International Research Journal of Management, IT & Social Sciences
Available online at https://sloap.org/journals/index.php/irjmis/
Vol. 8 No. 5, September 2021, pages: 476-486
ISSN: 2395-7492
https://doi.org/10.21744/irjmis.v8n5.1924

Utilizing Digital Applications in Improving Student Learning Outcomes (Review of Biology Teaching and Learning Strategies)

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Article history:

Submitted: 27 July 2021
Revised: 18 August 2021
Accepted: 09 Sept 2021

Keywords:

biology;
digital study;
digital;
learning;
publication review;
teaching;

Abstract

This paper aimed to review several publications on Biology teaching strategies by utilizing digital technology innovation to improve quality and learning outcomes. We selected study designs for several well-known publications, including Elsevier, Sagepub, ERIC, Google Books, and ResearchGate publications published in the last ten years to complement this paper. After the energy we need is gathered, we analyze as much data as possible with an exploratory approach to answer the research problem. For example, a study system that starts from data extract involves a coding and evaluation system and in-depth interpretation so that the data can be understood and answer questions with elements of high validity and reliability. We conclude that teaching with digital learning applications as learning resources refers to digital resources such as software, programs, or websites that engage students in biology learning activities and support learning objectives such as biology curriculum directions. Grounded strategies based on research evidence organize learning, so students think actively about biology from theory to application. Thus, the results of this study are helpful for the development of further research.

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1 Introduction

Biology learning activities occur under conditions that are not liked by students in Indonesian secondary schools (Prabowo et al., 2016; Putra et al., 2020). This could mean that students know that many students in other parts of the world, for example, enjoy learning with all kinds of technology (DiLullo et al., 2011). This technology-assisted learning activity serves as a portal to the world of biology, enabling them to gain hands-on experience with the methods, ideas, and emotions that come with actual study (Andarini, 2012). Others see biology laboratory practice as a pre-coordinated exercise, a detailed derivation of already studied solutions to seemingly insignificant problems. In teacher experience as a classroom biology teacher, one of the main challenges with classroom learning activities with only a whiteboard and the help of a high school biology teacher is that the instructor feels unprepared. Because it is not practical and takes a long time to demonstrate or carry out activities in the laboratory, this happens often. It turned out to be the main contributor to their disinterest in helpful work, namely by using technology such as digital applications (Andarini, 2012).

If the old system is without technology, the class feels very dull, and the topic is minimal. If students are required to pass an external exam, the teacher must follow the exam curriculum. According to high school biology laboratory research, many of them are underfunded and have outdated equipment (Davies et al., 2013; Maesaroh et al., 2020). Most high school biology students have difficulty learning and understanding biology topics, according to the classroom experience especially, especially in class. This indicates students' inability to successfully communicate, cope with fundamental everyday problems, and make predictions (Svoboda & Passmore, 2013). However, considering the condition and inability of students to utilize the biology knowledge from the teachers to explain natural biological phenomena, the limited ability of the teachers or the ignorance of the biology teacher's technology towards their students is very concerning. Finally, the solution for learning biology with digital is where practicum activities take place, allowing students and teachers to collaborate. So that biology practicum assignments and presentations are no longer as unattractive as they used to be when done in class (Phillips & Trainor, 2014).

Looking at the teaching activities of biology in Indonesia, we can see that today's practical courses will be taught in a lecture-style that has not changed over the last few decades (Putri et al., 2020). Women are the most significant part of the teaching staff, so women also have the most potential to learn biology teaching methods by integrating them with technology so that they can attract and inspire their students, but no longer by using a long lecture-style because it allows them to collaborate under a technology guide (Saputri, 2019). Once again, in this millennial century, high school teachers in Indonesia continue to use "printed books" as biology teaching materials, separating textual and digital experiments and remaining alone. This teaching approach shall not happen again. Ideally, the instructor is not just a source of data and knowledge. This strategy is not able to develop students' understanding of science or their belief in them. All things being equal, it counteracts the best feasible science technique, where students perform their tests under the instructor's control. All of that would be possible if the technology already existed between them (Tripp, 2011). Why not present students with real problems and encourage them to compose their answers rather than the teacher showing them what to do in front of the class? Perhaps, teachers use research facilities/equipment inaccessible as an excuse, just as technology is considered a luxury measure issue, whereas digital technology is like food to survive in today's world. However, it must be acknowledged that some food is poisonous. Likewise, some are mismanaged in technology to become technology poison for users or students (Liakos et al., 2018).

