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The Potential of Interactive Teaching Materials of Natural Science Practicum Courses in Elementary School by Distance Learning

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Abstrak

Pembelajaran jarak jauh bukanlah hal baru bagi dunia pendidikan, namun membutuhkan dedikasi dan inisiatif lebih dibanding pelaksanaan pendidikan konvensional. Pembelajaran jarak jauh dalam perkuliahan adalah pelaksanaan pembelajaran ketika mahasiswa dan dosen tidak dapat hadir tatap muka pada waktu bersamaan di ruang kuliah kampus. Salah satu upaya pelaksanaan pembelajaran jarak jauh adalah dengan menggunakan kegiatan literasi interaktif. Penelitian ini bertujuan untuk mengkaji bahwa era ini memberikan implikasi bagi Indonesia sebagai negara yang ingin menjadi negara maju khususnya dalam bidang pendidikan. Jenis penelitian ini adalah penelitian deskriptif dalam literature. Hasil deskripsi membahas: (1) Upaya untuk menyesuaikan pembelajaran Praktikum IPA sesuai perkembangan zaman; (2) Penyediaan bahan ajar untuk mendukung proses interaksi tutorial dalam kegiatan praktikum IPA; dan (3) Kesiapan mahasiswa dalam pelaksanaan praktikum IPA dalam pembelajaran jarak jauh. Penelitian ini menyoroti beberapa kontribusi secara teoretis dan empiris, serta memberikan rekomendasi bahwa pelaksanaan praktikum jarak jauh melalui media digital dan penggunaan bahan-bahan yang tersedia di lingkungan sekitar perlu dukungan instruksi secara interaktif sehingga dapat mendukung kompetensi praktikum mahasiswa.

Kata Kunci: bahan ajar, interaktif, praktikum IPA, pembelajaran jarak jauh

Abstract

Distance learning is not new to education, but it requires more dedication and initiative than the implementation of conventional education. Distance learning in lectures is the implementation of learning when students and lecturers cannot attend face to face at the same time in the campus lecture hall. One of the efforts to implement distance learning is to use interactive literacy activities. This study aims to examine whether this era has implications for Indonesia as a country that wants to become a developed country, especially in education. This type of research is descriptive research in the literature. The results of the description discuss (1) Efforts to adapt natural science practicum learning according to the times; (2) Provision of teaching materials to support the tutorial interaction process in natural science practicum activities; and (3) Students' readiness in implementing natural science practicum in distance learning. This study highlights several theoretical and empirical contributions. It provides recommendations that the implementation of remote practicum through digital media and the use of materials available in the surrounding environment need interactive instruction support to support student practicum competencies.

Keywords: *teaching materials, interactive, natural science practicum, distance learning*

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INTRODUCTION

Learning Natural Sciences is one part of learning that focuses on explaining phenomena that occur in the universe. Science learning is learning about natural science products and how these scientific products can be produced through the scientific method by paying attention to scientific attitudes (Rybalko et al., 2020) The main goal of learning science is to help students develop higher-order thinking skills to enable them to face the challenges of everyday life (Erlina, 2021). Natural science is not only limited to mastering a collection of scientific products in the form of facts, concepts, or principles but rather as a discovery process. Natural science education/learning is expected to be a vehicle for students to learn about themselves and their environment and prospects for further development by applying it in everyday life (Edelson et al., 2021). (Edelson et al., 2021)The science learning process should emphasize providing direct experience to develop competence in exploring and understanding nature scientifically. Natural science learning is directed at inquiry and action to help students gain a more meaningful understanding of the natural surroundings (Subiantoro, 2014) Natural sciences is one of the subjects contained in the educational curriculum structure, which is intended to recognize, respond to, and appreciate science and technology and instill habits of thinking and behaving scientifically, critically, creatively and independently (Grahito Wicaksono, 2020).

