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# Utilization of Surrounding Materials to Support Basic Chemistry Learning in the Covid19 Pandemic Era

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**ABSTRACT**
The Covid-19 pandemic has been going on for over a year. This condition affects various aspects of people's lives and habits, including education and learning aspects. This article aims to: 1) describe the needs analysis for practicum Basic Chemistry learning in Covid19 pandemic era; 2) describe the potential use of surrounding materials in supporting practical learning that can be done at home by students in Covid19 pandemic era; 3) describe the design of practicum Basic Chemistry learning in the Covid19 pandemic era. Data collecting by qualitative method obtained were carried out by observing and orienting practical Basic Chemistry learning as an alternative to practical learning in the Covid19 pandemic era. The data resource in this research is from the document of Basic Chemistry curriculum, practicum guideline, and learning experience in Basic Chemistry learning course. The research procedure at this stage, especially at the preliminary study stage, through reference studies, document analysis, and mapping of practicum titles that can be carried out to support Basic Chemistry courses in the Covid-19 pandemic era by utilizing surrounding materials. The results of the study, it can be concluded that practical activities are important in learning Basic Chemistry so that students do not lose the essential Basic Chemistry learning. During the Covid-19 pandemic era, practicum activities can be carried out by utilizing materials around students that are easily available. Learning designs that can be applied include project-based learning (PjBL) with modifications to the aspects of the work, which can be in groups or individually, according to student conditions, which is most likely to be implemented with all its strangeness and weakness.

***Keywords:*** *Surrounding materials, Basic chemistry practicum, Covid-19.*

## 1. INTRODUCTION

The Covid-19 pandemic has more than a year affected various aspects of life, including parts of education and learning. Both learnings in exact and non-exact fields are included in chemistry learning. The order of people's social life shifts and becomes an external factor that affects the current learning process [1]. Various attempts were made to adapt and compromise with the circumstances. The field of learning is the same, which was initially carried out offline/offline, starting to be implemented online/online. Chemistry learning, apart from being theoretical in the cognitive domain, also involves the affective and psychomotor domains by applying practicum activities. Physical restrictions and social activities on a large scale do not allow learning to be carried out face-to-face so that it has a major impact on learning activities that must be carried out with practical activities. Chemistry is a branch of science. The development and application of science require experimental work. Chemistry learning cannot be done only by providing theoretical material [2].

With the regulation and implementation of activities restrictions or physical distancing during the pandemic, laboratory practicums cannot be carried out as they should. But on the other hand, learning activities with experiential learning in the form of practicum in chemistry lessons cannot be eliminated. Chemistry learning is strived to remain in line with the nature of chemistry learning itself. The learning experience with chemistry practicum activities, especially at the university level, usually includes three stages: pre-laboratory, practicum implementation, and post-practice. Pre-practice (pre-lab) is a preparatory stage carried out by students by studying concepts and making work plans.

The next stage is the core activities carried out in accordance with the agreed objectives and work plans. This activity involves using tools and materials provided in the laboratory with varying levels of safety and risk [3]. The last stage is post practicum to analyse the data analysis of the experimental results to obtain the appropriate conclusions. This series of learning experiences have so far been considered effective because it can cover the cognitive, affective, and psychomotor domains.

These problems require alternative solutions that are possible to do. The alternative offered is in the form of laboratory learning with online technology as a learning medium as an intermediary between lecturers and students [4]. In order for the message to be conveyed, especially related to practical learning, a device is needed, one of which is a student worksheet. Student worksheets can contain practical instructions that allow students who are studying from home (SFH) to do in the Covid-19 pandemic era. Student practicum guidelines are needed to be able to carry out practical activities in a representative and relatively safe and easy way to carry out with an insight into green chemistry and utilize materials around them during the Covid19 pandemic era. This article aims to: 1) describe the needs analysis for practicum basic chemistry learning in the Covid19 pandemic era; 2) describe the potential use of surrounding materials in supporting practical learning with green chemistry insight that can be done at home by students in the Covid19 pandemic era; 3) describe the design of basic chemistry learning in practice in the Covid19 pandemic era.

## 2. THEORETICAL FRAMEWORK

### *2.1. Basic Chemistry Course and Its Learning*

This study is part of research on the development and implementation of practical learning in the Basic Chemistry course, which begins with an analysis of the need to support practical activities in the Covid-19 pandemic era. The importance of practical learning is sought with the aim of not reducing the essence of learning Chemistry, especially on Basic Chemistry course.

