International Summit on Science Technology and Humanity
ISETH 2025
ISSN: 2615-1588 (online)

Development of Student Worksheets (LKPD) Based on the Conceptual Change Model (CCM) to Minimize Misconceptions in Human Circulatory System Material for Elementary School Students

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Abstract

Purpose: Science education in elementary schools requires the cultivation of accurate conceptual understanding to minimize misconceptions. However, misconceptions are still found in the material on the circulatory system. This study aims to: a) describe the existing science worksheets in the field, b) test the validity of CCM-based worksheets, and c) test the practicality of CCM-based worksheets.
Development, Disseminate), but limited to the development stage. The subjects included 24 students and educators of class VI.3 at SD Muhammadiyah 16 Surakarta. Data collection techniques included observation, interviews, documentation, and Three-tier multiple choice diagnostic tests. The LKPD was validated by subject matter experts, media experts, and practitioners. Data were analyzed qualitatively and quantitatively.
Results: The results showed that: a) the LKPD on the circulatory system was ready for use, b) the CCM-based LKPD obtained 85% validation from subject matter experts and 87.5% from media experts (both Very Valid), c) the practicality test by practitioners was 85% (Very Practical). These results confirm that CCM-based LKPD is feasible and practical for minimizing misconceptions in circulatory system material.
Applications/Originality/Value: The validation and practicality results show that CCM-based LKPD is ready to be tested in IPAS learning on a wider scale. Although it has been declared Valid and Practical, it is necessary to establish a hypothesis that requires empirical testing in the future with a control group and pre/post-test design to test the effectiveness of this LKPD.

Introduction Section

With the implementation of the Merdeka Curriculum as the national curriculum in the 2024/2025 academic year, science subjects have been developed into Natural and Social Sciences (IPAS), which is a combination of basic sciences (IPA) and basic social sciences (IPS). Research (Asngad et al., 2021; Azzahra et al., 2023; Rachmawati et al., 2023) explains that IPAS is the study of living things, including plants, biodiversity, and inanimate objects, both in the natural and social environments. IPAS plays a role in stimulating students' curiosity about the phenomena around them. Through this integration, it is hoped that learning will be contextual, meaningful, and holistic, as well as relevant to students' lives. Therefore, the discussion of the position of science in IPAS is important so that the integration of these two branches of science can run effectively without reducing the essence of science learning as the basis for mastering scientific concepts.

The word “science” in English means “knowledge,” and is derived from the Latin word scientia, which means “I know” or “knowledge.” In the context of education, science is understood not only as a collection of knowledge about nature, but also as a process of acquiring knowledge through scientific activities, including observing phenomena, asking questions, conducting experiments, reasoning about findings, and communicating results. Thus, science is a vehicle for developing scientific skills, attitudes, and values that support the achievement of educational goals (Maulani et al., 2022). Based on this description, science is defined as the study of various natural phenomena, their symptoms, and the laws that govern them. However, in practice, science learning still faces a number of obstacles that affect student learning achievement (Rahman & Setyasto, 2025).

Science education essentially involves understanding content, concepts, and scientific work (Hariyatmi et al., 2022; Maulani et al., 2022; Septiani & Sari, 2024). These characteristics show that science is a complex field (Astutik et al., 2021; Segara & Setyaningrum, 2024) and abstract in nature (Fajriyanti & Sayekti, 2022; Kadirhanoğulları & Köse, 2024; Puriadi & Surnjono, 2024). Science learning is not merely memorizing concepts, but rather a process of discovery through a

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scientific approach (P. Agustina et al., 2025). For this reason, evaluating understanding is not sufficient when viewed from a biological perspective alone, as this can trigger misconceptions, including about the circulatory system (Fatimah et al., 2023). Science learning is recognized as an area where misconceptions often arise (Segara & Setyaningrum, 2024). Therefore, a strong grasp of concepts is necessary for students to understand these phenomena correctly (Addido et al., 2022). Conceptual understanding, critical thinking skills, and problem-solving skills are required for 21st-century science learning (Resbiantoro et al., 2022). Therefore, the delivery of material needs to be linked to students' direct experiences. This step aims to minimize misconceptions and strengthen conceptual understanding.

Misconceptions are understood as views that contradict scientific concepts that have been recognized by experts (Chavan & Khandagale, 2022; Irianti, 2021). Many students do not yet fully understand science concepts, making them prone to misconceptions (Astutik et al., 2021), which ultimately hinders the science learning process (Kadirhanoğulları & Köse, 2024). Therefore, conceptual learning is crucial to improve learning outcomes (Soeharto & Csapó, 2022). Various studies show that misconceptions about the circulatory system are still common at the elementary school level, so serious attention is needed to prevent ongoing learning problems.

Conceptual understanding is an important foundation that needs to be developed in students in order to avoid misunderstandings about the true meaning of concepts (Fauzannur et al., 2022). In the science curriculum in elementary schools, material is delivered through various themes, one of which is the circulatory system, which is taught in fifth grade (Izza et al., 2021). One measure of success in science learning is the ability of students to understand science concepts correctly (Arruum & Desstya, 2024), because misconceptions in understanding concepts still often occur in science learning.

