

ARTICLE

## Development of Interactive Worksheets Based on Problem Based Learning Assisted by iSpring Suite for Atomic Structure Material for High School Phase E

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### ABSTRACT

Education in the modern era refers to innovative learning methods and demands learner-centered learning. This research aims to develop interactive student worksheets based on Problem-Based Learning assisted by iSpring Suite as an effort to use innovative teaching materials and encourage active student engagement in the learning process. The purpose of this research is to produce valid and practical interactive worksheet based on Problem-Based Learning assisted by iSpring Suite for atomic structure material in high school phase E. This research was conducted using the 4D (four-D) research model. The subjects in this study were 3 lecturers from the Chemistry Department of FMIPA UNP, 2 chemistry teachers, and students from class X Phase E at SMA N 15 Padang. The instruments used in this research were validity sheets and practicality questionnaire sheets. The data processing results from the validity test used Aiken's V formula, while the practicality data was obtained by determining the practicality percentage from the comparison of the respondents' total scores to the maximum score. The results of the validity test analysis showed an average value of 0.87 in the valid category. Meanwhile, the practicality test results from the teachers showed a percentage of 91% in the very practical category, and the practicality test results from the students showed a percentage of 87.25% in the very practical category. Based on the results of the conducted research, it can be concluded that the interactive LKPD based on Problem-Based Learning assisted by iSpring Suite for atomic structure material in high school phase E is valid and very practical.

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### Keywords:

Development of Student Worksheet; PBL; iSpring Suite; Atomic Structure; Four D Models

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## 1. Introduction

Education is a key to the development of knowledge and the quality of a nation. Education in Indonesia continues to evolve and transform to face the challenges of the times [1], [2]. Innovative education in the modern era refers to new approaches in the learning process that adapt to technological developments and the demands of the times [3], [4], [5]. This era is characterized by rapid advancements in information and communication technology, which impact various fields of life, including education [6]. Innovative education aims to create a dynamic, creative, and relevant learning environment that meets the needs of today's students. An important aspect of education is the use of innovative and effective teaching methods to enhance students' understanding [7], [8]. Therefore, the education curriculum continues to change to improve the quality of education and produce a future generation with strong intellectual levels, character, and a lifelong learning spirit.

The government's policy on the implementation of learning as stated in Permendikbudristek No. 16 of 2022 is that it should be conducted in an interactive, inspiring, enjoyable, challenging, and motivating learning environment that encourages active student participation. Therefore, the learning process must be student-centered, necessitating the use of supportive learning tools such as student worksheets. Student worksheets (LKPD) play a central role in supporting the learning process. As a learning aid, well-designed LKPD can guide students in understanding the concepts being taught. In addition to serving as a guide and source of activities, LKPD also help students to learn independently outside the classroom environment [9], [10], [11]. By providing structured and relevant materials, LKPD facilitate students in self-directed learning at home or other locations, and this is crucial in developing students' independence and extending learning time beyond school hours.

Currently, there are two methods commonly used in the era of the Independent Curriculum at the high school level, namely Project Based Learning (PjBL) and Problem Based Learning (PBL). This study employs the Problem Based Learning method, because it is more appropriate for research material that has an abstract concept. Problem-Based Learning (PBL) is an active learning approach where students are presented with real-world situations or problems and then work collaboratively to solve them. This method emphasizes student-centered learning, where they develop a deep understanding of the material through active exploration and problem-solving. The process begins with posing a complex question or problem, which sparks students' interest and motivation to learn. By applying PBL, students not only acquire knowledge but also develop critical thinking, problem-solving, teamwork, and communication skills [12], [13], [14].

Technology plays a crucial role in modern education. The development of digital technology is currently applied in various educational institutions as a means of information, which includes accessing information and as a learning tool that supports learning activities and the assignment of tasks [15], [16], [17]. One technology that can be used to facilitate learning activities is the use of iSpring Suite in learning media. iSpring Suite is a software that can be used to develop learning media that includes various features such as audio, video, images, simulations, and other engaging content [18].