Basic Chemistry courses at the Department of Chemistry commonly consist of Basic Chemistry concepts, which are carried out based on a curriculum that is prepared regarding the national curriculum and has been updated at several times. The descriptions of these courses are Studies on basic concepts: Scientific Methods, Properties of Matter, Stoichiometry, Atomic Structure, Periodic System of Elements, Chemical Bonds, Forms of Matter, Energetics, Solutions, Colloidal Systems, and Everyday Chemicals. This course is presented through lectures, discussions, questions and answers, and assignments, as well as practicum or appropriate laboratory activities [5]. Basic competencies that must be mastered by students include: 1) Understanding that chemistry is the result of scientific activities that study material and its properties, which will be discussed in the Introduction Chapter, 2) Understanding the things that underlie stoichiometry, namely: the fundamental laws of chemistry, atoms, and molecules, the concept of moles and Avogadro's constant, compound formulas, chemical reactions and molarity and equivalence which will be discussed in the Stoichiometry Chapter. The Introduction chapter contains material: The stages of the scientific method, Chemistry as a scientific activity, matter, and energy, extensive and intensive properties, chemical and physical properties, elements, compounds, and mixtures. The Stoichiometry chapter contains Fundamental Laws of Chemistry, Atoms, and molecules, Mole Concepts, Avogadro's Constant, Compound Formulas, Chemical Reactions and Equalization, Molarity and Equivalents.

Students are required to master these concepts with comprehensive learning outcomes from cognitive, psychomotor, and affective aspects. The Basic Chemistry course as a branch of science and its practical activities has a perfect opportunity to implement environmental education to realize Green Education. In the implementation of the learning process in the classroom and the laboratory. With green chemistry-oriented learning tools, it is hoped that in the learning process, each student material can implement the principle of green chemistry in order to realize green education [6]. The demand for mastery of concepts can be achieved by theoretical learning and learning through practicum activities as a transition from theory and practice [7]. However, due to the Covid-19 pandemic, practicum activities cannot be carried out in the laboratory normally. Therefore, studies on developing a holistic theoretical understanding of how practicum through complex interconnections are needed [8]; [9]; [10]; [11]. A learning design that can be implemented in the Covid-19 pandemic era, especially related to practical learning, is very much needed as studied in this study. Collins & Ting (2017) suggest that the integrated model takes a critical stance on the dichotomy of theory practice and the separation of campus/classroom-based and practice-based studies [9]. Adapting the opinion of Flores (2016) regarding learning practices, among others, calls for the promotion of practicum as a space for transformation rather than as a process of applying theory [10]. In science learning such as chemistry, it will not be separated from practical activities.

### *2.2. Learning Process in Pandemic Covid19 Era*

Education and learning must continue in this era of the Covid-19 pandemic. One of the main tasks of teachers/lecturers is to organize a quality learning

process, both in virtual classrooms with various platforms. Likewise, for practicum learning, efforts should be made to continue to be carried out in the era of the Covid-19 pandemic. With the implementation of safety protocols during the pandemic, laboratory practicums cannot be carried out as they should. On the other hand, this practicum activity cannot be eliminated so that it is in line with the nature of chemistry learning itself [3]. To realize quality learning, lecturers and students need interaction in communication to achieve successful learning, which can be done synchronously or asynchronously using an appropriate and agreed platform. For practical learning in the Covid-19 pandemic era, alternatives are needed if they are carried out asynchronously, so they need to be solved in this study.

### *2.3. Chemistry Around Us*

As we know that chemistry is a branch of science. In everyday life, we also always encounter "chemicals" since we wake up and go back to sleep again, even while we are sleeping, there is a chemical process. It would not be an exaggeration to say that our world is a chemical world [12]. Is there anything around us that is not chemical? Pay attention to what's in our bodies! The chemicals and processes that occur in our bodies are varied and complex. Why if we chew rice without side dishes, over time, it becomes sweeter? Try to feel your sweat? What ingredients are in it? There are many more chemical processes in our bodies that cannot be observed directly. If we enter the kitchen at home, we will meet salt, which tastes salty because it contains the chemical sodium chloride, sugar which tastes sweet is a chemical that contains sucrose, sour vinegar is a chemical that contains acetic acid. Yellow turmeric will change colour if given lime water or lime juice contains Curcuma compounds that can be used as an acid-base indicator. When we go to the bathroom, freshwater turns out to be a chemical compound that contains hydrogen and oxygen atoms. Solid or liquid soaps and shampoos that can lather, release dirt, and are slippery to the touch because they are alkaline. Toothpaste that cleans and strengthens teeth also contains fluoride compounds. Porcelain cleaner contains compounds that are oxidizing agents. Air fresheners, perfumes with various aromas contain synthetic compounds found in lemons or other fruits [13]. Similarly, other materials that we can find around us, of course contain chemicals. These materials can be used for chemistry practicum learning by considering their safety and easily to obtain as practical learning materials.

