



# Development of Student Worksheets with Creative Values Through Project-Based Learning Model on Electrolyte and Non-Electrolyte Solution Material

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**Abstract:** Student worksheets give students the opportunity to participate in hands-on learning, discover strengths and learn from their mistakes. This research aims to produce student worksheets with creative values through the Project Based Learning model on electrolyte and non-electrolyte solution materials. This research is a development research, the method used in this research is the R&D (Research and Development) method with the ADDIE model modified into ADD, namely Analysis, Design and Development. The instrument in this research is a needs questionnaire, media and material expert feasibility questionnaire, teacher response questionnaire and student response questionnaire. The results showed that chemistry teachers need student worksheets with creative values through the Project Based Learning model on the material of electrolyte and non-electrolyte solutions. The feasibility of student worksheets was obtained at 77.08% with a feasible category, the practicality was in the very practical category with an average score of 89.50% and the attractiveness of student worksheets in the very attractive category with an average score of 89.97%. So it can be concluded that the developed creative value-loaded student worksheets is feasible to use in learning.

**Keywords:** Creative Thinking; PjBL; Student Worksheet

## Introduction

In the modern era, skill development focuses on higher-order thinking skills rather than lower-order thinking skills, such as understanding ideas and using them (Hasanah et al., 2021). Actually, education in Indonesia is still very low for higher-order thinking skills, including creative thinking skills (Syukri et al., 2021). William discussed and developed one study on creativity in Hartono (2019). He divided his formulation and characteristics of creativity into five indicators: fluency, flexibility, originality, elaboration, and evaluation. According to data from a survey conducted by Florida (2015), Indonesia's creativity level ranked 115 out of 139 countries in 2015, indicating that education in

Indonesia is still not directly connected to the values of creativity.

During learning at school, students' creativity can be developed. Suprpto (2018) and Dharma (2017) state that creativity is considered a natural component of everyone's mental processes, so there are no uncreative people. Scientific and contextual approaches are applicable and in line with 21st century learning (Setyosari, 2015).

Both students and teachers face difficulties in understanding the subject matter because many abstract concepts are contained in science learning, especially chemistry (Sanggara et al., 2018; Nashihuddin & Aulianto, 2017). Students are not significantly involved in the process of building concepts in their minds, which leads to a lack of creative thinking skills (Husein et al.,

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2015). The results of unstructured interviews with chemistry teachers at State Senior High School in Langsa City show that the learning model used is less varied. Based on the results of observations and interviews, researchers found that chemistry teachers still use package books as learning tools. During the learning process, the teacher presents the material based on the structure of the book content, and the questions answered by students only copy the answers from the textbook, so that students are not motivated to act creatively and think or focus their minds to find answers.

According to Rahardjanto et al. (2019), the Project Based Learning (PjBL) model is one of the most suitable learning models to center learning on students so that they are more active and improve their creative thinking skills. Yulita (2019) and Umar (2016) stated that PjBL is a learning model that involves students directly in knowledge transfer through research activities to complete specific learning projects and learn more about them. PjBL is a learning model that incorporates projects in the learning process and increases student creativity. The projects done by students can be individual or group projects that must be completed within a certain period of time by working together to produce a product, the results of which will then be displayed and presented. PjBL is project-based learning. In this project, simple and more complex tasks are used that are in the problem. Learners are asked to design the problem and then make decisions to solve the problem (Muafiah, 2019; Apriani 2018). John Dewey's ideas on the concept of "learning by doing" and the concept of a democratic classroom, which contains the idea that students are divided into small groups to complete interesting projects, are the sources of project-based learning. Based on different opinions, it can be concluded that project-based learning model is a model that uses projects in the learning process. This project-based model allows students to be creative as they investigate the problems they are facing and create various works that will be designed in the future.

A learning model can be used as a supporting tool to improve the learning process. Learning media help to convey learning messages in a more directed, interesting, effective and interactive way. They can also help improve the quality of learning. Student worksheets are one of the learning media that support this. According to Salirawati in Hartono (2019), student worksheets was chosen as a learning media because it is considered to be able to increase students' creativity and scientific attitude. The use of worksheets is effective for increasing student High Order Thinking Skills abilities at various grade levels, subjects, and learning models (Anjani, 2023). In student worksheets, there are blank pages where students can write what they know. This allows teachers to assess the extent of students'

understanding based on what they write. Student worksheets contain instructions to complete various tasks. Student worksheets consists of a collection of materials that include various instructions for completing tasks that must be completed by students. The tasks in the student worksheet must provide an in-depth explanation of the topic. Subakti (2021), student worksheet has a significant role in the learning process because it can increase students' activities in learning. Aprida (2023) was finding that PjBL which is supported by e-worksheets, has an effect on students' learning outcomes in science. In addition, using it in learning can help teachers direct their students to understand concepts through the activities they do.