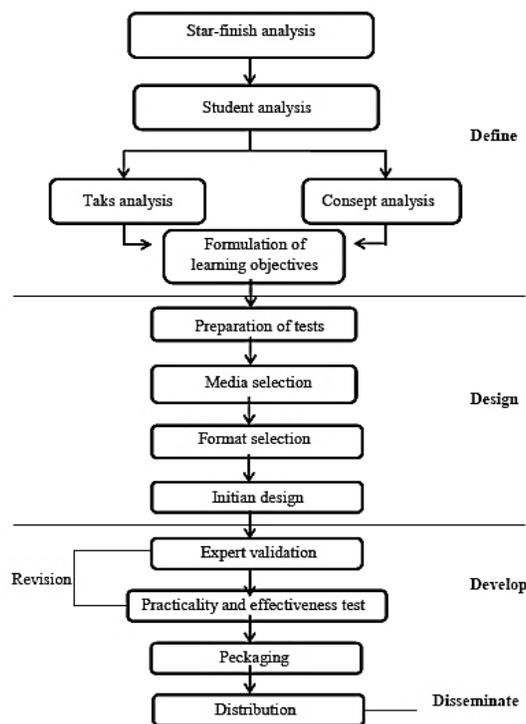
Chemistry is one of the subjects that is often considered difficult by many students due to its complexity in understanding abstract and mathematical concepts, as well as the need to comprehend various fundamental theories and principles. Based on school observations conducted at SMAN 12 Padang, SMAN 15 Padang, and SMA Pembangunan Laboratorium UNP, it was found that only 48% of students liked chemistry related to atomic structure material, and 60% of students did not understand atomic structure material. The results of interviews with the three schools revealed that they have not yet implemented the PBL model in teaching and have not used the iSpring Suite software in the learning process, making the learning implementation ineffective and inefficient. Meanwhile, the results of a student questionnaire showed that 97% of students are interested in worksheets that include videos/animations.

Based on the above explanation, the researcher is interested in conducting a study titled "Development of Interactive Worksheets based on Problem Based Learning Assisted by iSpring Suite for Atomic Structure Material in High School Phase E".

## 2. Experimental

This type of research is Research and Development (R&D). R&D research is used for the process of developing new products or refining products that have been previously created by researchers, after which the final product is tested for its effectiveness [19]. The product generated from this research is an interactive LKPD based on Problem-Based Learning assisted by iSpring Suite for atomic structure material in high school phase E. This research was conducted at the FMIPA UNP campus and SMA N 15 Padang during the 2023/2024 academic year. The subjects in this study for the trial were 3 lecturers from the Chemistry Department of FMIPA UNP, 2 chemistry teachers, and students from class X Phase E at SMA N 15 Padang. The object of this research is the interactive LKPD based on Problem-Based Learning assisted by iSpring Suite for atomic structure material in class X Phase E high school.

The development procedure is designed using the 4D development model. This model was developed by Sivasailam Thiagarajan, Dorothy S. Semmel, and Melvyn I. Semmel. The 4D development model consists of four steps: define, design, develop, and disseminate. The define stage is a needs analysis to identify the issues that will form the basis of the background. Next, the design stage involves planning or designing by determining the various elements needed in the development process. The develop stage involves realizing the design into a product and then conducting a validation process by media and material experts. Finally, the disseminate stage involves packaging or distributing the developed product [20]. However, in this study, the process is conducted only up to the develop stage due to time and budget constraints.



**Figure 1.** Development For 4-D Models

The data analysis technique is divided into two parts: validity analysis and practicality analysis. The first is the validity analysis technique, which is validators are provided with a question and are then asked to produce an assessment based on the updated categorical judgments by Boslaugh. Based on the scores received, which are proportionate to the predefined criteria, the validator will provide an assessment in the form of a questionnaire [21]. Next is the practicality analysis, the simplicity of production and use of the product is its practicality. Practicality can be tested on teachers and students [22]. The results of the practicality test of the product by teachers and students were then analyzed using a formula modified by Purwanto. The practicality test consisted of a questionnaire containing questions related to ease of use, time efficiency in learning, and the benefits derived from the developed product [23].

### 3. Results and discussion

#### 3.1 Validity

In the development of teaching materials such as worksheets (LKPD), validity testing must be conducted to assess whether the LKPD is valid or not. The instrument used for this purpose is a validation sheet. Validation data for the LKPD was obtained from 3 chemistry lecturers from UNP and 2 teachers from SMAN 15 Padang. The validation sheet for the LKPD consists of four components: measurement objectives, instructions, aspects assessed, and assessment results. According to BSNP (2012), there are four aspects assessed: the feasibility content in the LKPD,

linguistic components, presentation components, and graphical components. The criteria for LKPD validity are expressed on a five-point scale: 1 = strongly disagree, 2 = disagree, 3 = somewhat agree, 4 = agree, and 5 = strongly agree [24]. The data obtained is processed using Aiken's V formula. The average results obtained from these four components can be seen in the following table:

**Table 1.** Results of valid analysis

Aspect Assessed	V	Category
Feasibility content	0,86	Valid
Linguistic component	0,88	Valid
Peresentation component	0,86	Valid
Graphic component	0,87	Valid
<b>Total</b>	<b>0,87</b>	<b>Valid</b>

Based on the data obtained from the results of the LKPD test based on Problem Based Learning with the help of iSpring Suite Materials Atomic Structure of the four components received an average value (v) total of 0,87. The assessment obtaining from the validity test results showed that the problem-based LKDP based on problem-based learning with the assistance of the iSpring Suite Atomic Material Structure that has been produced is said to be valid.

