JICR - Journal of Innovation and Creativity Resource
Vol. 2, No. 1, 2023, pp. 7-12

Integration of creativity development and innovation in online science experiment learning at the middle school level in Meranti Islands District

Saktioto*, Juandi Muhammad, Ari Sulistyo Rini, Defrianto
Department of Physics, Universitas Riau, Pekanbaru 28293, Indonesia

ABSTRACT

To attain educational objectives for instructors and students in schools, the teaching method and the exhibition of experimental tools are still being developed in secondary schools. The COVID-19 period saw a delay in the experimental learning process because of the causes and circumstances of the pandemic's propagation. To keep the experimental science learning process going, though, alternate methods must be developed. This research proposes a novel approach for online media to promote creativity in science experiment learning. By combining online in a hybrid and integrated manner, this activity is completed as community service that doesn't obstruct learning. The outcomes of this activity show that learning is successful when equipment can be presented and when teacher-student interaction is successful using the provided model.

ARTICLE INFO

Article history:

Received Aug 11, 2023
Revised Sep 9, 2023
Accepted Sep 23, 2023

Keywords:

Integration
Online
Learning Model
Science Experiment

* **Corresponding Author**
E-mail address: saktioto@lecturer.unri.ac.id

1. INTRODUCTION

According to UU No. 20 of 2003, which states that education creates potential in a person in the form of religious spiritual strength, self-control, personality, intelligence, noble character, and skills required to live in a society with conscious and planned efforts, education plays a very important and major role in the development of one's personality [1-3].

The processes of studying and learning are interactive activities with an instructional purpose [4]. Teachers, students, objectives, materials, media, procedures, and evaluations are just a few of the interconnected components that make up the system and method of learning [5-6]. Learning can be seen as a reciprocal process involving both teaching and engaging in educational activities. The aim is to foster behavioral changes in the form of improved attitudes, skills, knowledge, and experiences. This, in turn, should make the learning journey more accessible and facilitate students' effective acquisition of knowledge in alignment with their intended goals [7]. To attain successful learning, a collaborative effort among different school components is essential, including teachers, facilities, infrastructure, parents, and the overall student environment [8-9]. Nevertheless, this educational goal encounters obstacles and disturbances, especially due to the ongoing Coronavirus Disease (COVID)-19 pandemic, which has led to the transition away from traditional face-to-face classroom learning in schools [10]. Undoubtedly, this situation poses a significant challenge for teachers and other stakeholders as they must now adapt to preparing learning materials that can be effectively delivered through online media. The primary goal is to ensure that learning objectives are still met, and students can comprehend the materials well despite the constraints imposed by the COVID-19 pandemic. This shift in the learning approach demands creativity, innovation, and technological proficiency to maintain a productive and meaningful educational experience for all students. Indeed, the teaching of science, particularly Physics, requires teachers to possess a diverse set of competencies. It goes beyond simply conveying theoretical knowledge; instead, it involves incorporating visual images to facilitate learning. Understanding Physics involves grasping a wide range of natural phenomena, relying on rational evidence, drawing from sensory experiences, and establishing a certainty of facts as they naturally occur.

To effectively teach Physics, educators must be adept at presenting complex concepts through visual aids, models, and demonstrations. This approach enhances students' understanding and enables them to connect theoretical knowledge with real-world experiences. A comprehensive grasp of natural phenomena and evidence-based reasoning is crucial for nurturing students' curiosity and critical thinking skills in the realm of Physics. By fostering a deep understanding of the subject, teachers can inspire students to appreciate the wonders of the physical world and cultivate an enduring passion for scientific exploration [11–13]. Engaging in practical experiences in a laboratory setting and utilizing teaching aids are believed to be highly effective in enhancing students' reasoning power and logical thinking [14]. However, due to the challenges posed by the COVID-19 pandemic, implementing this traditional learning process has become extremely difficult. As a result, many educational institutions have shifted to alternative methods, such as providing students with structured assignments that cover both theoretical concepts and an introduction to practical knowledge. These assignments may involve improvised practical exercises that can be carried out using available online media. While this approach may not fully replace hands-on laboratory experiences, it allows students to continue their learning journey and develop essential cognitive skills in a situation where physical presence in a laboratory is not feasible. As technology and online resources continue to advance, educators strive to create meaningful virtual learning experiences that help students grasp theoretical concepts and apply them creatively even in the face of pandemic-induced challenges [15]. As a result, they study less effectively and with less enthusiasm, which leads to a lack of comprehension of the subject matter. Additionally, the remote learning process will be challenging to manage in terms of science as well as the limited mental, mental, and social development and progress of students [16]. In addition, students spend a lot of time playing with technology, such as mobile phones or gadgets, in an effort to keep themselves occupied, lessen academic troubles, and find free possibilities. Students' affective, cognitive, and psychomotor impairments will develop in an unsuitable way [17]. Certainly, all of this makes fulfilling educational objectives difficult.