### *2.4. Online Learning*

The Covid-19 pandemic has resulted in fundamental policy changes in the world of education in the country. The Indonesian Minister of Education and Culture has issued several policies to regulate learning activities during this pandemic. This was issued through Circular Letter Number 4 of 2020, concerning the Implementation of Education Policies in the Emergency Period for the Spread of Coronavirus Disease (Covid-19), dated March 24, 2020. The policies described and basic are; changing the way of teaching and learning for students/students and teachers/lecturers with a policy of learning/teaching from home. This policy of learning/teaching from home greatly changes the habits or behaviour of teachers/lecturers and students/students so far. The best way is to do or strive for network-based learning (online). This learning is very different from conventional learning in schools / campuses, especially practical activities in the laboratory. Positively, this learning helps the continuity of learning during this pandemic. Teachers and students will remain safe in their respective places or homes without having to leave the house and meet face to face. Various online platforms as a mode of learning have been used as effective media both for face-to-face and sharing learning materials. These are preferred in online learning, such as Google classroom, zoom, What Sapp, and YouTube [14]. However, with this pandemic incident, it has become very difficult to maintain practical activities in the laboratory. Therefore, it is necessary to have a learning design solution during the Covid-19 pandemic, including practical learning activities.

## 3. METHODS

This article is part of a research carried out with a mixed method design, namely by collecting qualitative and quantitative data. In this presentation, a qualitative method is used, which is carried out by observing and orienting practical learning, which can be carried out as an alternative to practical learning in the Covid-19 pandemic era. The data source at this stage is the Basic Chemistry course curriculum document in the form of a semester learning plan (SLP/RPS) which includes learning achievements, indicators, and student learning experiences, as well as learning methods/strategies/models that can be used in practical learning in the pandemic era of Covid-19. Document of practicum equipment in the form of practicum instructions containing practicum titles in accordance with Basic Chemistry learning achievement. The research procedure at this stage follows the device development stage, especially at the preliminary study stage, through reference studies, document analysis, and mapping of practicum titles that can be carried out to support Basic Chemistry courses with a green chemistry perspective in the Covid-19 pandemic era by utilizing surrounding materials.

## 4. RESULTS AND DISCUSSION

The research results reviewed in this article are the results of research at the preliminary study stage on the importance of practicum activities in supporting

Chemistry learning. The data studied started from the analysis of learning designs (RPS), modification of practicum activities that can be carried out from students' homes or residences by utilizing surrounding materials, as well as practical learning designs during the Covid-19 pandemic era.

### *4.1. Analysis of Practicum Activity in Semester Learning Activity Plan*

Based on the result of material analysis in the Semester Learning Plan (known as SLP/RPS) for the Basic Chemistry course, there are study materials that involve practical activities in the laboratory which can usually be carried out before the Covid19 pandemic era. The RPS formulation in the Learning Activities section is presented in the table covering time meetings, final abilities achieved by students, learning achievement indicators, study materials, learning strategies, learning resources/media, time allocation, and students learning experiences, as well as evaluation/ assessment. Examples of data for Basic Chemistry course in practical activities are briefly presented in Table 1.

**Table 1.** Students learning experiences with practical activities on some material of Basic Chemistry

| Study Materials | Learning Strategy | Learning Experiences |
|---|---|---|
| Introduction: The stages of the scientific method, Chemistry as a scientific activity, matter and energy, extensive and intensive properties, chemical and physical properties, elements, compounds, and mixtures | 1. Discussion<br>2. Question and Answer<br>3. Mind map strategies<br>4. Practicum | 1. Question and Answer about the steps of the scientific method<br>2. Give examples of extensive and intensive properties of matter,<br>3. Create mind maps and define chemical and physical properties, elements, compounds, and mixtures<br>4. Doing practicum of a mixture separation |
| Solutions: Electrolyte and non-electrolyte solutions, colligative properties, acid – base, pH of the solution, hydrolysis, common ion, buffer solution, and titration | 1. Discussion<br>2. Question and Answer<br>3. Mind map strategies<br>4. Practicum | 1. Summarizing the concepts, looking for the main idea of teaching materials, questions and answers, and problems solving practice<br>2. Doing practicum of Acid-base titration |

Student learning experiences as formulated in the Basic Chemistry RPS in Table 1 can be carried out well and smoothly in campus laboratories before the Covid19 pandemic era. Since the Covid19 pandemic occurred at the beginning of 2020 or coincided with the even semester of 2019/2020, the policy of work from home (WFH) has been implemented, which immediately students also learn from home (LFH). Thus, practicum activities cannot be carried out in campus laboratories. Therefore, it is necessary to modify practicum activities that can be carried out at students' homes.