Natural science practicum in elementary school is a course that discusses practical topics within the scope of Natural Sciences, such as living things, food, mechanics, waves, electricity, and magnetism. These topics are available in the Natural science Practicum Course in Elementary School at the Universitas Terbuka (UT) (Rumanta, 2011). Natural science practicum in elementary school requires students to be able to apply science concepts in practical implementation. In addition, students are also expected to apply basic science concepts through experimental activities to become skilled in teaching natural science in elementary schools. Practical activities are an area in developing individual qualities of citizens who understand science and technology. Facilities, infrastructure, aids, curriculum, and other factors will be meaningless if the tutor cannot manage and organize all learning resources into meaningful things (Korshunov & Knyazeva, 2020). One of the science learning methods that can create conditions for achieving natural science concepts and components is carrying out learning using the practical method.

A learning activity will run optimally, one of which is if the learning facilities have been met. Learning facilities are certainly a basic need for students. Learning facilities include school buildings and furniture, learning tools, and educational media. The learning tools referred to here are teaching aids and teaching materials. Teaching materials can be interpreted as all forms of systematically arranged materials that allow students to learn independently and are designed according to the applicable curriculum (Magdalena et al., 2020). Teaching materials are an essential source of material for teachers in carrying out the learning process. Without teaching materials, it seems that teachers will have difficulty achieving learning objectives. In principle, teachers must always prepare teaching materials for the implementation of the learning process. The role of an educator in designing or compiling teaching materials greatly determines the success of the learning and learning process through teaching material (Budiastra et al., 2021). So that an educator is required to have the creativity to be able to compose engaging, varied, innovative, contextual teaching materials according to the needs of students (Aisyah et al., 2020). In other words, interactive teaching materials that are arranged according to the needs of students become an essential thing in learning activities.

According to (Magdalena et al., 2020), several criteria for suitable teaching materials are to have skill material, motivate students to learn further, and follow the times. In addition, teaching materials need to be adapted to student conditions and the learning strategies used by lecturers (Elvarita et al., 2020). The rapid development of technology and communication is undoubtedly the most influencing factor in developing teaching material. In addition, the shift in the education system, which is currently a distance education system, also forces the development of teaching materials that are easily accessible anytime and anywhere. In this case,

interactive teaching materials can be an alternative in the implementation of learning activities. Interactive teaching materials, namely: a combination of two or more media (audio, text, graphics, images, animation, and video) that users manipulate or treat to control the order and or natural behavior of the presentation (Magdalena et al., 2020).

The Universitas Terbuka has carried out distance learning since its inception. The open and distance education system (ODE) is a system that combines the concept of open education with a distance education system. The terms open and distance education indicate three concepts that need to be understood, namely (a) open education, (b) distance education, and (c) open and distance education (ODE). In the distance learning system, teaching materials are the leading learning resource for students. UT teaching materials are specially designed so that students can study independently without the help of a tutor (Budiastra et al., 2021).

In this description, several problems are discussed: (1) How is the effort to learn natural science Practicum according to the times; (2) How to provide teaching materials to support the tutorial interaction process in practicum activities; and (3) Students' readiness in implementing natural science practicum in distance learning.

METHOD

This study uses the "Charting the Field" method, collecting samples from several relevant literature sources. The collected literature sources discuss natural science practicum learning, interactive teaching materials in natural science practicum learning activities, and the implementation of natural science practicum learning in distance learning. Therefore, it can provide a clear picture of the potential for interactive teaching materials for natural science practicum courses in elementary schools in distance learning at the Universitas Terbuka. The selection of literary sources is based on the following criteria: (1) national and international journals that have an index; (2) journals must be accessible online; (3) books and laws that discuss university regulations regarding international students; (4) literature sources present new knowledge.