The rationale given above leads one to the conclusion that a number of the causes are due to the teacher's ignorance about instructional resources that can be used during the COVID-19 pandemic. The lack of originality, creativity, skill, and experience among teachers in utilizing learning media derived from alternative teaching techniques or resources is another issue [18]. At reality, it's not always necessary to spend a lot of money and prepare teaching materials and laboratory equipment at a unique location. There are also alternatives to tools and materials that serve the same function and instead foster some motivation, inspiration, and imagination that can encourage educators and students to innovate and be creative [19-20]. In order to increase awareness of the educational process through online media, remote practice, and adequate equipment/materials, efforts to motivate public service behavior, especially in the world of education for teachers and students, are very urgent, important, and mandatory. Universities provide possibilities for sharing, insight into utilizing the potential of the environment, and the use of straightforward tools and materials for practical work as teaching aids by teachers to students via online media with these efforts and solutions.

2. FORMS AND METHODS OF ACTIVITIES

For science teachers, particularly those in physics, the proposed kind of activity is in the form of teaching and learning through the creation of experiments and teaching resources. By showing equipment and practicum materials online as well as teaching aids, basic experiential learning about ideas from elementary to complicated natural phenomena is possible. In addition, it will be demonstrated to parents and tested on pupils. These practice tools can be demonstrated tangibly in both mechanical and non-mechanical (electromagnetic) forms in the form of simulations and actual practices that can be perceived by sound and sight, particularly on Zoom, Google, Webex, and other platforms. Both synchronous and asynchronous approaches are used for this activity. Understanding is a component of how invention and creativity are developed during the practical learning method used in this example:

a. Systematic approach: comprehending the flow of events that results in a work or product that can then be concluded, as well as how natural events have a causal relationshi.
b. Historical perspective: actions in the flow of time as it changes, events that demonstrate its effects and benefits, and events that lead to understanding.
c. Summary method: in order to draw a conclusion from an event, the premises of an event that are clearly and accurately tied to a series of natural events are connected, examined, and contrasted.
d. Using a comparative technique, one can develop and draw conclusions by presenting analogies of what happened and comparisons of how a natural phenomenon played out.

The activity and assessment process is an innovation model that includes:

a. Online material submission: Physics and science fundamentals.
b. Equipment and supplies for the practicum demonstration.
c. The procedure and evaluation of experimental instruments and supplies.
d. Using measurement and computation to understand iteration and simulation.
e. Oral and written assessment: Self-demonstration and simulation exercises.

The following modules provide an overview of activities:

a. To calculate the speed and dynamics of uniform linear motion based on its kinematic quantities, as well as to describe its properties, we consider uniform rectilinear motion, average velocity, and instantaneous velocity.
b. Understanding free fall motion's characteristics and estimating its speed.
c. Calculate the impact of mass, rope length, and deviation on the swing of a basic pendulum.
d. A straightforward pendulum experiment, an explanation of Hooke's law, and confirmation of the relationship between period and mass of the load on spring oscillations are used to calculate the gravitational acceleration.
e. Standing waves and sounds: a description of how standing waves are created and the distinction between knots and bellies. The reason behind the pressure change in the frequency range.
f. Understanding Lenz's law and magnetic permeability as well as the right-hand rule and Faraday's law of induction can help you better understand magnetism and electromagnetic induction.
g. Electric circuits and Ohm's law: identifying Ohmic and non-ohmic resistance; utilizing Ohm's law to establish the link between current and voltage; and applying Ohm's law to acquire the values of current and voltage.
h. Viscosity of Fluids and Archimedes' Law: a description of how to measure viscosity, see the impact of temperature on viscosity, demonstrate the truth of Archimedes' law, and calculate the density of liquids using the equations from Archimedes' law.
i. Describe the relationship between electric field strength as a function of charge voltage and as a function of distance from the sphere. Describe the relationship between electric potential as a function of charge voltage and as a function of distance from the sphere.
j. An explanation of the link between electric field strength and the separation between two capacitor plates as well as the relationship between a capacitor's electric field and its plate potential for a given fixed capacitor plate distance.
k. Understanding the fundamental principles and modes of functioning for the Wheatstone Bridge as well as identifying the unidentified resistance.
l. Joule's law: a description of the joule heat, a discussion of its influencing variables, and a description of how the joule heat is experimentally measured.
m. utilizing beam diagrams to determine the attributes of lenses and mirrors, explaining diverging and converging lenses and mirrors, and doing an analysis utilizing mirrors equation factors and equations.
n. Prism: Spectrometer operation explanation, prism refractive index calculation, and explanation of light dispersion in dispersing medium.
e. Lens focus: establishing the convex and concave lenses' focuses.