Technology must be a fundamental learner mover in any class because, behind the current status, things in education are facilitated by science, which is close to technology in elementary schools with options. This is within the framework of the technocrat's thinking and especially in the valuable characteristics of the scientific study space educator itself, both visible and unattainable in the school setting. School students with optional should be assisted by technology that pays little attention to age group, location, or even their ancestral origins, which have proven to be comparatively enthusiastic about logical technology, including the biological sciences themselves (Franklin, 2013). Regardless of whether the condition of schools in developed areas or not. Ideally, students should be helped because they do not change unless they are changed. The number of students offering science as an optional school biology subject has increased recently in Indonesia and other developing countries. Students are attracted to medical care calls because of the visible advantages (Batz et al., 2015). However, other components cannot be achieved if our children can only be less useful at work. Many of the most critical problems of the twenty-first century are relied on to have natural roots: preventing and tackling deadly diseases such as AIDS, finding sources of organic materials and energy, and caring for the world's rapidly growing population, some of the best examples of the times in which students are living is located (Landrain et al., 2013).

Furthermore, the Biology of science is near the edge of technology to solve some of science's most complex questions without the help of technology. How to understand the animal is big and growing? (Benton, 2013). So the solution is to search and immediately get the answer. How much is advised for us to have the choice to control nature, and how much is advised for us to have the choice? (Song et al., 2017). The rapid progress of data innovation underscores the power of progress, coordinated with the rapid increase of organic information, which is a strong driver for change. The topic that binds together in the new data innovation pattern is to move away from traditional learning and presenting "old books" that describe addresses and towards a more inclusive, dynamic, and explorative preparation of common-sense intelligence (Myers, 2019).

When students are exposed to such scientific methods in biology classroom practice, they are bound to acquire qualities such as interest, critical thinking, innovation, and persistence, which are essential in the science of integrated technology. During research facility assignments, advances in data, such as tapes and laser plates, and complex computers and laptops and intersectional innovations, may be able to reevaluate the relationship between science educators and their students. The problem faced by optional school science educators in Indonesia as a large developed country is the absence of subject information and entry into the scope of other hardware to teach science in an integrated manner with adequate learning technology like in developed and reputable neighbouring countries (Pearce et al., 2012).

2 Materials and Methods

This article examined various papers on Biology teaching methods that included digital technology advances as part of attempts to enhance quality and learning outcomes, becoming more popular in all areas, including work and study (Johnson et al., 2010). To supplement this article, we chose study designs from many well-known publications, including Elsevier, Sagepub, ERIC, Google Books, and ResearchGate papers released in the past ten years. We used secondary data since the public limitation policy was in effect at the time of our study, and the government's attempts to react to the epidemic were still a question mark as to when it would stop. After gathering the power, we needed, we used an experimental method to analyse as much data as feasible to solve the study issue. For instance, a research system that begins with data extraction includes a coding and assessment system and in-depth interpretation so that the data can be comprehended and questions can be answered with high validity and reliability. We follow data qualitative in designing this paper report Irwin (2013), in the qualitative data for secondary analysis in an ethical epistemology and social context (Klein & Ford, 2003; Bicalho et al., 2009).

3 Results and Discussions

In the results section, we present the results of a study on a number of evidence from publications that are serious about the importance of technology in the pursuit of biology for Indonesian conditions.

School situation

Observing school conditions and the needs of biology education, facilities for science educators, the answer is technology and application capabilities, and additional health (Kangas, 2010). To make learning progress from their old approach to using modern technological gadgets and take a variety of ways to handle insightful lab exercises to have a significant understanding of the rapidly evolving nature of information, interfaces and meet the needs and difficulties in a rapidly evolving world of mechanics (Patterson & Hennessy, 2016). This can install much enthusiasm in students' research facilities and lab activities and open doors to improve their learning outcomes. In science research center activities, quality, innovative tools, teaching science is difficult, but daily activities in the lab have unique challenges that make it a demanding job requiring advanced skills (McHaney, 2012). The new bearing in scientific research facilities is using mechanical gadgets to enhance students' learning and teaching experiences. This new trend has swept through optional biological science laboratories in developed countries, where a clear and astonishing change in the way students learn has taken place. However, this is not easy for the government unless each individual teacher is willing to change by means of the teachers' self-initiative (Groff, 2013).