Several studies reveal that misconceptions about the circulatory system are still common among fifth-grade elementary school students (Ramayani et al., 2024; Septiany et al., 2024). This material covers the structure and function of the heart, the characteristics of blood vessels, and the mechanism of the circulatory process. Common misconceptions include the function of the heart chambers, the nature of blood vessels, the differences between the ventricles and atria, the characteristics of arteries and veins, the function of the circulatory organs, and organ disorders(Izza et al., 2021). Students also often misinterpret the benefits of exercise on blood circulation based on accurate scientific concepts. Other common errors occur in the concepts of heart chamber function, blood vessel properties, and frequently considering the lungs as part of the circulatory system (Segara & Setyaningrum, 2024). In addition, some students still have difficulty understanding materials such as the mechanism of the human circulatory system, the blood clotting process, and the structure of the heart (Balela et al., 2021). Quantitative findings show misconceptions about the functioning of the heart and blood vessels, with 9.3% of students showing misconceptions related to heart function, 22.7% to the pulmonary artery, 38.2% to the pulmonary vein, 23.7% to arteries, and 16.5% in distinguishing arteries from veins (Syarafina et al., 2020). Accurate understanding is very important because it is related to students' ability to maintain their health (Damerau et al., 2022). Remediation is needed to instill the right concepts and maximize learning outcomes (Irianti, 2021), in line with the goal of science education to ensure that students can understand and apply concepts correctly (Köse, 2024). Therefore, educators need to understand the causes of misconceptions, which stem from students' basic understanding, limited assumptions, lack of conceptual understanding, low motivation to learn, and the mismatch between cognitive development stages and the level of difficulty of the material (Dwilestari & Desstya, 2022).

Several internal and external factors contribute to the emergence of misconceptions. Several studies show that misconceptions arise in students when they reconstruct their understanding based on personal findings and experiences (Irianti, 2021). Low learning independence also reinforces the emergence of misconceptions (Virgiandini & Muthmainnah, 2025). From the educators' perspective, many educators only convey the definition of a concept without relating it to the reality of students' lives (Astutik et al., 2021). In fact, educators' own misconceptions are one of the main causes of misconceptions among students (Desstya et al., 2019; Sadevi & Sayekti, 2023). This is exacerbated by the fact that elementary school educators who teach science are generally classroom educators without a background in science education, even though they have studied science material for several semesters (Desstya et al., 2021). Other findings show that 34.44% of educators have misconceptions about science (Fajriyanti & Sayekti, 2022). Therefore, educators play a crucial role in implementing appropriate learning strategies, being able to detect misconceptions early on, and teaching science concepts in accordance with correct scientific understanding.

Based on this, one strategy to minimize misconceptions is the use of LKPDs that are linked to students' daily lives (Astutik et al., 2021). LKPD is a teaching medium that includes structured material and tasks, which helps students overcome learning problems (Dawa et al., 2022; Idrus et al., 2022). In addition, LKPD is a reference in observation or experiment activities that require systematic work procedures (Ramlawati et al., 2022). Research shows that the use of LKPD makes learning more focused, organized, and structured (Balela et al., 2021), while encouraging active participation and enthusiasm for learning among students (Cahyati & Mustika, 2024). In project-based learning, LKPD serves to guide students at every stage of the project, from the planning stage to the evaluation stage (Khaira et al., 2025).

In educational practice, many educators rely on ready-made teaching materials without going through the process of planning and preparing them according to learning needs (Maimufi et al., 2021). A lack of conceptual understanding from an early stage, including as a result of misconceptions, has an impact on low student engagement in learning science at the next level. As a result, the small number of students who continue in the field of science can reduce the availability of science skills that are important for modern society (Palmer & Booth, 2024).

Based on data from SD Muhammadiyah 16 Surakarta, sixth grade students still experience various misconceptions about the circulatory system. Of the total 24 students, 23 took the test, and the results showed that the level of misconception was moderate, with a percentage of 50.87%. This information was obtained through a multiple-choice test consisting of 10 questions based on three indicators, namely recognition of the parts of the heart, understanding of the large and small circulatory systems, and identification of veins and arteries.

Findings from observations, interviews, documentation, and Three-tier multiple choice diagnostic tests at SD Muhammadiyah 16 Surakarta show that IPAS learning in class VI.3 is still separated between science and social studies and does not yet use a clear learning model. The school also does not yet have a mechanism for detecting misconceptions, so students' understanding is only assessed based on their ability to answer questions. In the material on the circulatory system, educators have never applied CCM, learning media are limited, and the student worksheets used are sourced from the internet without being adapted to students' needs. These conditions cause students to have difficulty distinguishing between the large and small circulatory systems. These findings emphasize the importance of developing more relevant learning models and student worksheets to help educators minimize misconceptions and strengthen students' conceptual understanding.

One effective learning model for minimizing misconceptions is CCM. This model is considered capable of honing students' inductive and deductive thinking skills (Rohmah & Fadly, 2021). In general, CCM is designed to correct initial misconceptions and guide students toward more accurate scientific concepts. The advantage of the CCM model lies in its ability to encourage students to think critically, reassess their understanding, and form more accurate and lasting concepts. With these characteristics, CCM is a relevant choice for science learning at the elementary school level.

The application of the CCM model in LKPD to reduce misconceptions in the circulatory system material is considered very relevant to the nature of IPAS learning, especially in the science section, which requires a deep understanding of concepts. The circulatory system material requires a coherent understanding of concepts and must not be misunderstood, so LKPD designed based on CCM can be a tool that helps students build a stronger and more focused scientific understanding.