3. ACTIVITY IMPLEMENTATION

The objective of this activity is to improve learning among lecturers and students who are involved in this community service activity in the form of Real Work Lectures (KuliahKerjaNyata), in addition to partners who are teachers of science subjects, particularly Physics in Junior High Schools (SMP/SMA/Equivalent) in Riau Province. The Riau Provincial Education Office's principal partners, the Riau Teacher Association of the Republic of Indonesia (PGRI), and the schools that will be involved in the implementation collaborate with school personnel. The targets are:

a. Teachers: Junior and senior high school physics and science teachers. Because not all teachers are available according to their field of study, not all schools have science/physics teachers, and sometimes teachers from other fields of study teach science/physics in these schools, these broad and overall targets are employed.
b. Students: Students will also receive training and evaluation in the form of examples and trials in the form of online learning media simulations employing these tangible and visual aids.
c. A comprehensive experiment that can be compared in terms of innovation will result in the type and form of practicum and teaching aids that will be generated. This is in addition to having competence, knowledge, and experience, says the lecturer.
d. University students Another challenge is taking part in the creation of materials for the laboratories and exhibitions that will be on show.

Utilizing online teaching resources, service activities were implemented with the goal of encouraging teacher innovation and originality in the use of physics teaching aids during the COVID-19 epidemic. More than 100 people with knowledge in Physics in particular will participate in this activity, which will be carried out collaboratively by instructors and students. Similar to how local governments, PGRI, the Indonesian Physics Association (PSI), professors, students, and junior high/high school/equivalent students in universities all actively contribute to the realization of effective community activities, Figure 1.

