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Development of an Integrated Students Worksheet (LKPD) for the Ternate Local Protection Project to Improve the Chemical Literacy of Senior High School Students

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A B S T R A C T

This study aims to produce integrated LKPD (student worksheets) of Ternate local potential projects to improve the chemical literacy of high school students. This study is a research and development orresearch and development (R&D), which uses the ADDIE development model (Analysis, Design, Development, Implementation, and Evaluation). The ADDIE model begins with a needs analysis conducted through a literature review and field study by means of classroom observation and questionnaire distribution. The research method used is a descriptive research method. The results of the needs analysis obtained a percentage of 100% indicating that the Ternate Local Potential Project integrated LKPD has never been used in the learning process. Furthermore, the development of the Ternate Local Potential Project integrated LKPD was designed, then tested for feasibility (validity test) by two expert teams. The validity data obtained an average value of 3.46 with a valid category. So that the Ternate Local Potential Project integrated LKPD that was developed has met the valid criteria and is feasible to use or can be implemented in chemistry learning in schools so that chemical literacy can be improved

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INTRODUCTION

Law no. 20 of 2003 explains about education is a conscious and planned effort to create a learning atmosphere and learning process so that students actively develop their potential to have spiritual religious strength, self-control, personality, intelligence, noble morals, and skills needed by themselves, society, nation and state. Based on Law No. 20 of 2003, this is used as the legal basis for the management of education in Indonesia, then education conducted in schools cannot be separated from the learning process and interaction between educators and students. Teachers or educators are required to achieve optimal learning.

The optimal learning process can be achieved, so teachers must be creative in determining the learning model, method, media or teaching materials that will be used in the learning process. One of the teaching materials that is often used is the student worksheet. Student worksheets or LKPD are learning activity sheets that contain theories, demonstrations, or investigations accompanied by clear instructions and work procedures to train students' skills or abilities according to the learning objectives to be achieved.

One of the abilities that students want to achieve is chemical literacy skills. As in the 21st century, learning requires students to be more active and have good literacy skills or abilities. Chemical literacy or science literacy is the ability to understand chemistry meaningfully, and be able to apply chemistry in everyday life (Nur at. el., 2021 & Pandu JL, 2018). There are five aspects of chemical literacy, namely knowledge (knowledge), context (context), competence (competency)and attitude (attitudes). Based on the results of the PISA assessment (Program for International Student Assessment) by OECD (Organization for Economic Co- operation and Development) in 2022, related to the results of the achievement of chemical literacy of students or learners in Indonesia, it is still low, namely 67 out of 81 countries with a score of 383 (Ministry of Education, Culture, Research and Technology, 2023 in Nur A.L, Arismunandar & Darman Manda, 2024).

The ability of students in learning is also based on the stage of development which according to Piaget's cognitive theory is cognitive development. Children's cognitive development refers to the classification of human age based on the level of cognitive maturity. In this phase or stage, children can think systematically, but are limited to objects that are concrete activities. At this stage, children will be able to think logically about concrete events and classify objects into different forms. So that with the existence of learning guides as learning resources, it will support the development of students in learning.

Based on observation data from the needs analysis conducted in the even semester of the 2023-2024 academic year at the Ulul Al Baab Madrasah Aliyah school, it was found that in the learning process, teaching materials from various sources have been used, including LKPD or LKS (student worksheets). However, the LKPD used does not yet contain chemistry material that is related to the local potential of the Ternate area. Because by utilizing local potential as a learning resource, students will be able to easily understand the chemistry

material being taught. Where students will be able to apply chemistry in everyday life so that it can motivate students in learning and chemical literacy can be improved.

One of the efforts to improve the chemical literacy value of students is to develop LKPD (student worksheets). Through LKPD, interaction will be created between teachers and students, thus helping students in following the learning process (Patresia et al., 2020). The development of this LKPD contains objectives, collections of materials, tools, materials, work methods and questions that can accommodate chemical literacy. This LKPD activity is integrated with a project-based learning model whose syntax is determining basic questions, designing project planning, preparing schedules, monitoring students and project progress, testing results, and evaluating experiences (Widarso Erwin, 2016; Nur A.L, Arismunandar and Darman Manda, 2024). With the development of integrated LKPD for Ternate local potential projects, it is hoped that students can freely explore their creativity and express themselves according to the topics presented independently or in groups. The local potential of Ternate in question is popeda on colloid material. Project-based learning can also improve student learning outcomes (Nur A. L. at. el., 2021) and learning becomes more meaningful (Hengki W. & Arismunandar, 2018).
Based on the background, the researcher will conduct research focused on "Development of Integrated Student Worksheets (LKPD) for the Ternate Local Potential Project to Improve Chemical Literacy of High School Students".