Table 1
Literature List

Literature Source	Title	Authors	Address
Journal	Implementation of STEM Approach-Based Science Learning in Welcoming the Industrial Revolution Era 4.0	Anggit Grahito Wicaksono	https://jurnallensa.web.id/index.php/lensa/article/view/98/45
Journal	STEM education to fulfill the 21st-century demand: a literature review	Widya, Ronal Rifandi, Yosi Laila Rahmi	https://iopscience.iop.org/article/10.1088/1742-6596/1317/1/012208/pdft
Journal	Video-based instruction on safety rules in the chemistry laboratory: its effect on student achievement	Bu¨lent Pekdag	https://doi.org/10.1039/D0RP00088Dt
Journal	Development of Inquiry-Based Interactive Multimedia for Virtual Practicum on Biotechnology Materials in High School	Ade Suryanda, Tri Handayani K, dan Shanti Damayanti	https://scienceedujournal.org/index.php/PSEJ/article/view/18/12
Journal	Revisiting Distance Learning Resources for Undergraduate Research and Lab Activities during COVID-19 Pandemic	Zhe Qiang, Alejandro Guillen Obando, Yuwei Chen, and Changhuai Ye	https://doi.org/10.1021/acs.jchemed.0c00609
Journal	Implementation of Remote Practicum on the Topic of Microbial Growth in the Covid-19 Emergency Period at the Sumatran Institute of Technology	Fina Khaerunnisa Frima, Sysi Novita, M. Rofif Nurfaizi, Riyanto Widodo, M. Husen	http://jurnal.unimus.ac.id/index.php/JPKIMIA

RESULTS AND DISCUSSION

This study presents a description of (1) natural science practicum learning according to the times; (2) interactive teaching materials in natural science practicum activities; (3) preparation for the implementation of natural science practicum in distance learning. Further description is as follows.

Natural science practicum learning according to the times

Natural science comes from the Latin is Scientia, which means knowledge. Natural science is also a collection of knowledge about objects and natural phenomena obtained from scientists' thoughts and investigations with the skills of experimenting using the scientific method. Science essentially includes two things, namely products and processes. Science products include facts, concepts, principles, theories, and laws. The scientific process includes ways to acquire, develop, and apply knowledge, including how to work, think, solve problems, and behave. The nature of science provides an understanding that science includes knowledge of nature and understanding the process of investigation and acquisition of that knowledge. Practically, the nature of science can be implemented through a practicum activity (Inuwa & Baraya, 2017). At the elementary school level, it is called elementary science practicum.

Table 2
Supporting Literature

Literature Source	Title	Year	Authors	Results
Journal	Implementation of STEM Approach-Based Science Learning in Welcoming the Industrial Revolution Era 4.0	2020	Anggit Grahito Wicaksono	Supporting aspects in science learning that meet the demands of the industrial revolution 4.0 are using innovative problem/project-based learning models, using approaches that involve elements of science, technology, and society, and can improve 21st-century skills, including critical thinking, problem-solving, and creativity.
Journal	STEM education to fulfill the 21st-century demand: a literature review	2020	Widya, Ronal Rifandi, Yosi Laila Rahmi	The application of STEM in education is a step to answer challenges in the 21st century. Students are prepared to face the 21st century (digital era): communicative, collaborative, critical thinking, creative and innovative. Then, the application of STEM learning in education can also prepare skilled workers in science, mathematics, and technology.

Natural science learning is learning about systematically exploring the natural environment so that it masters the systematic accumulation, mastering the collection of knowledge, and the discovery process. Natural science learning is a process that can help students learn more meaningfully through process skills so that they can master scientific knowledge and natural laws and apply them in real-life contexts (Wicaksono et al., 2017). The Industrial Revolution 4.0 presents a real challenge, especially for educators, to create a globally competitive generation (Korshunov & Knyazeva, 2020). The results of this study reveal that the supporting aspects in natural science learning that meet the demands of industrial revolution 4.0 are using innovative problem/project-based learning models, using approaches that involve elements of natural science, technology, and society, and can improve 21st-century skills, including critical thinking, problem-solving, and creativity.