The results of several studies show that the use of CCM and LKPD methods in learning has been proven to be feasible and valid for implementation as supporting teaching materials in science learning, especially in the subject of the circulatory system. Various learning models have also been integrated into the development of LKPD, such as Problem-Based Learning (Maimufi et al., 2021), Discovery Learning (Idrus et al., 2022), Contextual Teaching and Learning (Astutik et al., 2021), Conceptual Change (Rohmah & Fadly, 2021), and Critical Thinking Skills (Balela et al., 2021), including the HOTS-based approach (Cahyati & Mustika, 2024). In addition, the material developed in the LKPD is not limited to the circulatory system, but also covers material on human posture and the respiratory system. Each study highlights a different focus, but all lead to the same goal, namely reducing misconceptions and improving student learning outcomes (Septiany et al., 2024).

Although various studies have produced LKPDs with various learning models and technologies, there are a number of limitations that need to be considered. CCM-based LKPDs specifically for blood circulation material in elementary schools are still very rarely developed. Most of the available LKPDs are not designed to reduce misconceptions but only emphasize general conceptual understanding without structured strategies to detect misconceptions. The integration of technology with the CCM approach in this material is also minimal. In this context, learning efforts need to be directed towards a conceptual approach, namely the process of reorganizing initial misconceptions into appropriate scientific knowledge (Aydin & Karyağdi, 2023).

Seeing the various problems that arise, more appropriate teaching materials are needed, one of which is CCM-based student worksheets. The use of student worksheets with this approach is expected to reduce misconceptions and help students not only memorize but also truly understand the concepts being studied. Good mastery of science concepts, including the ability of students to answer a series of questions in the form of tests, is an important indicator in assessing the achievement of this understanding (Fauzi et al., 2024). Therefore, this study focuses on developing CCM-based LKPD to minimize misconceptions in the material on the human circulatory system for elementary school students. The specific objectives of this study are to: a) Describe existing science worksheets in the field, b) Test the validity of CCM-based worksheets, and c) Test the practicality of the CCM-based worksheets.

Methodology

Research Design

This study applied a research and development (R&D) method using the 4-D model (Define, Design, Development, and Disseminate). However, the study was limited to the Development stage only, namely the validity test of the LKPD by validators. In the Define stage, the researcher identified the needs and objectives of the development through five steps. First, initial and final analyses were conducted to identify problems in teaching and learning IPAS material on the circulatory system through interviews with a sixth-grade teacher, initialed N, at SD Muhammadiyah 16 Surakarta. Second, student analysis was conducted to adapt the LKPD to student characteristics, abilities, and experiences. Third, task analysis to identify and map the types of tasks relevant to the circulatory system material and learning outcomes. Fourth, concept

analysis to detail the sub-concepts of the material as the basis for developing CCM-based LKPD. Fifth, learning objective analysis was carried out to determine the achievement indicators and specific objectives of developing CCM-based LKPD. This analysis helped determine the content of the LKPD while ensuring its suitability for the learning objectives.

The Design stage begins after the learning objectives have been set, with a focus on selecting media, material formats, and designing the initial version of CCM-based LKPD on the material of the circulatory system. This stage consists of four steps. First, tests are developed to obtain instruments for evaluating student abilities, including products, processes, and psychomotor skills. Second, the media is determined based on an analysis of the tasks, concepts, student characteristics, and available resources. Third, the format is determined, including the design of the worksheet layout (layout, images, and text) that is appropriate for the CCM stages and supports student understanding. Fourth, the initial product design is reviewed by the supervising lecturer and revised until a final design is produced. The final design is ready to be tested through material validation, media validation, and practicality testing.

The Development stage was carried out by receiving input from formative evaluations and making improvements as needed. This stage consisted of two steps. First, expert validation of the LKPD involving subject matter experts, media experts, and practitioners. Suggestions from validators were used as a basis for improving and refining the LKPD to ensure that it was appropriate, effective, useful, and of high technical quality. After the revision of draft I is complete, draft II is produced, which meets the eligibility criteria.

The 4-D model procedure chart according to Thiagarajan is shown in Figure 1.

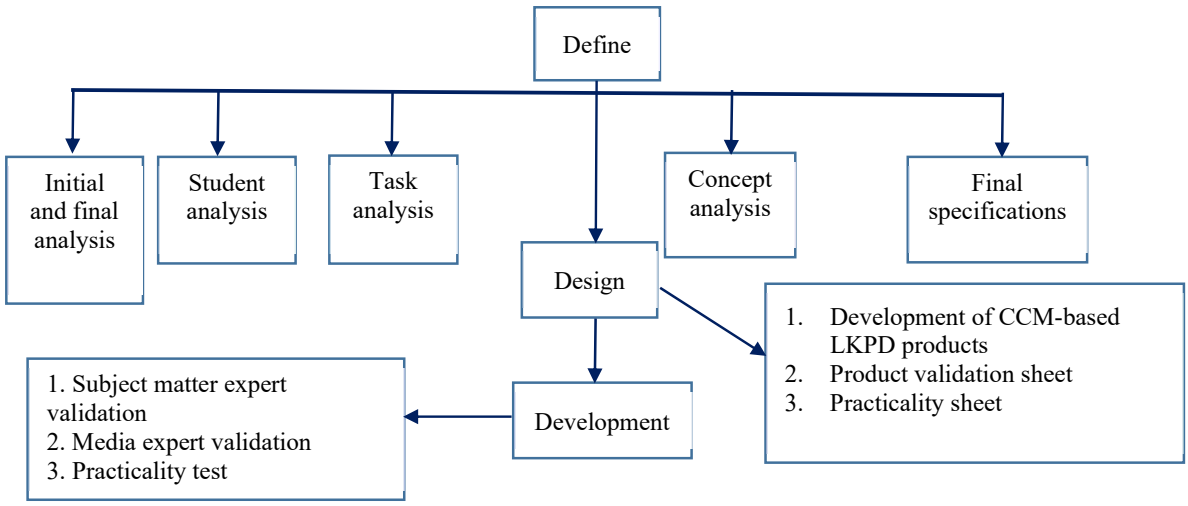

Figure 1. 4-D Model Procedure (Thiagarajan et al., 1974).

