contrary, they become the main supporting factor in the smooth implementation of online learning. However, the readiness of the teacher is not always balanced with the readiness of students to take part in online learning. This is shown by the questionnaire filling which states that around 49% of teachers stated that their students did not have a quota to access online learning, and only 61% of teachers stated that their active students were more than 75%. This means that there are still many students who cannot participate in online learning in full for various reasons that have not been explored. Temporary estimates of students also have difficulty accessing the internet network due to limited personal quotas and / or means of access. Therefore, training for students is also needed.

Biology Learning Strategies During the Covid-19 Pandemic

The covid 19 pandemic is currently hitting the world, making many changes in all fields including the field of education. In the world of education, learning activities that usually take place face-to-face (offline) become online learning (online). This change makes teachers have to develop learning strategies for learning activities online (online). For this reason, teachers must be creative and innovative so that online learning can take place well. Science / Biology material is a subject in which it has unique characteristics, namely it is very close to nature and everyday life, in which there are also practicum or observation activities. This will bring its own challenges and strategies for implementing science / Biology learning online.

As an initial strategy applied by Biology teachers, it is to prepare Biology materials/materials in online learning. Based on questionnaire data from 226 respondents who were netted through Google Form (GF), science / biology teachers need varying amounts of time in preparing science / biology materials. The time required for science / biology teachers at most can be seen in the following table

TABLE 5. The average amount of time that teachers spend preparing for online learning

No	Duration	Number of respondents	Percentage (%)
1	1 hour	25	11,1
2	2 hours	35	15,5
3	3 hours	30	13,3
4	4 hours	19	8,4
5	More than 4 hours	Less than 10 respondents	Less than 1%

Based on the answers of respondents in table 4.6 above, the time needed for science / biology teachers to prepare the material for online learning is in the range of 1 to 4 hours. The time chosen by the most respondents to prepare material for online learning was 2 hours, namely 35 science / biology teachers or 15.5% of the total respondents.

The time that varies is greatly influenced by the subjectivity of the teacher concerned. The subjectivity in question is also related to the pedagogical ability of teachers. Pedagogical competence according to Permendikbud No. 16 of 2007 is the ability of teachers in terms of designing and implementing learning, evaluating and understanding students. The learning planning ability includes the ability of each teacher to choose models, methods, and media. The difference in the number of loads / hours of teaching and the complexity of the material as well as the adjustment of the offline learning system to online are also factors that differentiate the time it takes for teachers to prepare teaching materials.

The change in meeting methods from offline to online presents a challenge for science / biology teachers. The challenges or difficulties experienced by science / biology teachers in preparing online biology learning plans include selecting effective and efficient learning media, designing learning that can facilitate students to think critically, creatively, develop character and learn independently and develop authentic assessments. The percentage of respondents' answers related to the challenges and difficulties of teachers in planning online learning is seen in table 6 below

TABLE 6. Challenges of constructing biology lessons online

No	Challenge	Number of Respondents	Percentage (%)
1	Design student-centered learning	125	55,3
2	Choosing effective learning media	150	66,4
3	Choosing efficient learning media	119	52,7
4	Designing active learning for students	135	59,7
5	Designing learning activities that develop critical thinking skills for students	144	63,7
6	Designing learning activities that develop creative thinking skills for students	133	58,8
7	Designing learning activities that develop student character	121	53,3
8	Designing learning activities that are able to develop self-regulated learning skills	131	58
9	Designing authentic learning evaluations	107	47,3

Based on table 6 above, the challenges / difficulties in planning Science / Biology learning online with the highest percentage were choosing effective learning media, namely 150 respondents (66.4%). Effective learning media is one of the determining factors for the achievement of learning objectives. Especially during a pandemic like this, which usually can use learning media in schools directly, but because of the pandemic, teachers and students alike experience limitations in using existing media in schools. Learning media is a tool, method, technique used in the learning process, both those used by teachers and students, which functions to activate and streamline teacher and student communication (Hamalik, 1994 /). Therefore, teachers must really think about what media are suitable for online learning. In addition to the difficulty of choosing effective media, the teacher also had difficulties in developing learning that was able to develop critical and creative thinking skills, namely 144 (63.7%) and 133 (58.8%). The ability to think critically and creatively is a skill that students must master in 21st century learning. The ability to think critically is an art in analyzing and evaluating how they think to improve it (Paul & Elder, 2008). In critical thinking, there are six basic skills (Filsaime, 2008) which include the ability to interpret, analyze, evaluate, inference, explain and self-regulate.