Another study was conducted by Widya et al., 2019 regarding Science, Technology, Engineering, and Mathematics (STEM) learning and the role of STEM learning in facing the challenges of the 21st century. STEM learning integrates science, technology, and mathematics to develop students' creativity through problem-solving. By applying the 4 STEM components, students can use the knowledge gained to solve problems in everyday life according to the demands of today's work. This is in line with the expert opinion,

which states that the application of STEM in education is a need of the world today (developing countries and developed countries). The application of STEM in education is also a step to answer challenges in the 21st century. Students are expected to have characters that are following 21st-century learning. Students are prepared to face the 21st-century era (digital era): communicative, collaborative, critical thinking, creative and innovative. Then, the application of STEM learning in education can also prepare skilled workers in science, mathematics, and technology.

The following are the results of learning in natural science practicum through video instructions. Examples of the wrong answers of the student groups to the posttest questions about safety rules are provided in Table 3.

Table 3
Examples of the Wrong Answers of the Student Groups in the Posttest

Categories	Groups	Posttest
Confusing the rules	Control	Things like slippers should not be worn.
	Experimental	Chemicals should not be sniffed.
Knowledge gleaned from everyday life	Control	Water should not be spilled on electric cables.
		We should not burn a flame randomly anywhere.
	Experimental	Electrical devices should not be touched with a screwdriver.
		Broken glass materials should not be touched.
Unscientific answers	Control	We need to come to the laboratory with our stomachs full.
	Experimental	We need to carry hot containers with a cart.

(Sumber: Pekdağ, 2020)

The study results indicate that the elementary science practicum is carried out to implement the nature of science learning so that students can interpret the learning process better. Primary science practicum is an activity to verify or prove a fact or natural phenomenon related to science learning material. Practicum is a learning method by practicing directly to prove a concept being studied. Practicum can make an exciting learning process so that the learning outcomes obtained in attitudes, knowledge, and skills. Some elementary science content or materials are presented in the form of practicum, including the characteristics of living things, changes in substances, ecosystems, light reflection, light refraction, measurements, and styles (Fuentes-Abeledo et al., 2020).

Practicum in elementary science learning also applies the scientific method through interrelated stages based on factual evidence. The scientific method is a systematic way used by scientists to solve the problems at hand. This method uses systematic, orderly, and controlled steps (Siregar et al., 2020). The operational steps of the scientific method, namely (1) formulating the problem; (2) developing a framework of thinking; (3) proposing a hypothesis; (4) testing the hypothesis; (5) processing and analyzing data; and (6) draw conclusions. These six stages, either directly or indirectly, have accommodated the elementary science learning process, which is carried out practically.

In elementary school, natural science practicum courses are taught in the education study program of a primary school teacher in Universitas Terbuka, which consists of practical topics of living things, food, mechanics, heat, waves, optics, electricity, magnetism, and the earth and the universe. In the Natural science practicum course in elementary school, students can clarify concepts that have been studied previously, develop experimentation skills and develop scientific thinking and work skills. This course requires students to apply science concepts in practical implementation (Siregar et al., 2020). It is expected that students can apply basic science concepts through an experimental activity to understand the basic concepts of science better and be skilled in teaching in elementary schools. In the learning process, especially practicum learning, learning resources are one of the essential things in supporting the learning process. In his research exploring natural science practicum activities during the covid-19 pandemic, he stated that the lack of references in natural science practicum courses was one of the obstacles in carrying out practicums, primarily when distance learning was

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implemented (Anggrella et al., 2021). It was also stated that students need a learning resource that is not only in the form of practical instructions but also learning resources that can be integrated by developing students' 21st-century skills, and can be accessed anywhere, so that teaching and learning activities become more flexible. This is supported by the results of student questionnaires on the need for learning resources. The majority of students stated that they needed learning resources in the form of electronic media, while the rest stated that they needed learning resources in modules and textbooks.

K. Khairiah, 2018 researched the needs analysis of the development of plant physiology practicum instructions for distance learning and revealed that students found it challenging to understand the material without supporting media and teaching materials following the lecture plan. Students also think that, generally, practicum cannot be carried out without a laboratory. Therefore, practical instructions are needed with simple materials and procedures to carry out practicum independently without a laboratory. According to students, the format of the practicum guide is more attractive to students in the digital format.