### *4.2. Modification of Basic Chemistry Practicum Activities during the Covid-19 Pandemic Era*

Modification of practicum activities to support basic chemistry learning needs to be done during the Covid19 pandemic era so that students still have practical experience and they don't lose the essence of the chemistry learning process that is inseparable from practicum activities [3]. Based on the orientation results, it is possible that practicum activities can be carried out at the student's home or residence by utilizing surrounding materials. Examples of modifications to practicum activities by utilizing equipment and materials that are easy to find or available in the vicinity can be seen in Table 2.

**Table 2.** Students learning experiences with practical activities on some material of Basic Chemistry

| Learning Materials | Practical Learning Experience | |
|---|---|---|
| | Original | Modified |
| Solutions: Electrolyte and non-electrolyte | Conducting acid-base titration practicum (using | Conducting practicum using natural acid-base indicators and |

| Learning Materials | Practical Learning Experience | |
|---|---|---|
| | Original | Modified |
| solutions, colligative properties, acid – base, pH of the solution, hydrolysis, common ion, buffer solution, and titration. | indicators provided in the laboratory such as Phenolphthalein/ PP and burette titration equipment) as well as chemicals commonly used for acid and base titrations | acidic and basic materials that can be found around. Whenever possible, conduct and design titration practicum with simplified procedures with simple tools and materials |

Table 2 presents data on the results of orientation and modification of practicum titles supporting the Basic Chemistry courses that are modified and allow students to do it at home by using tools and materials that are easily available or found around. Figure 1. is an example of a practical activity that is easiest and can be done by students by using around materials.

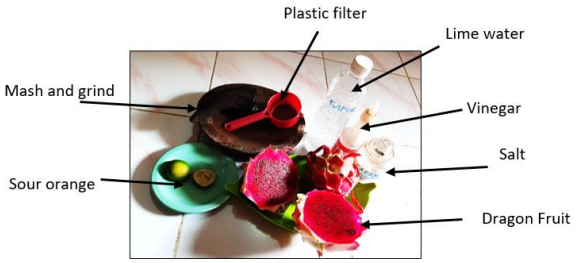


**Figure 1** Equipment and Materials for practicum of natural acid and base indicator that may be found around.

Daily tools and materials, as presented in Figure 1 are relatively easy to obtain. If students do not have to use the same tools and materials as shown in the Figure 1, they can be adapted to the conditions in their respective areas or places of residence. Dragon fruit can be replaced by other fruit or other natural ingredients, such as fruit, leaves, or coloured flowers. The mashing tool can also be replaced by other tools that are easily obtained or owned by students. Blenders can also be used for students who live in urban areas or who have modern pounding tools. However, using a blender requires more ingredients. In this case, it can foster creative thinking skills. The procedure taken is also simple and relatively safe to do at home. Figure 2, presents one example of the practicum procedure carried out in the natural acid-base indicator.

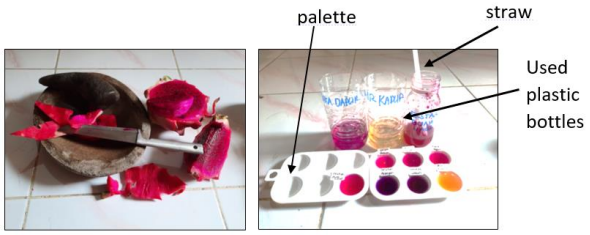


**Figure 2** The part of procedure of natural acid and base indicator practicum.

Straws, as shown in Figure 2 are used instead of pipettes. But the procedure to use it is not by suction. The simple procedure can be done by using the thumb to open and close the flow of liquid when taking (the straw is opened and dipped into the liquid), then closed with the thumb and lifted towards the destination container to be dripped (thumb is opened when dripping). This procedure can be done if it is ensured that the fluid used is safe. A simple procedure for using a dropper substitute can be seen in Figure 3.


**Figure 3** A simple procedure for taking materials using a straw as a feeding device instead of dropper pipette (A) fluid collection and (B) fluid drip.