Research Subject

This research involved two validators, namely subject matter experts and media experts, along with a practitioner. In addition, the research also involved 23 students from class VI.3 and their teachers.

Data Collection Techniques

The data collection techniques in this study are described in accordance with the stages of the research conducted. In the needs analysis stage, data collection techniques were carried out through observation, interviews, documentation, and tests. Observations were conducted to directly review the IPAS learning process, including student responses during activities. Interviews were conducted to explore information about students' misconceptions on the material of the circulatory system, teaching strategies, teaching materials, curriculum, methods, and learning media, involving a sixth-grade teacher at SD Muhammadiyah 16 Surakarta. Documentation was carried out as supporting data, in the form of student worksheets used by educators and relevant IPAS textbooks. Tests were used to determine students' misconceptions using a three-tier multiple-choice instrument, consisting of three levels of questions. The first level (tier 1) consisted of conceptual questions with four answer choices. The second level (tier 2) asked for the reasons behind the answers chosen in the first tier, also with four choice reasons, while the third level (tier 3) measured the extent of students' confidence in answering the questions in the first and second tiers.

Data collection techniques during the development stage were carried out through expert assessment using expert validation sheets for material and media experts to assess the validity of CCM-based LKPD, and practicality assessment, using practicality sheets, to assess the applicability of LKPD by sixth-grade practitioners.

Data Analysis Techniques

The data obtained from this research and development consists of two types. First, qualitative data, which includes data reduction, data presentation in the form of descriptive narratives, and the process of drawing conclusions (Miles et al., 2014).

Second, quantitative data, in the form of validation scores given by subject matter experts, media experts, and practitioners, which will then be analyzed using the following formula:

$P = (F / N)$ x 100%

Explanation:
P = Percentage of questionnaire data
F = Total score obtained
N = Maximum score (Agustina et al., 2023)

The results of the scores obtained are then calculated using the above formula and converted into a percentage. Next, the validity percentage results from the subject matter experts are interpreted into the validity criteria in Table 1.

Table 1. Learning Tool Validity Criteria.

Numbering	Validity Score (%)	Validity Criteria
1.	84 – 100	Highly Valid / Not Revised
2.	68 – 84	Valid / Not Revised
3.	52 – 68	Sufficiently Valid / Needs Revision
4.	36 – 52	Less Valid / Needs Revision
5.	20 – 36	Highly Insufficient / Needs Revision

Source: (Dawa et al., 2022)

Meanwhile, the scores obtained from the practicality test were analyzed using the following practicality calculation formula:

Percentage (%) = (*Score obtained* / *Total score*) × 100% (Gupurli et al., 2024).

Then, the results of the practicality percentage from practitioners can be interpreted into the practicality criteria in Table 2.

Table 2. Practicality Criteria for Learning Tools.

Numbering	Practicality Score (%)	Practicality Criteria
1.	0 – 20	Highly impractical
2.	21 – 40	Not Highly practical
3.	41 – 60	Quite practical
4.	61 – 80	Practical
5.	81 – 100	Highly practical

Source: (Naibaho & Khairuna, 2025)

Result

Previously Existing Science LKPD

Based on the results of observations, interviews, documentation, and reinforced by diagnostic tests in class VI.3 with a teacher whose initials are N at SD Muhammadiyah 16 Surakarta on August 19–21, 2025, it was found that IPAS learning is still taught separately between science and social studies and misconceptions have never been detected. The CCM model has never been used and generally there is no learning model, and learning media are limited. The student worksheets used are taken from the internet without modification and are incomplete, and even the student worksheets are unable to measure the level of student understanding. In addition, the student worksheets also only focus on certain subchapters. Students

often have difficulty distinguishing between the large and small circulatory systems. This indicates the need to develop more creative learning models and LKPD to minimize misconceptions and strengthen students' conceptual understanding.

Results of the Material and Media Expert Validation Test

Results of the Material Expert Validation Test

The validation results show that the material is in line with the Merdeka Curriculum and learning outcomes and objectives. This validation ensures that the scientific concepts in the LKPD are correct and do not cause misconceptions. The assessment covers clarity of language, relevance of material to student development, suitability of presentation to CCM stages, and task instructions designed to be easily understood by students. However, some refinements and improvements were needed based on the input provided by the validators. The validators suggested that the sequence of the large and small blood circulation be corrected. Therefore, the researchers made improvements by sorting the numbers in the LKPD according to the large and small blood circulation sequences. The material expert validation process was carried out by Mrs. Lina Agustina, S.Pd., M.Pd. The validation results are shown in Table 3.

Table 3. Material Expert Validation Test Results.

Numbering	Assessment Aspects	Validity Score (%)	Validity Criteria
1.	Content	86%	Highly Valid
2.	Language	100%	Highly Valid
3.	Construction	75%	Valid
4.	Relevance to CCM	75%	Valid
5.	Clarity of Instructions	75%	Valid

The results of expert validators from all aspects of assessment show that LKPD obtained an average percentage of 85%, including the criteria of Highly Valid for field testing. Thus, the developed LKPD can be tested on a wider scale.