Interactive teaching materials in natural science practicum activities

Table 4
Supporting Literature

Literature Source	Title	Year	Authors	Results
Journal	Video-based instruction on safety rules in the chemistry laboratory: its effect on student achievement	2020	Bülent Pekdağ	Video-based instruction as one type of interactive teaching material seems to be a practical approach to teaching science. Teachers can use this video-based approach in their classrooms to ensure that students improve their understanding of concepts in science.
Journal	Development of Inquiry-Based Interactive Multimedia for Virtual Practicum on Biotechnology Materials in High School	2020	Ade Suryanda, Tri Handayani K, dan Shanti Damayanti	Usually, teachers deal with challenging genetic engineering activities by using media. Standard media used is PowerPoint presentations or videos. The teacher reveals the need for audio and visual media to describe the genetic engineering process more clearly and interactively so that it is easier to understand.

A study was conducted by Suryanda (2020) to develop teaching material in the form of inquiry-based interactive multimedia for a virtual practicum on biotechnology materials in high school. The study stated that students would usually understand better when invited to play an active role and conduct their experimental activities, such as practicum. However, this is constrained by time allocation because it requires more time when doing the practicum. It is difficult to carry out practicum on genetic engineering in schools because of inadequate facilities and infrastructure. Therefore, teachers usually get around this challenging genetic engineering by using media. Media that teachers generally use are PowerPoint presentations or videos. The teacher reveals the need for audio and visual media to describe the genetic engineering process more clearly and interactively so that it is easier to understand.

Another study on the effect of video-based instruction on safety rules in a chemistry laboratory on student achievement was conducted to understand the effect of video-based learning on increasing students' understanding of chemical laboratory safety rules compared to traditional learning. Video-based instruction as a type of interactive teaching material seems to be an effective approach to teaching science. Teachers can use this video-based approach in the classroom to ensure that there is an increase in students' understanding of concepts in science (Pekdağ, 2020).

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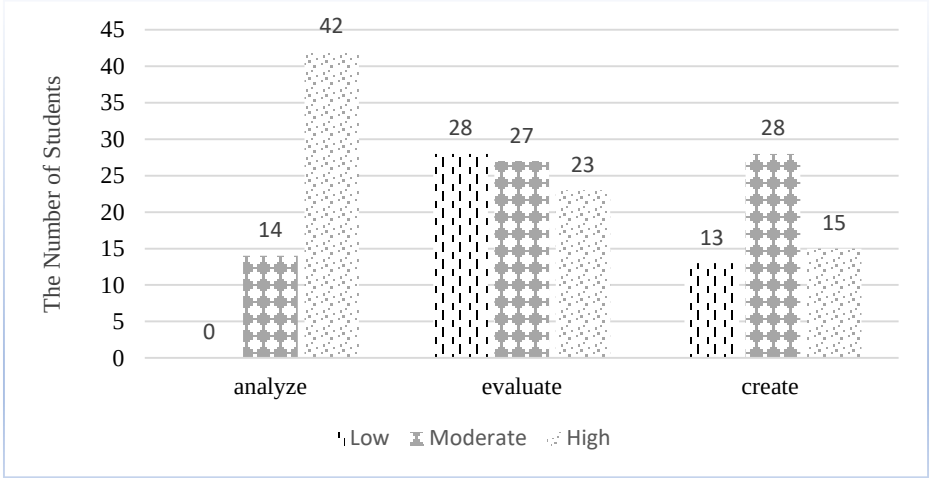

Picture 1. Percentage of N-gain Criteria for Student Learning Outcomes in 2 Testing Groups
(Source: Budiastra et al., 2021b)

