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Validity of Student Worksheet based on Creative Problem-Solving Model to Improve Science Process Skill

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ABSTRACT

This study aims to describe the validity of student worksheets based on the creative problem-solving model to improve the science process skills of junior high school students. The method used is the Plomp model development method which consists of three stages, namely the preliminary research stage, the development stage, and the assessment stage. The validity of student worksheets based on CPS is obtained from the validation method with an instrument in the form of a validation sheet and assessed by experts with validation by one science lecturer and two junior high school science teachers. The validation results show an average score of 91.02% on all main assessment criteria, including content, language, construction, and design. Based on the results of the study, it can be concluded that student worksheets based on the CPS model are expected to be a reference and guideline in helping students carry out the learning process, understand the available problems and solve them, and train to improve science process skills.

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1. Introduction

Education is a deliberate and systematic effort to foster a learning environment and process that encourages students to actively develop their potential. This includes nurturing religious and spiritual strength, self-discipline, personal character, intelligence, ethical values, and the skills necessary for both personal growth and societal contribution (Rahman, 2022). Education plays a role in preparing the younger generation to answer future challenges. This is in line with Indonesia's national education goals which focus on developing superior and characterful human resources. Meanwhile, science education, according to Sudjana (2009) in his book Science Learning in Schools is a learning process that equips

students with knowledge and understanding of the universe and its contents. This process emphasizes developing curiosity, scientific attitudes, and critical thinking skills Furthermore, Hamalik (2004) in his book Learning Models explains that science education aims to prepare students to become individuals who have scientific literacy, able to solve problems and adapt to change. Science education is not just about memorizing formulas and facts, but also about understanding concepts, conducting investigations, and building interpretations (HJamalik,2004). Through science education, students are invited to become active and independent learners in uncovering the mysteries of the universe.

In essence, science education must emphasize the development of students' science process skills, as science is fundamentally constructed upon scientific products, scientific processes, and scientific attitudes (Sayekti et al., 2019). Science process skills (SPS) refer to the ability to apply scientific methods in the exploration and understanding of scientific knowledge (Saleh, 2020). The term "skills" denotes the capacity to think critically, reason logically, and act effectively and efficiently to achieve specific objectives, including demonstrating creativity. Meanwhile, "process" can be defined as a set of complex skills employed by scientists in conducting scientific investigations. These processes consist of distinct components that individuals must master to carry out effective scientific inquiry (Rohmatul, 2023).

The importance of science process skills is underscored in the Indonesian national curriculum, particularly as reflected in the standards of student learning outcomes (Mahmudah, 2019). However, several factors have contributed to the low proficiency in science process skills among students, one of which is the continued reliance on teacher-centered instructional practices, rather than student-centered approaches. Ideally, classroom instruction should be designed to provide students with opportunities to observe, question, experiment, reason, present, and create. However, the implementation of learning experiences aimed at cultivating science process skills remains suboptimal.

In response to this challenge, enhancing students' science process skills requires the adoption of instructional models that actively engage students in problem-solving processes. One promising approach is the Creative Problem Solving (CPS) model, which encourages students to think critically and creatively while collaboratively addressing real-world problem. According to Pepkin (2004), the Creative Problem Solving (CPS) model is an instructional approach that emphasizes the development of problem-solving abilities, alongside the enhancement of creative thinking skills. Unlike traditional learning models that primarily focus on content delivery and conceptual mastery, CPS encourages active student participation throughout the learning process. This model promotes an environment where students are empowered to express their ideas freely, engage in critical thinking, and collaborate in addressing and resolving problems (Saminanto, 2011). The Creative Problem Solving (CPS) model emphasizes learning through problem-solving while simultaneously enhancing students' skills (Malisa, 2018). CPS is categorized as a constructivist-based learning model, in which students are positioned at the center of the learning process, making it effective in fostering active student engagement (Udiyah, 2017). Learning processes can be greatly supported by using concrete instructional tools, one of which is the student

worksheet. Student worksheets (Lembar Kerja Peserta Didik or LKPD) function as essential learning resources designed to facilitate instruction. They consist of structured materials that provide both information and tasks intended to be completed by students independently (Widodo, 2017).