LITERATURE REVIEW

A. Student Worksheets (LKPD)

Student worksheets (LKPD) are part of the learning tools that contain objectives, materials, tools and materials, work methods, and questions. Prastowo, A. (2015) also explains that LKPD is a teaching material that minimizes the role of educators and activates students in learning. LKPD is a printed teaching material that contains a summary of the material, instructions for learning activities, assignments, and evaluation practice questions. implemented in student activities to achieve competency standards (Patresia, I., Silitonga, M., & Ginting A., 2020).

B. Project Based Learning Model

The project-based learning model emphasizes contextual problems experienced by students directly, so that students can develop their creativity through projects to obtain a meaningful product.

1) Steps of Project Based Learning Model

The steps of the project-based learning model are: determining basic questions, designing project planning, preparing a schedule, monitoring students and project progress, testing results, and evaluating experiences (Widarso Erwin, 2016; Nur A.L, Arismunandar & Darman Manda, 2024).

2) Advantages of Project-Based Learning Models;

a) Increase students' motivation to learn and respect each other;

b) Make students more active and successful in solving problems;

c) Increase collaboration; d) Improve students' skills in managing resources.

3) Weaknesses of Project-Based Learning Models

The weaknesses of the problem-based learning model (Daryanto & M. Raharjo,

2012) are; a) It takes a lot of time to solve problems; b) Requires quite a lot of costs.

C. Chemical Literacy

Chemical literacy is an understanding of the properties of material particles, chemical reactions, chemical laws and theories and general chemical applications in everyday life. According to Shwartz, et al., (2006) people who have chemical literacy must understand the basic concepts of science/chemistry. Chemical literacy is related to the ability of students/learners to appreciate nature by utilizing science and technology in learning (Nur at. el., 2021; Imansari and Maulinda. (2018).

Assessing chemical literacy can use the compatibility between the PISA scientific literacy assessment framework and the Shwartz frameworket al, (2005, 2006). Aspects of science/chemistry literacy in the 2015 PISA assessment (Pandu.JL, 2018), are described in table 1.

Table 1. Aspects of Chemical Literacy

Aspects	**Deskription**
Knowledge	Personal and global issues. These can be current issues or past issues that require an understanding of science and technology
Context	An understanding of the basic facts, concepts and explanatory theories that form the foundation of scientific knowledge. This knowledge includes knowledge of the universe and technological artifacts, knowledge of how ideas are generated and an understanding of the rationale underlying these procedures and the justification for their use
Competence	Ability to explain phenomena scientifically evaluating and designing scientific inquiries
Attitude	A set of attitudes toward chemistry as indicated by an interest in science and technology, an assessment of appropriate scientific.

METHODS

This research is research and development orresearch and development (R&D), which uses the ADDIE development model (Analysis, Design, Development, Implementation, and Evaluation) from Branch (2009). However, this research is limited to the stage development namely product development.

The stages in the ADDIE development model are: 1) The analysis stage includes needs analysis which aims to determine the conditions in the field with the expected conditions; 2) Stage Designor the planning stage includes the preparation of research instruments and initial product design; 3) Stagedevelopmentor the development stage includes product development, validation, and product assessment each by two validations and for high school

students totaling 29 people. This research was conducted at the Ulul Al Baab Ternate Islamic High School.

The data generated from this development is qualitative and quantitative data. Quantitative data were obtained from student and teacher questionnaire instruments on LKPD which were then modified into quantitative data. While qualitative data were obtained from the results of responses and suggestions given by the expert team. For the validity criteria of LKPD, refer to Nurdin (2007) which is presented in Table 2.

Table 2. Validity Criteria Guidelines

Score Interval	Validity Criteria
$3.50 \leq \bar{\upsilon} < 4.00$	Very Valid Valid
$2.50 \leq \bar{\upsilon} < 3.50$	Valid
$1.50 \leq \bar{\upsilon} < 2.50$	Valid Enough (revised)
$1.00 \leq \bar{\upsilon} < 1.50$	Invalid (total revised)

RESULTS

In this study began with a needs analysis to obtain initial data conducted based on the ADDIE model. The needs analysis includes preliminary study activities consisting of literature studies and field studies, it was found that the development of integrated LKPD for Ternate local potential projects is very much needed by students or learners to improve chemical literacy or learning objectives. Data from the results of the literature study analysis were obtained a) analysis of chemical material, which refers to existing core competencies and basic competencies; b) Learning activities using LKPD but have not utilized the local potential of the region. Furthermore, this chemical material is used to design or design integrated LKPD for Ternate local potential projects. The local potential of Ternate in question is popeda as a typical Ternate food whose context is in accordance with colloidal chemistry material. And the analysis of student character, namely in grades IX and X of Ulul Al Baab Ternate Madrasah Aliyah school, totaling 29 students and aged 15-17 years. And then the data from the results of the field study analysis were also obtained, namely 100% (figure 3) students answered that they had never used integrated LKPD/LKS for Ternate local potential projects in the learning process.