Figure 1 shows that innovative teaching materials in blended learning can improve the ability to analyze, evaluate and create learning processes in distance learning systems. Teaching materials are a set of subject matter that refers to the curriculum used to achieve predetermined competency standards and essential competencies (Lestari et al., 2019). Teaching materials or learning materials (instructional materials) broadly consist of knowledge, skills, and attitudes that students must learn to achieve predetermined competency standards. In detail, the types of learning materials consist of knowledge (facts, concepts, principles, procedures), skills, and values and attitudes (Aisyah et al., 2020) There are three main functions of teaching materials for the implementation of the learning and learning process. The three functions are as follows: (1) Teaching materials are guidelines for teachers who will direct all activities in the learning and learning process, as well as a substance of competence that should be taught/trained to students; (2) teaching materials are guidelines for students who will direct activities in the learning and learning process, as well as a substance that should be studied/mastered; (3) teaching materials are an evaluation tool for achievement/mastery of learning outcomes. As an evaluation tool, the teaching materials delivered must be following the indicators and essential competencies to be achieved by the teacher. The subject syllabus has formulated these indicators and essential competencies (Dewi et al., 2021).

According to Magdalena et al., 2020 the criteria for suitable teaching materials are as follows (1) Teaching materials must be relevant to competency standards and essential competencies; (2) Teaching materials must-have aspects of knowledge, namely facts, concepts, principles, and procedures; (3) Teaching materials have skill materials; (4) Teaching materials must have the principle of consistency; (5) Teaching materials must have the principle of adequacy; (6) Teaching materials must motivate students in distance learning; (7) Teaching materials must be related to the previous material; (8) Teaching materials must be arranged systematically from the simple to the complex; (9) Teaching materials must be helpful for students; and (10) Teaching materials must be following the times.

Interactive teaching materials are multimedia or teaching materials that combine several media that can be used in learning (Rismawati & Nasution, 2020). Interactive teaching materials are alternative teaching materials that can be used to support learning to increase understanding of the material being studied. Printed or conventional teaching materials have the disadvantage that they are easily lost and damaged. There are not so varied teaching materials because teachers cannot maximize the use of current information technology advances (Kriswanto & Rochmawati, 2020).

The utilization of teaching materials in the learning process has an important role. According to(Puspita et al., 2021), this role includes teachers and students in classical, individual, and group learning. To obtain a more precise understanding, each role will be explained as follows:

For teachers, teaching materials have a role, namely:

1. Save teacher time in learning. With the existence of teaching materials, students can be assigned to study the topic or material to be studied first, so the teacher does not need to explain in detail anymore.
2. Change the teacher's role from a teacher to a facilitator. With the existence of teaching materials in learning activities, the teacher facilitates students than delivering the subject matter.
3. Improving the learning process to be more effective and interactive. With teaching materials, learning will be more effective because teachers have much time to guide their students in understanding a learning topic, and also, the methods they use are more varied and interactive because teachers do not tend to lecture.

For students, teaching materials have a role: (1) Students can learn without the presence of a teacher. (2) Students can study anytime and anywhere they want. (3) Students can learn according to their own pace. (4) Students can learn according to the order of their choosing. (5) Helping potential students to become independent learners. (Khoerul Anwar and Fadlillaturrahmah, 2017) revealed that learning using e-modules and video tutorials is considered very supportive of learning, especially during the pandemic, limiting access to offline learning, for example, direct practicum in the laboratory. The course must also be supported by the ability and creativity of educators to create or develop learning media that can provide convenience and inspire students to study better, even though it is limited to online only. The use of e-modules provides many conveniences to students. In other words, they are more inspired to achieve good learning outcomes (Perdana et al., 2019).