In addition, teachers also have difficulty designing active and student-centered learning. Active learning is easier to do when learning takes place face-to-face (offline) with group formation, practicum etc., and this is a challenge in online learning. Another difficulty is designing learning that is able to develop student character. In online learning, teachers must really choose characters that can be developed in online learning, for example discipline and responsibility. Learning planning that facilitates student independent learning is also not easy for teachers, because it is not easy to generate student learning motivation during Learning From Home (BDR)

Apart from the challenges / difficulties above, the teacher too compared to other applications. However, the advantage of this Video Conference is that it still allows face-to-face online / syncronus, so that as if students are in the classroom, they can meet teachers and friends even though they are virtual. Video conferencing is effective for explaining relatively complex materials or facilitating presentations and discussions.

Certain schools also use a Learning Management System (LMS) platform such as Moodle, Edmodo, Canvas, etc. There were schools that had subscribed to and used LMS in their learning before the pandemic, so this platform was still used during the Covid-19 pandemic. Apart from LMS, teachers also take advantage of social media such as Facebook (FB), Instagram, Twitter in online biology lessons. This is also because almost all students who are millennial have social media such as FB and Instagram.

Apart from the reasons above, the ease of evaluating is also a separate consideration for teachers in choosing an online learning platform. This is also in accordance with the principle of evaluation, namely practicability, that the evaluation tools compiled must be easy in technical preparation, easy to work on techniques and easy to correct answers (Arikunto, 2008)

The things that are the basic considerations for teachers in choosing platforms in online learning are summarized in table 7 below.

TABLE 7. Basic considerations for teachers in choosing an online learning platform

No	Basic consideration	Number of Respondents	Percentage (%)
1	Easily accessible to students	208	92%
2	Teachers know how to operate it	178	78,8%
3	Practical and simple for teachers and students	155	68,6%)
4	Can interact online with all students at the same time	126	55,8%)
5	Help students understand the learning material	101	44,7%)
6	Can encourage students to study independently and regulate their own learning pace	98	43,4%)
7	Does not use up a lot of internet quota for both students and teachers	68	30,1%)
8	Not pay	48	21,2%)

This ease of access is the main reason for respondents in determining the platform / form of means used in online learning, namely as many as 208 respondents or 92%. The next consideration is that the teachers are able to operate as many as 178 teachers (78.8%), these facilities are practical and simple for 155 student teachers (68.6%) and 126 (55.8%) can interact with students simultaneously via online. The teacher also considers that the tool chosen can help students understand the material. This becomes very important for the achievement of learning objectives. As many as 98 (43.4%) teachers also considered that the chosen medium should be able to encourage students to learn independently and regulate their own learning pace. This is because in online learning situations, students organize / control / organize their own learning activities. The consideration of using an economic data package is also important, considering that in a pandemic situation like this, many parents of students are affected economically both in the field of work and business.

The learning process during the pandemic is divided into three ways, namely direct learning (Synchronous), indirect learning (Asynchronous) and mix of synchronous and asynchronous. Based on the data from the questionnaire results, the way to combine (mix) synchronous and asynchronous was chosen by the majority of the teachers by 39.8%. while the form of asynchronous 34.1% and 24.8% synchronous. The basis for the selection put forward by the respondents is to also adjust to the conditions of students, teachers and schools, practical, effective, communicative and interactive, that is, it can facilitate two-way interaction between teachers and students, in addition to considering the use of data packages that are made as economical as possible so as not to burden students.

In the online Biology learning process the teacher performs various activities / methods. This is done so that online learning becomes more varied. The forms of online learning activities carried out by teachers during the Covid-19 Pandemic can be seen in table 8 below.

Based on the data above, most of the teachers / respondents gave independent assignments to students, namely 207 teachers (92%), gave 196 question exercises (87.1%) and gave 146 quizzes (64.9%). These three things are done by the teacher to facilitate students to learn independently, practice a lot with questions and quizzes so that students are expected to be able to understand the material well in online Biology learning.