To obtain the integrated LKPD product of the Ternate local potential project, a design is used according to the stages of the ADDIE model which is then developed and subjected to a feasibility test (validity test). The validity test aims to determine whether or not the integrated LKPD product of the Ternate local potential project that has been developed is valid. The results of the validity test show that the average validity result of the LKPD (Table 1) obtained a value of 3.46 with a valid category. Because the validity is in the interval $3.46 \leq \bar{\upsilon} \geq 4.00$ (product validity criteria refer to Nurdin, 2007). The integrated LKPD product of the Ternate local potential project produced in this research and development has characteristics, namely chemical literacy text and Ternate local potential. Thus, it can be concluded that the integrated LKPD of

the Ternate Local Potential Project that was developed has met the valid criteria and is suitable for use in chemistry learning in schools, so that chemical literacy can be improved.

DISCUSSION

A. Analysis stage of integrated LKPD for Ternate Local Potential Project

The analysis stage of the ADDIE model includes the results of the needs analysis carried out in the preliminary study consisting of the results of the literature study and the results of the field study. The results of the literature study were taken from books, scientific articles and other reading sources related to this research and the results of the field research were taken through the needs analysis obtained from students.

Based on the results of the literature study analysis, an analysis of chemical material was obtained, which refers to the existing core competencies and basic competencies. Furthermore, this chemical material was designed for the integrated LKPD of the Ternate Local Potential Project, namely on the concept of colloidal chemical material. And the analysis of student character, namely in grades IX and X of the Ulul Al Baab Ternate Madrasah Aliyah school, totaling 29 students and aged 15-17 years. Based on Piaget's learning theory, this age range is at the formal stage. At this stage, students have been able to think logically by conducting experimental projects based on hypotheses designed according to the instructions in the LKPD and accompanied by scientific methods. At this formal stage, students can integrate chemical literacy values during the learning process to complete their projects. Then, data from the results of the field study analysis were also obtained, namely 100% (figure 3) of students answered that they had never used the integrated LKPD/LKS of the Ternate local potential project in the learning process. This shows that there is no integrated LKPD for Ternate local potential projects, so the development of this LKPD is very much needed by students, teachers and schools in general, so that learning becomes more meaningful (Hengki W. & Arismunandar, 2018).

The data from the analysis of the field study are briefly described as follows:

Figure 1 for the question: Do you enjoy studying chemistry?

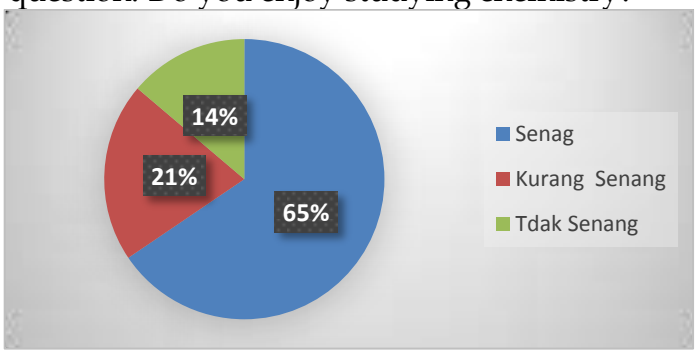


Figure 1. Diagram of the Joy of Learning Chemistry

Based on the results in Figure 1, 65% of students answered that they enjoyed learning chemistry, 21% of students answered that they were less happy and 14% of students answered that they were not happy.
Figure 2 for the question: Do you need LKPD that is interesting/related to the environment and close to everyday life in chemistry learning?

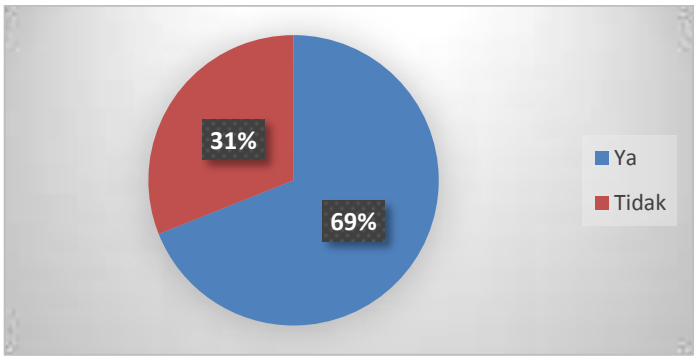


Figure 2. Diagram Required LKPD that is Interesting/Related with the Environment

Based on the results in Figure 2, 69% of students answered Yes and 31% of students answered No. From these answers, it shows that interesting LKPD/related to the environment and close to everyday life are needed in chemistry learning. Next, Figure 3 for the question: Have you ever used LKPD/LKS integrated with the Ternate Local Potential Project in the learning process?