Preparation for the implementation of natural science practicum in distance learning

Table 5
Supporting Literature

Literature Source	Title	Year	Authors	Results
Journal	Revisiting Distance Learning Resources for Undergraduate Research and Lab Activities during COVID-19 Pandemic	2020	Zhe Qiang, Alejandro Guillen Obando, Yuwei Chen, and Changhuai Ye	Some suggested strategies and approaches for research and laboratory activities in distance learning include (1) Question-Based Literature Review; (2) Visualizing Experiments from Virtual Journals; (3) Safe and Simple Projects at Home; and (4) Learning and Using Computing Tools. The four approaches can increase student engagement and learning outcomes by making the learning experience from home more efficient and rewarding.
Journal	Implementation of Remote Practicum on the Topic of Microbial Growth in the Covid-19 Emergency Period at the Sumatran Institute of Technology	2020	Fina Khaerunnisa Frima, Sysi Novita, M. Rofif Nurfaizi, Riyanto Widodo, M. Husen	Through remote practicum activities with three stages: practicum preparation stage, practicum implementation, and implementation evaluation, students can practice practical skills at home using daily chemicals.

Studies carried out regarding distance learning resources for lab activities during the COVID-19 pandemic show that the implementation of laboratory activities requires a different approach, especially with more limited resources than lecture-based learning in general (Subotin et al., 2021) As an essential part of active student learning, practical research and laboratory activities in distance learning need to be carefully designed. Several strategies and approaches for active laboratory activities are: (1) Question-Based Literature Review; (2) Visualizing Experiments from Virtual Journals; (3) Safe and Simple Projects at Home; and (4) Learning and

Using Computing Tools. According to Subotin et al., 2021, the four approaches can increase student engagement and learning outcomes by making the learning experience from home more efficient and valuable.

Another study discusses the application of remote practicum on microbial growth during the COVID-19 emergency at the Sumatra Institute of Technology (Lassoued et al., 2020). The study was carried out through three stages: practicum preparation stage, practicum implementation, and implementation evaluation. The evaluation results of the study showed that students were able to practice practical skills through a remote practicum at home using daily chemicals.

Table 6
Report Value Group

Group Value	Number of Students (%)
High	83%
Currently	13%

Table 6 shows the number of students who fall into the high-value category, indicating that a total of 83% of students have understood the lecture material through the implementation of practicum. The empirical description of the results of the management of natural science practicum shows that there are several important activities, namely (1) planning for natural science practicum, (2) strategy for implementing natural science practicum, (3) supervision of natural science practicum, and (4) evaluation of the results of natural science practicum (Astuti, 2015)

1. Science practicum planning

Planning is essential in practicum management because it is carried out to determine the title and objectives of the practicum to be carried out, practicum targets that are adjusted to the practicum class, practicum material to be carried out, and evaluation instruments that can be used as a reference or guideline for student work assessment both during the practicum and during the practicum. Assessment of practicum results, making worksheets adapted to topics, learning materials, and school conditions, dividing groups of practitioners who adhere to the principles of justice and equity, and making practical rules. Without planning, practicum activities will not run well, and learning objectives will not be achieved.

2. Strategy for implementing science practicum

After implementing practicum management planning, the next stage is practicum implementation. The teacher determines the practicum place that is adapted to the practicum material. Whether in the laboratory or outside the laboratory, adjusts the position of each group. So that the groups do not interfere with each other, group members can work optimally, and prepare practicum tools if held in a separate laboratory—assisted by the laboratory assistant. They were next, providing direction on the work steps, explaining the use or operation of practicum tools, carrying out observations or experiments, and then, together with the laboratory assistant storing back the practicum tools that have been used.

3. Supervision of science practicum

Supervision aims to determine how the implementation of the practicum and according to the plan. Supervision is also carried out to minimize the occurrence of violations by students during the practicum. Things that are carried out at this stage are making preparations for supervision, determining what points will be supervised, conducting supervision during practicum students, guiding students when carrying out activities, and giving warnings and sanctions to students who violate the rules and regulations.

4. Evaluation of science practicum results

The last activity carried out was the evaluation of the results of the practicum. This activity aims to determine how far the practicum activities are going and how the results are so that students' absorption of practicum material can be known. At this stage, the teacher collects practicum reports and then checks and gives grades. In the next step with the students, the teacher holds a class discussion to make the correct conclusions

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about the results of the practicum associated with the existing theory. After finishing all making conclusions, students are then given a post-test which aims to find out how much students' absorption of the practical material that has been implemented.