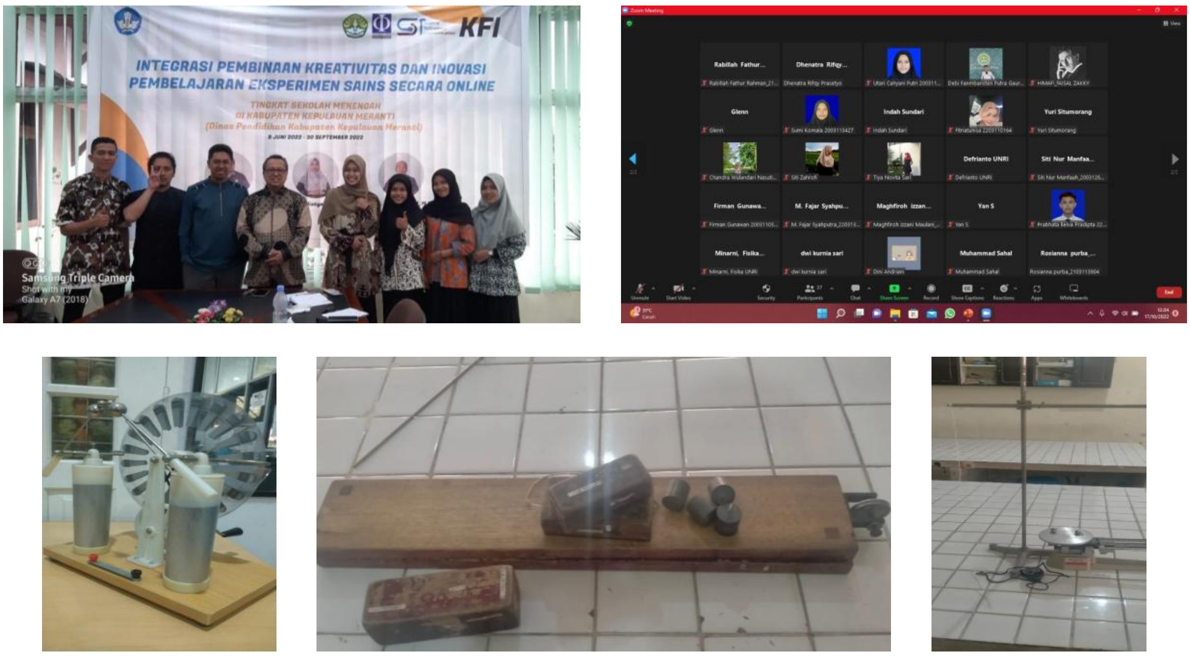

Figure 1. Implementation of online science experimental learning activities and its apparatus.

These external activities include:

a. Off-campus learning for students: Off-campus learning for students offers fresh perspectives, possibilities, and skills in addition to practice in applying knowledge while gathering theoretical, practical, and demonstrative materials that will be published in online media. Physical quantities on many straightforward natural events can be designed, put together, measured, and calculated, which is a wonderful experience. Students may also obtain this output in the form of training certificates for using online learning resources to prepare practica and presentations. Involved in the development of the module and the experiential learning process are 10 students who have teaching experience.

b. College Collaboration with Partners: This service activity's teaching and learning activities gave birth to a partnership between Universitas Riau professors and Riau teachers, particularly in districts and cities, for the benefit of students' education. They also improve collaboration in effective and efficient online learning by instructing students, students, and teachers as well as enhancing lecturers' ideas.
c. Other outcomes include collaboration on the creation of innovation modules that are created automatically.
d. Learning Innovation in Schools: Schools produce and develop media-oriented learning materials for use online so that instructors can demonstrate experiments using tools, computers, laptops, or smartphones while encouraging students' inventiveness. The preparation module's materials present 15 different innovation system types, and one activity for fostering creativity and innovation is detailed in the form of a practicum, components, and materials.
e. Innovations made and developed by teachers and students that are focused on using the same practical/demonstrative methods and resources but contain fundamental philosophical notions for teachers and students to understand and analyze natural occurrences boost community resilience. While it is still important to emphasize simplicity in technology and innovation in order to foresee advanced technology and high costs, the main goals of teaching tools and materials are the fundamental philosophy and understanding of natural phenomena, particularly physics. Compared to those based on advanced technology, measuring this base is much more crucial.
f. Publication: This service can be published as video in addition to print and electronic media. Additionally, the printed version of this activity has been documented as a module as a companion publication for instructors, advanced students, and senior students.

Figure 2. Group of students and presenter at integration level community service at Universitas Riau.

Figure 2 depicts a task from the second group integration real work lecture, which was held in Labuhbaru Barat Village, PayungSekaki District, Pekanbaru City in 2023.

4. CONCLUSION

Innovative learning models to encourage teachers' confidence in conducting experiments through online media, believing that science and physics experiments can be carried out with simple equipment and tools, and successfully exposing some misconceptions about science and physics material that have not been fully revealed, among other things, have been successfully completed and provide significant results.

ACKNOWLEDGEMENTS

The author would like to thank LPPM Universitas Riau for the support of facilities and financial support through Grant DIPA Universitas Riau so that this community service activity can be carried out properly. The author also thanks FMIPA Universitas Riau for the support of facilities for using laboratory equipment and internet.

REFERENCES

[1] Irawati, E., & Susetyo, W. (2017). Implementasi Undang-Undang Nomor 20 Tahun 2003 Tentang Sistem Pendidikan Nasional Di Blitar. *Jurnal Supremasi*, 3.

[2] Syahrul, S., Dewita, D., & Restu, R. (2018). Implementasi pewarna alami untuk diversifikasi mie sagu ikan pada pelaku usaha mikro mie sagu di Kabupaten Kepulauan Meranti, Riau. *Riau Journal of Empowerment*, *1*(1), 31-36.

[3] Ratnasari, C., Yuliantoro, Y., & Fikri, A. (2021). Eksistensi Kelenteng Hoo Ann Kiong sebagai Objek Wisata Budaya di Kabupaten Meranti. *INNOVATIVE: Journal Of Social Science Research*, *1*(2), 393-398.