According to Ihsan et al. (2017), the condition of schools in Indonesia is indeed an important note not only for academics and stakeholders in Indonesia as a developing country but also for the general public when making difficult choices regarding school care that can achieve reasonable goals, biotechnology, the environment, and the environment.

Environment. Other problems involving science (Purcell, 2014). Science training is being rethought thanks to new mechanical gadgets as assets in the activities of scientific research facilities. Understanding what these tools are and how to use them is essential knowledge for teachers and their students. Since they were found to offer students a large amount of up-to-date knowledge about new advances for scientific operations in research facilities, the benefits of new innovative gadgets have been identified (Vakulenko et al., 2019). The adaptability that students need to understand education center administrators highlights the forces and approaches that drive quickly.

Moreover, as science recognizes a clear quality improvement in robotic exploration, researchers understand their obligations have shifted (Kumaravadivelu, 2012). They should give birth to future specialists and analysts, but also a typically equipped population. As new computer applications can reproduce lab associations, such as ingenious lab handbooks, the introduction of electronic checkpoints is turning into a reality (Sirius & Cornell, 2015). This gadget is an excellent navigation guide with visual and visible allure. They are precious for revealing something to students. The use of these new mechanical resources will help change the atmosphere in science research office classrooms and provide (Osborne, 2014). Opportunities to engage students in essential thinking and critical thinking; Opportunities to work out the informational value of the activity; Stimulate students' desire to master; The reasoning capacity required to acquire and apply sufficient technology so that results can be improved can be seen (Ottenbreit-Leftwich et al., 2010).

Technology and learning outcomes

Individual students learn in further education has changed significantly due to innovative advances (Rowland, 2012). In contrast to traditional conversation-based learning, which considers students as separate recipients of data with no place for student contributions or innovations, innovation-based learning fosters student creativity and further develops student outcomes by adopting holistic learning strategies. Students can do anything from transferring recorded conversations to referring to computerized translations of class-covered subjects using technology-based learning in further education so that learning is more accessible and personalizes students (Da Silva & Las Casas, 2017).

Customized and personalized learning

Refers to various learning experiences and instructional methods in meeting learners' various learning needs, interests, and backgrounds (Phillips & Trainor, 2014). For further education students, innovation takes a fundamental part in modifying and individualizing their schools. Innovation empowers instructors to give individual students more opportunities by reducing the need to deliver large enormousts of material. It turns out that it is much easier for educators to change their training strategies to suit students' interests and prerequisites because they have more opportunities to understand and engage with them (Senge et al., 2012). In addition, incorporating innovation into the classroom provides excellent results for children with special needs to learn more successfully. For example, it empowers students to study at their own pace and quickly return to exam subjects. Students who study the Internet and other mechanical devices approach various assets that enable them to participate and lead research in various ways, improving student learning outcomes towards personalizing learning in their lifetime (Su & Cheng, 2015).

An agreeable disposition

Referring to the discussion of learning technology in the country, extensive activities and concentrating alone in the library are similar to the usual advanced education model of the past. However, it is different; several future developing institutions are increasingly advancing online synergistic learning techniques (Rubin, 2017). For example, coordinated online efforts on different endeavours with colleagues on different discussions or reports taking part in their virtual learning conditions. It involves leveraging current innovations to enable students and educators to work together on research. The innovation allows small gatherings to study thinking in open learning conditions with multiple performances and screen-sharing capabilities instead of a typical classroom. This kind of participation among students can occur in the same classroom, in the same place, or even worldwide. So it would not hurt if Indonesia joined in slowly shifting to promising learning like the other world (Everist, 2010).