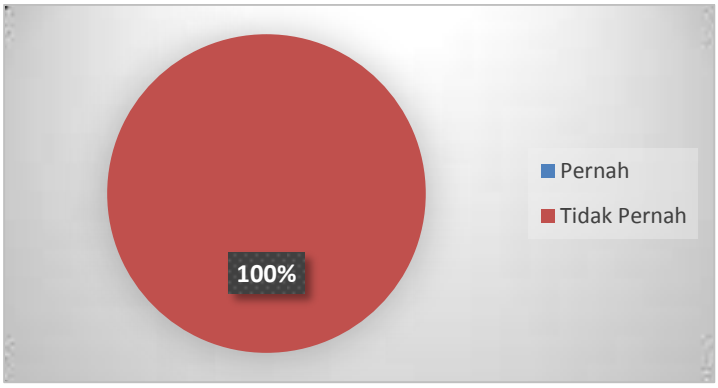


Figure 3. Diagram Never using integrated LKPD Ternate Local Potential Project

Based on the results in Figure 3, 100% of students answered that they never used the Ternate Local Potential Project integrated LKPD/LKS in the learning process. Next, Figure 4 for the question: In your opinion, chemistry learning will be more interesting if the Ternate Local Potential Project integrated LKPD/LKS is developed around students?

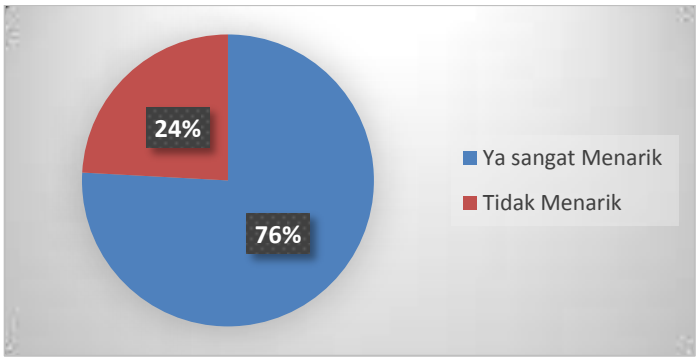


Figure 4. Diagram of the Chemistry Learning Diagram Developed Integrated LKPD Ternate Local Potential Project

Based on the results in Figure 4, 76% of students answered that chemistry learning would be more interesting if the Ternate Local Potential Project integrated LKPD/LKS was developed, and 24% of students answered that it was not interesting.

Next Figure 5 for the question: How do you respond to development of integrated LKPD/LKS Ternate Local Potential Project as a reference in chemistry learning?

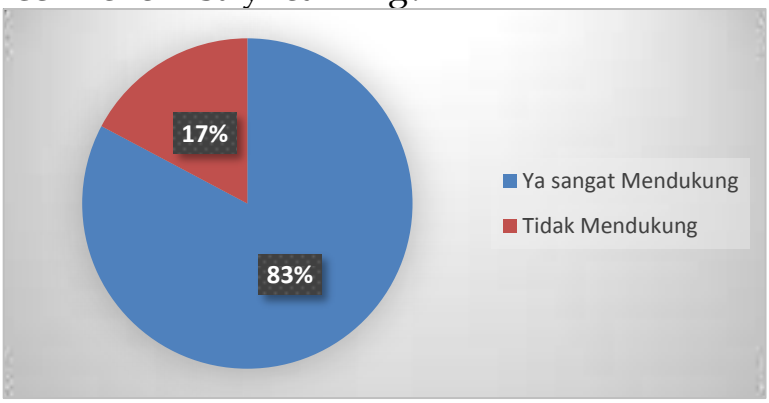


Figure 5. Response diagram to LKPD Development Integrated Ternate Local Potential Project

Based on the results in Figure 5, 83% of students answered Yes and strongly support the development of the Ternate Local Potential Project integrated LKPD as a reference in chemistry learning, and 17% of students answered No.