Student Worksheets (LKPD) are a form of instructional media that contain information and learning activity instructions, aimed at encouraging students to develop critical thinking skills and learn independently (Arsyad, 2011). In practice, LKPD plays a significant role in supporting an active and structured learning process. To ensure the quality of LKPD, it is essential to fulfill the aspect of validity, which is a key requirement in the development of learning media (Plomp, 2013). This validity is obtained through validation by competent experts who assess the appropriateness of the content, structure, and presentation. According to the guidelines issued by the Ministry of National Education (Depdiknas, 2004), the feasibility of LKPD is determined by four main aspects: Construction requirements, language requirements, content requirements and design requirements. These four aspects serve as key indicators in determining the quality and feasibility of LKPD as an effective learning medium.

2. Method

This study is a type of research and development (R&D) aimed at producing an instructional product in the form of a Student Worksheet (LKS) based on the Creative Problem Solving (CPS) approach for mixed division material. The developed product is expected not only to be valid for use in the learning process but also to contribute to improving students' learning outcomes (Wardinin, 2020).

The development model employed in this research is the Plomp model, developed by Tjeerd Plomp. This model was selected because it integrates scientific research with practical aspects of instructional design, thus facilitating the development of systematic, structured, and applicable educational solutions, particularly in the design of open learning materials.

The Plomp model consists of three main phases, namely: Preliminary Research, this phase aims to identify the needs and context of the development process, including curriculum analysis, student characteristics, and existing problems in the learning process. The outcomes of this phase serve as the foundation for the initial product design. Development or Prototyping Phase In this phase, the CPS-based Student worksheet prototype is designed and developed. The prototype is then subjected to limited trials and revised based on feedback from experts (validators) and preliminary testing. Assessment Phase, the final phase includes expert validation, readability testing, and limited implementation to evaluate the effectiveness and practicality of the LKPD in a real learning context (Plomp, 2013).

All stages are carried out sequentially and continuously, with evaluations conducted at each phase to ensure that the developed product meets the criteria of validity, practicality, and effectiveness as an instructional medium.

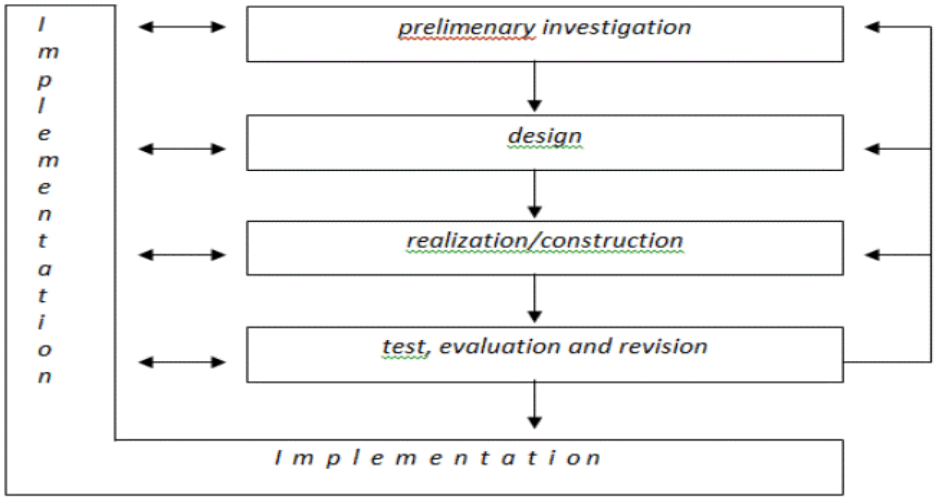

Figure. 1. Plomp Development Model (Source: Plomp, 1997)

In the preliminary investigation stage, various analyses were conducted, including the analysis of student needs and problems, curriculum analysis, and an evaluation of existing student worksheets (LKPD), which were obtained through interviews, observations, and literature studies. In the development or prototyping stage, a prototype of the student worksheet (LKPD) was created. At this stage, the LKPD was also equipped with relevant research instruments to support the evaluation process. During the assessment stage, evaluations were made regarding the validity and practicality of the LKPD. Validity was determined by experts, while practicality was assessed based on how well the LKPD could be applied by both teachers and students.