Based on Table 1, it can be seen that the content feasibility component of the LKPD has a validity value of 0,86. This indicates that the LKPD is in accordance with the Learning Outcomes (CP), Learning Objective Pathway (ATP), and the learning material contained in the Merdeka Curriculum. The practice questions in the LKPD and the model used are in line with the Merdeka Curriculum. The content of the LKPD enhances students' knowledge, and the activities within the LKPD are consistent with the syntax of problem-based learning. As in the research by Saputra et al (2019), explains that by using the problem-based learning model, students collaboratively engage in critical thinking to solve their problems, thereby creating a creative and effective learning system [25].

In the linguistic component section, it has a validity value of 0,88 which means that the instructions, information, language, and sentences used in the student worksheets (LKPD) are clear and understandable. This is because the language used already conforms to Indonesian spelling or language rules, and the sentences are well-constructed, making them easy to understand. The student worksheets present the material in a simple, effective, and communicative language [26], [27].

In the presentation component, it has a validity value of 0,86 which indicates that the designed student worksheets (LKPD) are systematic and sequential according to the learning objectives. The stages in the LKPD already reflect the Problem Based Learning model, and the concepts of the material, illustrations, videos, and animations are appropriate for the atomic structure material. Meanwhile, the graphical component has a validity value of 0,87 showing that the typography, including the type and size of the font, is correct and readable. The layout and design of the entire

LKPD are appealing. The illustrations, videos, images, and graphics are appropriately presented, and the navigation buttons function well. This involves the use of iSpring Suite technology in the development of learning materials, allowing for the creation of interactive content. Through graphic design tools and interactive features, users can incorporate elements such as quiz questions, simulations, and drag-and-drop activities [28], [29], [30], [31].

### 3.2 Pratikality

LKPD that have been validated and revised based on the advice and input of the five validators are then tested for practicality. This practicality test was conducted to determine the level of practicality of the Interactive LKPD based Problem Based Learning with the help of the iSpring Suite material Atomic Structure has been developed. The practicality test was conducted on two chemistry teachers and 10 students of SMAN 15 Padang. The practicality test results were obtained through the distribution of lifts to teachers and pupils. There are three assessed aspects of the practicality test, namely; the ease of use aspects, time efficiency and and benefits of such developed LKPD. The data obtained from the practicality test was analyzed using a formula modified by Purwanto. Based on Purwanto in the research Yuliawati & Indah (2019) explains that the practicality of a developed teaching material product is categorized as follows: a range of 86-100% is very practical, 76-85% is practical, 60-75% is moderately practical, 55-59% is less practical, and  $\leq 54$  is not practical [32]. This framework was used to evaluate the practicality of the interactive LKPD developed in this study. The practicality tests performed on teachers and students are shown as follows:

**Table 2.** Pratical Results by Teachers

Aspect Assessed	NP	Category
Easy to use	85%	Practical
Time effieience	100%	Very practical
Benefit	88%	Very practical
<b>Total</b>	<b>91%</b>	<b>Very practical</b>

The results of the practicality test by two chemistry teachers SMAN 15 Padang analysed with the formula modified by Purwanto (2010), obtained an average score (NP) of 91% with the category very practical. It can be concluded that the Interactive LKPD based Problem Based Learning assists the iSpring Suite material Atomic Structure that has been designed to be practically used.

**Table 3.** Pratical Results by Students

Aspect Assessed	NP	Category
Easy to use	91%	Very Practical
Time effieience	90%	Very practical
Benefit	81%	Practical
<b>Total</b>	<b>87,25%</b>	<b>Very practical</b>

Based on the graph above it can be seen that the results of the practicality test that has been carried out to 10 students obtained an average score (NP) of 87,25% with the category very practical. It states that this LKPD students can better understand the matter of atomic structures through problem-based learning. The practicality test was conducted in a small group of 10 students to determine whether the developed LKPD is feasible for use, thereby making the learning process more effective [33].

#### 4. Conclusion

The results of the research and development conducted by the author have led to the development of an interactive worksheets based on Problem-Based Learning, assisted by iSpring Suite, on the topic of atomic structure for Phase E using the 4D development model. This LKPD has been validated and is practical. The level of validity obtained from the validators has an average v value of 0,87 categorized as very valid. The level of practicality by chemistry teachers has an NP value of 91%, categorized as very high practicality. The level of practicality by students has an NP value of 87,25% also categorized as very high practicality. This concludes that the LKPD is practical for use by both teachers and students. The developed LKPD greatly assists teachers in the implementation of learning, and students can understand the atomic structure material through problem-based learning in this LKPD.

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