B. Design and development stage of integrated LKPD for Ternate Local Potential Project

The integrated LKPD product of the Ternate local potential project uses the ADDIE model stages that have been designed for development, then tested for feasibility (validity test). In this study, the validity test was carried out by two expert teams. Aspects of the feasibility of validation include substance (material with KI and KD, suitability of achievement indicators), suitability of content with chemical literacy values, suitability of the integrated LKPD of the Ternate local potential project, writing style, and appropriateness of language use. The results of the validity test carried out by the

expert team are in the form of suggestions for improvement and revision of the integrated LKPD of the Ternate local potential project as a learning resource that can improve chemical literacy or learning objectives for high school students.

The advice from the experts, and has been revised briefly outlined as follows:

1) Correct use of Indonesian

I. KOLOID POPEDA

Kompetensi Dasar	Indikator Pencapaian Kompetensi
3.14 Mengelompokkan berbagai tipe sistem koloid, dan menjelaskan kegunaan koloid dalam kehidupan berdasarkan sifat-sifatnya.	3.14.1 Menjelaskan perbedaan koloid, suspensi dan larutan sejati. 3.14.2 Mengelompokkan berbagai tipe sistem koloid berdasarkan jenis fase terdispersi dan pendispersinya dan interaksi fase terdispersi dan pendispersinya. 3.14.3 Mengidentifikasi berbagai jenis produk yang termasuk sitem koloid dalam kehidupan sehari-hari 3.14.4. Menjelaskan sifat-sifat koloid 3.14.5. Menjelaskan pembuatan koloid, dan peranannya dalam kehidupan sehari-hari.

POPEPDA

Gambar 1 Koloid Popeda

Koloid popeda merupakan makanan khas tradisional masyarakat Ternate yang menunjukkan salah satu potensi lokal sebagai kebanggaan di daerah Ternate pulau rempah-rempah dan masyarakat di Maluku Utara pada umumnya. Bagi Masyarakat Ternate popeda mengandung nilai budaya, yang pada bab ini akan di pelajari filosofis popeda yang terkait dengan kimia koloid.

Figure 6. Before Validation

I. KOLOID POPEDA

Kompetensi Dasar	Indikator
3.14 Mengelompokkan berbagai tipe sistem koloid, dan menjelaskan kegunaan koloid dalam kehidupan berdasarkan sifat-sifatnya.	3.14.1 Menjelaskan perbedaan koloid, suspensi dan larutan sejati. 3.14.2 Mengelompokkan berbagai tipe sistem koloid berdasarkan jenis fase terdispersi dan pendispersinya dan interaksi fase terdispersi dan pendispersinya. 3.14.3 Mengidentifikasi berbagai jenis produk yang termasuk sitem koloid dalam kehidupan sehari-hari 3.14.4. Menjelaskan sifat-sifat koloid 3.14.5. Menjelaskan pembuatan koloid, dan peranannya dalam kehidupan sehari-hari.
Tujuan Pembelajaran	
1 Dapat menjelaskan perbedaan koloid, suspensi dan larutan sejati. 2 Dapat mengelompokkan berbagai tipe sistem koloid berdasarkan jenis fase terdispersi dan pendispersinya dan interaksi fase terdispersi dan pendispersinya. 3 Dapat mengidentifikasi berbagai jenis produk yang termasuk sitem koloid dalam kehidupan sehari-hari 4 Dapat menjelaskan sifat-sifat koloid, pembuatan koloid, dan peranannya dalam kehidupan sehari-hari.	

POPEPDA

Gambar 1 Koloid Popeda

Koloid popeda merupakan makanan khas tradisional masyarakat Ternate yang menunjukkan salah satu potensi lokal sebagai kebanggaan di daerah Ternate