[4] Pinandita, M. A., Yuliani, G., Subarnas, A., Widhiyatna, D., & Mutiara, S. (2020). Karakterisasi Dan Estimasi Sumber Daya Gambut Sebagai Material Adsorben Logam Berat Dalam Larutandi Blok Teluk Meranti, Kabupaten Pelalawan, Provinsi Riau. *Buletin Sumber Daya Geologi*, *15*(2), 101-115.

[5] Mahmudah, L. (2017). Pentingnya pendekatan keterampilan proses pada pembelajaran IPA di Madrasah. *ELEMENTARY: Islamic Teacher Journal*, *4*(1).

[6] Kusumaningrum, B., Kuncoro, K. S., Sulistyowati, F., & Arigiyati, T. A. (2021). Meningkatkan minat belajar daring selama masa pandemi covid-19. In *Prosiding Seminar Nasional Hasil Pengabdian Kepada Masyarakat,* 1(1), 206-211.

[7] Saktioto, S., Muhammad, J., Rini, A. S., Ramadhani, P. O., Nurbaiti, N., Putra, M. R. F., ... & Septyawan, G. (2023). The potential of liquid tofu waste as an alternative of liquid organic fertilizer in West Labuhbaru Village. *Journal of Innovation and Creativity Resources*, *1*(2).

[8] Syaparuddin, S., Meldianus, M., & Elihami, E. (2020). Strategi pembelajaran aktif dalam meningkatkan motivasi belajar pkn peserta didik. *Mahaguru: Jurnal Pendidikan Guru Sekolah Dasar*, *1*(1), 30-41.

[9] Kristin, F. (2017). Keberhasilan belajar mahasiswa ditinjau dari keaktifan dalam perkuliahan dengan menggunakan pembelajaran active learning. *Jurnal Pendidikan Dasar Perkhasa*, *3*(2), 405-413.

[10] Bao, W. (2020). COVID-19 and online teaching in higher education: A case study of Peking University. *Human behavior and emerging technologies*, *2*(2), 113-115.

[11] Aji, R. H. S. (2020). Dampak COVID-19 pada pendidikan di indonesia: Sekolah, keterampilan, dan proses pembelajaran. *Jurnal Sosial & Budaya Syar-i*, *7*(5), 395-402.

[12] Dewi, W. A. F. (2020). Dampak Covid-19 terhadap implementasi pembelajaran daring di Sekolah Dasar. *Edukatif: Jurnal Ilmu Pendidikan*, *2*(1), 55-61.

[13] Ananda, R., Fadhilaturrahmi, F., & Hanafi, I. (2021). Dampak Pandemi Covid-19 terhadap Pembelajaran Tematik di Sekolah Dasar. *Jurnal Basicedu*, *5*(3), 1689-1694.

[14] Baety, D. N., & Munandar, D. R. (2021). Analisis efektifitas pembelajaran daring dalam menghadapi wabah pandemi covid-19. *EDUKATIF: Jurnal Ilmu Pendidikan*, *3*(3), 880-989.

[15] Varma, A., & Jafri, M. S. (2020). COVID-19 responsive teaching of undergraduate architecture programs in India: learnings for post-pandemic education. *Archnet-IJAR: International Journal of Architectural Research*, *15*(1), 189-202.

[16] Kee, C. E. (2021). The impact of COVID-19: Graduate students' emotional and psychological experiences. *Journal of human behavior in the social environment*, *31*(1-4), 476-488.

[17] Lee, J., Myamesheva, G. H., & Kindikbayeva, K. K. (2017). Education in the 21st century: Digital philosophy and philosophy in digital reality. *Advanced Science Letters*, *23*(10), 9368-9373.

[18] Dewi, R. R. V. K., Muslimat, A., Yuangga, K. D., Sunarsi, D., Khoiri, A., Suryadi, S., ... & Iswadi, U. (2021). E-Learning as Education Media Innovation inthe Industrial Revolution and Education 4.0 Era. *Journal of Contemporary Issues in Business and Government*, *27*(1), 2868-2880.

[19] Nasution, A., Minarni, M., Farma, R., & Ningsih, S. A. (2021). Pembuatan Alat Laboratorium Untuk Praktikum Optik Geometri Tingkat Sma Berbasis Laser Dioda. *Komunikasi Fisika Indonesia*, *18*(2), 137-145.

[20] Smyrnaiou, Z., Georgakopoulou, E., & Sotiriou, S. (2020). Promoting a mixed-design model of scientific creativity through digital storytelling—the CCQ model for creativity. *International Journal of STEM Education*, *7*, 1-22.