This study primarily focused on the validity stage. Validity serves as an indicator to measure the accuracy and credibility of the developed product, ensuring that the assessment tool accurately measures the intended concepts and is effective in evaluating the relevant aspects. Validity encompasses the accuracy, relevance, and usefulness of the conclusions, which are guaranteed through expert evaluation. The validity testing of the student worksheet prototype was conducted by involving three experts: two science teachers from SMP Asa Cendekia, Sidoarjo, and one university lecturer. Based on the feedback and suggestions provided by the experts, revisions were made to ensure that the student worksheet better aligns with user needs and supports effective learning processes. The validity analysis was carried out using data obtained from questionnaires completed by the experts, providing insights into the validity of the student worksheet.

Data analysis started with specified scores for each item, with validation score specified based on the scale Likert (Riduwan,2012).

Table.1 Likert scale

Scale	Criteria
4	Very good
3	Good
2	Good less
1	Very Less

Next, the percentage of data calculated using a Likert scale is calculated using the following formula:

Percentage (%) = $\frac{total\ score}{maximunm\ total\ score}$ x 100% (1)

Decide, maximum total score = highest value × total aspects × total validators The results of calculating the scores obtained by each student are translated according to the value interpretation criteria contained in Table 2 below (Riduwan,2012).

Table 2. Interpretation Criteria for Percentage Values of Validation Results

Percentage	Criteria
81% - 100%	Very valid
61% - 80%	Valid
41% - 60%	Quite valid
21% - 40%	Less valid
0 %- 20 %	Not valid

3. Results and Discussion

Results

The validity of the Student Worksheets based on Creative Problem-Solving Models for Mixed Separation Materials, aimed at practicing science process skills, is determined using expert validation instruments. These instruments are aligned with the steps of the Creative Problem-Solving (CPS) model, leading to the development of the Student Worksheets. (Malisa, 2018).

The worksheets are then validated exclusively by experts in the relevant field, ensuring a thorough assessment of their effectiveness and quality. Student worksheets that meet the requirements must fulfill several aspects including content aspect, construction aspects, language aspects, and design aspects (Wulandari, 2023) The validity period of the Student Worksheet Based on Creative Models for Problem Solving in Separating Mixed Materials includes presentation requirements, language requirements, content requirements and design requirements that must be met with valid criteria. The validators who provided assessments of this validation process were one expert lecturer and 2 science teachers at ASA cendekia junior high school. The results of validation creative problem-solving student worksheets are as follows.

Table 3. Results of student worksheet validation analysis

No	Assessment criteria	Assessment			Total	Percentage	Total Percentage	Category
		V1	V2	V3				
A.	Content aspects						91.02%	Very valid
1.	The suitability of the topic in the LKPD with the main topic of the material.	3	4	4	11	91,06%		
2.	The activities carried out support the understanding of the material. dipelajari.	3	4	4	11			
B.	Construction aspect							
3.	Have clear learning objectives	4	4	4	12	89,50%		
4.	Use clear and simple sentence structure so that it is easy to understand.	3	4	3	10			

No	Assessment criteria	Assessment			Total	Percentage	Total Percentage	Category
		V1	V2	V3				
5.	Have clear instructions for students regarding the topic being discussed.	3	4	3	10			
6.	Create illustrations that can help students in finding material concepts.	3	4	4	11			
C. Language aspects								
7.	The correctness of the grammar used (in accordance with the rules of good and correct Indonesian).	4	4	4	12	88,88%		
8.	Using simple and clear sentences	3	4	3	10			
9.	Writing LKPD using terms/symbols/symbols consistently	3	4	3	10			
D. Design aspect								
10.	Use of fonts (type and size to make reading easier)	3	4	3	10	93,75		
11.	Interesting cover	3	4	4	11			
12.	Matching the background with the text color	4	4	4	12			
13.	Harmonious image text layout	4	4	4	12			
TOTAL		**43**	**52**	**47**	**142**			

Discussion

The validity of the data obtained from validation results using expert validation sheets include content aspects, language aspects, construction aspect and design aspects. Regarding the validity value in the content aspect, the criterion value was 91% with very valid criteria. Student worksheets are designed according to the suitability of the topics in the LKPD with the main topic of the material, namely the separation of mixtures. The activities within the worksheet are integrated with the Creative Problem-Solving (CPS) model, ensuring that the material is clearly depicted and accurately represented. It shows that the student's worksheet has appropriate content with indicators of achievement of learning outcomes, the correctness of the content/material supports the clarity of the material, the suitability of the student worksheet to the needs of students and its suitability as a learning tool Meanwhile, the value of the construction validity aspect is 89.50% with very valid criteria. The student worksheets are designed with clearly defined learning objectives, ensuring alignment with the expected instructional outcomes. The worksheets use clear and concise sentence structures, making the content easy for students to grasp and understand. Additionally, the worksheets include clear instructions related to the topic being discussed, effectively guiding students through the learning process. Visual illustrations are also included to support conceptual understanding, assisting students in applying key scientific concepts.