Based learning estimation

According to Booth (2014), the straightforward way technology is learning is very important in advancing multipurpose learning frameworks. Teaching staff can now sift through everything from student information on subjects through self-surveyed online tests to their interest in online conversational encounters and the time they spend in the library, in contrast to in the past when the primary accessible measure was test results or student participation. Even though there may be some direct costs associated with creating flexible learning innovations, real benefits can be demonstrated in more outstanding student commitment and faster theme authority (Gaston, 2013). Alternative ways that further education institutions can take advantage of innovation to improve student learning outcomes include flexible learning options. The current acceptance of teaching materials is not limited to libraries or homeroom teachers due to the advancement of innovation. Students can take study materials and concentrate anywhere, anytime, thanks to intelligent tools connected to the Internet so that the gap between rich and developing countries is almost simplified (Johnson et al., 2010).

Find content smart

With the use of innovation, teaching can be made more intuitive and effective, and productive. Biology course materials on designated education-based websites and sophisticated and creative computer-based discussion rooms are some of the instruments that encourage strong communication and engagement among students of all levels of education (National Research Council, 2011). In addition to demonstrating thinking in new and unconventional ways, technological innovations can make biology learning very interesting and impressive to students (Huberman & Miles, 2013). Teachers can increase the dynamic contribution of students to a more enjoyable learning system by using the latest gamification and robotics to make the learning atmosphere more attractive among students who are now increasingly millennial as well as virtual field trips and other web-based learning technologies, for example, which can be done in a classroom environment. the normal that we have left behind (Marreez et al., 2010). Cooperative learning encounters like this help students work on their cognizance, memory, and critical thinking capacities. Moreover, innovation might assist with looking gatherings, cooperative plan groups, and other comparable shared learning bunches accomplish better understudy results by smoothing out their work. Moreover, innovation might help dynamic understudy contribution in the homeroom, a significant component in data maintenance. Various kinds of advances might be used to test and realize what turns out best for understudies regarding data maintenance (Carrier et al., 2004; Martini et al., 2012).

Increasing learning experience

Teachers can create highly engaging, inventive, and unique informative materials by coordinating contemporary innovations, for example, artificial intelligence, and artificial reasoning, into further education (Moolenaar & Sleegers, 2010). Students from different foundations and with shifts taking prerequisites may benefit from the use of such learning tools today. In addition, innovation empowers instructors to reduce bias by monitoring and to break down the repetition of student comments in class and watching reports of their reactions. They can also use short surveys, talk comments, online tests, and other tools to respond to visiting questions quickly and appropriately (Ferris, 2014).

Evidence from the field

Moravec et al. (2010), said that the time saved by switching talk topics to learn before address (LBL) exercises were utilized to encourage understudies to put their acquired skills into practice. The proportion of understudies who answered five of six LBL-related test questions correctly in 2009 was significantly higher (p 0.001) than in 2007/8. In extensive fundamental science courses, LBLs coupled with intelligent activities can substantially enhance learning gains. Similarly, Sahronih et al. (2019), said that this research aims to determine the effect of intelligent learning media on the outcomes of understudy scientific learning. The effect was determined by compiling data from previous studies on similar topics using the meta-investigation method. Intelligent sight and sound are the intuitive learning medium type with the highest effect of 39.44 percent. Biology, with a 41.77 percent effect size, was the confluence of scientific images with the most impact size.

Furthermore, the findings of Weng et al. (2020), said that the goal of this study was to look at the effects of augmented reality (AR) innovation on students' learning outcomes (as measured by Bloom's intellectual levels) and attitudes toward science. A kind of AR was incorporated into the print book to bring it up to date. A semi-experimental protest and post-test design was used to assess the produced book's effectiveness on learning outcomes and attitudes toward science. The evaluation included 68 10th grade understudies. The findings revealed that using AR innovation may potentially enhance understudy learning outcomes at the investigating stage and their learning mentalities regarding science (McGill et al., 1992; Hedegaard, 2014).