Figure 7. After Validation

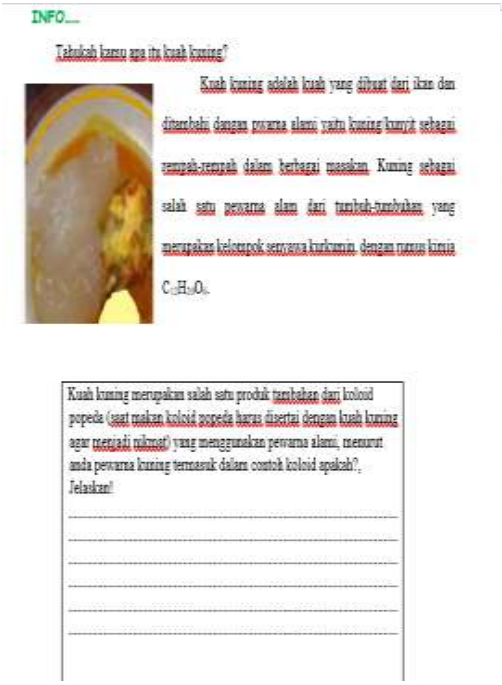


Figure 8. Before Validation

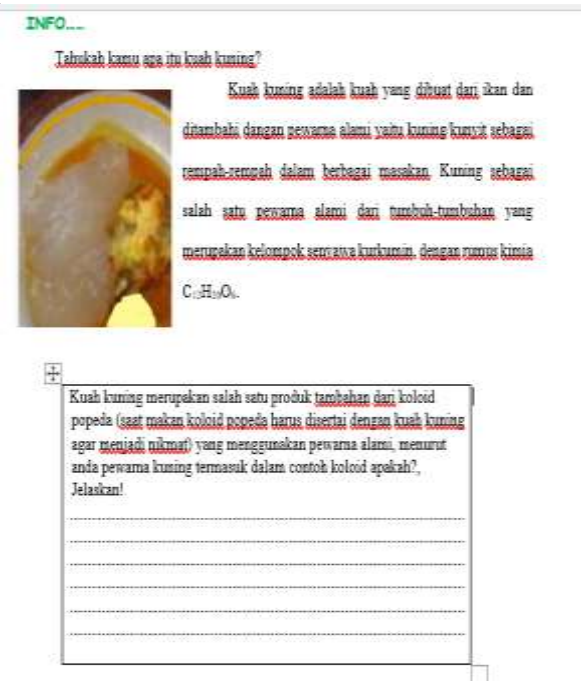