Media Expert Validation Results

The results of validation by media experts can be seen in terms of LKPD design, readability, layout consistency, visual appeal, media quality, media function, media validity, and clarity of instructions. Several improvements and refinements are needed in accordance with the suggestions provided by the validator. The validator provided feedback to separate the tools and materials in stage 1, namely committing to learning outcomes, adding video links even though they were already equipped with QR codes, adding comparative media to the SIPEDA (Blood Circulation System) section, and adding a literature review from books/journals. The researcher followed up by making improvements, namely separating the tools and materials in stage 1, adding video links for alternatives, adding comparative media to the SIPEDA media, and adding reference sources. The results of the media expert validator's assessment were carried out by Mr. Mazwar Ismiyanto, M.Pd. The validation results are shown in Table 4.

Table 4. Media Expert Validation Test Results.

Numbering	Assessment Aspects	Validity Score (%)	Validity Criteria
1.	Design Appearance	100%	Highly Valid
2.	Readability	100%	Highly Valid
3.	*Layout* Consistency	100%	Highly Valid
4.	Visual Appeal	75%	Valid
5.	Media Quality	75%	Valid
6.	Media Functionality	75%	Valid
7.	Media Validity	100%	Highly Valid
8.	Clarity of Instructions	75%	Valid

The results of media expert validation of all aspects of the assessment show that LKPD received an average score of 87.5%, including the criteria of Highly Valid for field testing. With these improvements, LKPD is ready for use on a wider scale.

CCM-Based LKPD Practicality Test Results

The practicality of CCM-based LKPDs in terms of usage, instructions, time, media, and usefulness. The results of practicality tests by practitioners, namely Mrs. N, show that CCM-based LKPDs meet all assessment criteria and therefore do not require improvement in any aspect. The results of practicality testing by practitioners are shown in Table 5.

Table 5. LKPD Practicality Test Results.

Numbering	Assessment Aspects	Practicality Score (%)	Practicality Criteria
1.	Ease of Use	86%	Highly Practical
2.	Clarity of Instructions	100%	Highly Practical
3.	Timeliness	75%	Practical
4.	Appropriateness of Media	75%	Practical
5.	Usefulness	75%	Practical

The results of the LKPD practicality test from all aspects of assessment obtained an average percentage of 85%, which falls under the criteria of Very Practical for field testing.

The test results from media experts, material experts, and practitioners are broadly shown in Figure 2.

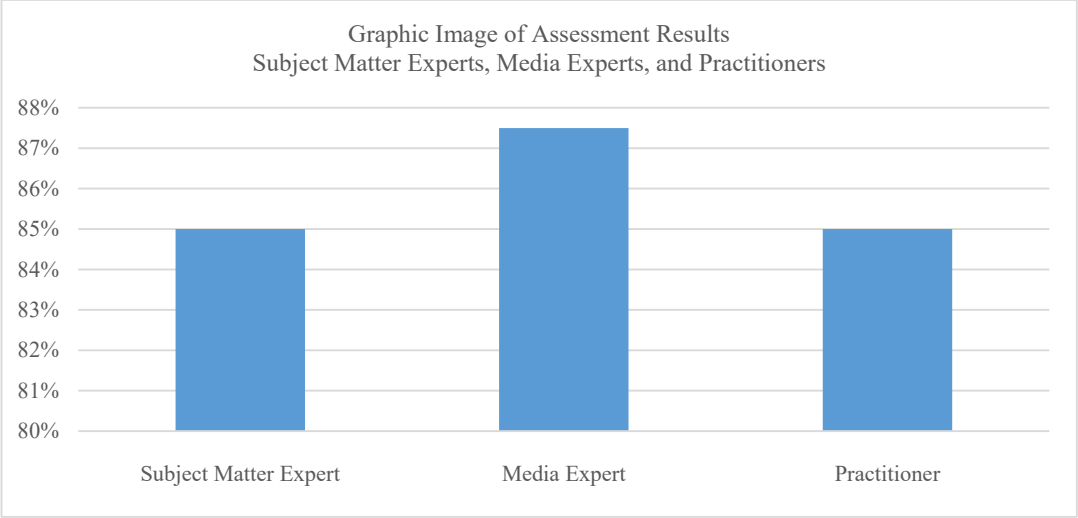

Figure 2. Graph of Assessment Results from Subject Matter Experts, Media Experts, and Practitioners.

Discussion

Existing Science LKPD in the Field

Based on the results of observations, interviews, documentation, and reinforced by diagnostic tests conducted by researchers together with the sixth grade teacher, Mrs. N, at SD Muhammadiyah 16 Surakarta on August 19-21, 2025, a number of findings related to problems in learning were obtained. At this school, IPAS learning is still taught separately. IPAS learning shows a similar trend to the findings (Meylovvia & Julianto, 2023), which state that students still face obstacles in integrating the aspects of science and social studies in a balanced manner in a single learning process. Some students even consider IPAS learning complicated because they have to understand two perspectives at once. In practice, science is taught in the first hour and social studies in the next hour, or vice versa. This pattern is not fully in accordance with the applicable rules. In terms of misconceptions, it is known that schools have never made an effort to detect misconceptions among students. This condition is in line with the results of a study (Fabilla et al., 2023), which revealed

that in the early stages of the learning process, educators generally do not identify possible misconceptions in the material being taught. The above explanation is supported by the researcher's initial observations, which show that educators have never detected misconceptions before. At the end of each lesson, educators only ask questions about that day's lesson. If students are able to answer, they are considered to have understood, but if they are unable to answer, they are considered to have misconceptions.