One of the main components of high school is electrolyte and non-electrolyte solutions. According to Yusnelti (2019), electrolyte and non-electrolyte solutions are chemicals that require high mastery of concepts to solve real problems. Haristy (2013) said that electrolyte and non-electrolyte solution materials require high accuracy to analyze and distinguish solutions based on their electrical conductivity. So, teaching materials that help students understand with the right model must exist.

Based on the description above, innovation and innovative ideas are needed to increase student creativity. Therefore, the author is interested in researching the development of learning media for student worksheets with creative values using a project-based learning model on electrolyte and non-electrolyte solution materials. The purpose of this research is to produce student worksheets with creative values that are feasible, practical, and interesting.

## Method

The type of research used is Research and Development (R&D). The product produced is student worksheets with creative value through Project Based Learning model on electrolyte and non-electrolyte solution material. The development model used refers to the ADDIE development research model (Analyze, Design, Development, Implement and Evaluate). The stages of developing learning devices with the ADDIE model can be seen in Figure 1.

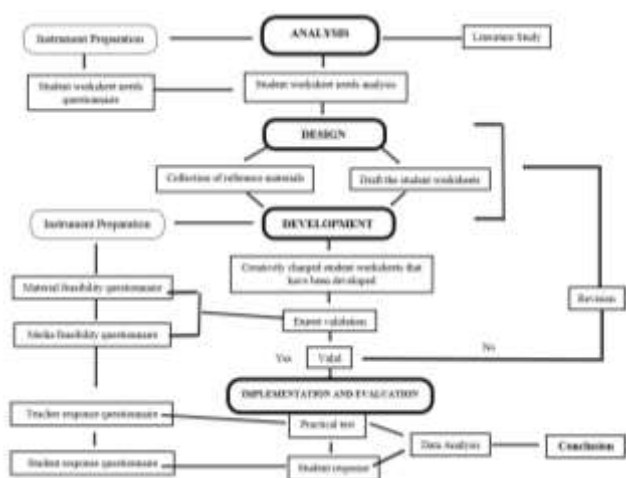


Figure 1. Research Stages

This research aims to produce a product, namely student worksheets with creative values. At the analysis stage, the teacher's needs for student worksheets with creative values were analyzed. The second stage is the design stage. At this stage, learning media design is carried out in the form of student worksheets with creative values that are designed and adjusted to the core competencies, basic competencies and achievement indicators. The third stage is the development stage. At this stage, material and media feasibility validation is carried out, then continued with t student worksheets with creative values.

The subjects in this study were chemistry education lecturers, chemistry teachers and students. The instrument of this research is questionnaire. There are 5 questionnaires, namely in the form of a teacher needs questionnaire sheet aimed at knowing the teacher's needs for student worksheets with creative values in learning, a media feasibility questionnaire sheet and a material feasibility questionnaire sheet. This aims to find out the expert's suggestions and input on the product developed before it is tested in learning, the teacher's response questionnaire sheet to the practicality of the student worksheets and the student's response questionnaire sheet to the attractiveness of the student worksheets with creative values. The questionnaires are described in several statement items. This study uses a Likert scale with a rating scale with a score of 1 (very bad), score 2 (bad), score 3 (enough) and score 4 (very good).

## Result and Discussion

The results of the study were obtained from the research process and the results of the development of student worksheets with creative values through the Project Based Learning model on the material of electrolyte and non-electrolyte solutions. Data analysis

is carried out in accordance with the steps described in the research methodology so that a feasible, practical and attractive product is produced.

### Stages of Development

The analysis stage in this study is an analysis of the needs of chemistry teachers for student worksheets with creative values. The needs analysis was obtained from the data of the questionnaire sheet of student worksheets needs with creative values filled in by 5 chemistry teachers. The results of the questionnaire data sheet of teacher needs for student worksheets with creative values can be seen in Table 1.

Table 1. Results of teacher needs analysis data

Indicator	Assessment Results	Category
Student worksheets	95.00%	Very need
Creative	80.00%	Need
Project Based Learning	87.50%	Very need
Electrolyte and non-electrolyte solutions	90.00%	Very need
Mean score (%)	88.12%	Very need

Based on table 1, the data results from the calculation of the teacher needs questionnaire on student worksheets with creative values obtained an average score of 88.12%. From the results of these data, it states that chemistry teachers really need student worksheets with creative values.

The second stage is design or design. This stage is carried out to design the student worksheets products developed. The design stage has several steps, namely format selection and initial product design. Format selection is carried out to determine the format used in the development of student worksheets. The preparation of the format used in the development of student worksheets refers to the requirements for preparing student worksheets proposed by Prastowo (2019) which consists of basic competencies, equipment or materials used, brief information, work steps and reports or tasks to be completed. The last step is the initial design of the product, where the initial design of the product developed is carried out.