Figure 9. After validation

2) The answer column is enlarged

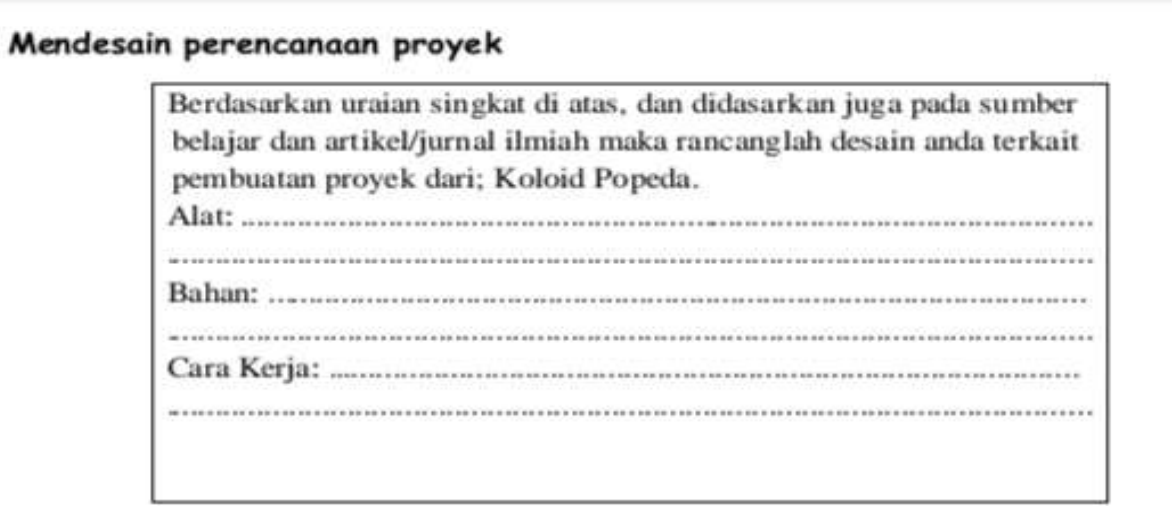
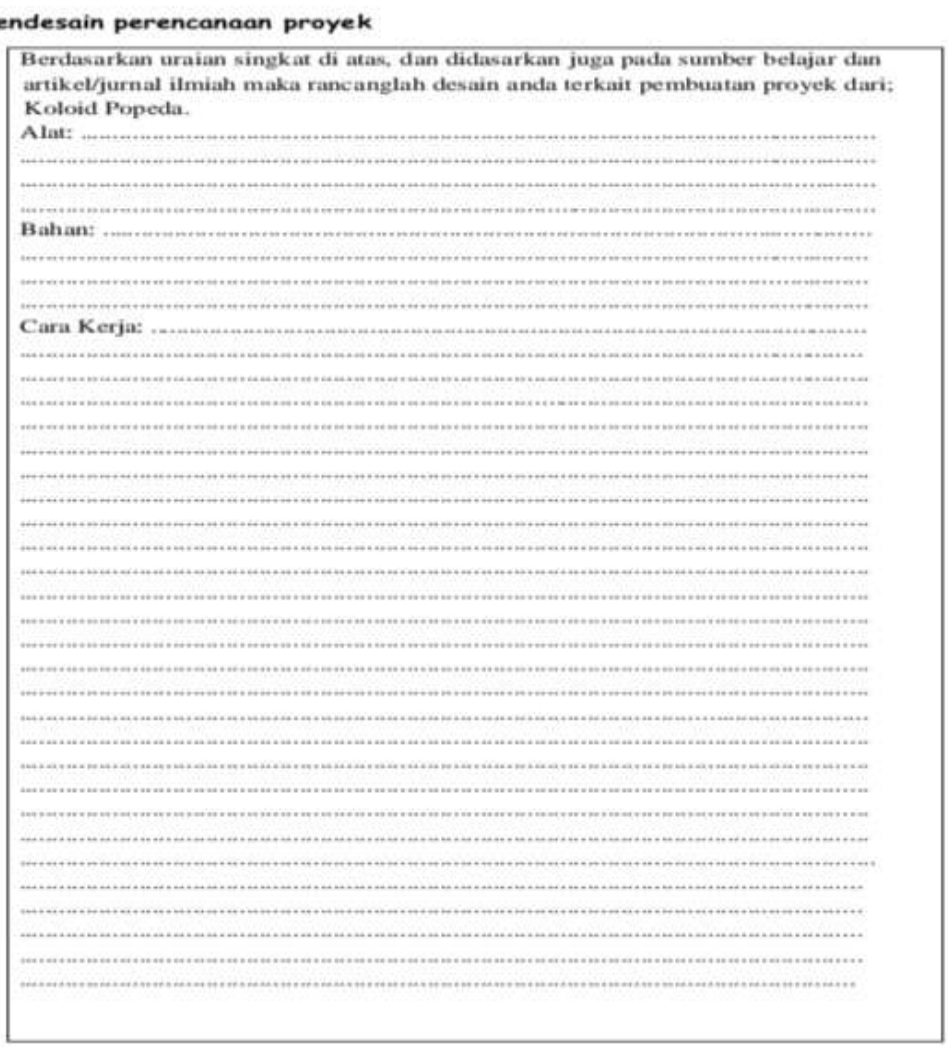