The Universitas Terbuka implements a distance learning system. Students' practicum experiences are developed using practical guidelines, dry labs, and wet labs in collaboration with other institutions. Students who experience difficulties in carrying out practicals are facilitated through access to services such as remediation, intervention, academic counseling, and learning clinics for students with difficulties which are carried out both online and face-to-face depending on student needs. UT practices an approach to sharing learning resources through online access to digital libraries, dry lab, self-exercise, video, radio, UT-TV, and Contact Center, some of which are publicly available. Table 4 presents UT indicators for teaching and learning. In the semester cycle, the UT administration system begins with the admission of new students through course registration, provision of learning materials, learning support, and assessment at the end of the semester. This cycle continues for several semesters for different groups of students, depending on the program and level, usually 8 semesters for undergraduate programs, 4 semesters for master's programs, and 6 semesters for doctoral programs, and finally leads to the student's graduation at the end of the program.

The learning support modes that students can choose can generally be categorized into four types: distance learning with online tutorials, mixed distance learning supported by online tutorials, distance learning, which is fully supported by face-to-face tutorials, and online learning (Lassoued et al., 2020) The tuition fee charged to students depend on the learning support service provided to students. In addition to the learning support, all students are provided with the following support services: (a) Printed learning materials are sent to student locations; (b) Digital learning materials sent via email to students can be downloaded into 2 types of gadgets: Android or IOS, and notebook or desktop; (c) Online tutorials for all courses; (d) Paper-based semester exams in more than 800 cities in the country, and more than 40 country locations abroad; and (e) Other services at an additional cost or the request of the student, for example, face-to-face tutorials, online exams.

In the distance learning system, teaching materials are the primary learning resource for students. UT teaching materials are specially designed so that students can study independently without the help of a tutor. Among the various teaching materials, interactive teaching materials containing audio, video, text, or graphics can be an alternative for students. (Grahito Wicaksono, 2020) revealed that teaching materials in the form of video tutorials regarding remote practicums could represent a teacher as a student mentor in implementing practical learning. In addition, video tutorials designed as interactive practicum guides are considered more effective during distance learning because students can access them anytime without being limited by time as using virtual meeting applications (Suryanda, 2020)

Research from Anggreini A (2021) states that E-modules is the best alternative in developing teaching materials for distance learning, where there are learning objectives, materials, learning activities, exercises, quizzes, and feedback equipped with videos. Anggreini A (2021) also stated that in distance learning, students need learning resources in the form of interactive videos that can be packaged in e-modules as interactive teaching materials. In the study, it was found that the use of e-modules as teaching materials immensely helped students in solving distance learning problems.

CONCLUSIONS

According to the times, the learning process for natural science practicum courses can be done using various digital media. The implementation of the practicum can be in the form of distance learning with online tutorials, mixed distance learning supported by online tutorials, and distance learning, which is fully supported by face-to-face tutorials, and fully online learning. Interactive teaching materials are a combination of two or more media (audio, text, graphics, images, animation, and video) that are manipulated or treated by users to control the order and or the natural behavior of the presentation. Interactive teaching materials are considered

very supportive of the learning process and make students more inspired to achieve learning outcomes. In practicum courses, especially natural science practicum in elementary schools, it is difficult to understand the material without supporting media and teaching materials following the material in the lecture plan. So we need teaching material that is not only in the form of practical instructions but also learning resources that can be integrated by developing 21st-century skills for students, and can be accessed anywhere, so that teaching and learning activities become more flexible.

SUGGESTIONS

Distance learning, which is becoming a trend in the current learning system, cannot be separated from interactive teaching materials. Innovations in distance learning systems need to be further developed. The use of e-modules as a form of interactive teaching materials is considered very helpful for students in solving distance learning problems.

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