Then there is evidence from the study of Harris et al. (2020), and his colleagues that they recommend that instructors use thorough showing rehearsals in their online courses, which they may do explicitly via dynamic learning. All understudies, especially those from minority or disadvantaged groups, will benefit from combining educational methods to increase dynamic and thorough displaying concepts. As a first step toward more thorough instruction in nature and developmental science courses, we encourage educators to concentrate on small changes. Yang et al. (2020), see the feasibility of integrating an Interactive Whiteboard (IWB) into middle school science instruction is investigated in this study. The findings demonstrate that IWB understudies have significantly superior learning aptitudes. They will also have more positive attitudes about their learning environment in general. Examine educator understudy verbal cooperation; the whole showing measure was captured as a showing video (Herbst, 2004; Marcus & Sutin, 1985).

The study of Utomo et al. (2020), determined the suitability of a STEAM-based biotechnology curriculum with streak movement for secondary school science instruction. The examination design was based on the planning model for R2D2 advancement, with a single gathering pretest-posttest plan serving as adequacy tests. With a final score of 89.85, the aftereffects of the approved material, media, and customers revealed that the module was significant. Then Mafugu (2021), also said that following the outbreak of the COVID-19 pandemic, higher institutions all around the globe made a crisis shift to web-based learning (Aslan et al., 2020; Suroso et al., 2021; Nugraha et al., 2021; Manullang et al., 2021). It will assess the impact of guided buddy peer collaboration on understudies' achievement in this section. The data was gathered using a Biology Achievement Test. During the lockdown, there was a significant difference in the execution of the two gatherings. The instructor-led collaboration had a significant impact, but the advanced gap affected understudy presentations. Tafirenyika (2021), said that the issue of the COVID-19 epidemic, higher institutions all around the globe made a crisis transition to web-based learning. This study looks at the impact of guided companion peer connection on understudies' achievement. The data was gathered using a Biology Achievement Test. During the lockdown, there was a significant difference in the execution of the two groups. The automatic barrier had little effect on understudies' exhibition, while speaker-directed collaboration had a significant impact (Ashenfelter et al., 1999; Ioannidis et al., 2014).

Similarly, Adebanjo (2020), who studied information and communication advances (ICT), has altered the instructional approach in training from an educator-centered to a student-centered methodology, which has improved teaching and learning. The goal of this study was to see how understudies' scholastic achievement in Biology might be improved with the help of data and correspondence innovation. The influence of sex on the direction was also investigated. The findings revealed that ICT aided mentoring significantly affected understudies' scientific achievement. In any event, there was no significant effect of gender orientation on outcomes. It was recommended that the Government provide ICT assets to auxiliary schools in Indonesia and that instructional experts emphasize current instructional assets. Likewise, Ungaya (2020), study is a term used to describe a person at the KCSE; scientific courses, especially science, have shown a decline in performance compared to non-science topics. Students' perceptions of science as dull and challenging have been linked to execution because of the theoretical concept of its content (Vescio et al., 2008; Cheng et al., 2009).

According to research, the utilization of innovation in scientific guiding or instructing may operate on the theoretical substance and create interest among understudies when there are sufficient innovation assets. The last review from Suryawati et al. (2017), said that analyze, design, and nurture a model for improving the capacity and intensity of Education College graduates. The evaluation was conducted following the Indonesian Government's agreement on the Indonesian Qualification Framework's six levels (IQF). The article included an essential examination of the developed models for reinforcing the incoming Biology Education Department (Handayani et al., 2019; Sanchez et al., 2020).

4 Conclusion

In this final section, we summarize the results of the study and discussion of the advantages and advantages of technology when adopted in biology learning in educational and teaching less developed countries. We found data that

ISSN: 2395-7492

had answered the problem with elements of high validity and reliability. We can conclude these findings, among others, we see the actual conditions of schools that have not been able to fully adopt technology. Then we include findings of how technology makes biology learning outcomes higher, how learning technology can make students become personalized learners. In adopting technology, of course, there must be a logical estimation so that the technology can be achieved as desired. In the last section, we examine several field study evidence on how the mainstream of digital technology has been successfully applied in many learning contexts and countries so that there is no longer confusion about how helpful technology can be in improving student learning outcomes.

Conflict of interest statement
The author declared that he have no competing interests.

Statement of authorship
The author have a responsibility for the conception and design of the study. The author have approved the final article.

Acknowledgments
I am thank all contributions in feedback and donor from various parties until this study was done as expected. Without this support, this project will not be done.

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