Figure 10. Before Validation


Mendesain perencanaan proyek

Berdasarkan uraian singkat di atas, dan didasarkan juga pada sumber belajar dan artikel/jurnal ilmiah maka rancanglah desain anda terkait pembuatan proyek dari; Koloid Popeda.

Alat: .....

Bahan: .....

Cara Kerja: .....

Figure 11. After Validation

3) Monitor project progress

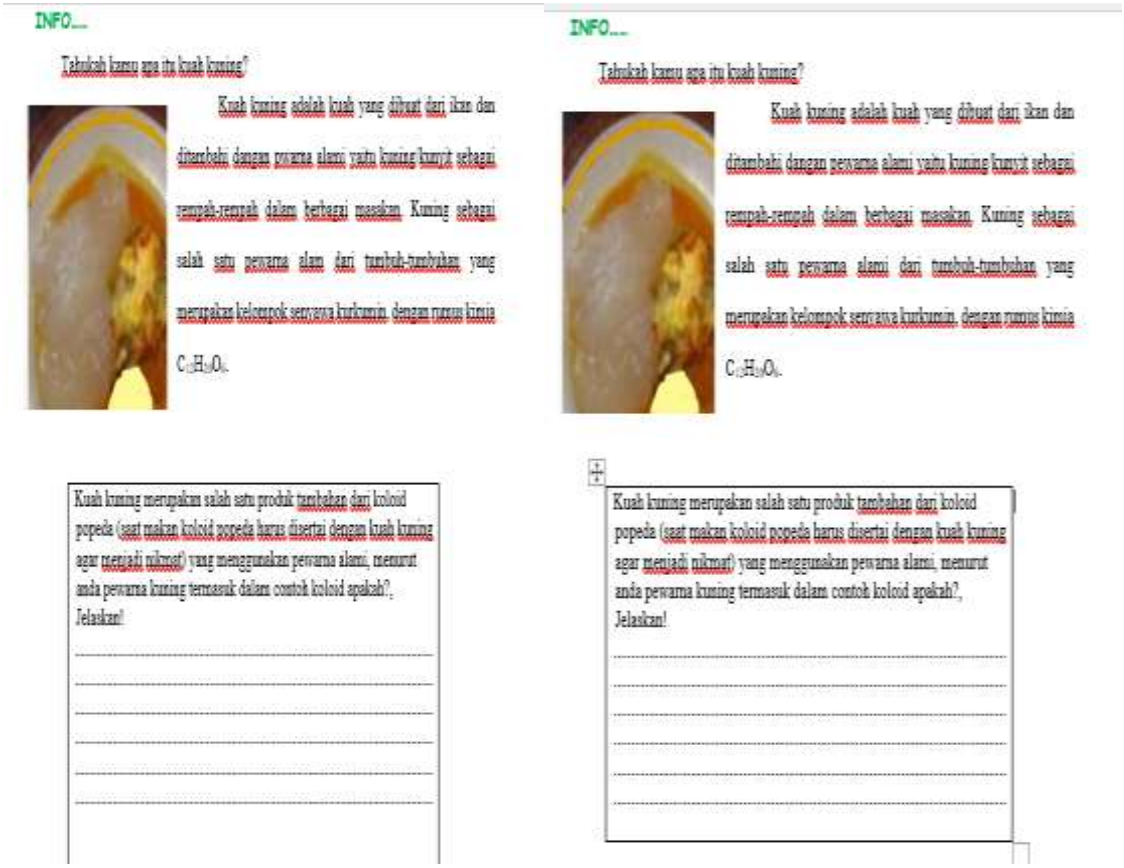


Figure 12. Monitoring project progress; a Before Validation; b After Validation

The results of the integrated LKPD product design for the Ternate local potential project using the ADDIE model stages were then developed and the results of the feasibility test (validity test) were obtained. The data on the validity results of the integrated LKPD for the Ternate local potential project by the validator are in the form of an assessment presented in table 2.

Table 3. Results of Validity of Integrated LKPD for Ternate Local Potential

No.	Rated Aspect	Assessment Result		Average ($\bar{v}$)	Criteria
		V1	V2		
1.	Substance	3.00	3.50	3.25	Valid
2.	Fill in the LKPD	3.00	3.25	3.25	Valid
3.	Writing layout	4.00	3.50	3.75	Very valid
4.	Language	3.25	4.00	3.62	Valid
	Rata-rata validasi LKPD			**3.46**	**Valid**

Based on table 2, the average result of the validity of the LKPD obtained a value of 3.46 with a valid category. Because the validity is in the interval $3.46 \leq \bar{v} \geq 4.00$ (the criteria for product validity refer to Nurdin, 2007). The integrated LKPD product of the Ternate local potential project produced in this research

and development has characteristics, namely chemical literacy texts and Ternate local potential. The literacy text presented in the LKPD is expected to provide stimulation for students to learn colloidal chemistry material. And can facilitate student understanding because it is presented by utilizing local potential around them. The literacy text contains local potential content of Ternate, namely popeda colloids in colloidal chemistry material. Ternate's local potential is adjusted to the application of colloidal material as a learning resource. Thus it can be concluded that the integrated LKPD of the Ternate local potential project that was developed has met the valid criteria and is feasible to use or can be implemented in chemistry learning in schools, so that chemical literacy can be improved.

CONCLUSIONS AND RECOMMENDATIONS

a. Conclusions

The results of the needs analysis obtained a percentage of 100% indicating that the integrated LKPD of the Ternate local potential project has never been used in the learning process. Furthermore, the development of the integrated LKPD of the Ternate local potential project was designed, then tested for feasibility (validity test) by two expert teams. The validity result data obtained a value of 3.46 with a valid category. So that the integrated LKPD of the Ternate local potential project that was developed has met the valid criteria and is feasible to use or can be implemented in chemistry learning in schools.

b. Recommendation

This research recommendation requires further research to be implemented widely, because in this study it has only reached the stage of developing integrated LKPD for Ternate local potential projects to improve students' chemical literacy so that learning becomes more meaningful. By producing integrated LKPD products for Ternate Local Potential Projects on colloid material to improve students' chemical literacy, it is hoped that teachers can apply integrated LKPD for Ternate local potential projects, especially in Ulul Al Baab Ternate Islamic High School and SMA/MA in general.

FURTHER STUDY

Further research should focus on testing the effectiveness of LKPD products integrated project local potential of Ternate. PLKPD product integrated local potential projects to improve literacy This student's chemistry canapplied in schools (in large classes), because its quality has been assessed by a team of experts or specialists. This can be achieved through long-term research projects that examine the impact of chemical literacy, and creative material choices according to local potential as learning resources in order to improve learning objectives or so that the quality of education can be improved. In addition, researching chemical literacy in colloidal chemistry material, including sustainable methods for students to construct their knowledge through the use of local potential so that it will provide students with a complete understanding of learning according to the profile of Pancasila students. The results of this study can provide recommendations for the development of LKPD integrated local potential projectsneeds to be expanded

(not only the local potential of Ternate, namely the popeda colloid) so that it can be applied throughout Indonesia and all the diversity of local potential in Indonesia can be developed as a source of learning.

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