TABLE 8. Online biology learning activities

No	Description	Number of Respondents	Percentage (%)
1	Give independent assignments	207	92%
2	Provide practice questions	196	87,1%
3	Give a quiz	146	64,9%
4	Explain the learning material in the form of a video	139	61,8%
5	Explain learning material in written form	121	53,8%
6	Question and answer	117	52%
7	Discuss practice questions	101	44,9%
8	Explain learning material in written form accompanied by audio	99	44%
9	Class discussions	58	25,8%
10	Provide opportunities for students to discuss in groups	46	20,4%
11	Give assignments in groups	42	18,7%
12	Class presentations	21	9,3%

Apart from the three things above, the teacher also provides an explanation of the material via video and also a written summary. Providing material with video was done by 139 respondents (61.8%) and giving material in writing was 121 (53.8%). In addition, the teacher also conducts questions and answers, discusses exercises, class discussions, group discussions, gives group assignments and presentations. Here, the teacher tries to provide a variety of activities, so that online learning activities are not too different from offline learning activities before the pandemic.

In collecting assignments, the teacher also uses several applications including WhatsApp Group, Google Classroom, email, Google Drive and Moodle. The most widely used application for assignment collection is the WhatsApp group (WAG) as many as 148 (65.89%) teachers / respondents. This wag is used as the most means of collecting assignments because it is practical and almost all students use this application in their daily lives. Assignment submission through Google Classroom is the choice of most teachers, namely 135 (60%), because this application is also easy to install, simple and free of charge. The method of collecting the next task is to take advantage of facilities from Google related to data storage, namely Google Drive. This Google drive has a large storage capacity and is automatically integrated with email, making it more practical. Teachers also use email, because this application is familiar to students and teachers, almost all teachers and students already have an email address. For schools that use LMS, collection via school LMS, for example Moodle, is an option for assigning assignments. Assignments that are collected using these tools / applications will be more structured to make it easier for the teacher to also correct. Based on the data above, it can be concluded that ease (access, correction, practicality, effectiveness, clear and neat structure, large data storage features and economical use of data / quotas in assignment collection are things that are considered by the teacher. In science / biology learning, practicum activities are one of the methods used to develop students' science process skills. Through this practicum activity, students also learn to find a concept. In face-to-face learning, practicum is easy to implement. During this pandemic, with online learning, practicum activities were a challenge for science / biology teachers. The activities carried out by the teacher in managing practicum activities during online learning include providing LKPD so that students do simple practicum with tools and materials at home. This can be done for simple science / biology materials such as plant growth and development materials, substance transport, additives, biodiversity, environmental pollution. The results of student practicum activities are reported in the form of videos and then uploaded on their social media, some are made in the form of written reports. For complex materials that require complex special tools and materials, the teacher provides videos for students to analyze. The teacher also uses the virtual lab for practicum activities. In addition, there are also teachers who make demonstration videos / tutorials about practicum activities.

In offline and online learning activities, the media is one of the things that determines the achievement of learning objectives. The media used by science / biology teachers during the pandemic can be seen in the following table 9.

TABLE 9. Science/Biology online learning media during the pandemic

No	Media	Number of Respondents	Percentage (%)
1	Power Point (PPT)	195	86,7%
2	Video	188	83, 6%
3	Journal articles	86	32%
4	Virtual Lab	31	13,8%

Based on table 9 above, Power point media (PPT) is the media most widely used by teachers, namely 195 (86.7%), this is because Power points are familiar among teachers, easy to make and can also be varied by inserting pictures. / Video. Then the video was chosen by 188 teachers (83.6%) to deliver the material. This video is also an easy medium to obtain, the teacher can download or share a video link from YouTube to students and then the students observe it themselves. Apart from PPT and Video, teachers also use journal articles and virtual media labs to deliver material. By analyzing journals, teachers can practice students' analytical and critical thinking skills. Virtual labs can be used to visualize some practicum activities that are not possible to do because of limited tools, laboratory materials owned by schools and limitations to carry out offline practicum activities.

In the online science / biology learning process, as many as 82% of teachers set certain rules so that the learning process can run effectively and efficiently. The rules set by the teacher such as timeliness of submitting assignments, joining video conferencing, rules during video conferencing (such as students being asked to wear uniforms, on camera, muting their voices). Whereas 17.8% of teachers did not set standard rules, the important thing was that students participated in view of the diverse conditions of students, sometimes due to limited facilities (cellphones / laptops, connections) so that teachers gave their own tolerance and learning was also more flexible.