The third stage is the development stage. At this stage, the development of student worksheets with creative value through Project Based Learning Model on electrolyte and non-electrolyte solution materials was carried out. The initial design developed by the researchers was validated by two expert validators who are lecturers of Chemistry Education, Faculty of Teacher Training and Education, Universitas Samudra. Then the revised results which were declared feasible by the validators were distributed to chemistry teachers as well

as providing questionnaires to assess the practicality of student worksheets and the attractiveness of student worksheets with creative values to students.

*Feasibility of student worksheets*

Based on the results of the material and media feasibility assessment, it is obtained that the student worksheets with creative values is suitable for use in learning. In addition to providing an assessment, the validator also provided suggestions and input on the student worksheets with creative values before the teacher's response to the practicality assessment and the students' response to the attractiveness of the student worksheets with creative values. This is in accordance with the results of research by Fitriyah (2021) and Kristiani et al. (2017) which show that project-based learning can improve students' creative thinking skills and critical thinking skills. In addition, Lestari (2022) and Haspen (2021) stated that the ethnoscience integrated module was able to improve students' creative thinking skills. critical thinking skills also increased with the implementation of ethnoscience integrated learning (Damayanti, 2017). The average overall validator assessment results after revision can be seen in Table 2.

**Table 2.** Average Validator Assessment Results

Feasibility	Assessment Results	Category
Material	79.16%	feasible
Media	75.00%	feasible
Mean score	77.08 %	feasible

Based on Table 2, the average results of the validator's assessment of student worksheets with creative values through the Project Based Learning model on the material of electrolyte and non-electrolyte solutions developed is 77.08% which is in the feasible category. These results concluded that the student worksheets with creative values through the Project Based Learning model on the material of electrolyte and non-electrolyte solutions is feasible to use with revisions according to suggestions.

*Practicality of student worksheet*

The level of practicality of student worksheets with creative values through the Project Based Learning model can be seen from the results of the teacher response questionnaire which contains statements of response to the student worksheets developed by the researcher. The results of the teacher response assessment of each aspect to assess the practicality of the student worksheets with creative values can be seen in Table 3.

**Table 3.** Teacher Response Assessment Results

Aspects	Assesment Results (%)	Category
Practicality	77.50	Practical
Creative value	95.00	Very Practical
Presentation of material	88.75	Very Practical
Linguistics	90.00	Very Practical
Expediency	90.00	Very Practical
Mean score (%)	88.25	Very Practical

Through the calculation of data from the teacher response questionnaire sheet, the average score is 88.25% with a very practical category. This proves that the student worksheets with creative values through the Project Based Learning model on the material of electrolyte and non-electrolyte solutions developed can be used. This is in accordance with Dwimardianti's research (2021) which shows that the results of the student worksheets practicality test research developed obtained an average score of 3.72% in the very practical category.

*Attractiveness of student worksheets*

The attractiveness of student worksheets with creative values through the Project Based Learning model can be seen from the results of the students' response questionnaire which contains statements of response to the student worksheets developed by the researcher. The results of the assessment of students' responses to each aspect to assess the attractiveness of student worksheets with creative values can be seen in table 4.

**Table 4.** Results of learner response assessment

Aspects	Assesment Result (%)	Category
Display	95,41	Very Interesting
Material	88,33	Very Interesting
Language	90,33	Very Interesting
Ease of Usage	87,50	Very Interesting
Usage	88,33	Very Interesting
Mean score	89.97	Very Interesting

Based on table 4, the calculation of data from the student response questionnaire sheet obtained an average score of 89.97% with a very attractive category. Based on the assessment of the aspects of appearance, material, language, convenience and use in this attractiveness test, most students stated that the variety of letters, images and backgrounds on the display was fairly interesting. According to Lubis (2021), interesting teaching materials are related to the functional aspects of these teaching materials, interesting student worksheets can make it easier for students to understand the material, increase cooperation in groups and increase

learning independence and student activeness. Student worksheets with creative values contains tasks so that it can encourage students to think and can measure students' abilities in learning. The existence of innovative creative value-loaded student worksheets

## Conclusion

Based on the results of the research conducted, it was found that LKPDs containing creative values through the Project Based Learning model on the material of electrolyte and non-electrolyte solutions were needed by chemistry teachers with an average score of 88.12%. The feasibility of LKPD in the material aspect meets the very feasible category with an average score of 79.16% and media feasibility meets the very feasible category with an average score of 77.68%. The practicality of LKPD is in the very practical category with an average score of 88.25%. The attractiveness of LKPD in the category is very attractive with an average score of 89.97%. So it can be concluded that the developed creative value-loaded student worksheets is feasible to use in learning.

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## Author Contribution

All authors made sufficient contributions to the study and agree with the results and conclusions.

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## Conflicts of Interest

The conduct and publication of this work do not include any conflicts of interest.

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