The use of equipment and materials that are available around us and are relatively easy to obtain, it turns out that practical activities can be carried out to support basic chemistry learning in the Covid19 Pandemic Era. The procedures taken are also simple and relatively safe. Thus, if practicum activities can be carried out, students will not lose the essence of learning science, such as learning basic chemistry. Data observation on practicum results can also be used for practical purposes that support learning objectives. An example of the practical results of natural acid-base indicators by using dragon fruit is presented in Figure 4.

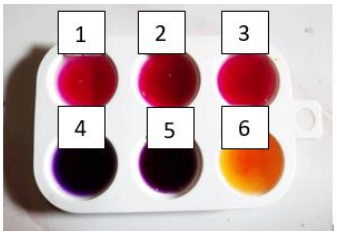


**Figure 4** Observations of color changes in natural acid-base indicator practicum by using dragon fruit extract in several kind of solutions.

The kind of solutions observed in Figure 4 namely; (1) saline solution, (2) sour orange, (3) vinegar, (4)

detergent solution, (5) soap solution, and (6) lime water. The natural acid-base indicator made from dragon fruit extract shows the difference color depending on the properties of the solution.

### *4.3. Designing of Basic Chemistry Learning with practicum activity in the Covid-19 Pandemic Era*

Based on the results of the need assessment analysis for practical activities to support Basic Chemistry learning, it is essential that students do not lose the essence and nature of science learning. Students must be able to unify the nature of science in the scientific process [15], and the nature of science is closely related to everyday life [16]. Therefore, it is possible to use surrounding materials in daily life as a support for practical activities. The orientation results also show that the surrounding materials have great potential to support practical learning of Basic Chemistry.

Based on a needs analysis of the importance of practicum activities in supporting science learning (in this case Basic Chemistry) and the potential use of surrounding materials to support practical Basic Chemistry learning, it can be packaged in a learning design that allows it to be implemented during the Covid19 pandemic era. For practical learning in the Covid-19 pandemic era, an alternatives are needed if they are carried out asynchronously. Based on the results of the need analysis and potential use of surrounding materials and the possibility of carrying out practical learning carried out independently by students asynchronously.

Learning can be designed in the form of projects that can be done individually or in groups. Practicum activities carried out individually, or in groups, each has advantages and disadvantages. If done in groups, the advantage is that students can work together cooperatively to achieve the same goal, discuss, and share tasks so that project assignments are not too heavy. In addition, group work will foster social attitudes even though students still have to implement social distancing. The weakness if it's done in groups, there are coordination problems because it's done online and the difficulty in distributing job descriptions. Meanwhile, if the project tasks are designed individually, the advantages include project execution can be more smoothly, there are no constraints on the division of job descriptions, the project can be carried out according to each individual condition. The weakness if it is done individually is that it cannot foster social and cooperative attitudes. Students get practical learning experiences from themselves under the guidance of the lecturer as a facilitator.

Project-based learning design (PjBL) can be applied through several stages, namely: 1) Essential questions to design the project; 2) Plan as the procedure for the project; 3) Create schedules; 4) Action the project with the monitoring; 5) Reporting and presenting the report of the project; 6) Evaluating of the process of the project [17]; [18]. This stage can be done individually or in groups. However, if there are limitations or obstacles, students can choose to work on projects individually, or in small groups online or offline with health protocols during the Covid-19 pandemic [19].

## 5. CONCLUSION

Referring to the research objectives in this article, and based on the results of the needs analysis, it can be concluded that practical activities are essential in learning Basic Chemistry, so that students do not lose the sensation of learning science (Basic Chemistry) as part of the essence of science. During the Covid-19 pandemic era, practicum activities can be carried out by using materials around students that are easily available. Learning designs that can be applied include project-based learning (PjBL) with modifications to the aspects of the work, which can be done in groups or individually, according to student conditions, which is most likely to be implemented with all its strangeness and weakness. Modification of project-based learning that can be done through stages; 1) Essential question to design the project (can be clarified with the lecturer at the beginning of the lesson); 2) Plan as procedure for the project (this step can be done by students independently, either in groups or individually); 3) Create a schedule (adjusted to student conditions and available time allocation; 4) Action the project with the monitoring (students carry out projects asynchronously with guidance/consultation via online mode); 5) Reporting and presenting the report of the project (conducted synchronously face-to-face online using an agreed platform); 6) Evaluating of the process of the project (can be done by synchronous reflection between students and lecturers).

## AUTHORS CONTRIBUTION

All authors conceived and designed this study. All authors contributed to the process of revising the manuscript, and at the end all authors have approved the final version of this manuscript.

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