Learning evaluation is an activity to measure the achievement of learning objectives. In addition, evaluation can also be used to see the effectiveness of learning activities and as input for further improvement of learning. In online Biology learning, the most widely used evaluation technique for science / biology teachers is quizzes / tests totaling 75.1%. Apart from quizzes / tests, evaluation was also carried out in the form of assignments for making videos of 9.3%, making papers and journals. The test / quiz technique ranks first as an evaluation technique used by teachers based on several considerations such as being able to measure cognitive and skill aspects, easy to compile and correct, easily accessible to students, practical, fast and accurate.

During online Biology learning, teachers / respondents experienced problems / difficulties in conducting assessments, especially in assessing student character. This can be seen from the results of the respondents' answers, namely as many as 153 (68%) teachers experienced difficulties in character assessment. Furthermore, teachers also experience difficulties in assessing activities, skills, affective and authentic assessment. The obstacles for teachers in conducting online assessment of Biology learning can be seen in table 10.

TABLE 10. Obstacles for teachers in conducting learning assessments

No	Assessments	Number of Respondents	Percentage (%)
1	Character ratings	153	(68%)
2	Assessment of activity	125	(55,6%)
3	Skills assessment	124	(55,1%)
4	Affective assessment	118	(52,4%)
5	Authentic assessment	115	(51,1%
6	Cognitive assessment	67	(29,8%)

In online learning, apart from teachers, students are also very important factors for the success of online learning. Students as a learning center, sometimes they are not able to carry out their roles optimally because of the limitations / obstacles faced by students. According to the teacher / respondent, students have obstacles / constraints in online learning so that they cannot participate in online learning optimally. According to teachers / respondents, the most obstacle faced by students was the limited quota / data package that 179 students had (79.6%). This happens to students with middle to lower economic backgrounds. The second obstacle is the difficulty of internet network connections around the 150 students' residences (66.7%) and the lack of online learning infrastructure owned by students (laptops, cellphones), namely 140 (62.2%).

In addition to the three reasons above, the things that become obstacles for students are students who are less disciplined during the online learning process, both during teaching and learning activities, collection of assignments that are often late, student saturation during online learning, lack of parental assistance and changing the paradigm of offline learning to online. During offline students are accustomed to learning together, interacting with teachers and friends directly, being students must learn on their own and carry out learning activities independently. The period of adaptation from offline to online learning activities also indirectly affects students' motivation in learning. This can be seen from students who are bored, forgetting schedules, doing simple assignments and even not according to the time set by the teacher.

Limitations

(1). This research was conducted online so that the results are more representative of the condition of teachers / respondents who actually have access to the internet network, while teachers who really have not been able to access the internet network are not described which is probably quite a large number, especially in the regions. (2). In this research report also only provides an overview of the strategies of teachers in science / biology subjects in general, does not discuss further about the strategies applied to a particular subject in detail. (3). The location / area setting of the teacher as a respondent has not been discussed further. (4). This study also did not discuss the conditions / backgrounds of students specifically related to their economic and socio-cultural family backgrounds.

CONCLUSION

The challenges (difficulties) faced by science / biology teachers in science / biology learning in the Covid-19 emergency response situation vary by region and school but are generally related to the availability of a stable internet network signal, means for internet access (HP and / or laptops), the ability to use ICT facilities (hardware and software), and school support (WiFi, trainings, and online learning facilities). Difficulties especially faced by teachers who have not fulfilled the availability of internet network access and the ability to use ICT facilities are relatively low, and lack of school support; while teachers who can access the internet network smoothly and have the ability to use ICT facilities and receive school support do not experience difficulties. On the contrary, they become the main supporting factor in the smooth implementation of online learning.

• The learning strategies applied by science / biology teachers in teaching science / biology material in the Covid-19 emergency response situation are to modify the form of learning synchronously using video conferencing (Zoom, Google meet), WAG, discussion forums at LMS, Google Classroom and asynchronous with assignment submission via WAG, email, LMS, Google Classroom. In the learning process, the teacher uses various media such as PPT, video, virtual lab and independent practicum with the equipment and materials around the students. In the evaluation process, many teachers use written test techniques using google forms, email, or online quizzes such as Quizziz. The things that are considered by the teacher in determining strategies for teaching science / biology in the emergency response situation of Covid-19 are the condition of students, ease of access, practicality, flexibility, effectiveness and conditions of internet connection as well as data / quota usage capacity.

Based on the discussion above it is suggested that for further research, it can discuss in more detail about science / biology learning strategies in science / biology materials, the location / area setting of teachers as respondents, and the characteristics and backgrounds of students from family, economic and socio-cultural aspects.

ACKNOWLEDGMENT

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