These findings are reinforced by research (Indrajatun & Desstya, 2022), which states that students who experience misconceptions have different characteristics from students who have not mastered the concept. Students who have misconceptions generally show confidence in their understanding, even though this understanding contradicts the actual scientific concept. Conversely, students who do not understand the concept generally do not have a clear knowledge base of the concept being studied. Thus, the actions taken by the educator cannot be categorized as an appropriate attempt to detect misconceptions. This view is also in line with the statement (Fabilla et al., 2023) that misconceptions in students can be caused by several factors, such as learning habits that emphasize memorization, the use of foreign terms that are difficult to understand, and the application of lecture-dominant learning methods without the support of learning models that are suitable for science subjects. These conditions have the potential to hinder the effectiveness of learning. This view is reinforced by research (Rasidah et al., 2022), which emphasizes attention and handling of these issues so that learning is more interesting, meaningful, and relevant. These efforts are expected to improve learning outcomes while helping students understand concepts more effectively and retain them for a longer period of time. In this study, educators have never detected misconceptions in the material on the circulatory system. This condition is what prompted the researchers to develop worksheets that serve to minimize misconceptions.

Science education on the circulatory system has also never applied the CCM model before, and even educators are new to this model. In their teaching, they do not usually use specific models, such as PJBL or PBL, but in practice, students have been asked to make projects sticking the organs of the circulatory system.

Science education on the circulatory system has also never applied the CCM model before, and even educators are new to this model. Until now, learning has not used a specific model, such as PJBL or PBL consistently, only occasionally asking students to make projects sticking circulatory organs. This finding is reinforced by the views of (Rohmah & Fadly, 2021), which explain that one solution to minimize misconceptions is through the application of the Conceptual Change model. This model was then integrated into the LKPD developed by researchers because it proved to be practical and quite effective in helping students understand science concepts more accurately. Support for learning innovation was also found in the study (Dawa et al., 2022), which indicated that many students still had difficulty solving problems optimally, while educators tended to rely on textbooks as learning materials. These results are in line with the findings (Septiani & Sari, 2024), which reveal that the use of learning media by educators is still minimal. It is limited to textbooks, PowerPoint, YouTube videos, and simple teaching aids that have not been utilized optimally. A similar view was expressed by (Setyaningsih & Wascita, 2021), who emphasized that practical activities are an important part of science learning because they reinforce the mastery of applied material. However, practical activities in this school are still limited and carried out with makeshift facilities and infrastructure, thereby reducing the effectiveness of learning. This condition is in line with the results of a study by (Dewi & Hidayat, 2022), which states that effective teaching can increase students' focus and ability to absorb material. Conversely, ineffective learning can have a negative impact on students' academic development.

Judging from the worksheets used in learning, it is evident that educators only use ready-made worksheets from the Google platform, which are then printed in black and white and completed twice without any instructions or student identification columns. This finding is in line with the results of a study (Hariyatmi et al., 2021), which states that assessment is a crucial indicator for monitoring student learning progress. However, the LKPD used by educators has not been able to comprehensively measure students' understanding of concepts at the sixth-grade cognitive level because the material is still limited to certain subchapters. In line with this, research (Maulani et al., 2022) explains that many LKPDs only contain summaries of material and sample questions, without directing students to in-depth scientific activities. This condition emphasizes the importance of educators' creativity in developing worksheets so that they function optimally. This view is reinforced by (Maimufi et al., 2021), which emphasizes that today's educators must be able to create teaching materials that are creative, diverse, interesting, and tailored to students' needs.

The lack of innovation in learning makes learning activities tend to be monotonous, thereby reducing students' interest in actively participating. Educators say that students find it difficult to distinguish between the mechanisms of the large and small circulatory systems because they are often confused. This finding is reinforced by research (Idrus et al., 2022), which reveals that teaching materials can help educators manage learning while making it easier for students to understand the material. This condition indicates that the use of learning models and worksheets is still not optimal. In line with this, the results of a study (Balela et al., 2021) recommend the use of worksheets designed to encourage critical thinking so that students understand concepts in depth, rather than just memorizing them. This is important because educators not only deliver material but also ensure that students' understanding is in line with scientific concepts. Therefore, the learning models and LKPDs developed must be able to minimize misconceptions while strengthening students' understanding of concepts. Based on the results of observations, interviews, and documentation, it appears that educators' creativity in applying learning models and developing varied LKPDs still needs to be improved.

Results of Expert Material and Media Validation Tests

Results of Content Expert Validation

In the development of LKPD, validity and practicality are evaluated. The average score for validity and practicality is obtained through assessment by subject matter experts, media experts, and practitioners. Subject matter expert validation covers aspects of content, language, structure, relevance to the CCM, and clarity of instructions. Media expert validation covers aspects of design, readability, visuals, and layout, as well as readability. Practicality by practitioners is measured in terms of time, ease of use, usefulness, media suitability, and clarity of instructions after the product has been developed.

Validation testing by subject matter experts showed that the LKPD received an average score of 85% with a rating of Highly Valid. This is in line with the findings (Agustina et al., 2023), which explain that validation by subject matter experts is carried out to assess the completeness and accuracy of the LKPD content. Based on the results of the CCM-based LKPD validation, the material is in accordance with the Merdeka Curriculum, in line with learning outcomes and objectives, free from misconceptions, communicative language and appropriate for student development, follows the CCM stages, and provides clear task instructions. These findings are in line with the results of a study (Rohmah & Fadly, 2021), which explains that the application of the STEM-based conceptual change learning model is able to generate conceptual conflicts so that students are more active in asking questions and expressing ideas. Meanwhile, this CCM-based LKPD uses LKPD in accordance with the CCM stages in the blood circulation system material. The preparation of this LKPD is based on field requirements, including an analysis of the IPAS learning conditions, student characteristics, and the adjustment of learning activities to learning outcomes.