The validity value of the language aspect is 88,8% describe valid criteria. Means that the language presented on student worksheets has been developed following the suitability of the language used with Indonesian language rules, simplicity of sentence structure, clarity of instructions and directions, sentences that do not contain double meanings and the language used is communicative. The validity score for the design criteria aspect was 93.75%, indicating that the student

worksheet met the valid criteria. The student worksheet exhibits strong visual appeal, using aesthetically pleasing and easy-to-read fonts. Consistency is maintained in the use of font type and size, as well as in the layout of headings and illustrations across the page. The design avoids excessive variation in font, color, and format, resulting in a balanced and cohesive appearance that enhances usability. The worksheet has an attractive and well-organized cover, integrating the heading, relevant illustrations, the institution's logo, and other design elements in a visually harmonious manner. Additionally, an appropriate combination of background and text colors is used to ensure readability. The included images are not only visually appealing but also serve to clarify the material.

The overall validity assessment produced an average score of 91.2%, indicating a high level of validity. Consequently, it can be concluded that the student worksheet, developed based on the Creative Problem Solving (CPS) model for the topic of mixture separation, is effective as an instructional tool. This worksheet facilitates active student engagement in the learning process, thereby enhancing comprehension and retention of the subject matter through a problem-based learning approach (Saminanto, 2011). Furthermore, the worksheet supports the development of student competencies across the cognitive, affective, and psychomotor domains, and expected to be a reference and guideline in helping students carry out the learning process, understand the available problems and solve them, and train to improve science process skills.

The improvement in students' science process skills is evident using the CPS model worksheet (LKPD), as demonstrated by the N-Gain analysis results for each science process skills indicator measured, including observing, formulating problems, hypothesizing, identifying variables, and drawing conclusions. These results are presented in the following table.

Tabel 4. Result Data N-Gain for Each Observed Science Process Skills Indicator

Science Process Skills Indicator	N-gain	Category
observing	0,74	High
formulating problems	0,66	Moderate
hypothesizing	0,95	High
identifying variables	0,71	High
drawing conclusions	0,84	High

Based on the results, it is known that each indicator experienced an increase in the average score between the pretest and posttest, indicating an improvement in science process skills after the implementation of CPS model learning using LKPD.

The implementation also revealed students' responses covering indicators such as understanding of the material, students' interest in learning, and the perceived usefulness of the learning method. The results showed that junior high school students displayed a very positive attitude toward the learning process, with an average response percentage reaching 86%, categorized as excellent. This indicates that the CPS model worksheet (LKPD) effectively supports the improvement of their science process skills.

The research findings show that the learning model and LKPD applied are in line with constructivist theory, which emphasizes that learning is an active process

in which students construct their own understanding through experience and interaction with their environment (Sugrah, 2019). The CPS model consists of steps such as problem clarification, brainstorming, evaluation and selection of ideas and strategies, and implementation of solutions (Anjiana, 2023). The CPS model is closely related to the improvement of science process skills because both involve stages of creative and analytical problem-solving. Thus, this research can serve as a basis for developing innovative learning methods to enhance students' science process skills.

4. Conclusions

Based on the research findings and analysis, it can be concluded that the Student Worksheets developed using the Creative Problem Solving (CPS) model for the topic of mixture separation have demonstrated a high level of validity. These worksheets function as effective instructional tools, supporting student-centered learning and contributing to improved academic performance. The validation results indicate an average score of 91.02% across key evaluation criteria, including content, language, construction, and design. Consequently, the CPS-based Student Worksheets can be considered both valid and pedagogically sound for classroom implementation, as they actively engage students in problem-solving activities and support the development of essential science process skills. Thus, this research can serve as a basis for developing innovative learning methods to enhance students' science process skills.

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