This assessment aims to ensure that the LKPD developed enables students to learn about the circulatory system without misconceptions. This study is in line with the findings (Maimufi et al., 2021), which show that LKPD on the circulatory system material is able to provide new experiences and encourage student engagement. This CCM-based LKPD consists of six stages in CCM, namely from the Commitment to Learning Outcomes stage to the Exceeding stage, which can minimize misconceptions. This is in line with research (Thiagarajan et al., 1974; Yager, 2009) that CCM consists of six stages, namely: 1) Commitment to Results, 2) Expressing Beliefs, 3) Confronting Beliefs, 4) Accommodating Concepts, 5) Expanding Concepts, 6) Transcending. Each stage has learning achievement measures that serve to assess student understanding.

The LKPD product, as initially planned, consists of a cover page, table of contents, foreword, concept map, student identity, learning outcomes, learning objectives, instructions for use, introduction, and stages in CCM. The learning outcomes applied in this LKPD refer to the 2025 Ministry of Education and Culture Regulation.

The results of the LKPD front page and its objectives are shown in Figure 3.

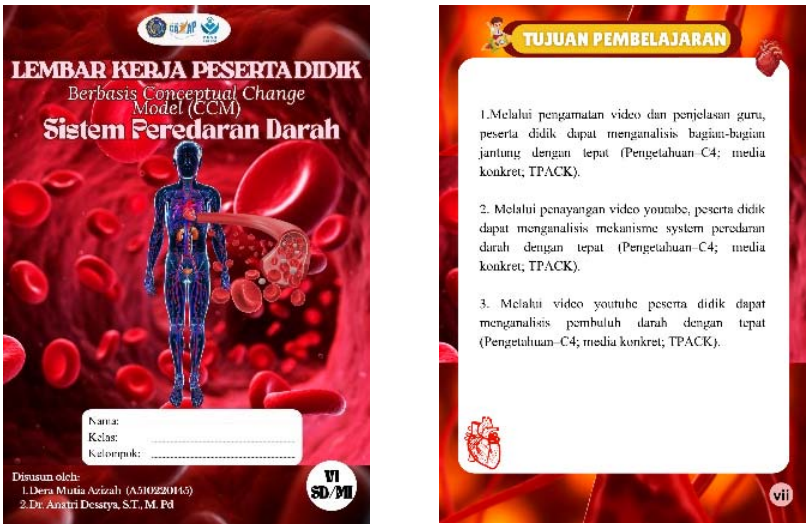

Figure 3. Cover Page and Learning Objectives.

The first stage in this LKPD refers to stage 1, namely Commitment to Learning Outcomes. This stage contains learning objectives, activity instructions, images related to the theme, video clips, tools, materials, activity steps, and stimulating questions. In this stage, students are asked to observe and examine a phenomenon based on concrete media and YouTube videos.

The first stage of Commitment to Learning Outcomes in CCM-based LKPD is shown in Figure 4.

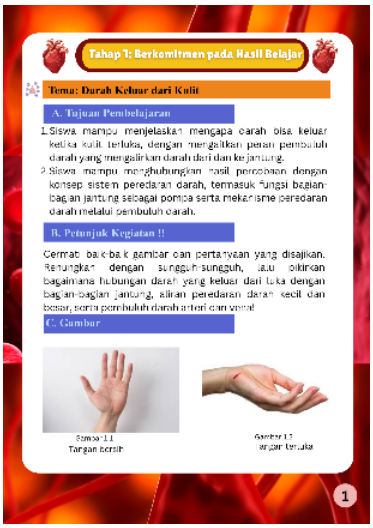

Figure 4. LKPD stage 1. Committed to Learning Outcomes.

The second stage in this LKPD refers to stage 2, namely Conceptual Understanding through Activities. This stage presents the steps of the activity, SIPEDA media images, and answer sheets. In stage 2, students are asked to form groups, discuss the material, and write down the results of the discussion on the answer sheet based on the problems in stage 1. Then, students observe the SIPEDA media provided by the educator and answer the answer sheet based on their initial understanding with their group members.

The Conceptual Understanding through Activities LKPD is shown in Figure 5.

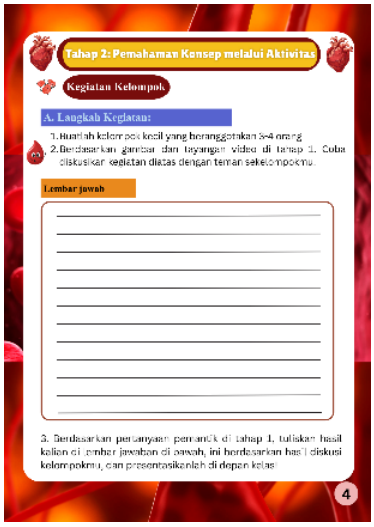

Figure 5. LKPD stage 2. Conceptual understanding through activities.

The third stage in this LKPD refers to stage 3, namely Facing Beliefs. This stage contains instructions for activities in stage 3 and the steps for the activities. Students at this stage are asked to observe the educator operating the SIPEDA media, try operating it themselves, and answer the questions on the answer sheet provided.

The results of the Facing Beliefs LKPD are shown in Figure 6.

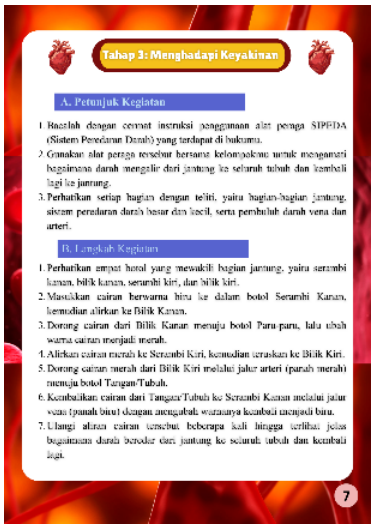

Figure 6. LKPD stage 3. Facing Beliefs.

The fourth stage in this LKPD refers to stage 4, namely Accommodating Concepts. This stage presents the steps for stage 4 activities and the answer sheet. At this stage, students are given an explanation of the correct material on the circulatory system by the educator, starting from the parts of the heart, the blood flow, to the blood vessels. Next, students are asked to write the correct answers on the answer sheet provided based on the explanation by the educator.

The results of the Accommodating Concepts LKPD are shown in Figure 7.

Figure 7. LKPD stage 4. Accommodating Concepts.

The fifth stage in this LKPD refers to stage 5, namely Expanding Concepts. This stage presents the steps for stage 5 activities and the answer sheet. In this stage, students are directed to work on questions outside the concepts they have already understood, so that they can expand their concepts after understanding the previous concepts.

The results of the Expanding Concepts LKPD are shown in Figure 8.

Figure 8. LKPD stage 5. Expanding Concepts.

The sixth stage in this LKPD refers to stage 6, which is Beyond. In this stage, students are assigned to make posters using cut-and-paste techniques based on three main topics, namely the parts of the heart, blood circulation, and blood vessels.

The results of the Beyond LKPD are shown in Figure 9.

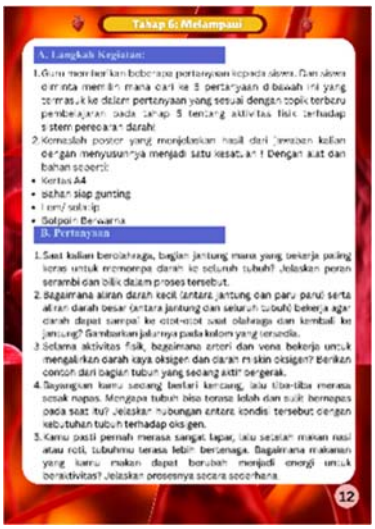

Figure 9. LKPD stage 6. Beyond.

Media Expert Validation Test Results

In the validation test by media experts, the results of all aspects obtained an average score of 87.5% with the criteria of Very Valid. These research results are in line with the findings (Agustina et al., 2023), which explain that validation by design experts assesses the quality of LKPD. CCM-based LKPD has a good design, easy-to-understand readability, good layout, attractive visual appearance, excellent media quality, and clear and functional instructions. These results are also supported by research (Dawa et al., 2022), which developed PBL-based LKPD on the material of the human circulatory system for eighth-grade junior high school/MTs students and obtained high validity in small and large-scale trials. The CCM-based LKPD is intended for elementary schools and has the same criteria of Very Valid, making it suitable for testing on a larger scale. In the development process, the researchers paid attention to systematic concept analysis, mapped sub-materials based on initial and final analysis and learning outcomes, and formulated learning objectives through the determination of learning achievement indicators. Therefore, it can be assured that this LKPD is capable of achieving its

main objective, which is to minimize students' misconceptions about the circulatory system. This product, which has been declared to be highly valid and feasible, is ready to be distributed on a wider scale.

Results of the Practicality Test of CCM-Based LKPD

The results of the practicality test conducted by sixth-grade teachers at SD Muhammadiyah 16 Surakarta showed that the LKPD achieved an average score of 85% with the criterion of Very Practical. This finding is in line with research ((Putra et al., 2023), which explains that practicality is carried out descriptively through the calculation of the average of each aspect and includes ease of use, clarity of instructions, timeliness, media suitability, and benefits in learning. The consistency of these results is also seen in the research (Balela et al., 2021), which developed LKPD based on critical thinking skills on the concept of the circulatory system at the high school level and obtained the criteria of Practical to Very Practical. With high practicality results, it indicates that the product is suitable for use as supporting teaching materials. Meanwhile, the CCM-based LKPD that the researchers developed for the elementary school level obtained the Practical criterion, so this product is also capable of being implemented in learning.

These results are also reinforced by research (Putra et al., 2023), which confirms that validation by practitioners aims to ensure that products have met applicable procedures and standards. Similarly, (Maulani et al., 2022) explains that practicality by educators provides confidence in the questionnaire results while assessing the feasibility of LKPD. In particular, the CCM-based LKPD developed by these researchers is considered Very Practical because it presents six stages of CCM, namely 1) Commitment to Learning Outcomes, 2) Expressing Beliefs, 3) Confronting Beliefs, 4) Accommodating Concepts, 5) Expanding Concepts, and 6) Transcending. CCM-based LKPDs are still rare, because they are generally applied directly in learning activities without being formatted into structured LKPD tools. The preparation of this LKDP guides students to learn in a structured manner according to the CCM stages so that misconceptions can be detected. In addition, this LKPD is equipped with SIPEDA media that is tailored to learning outcomes. This media helps students understand the concept of the circulatory system, including the parts of the heart, the flow of the large and small circulatory systems, and the veins and arteries.

An example of the SIPEDA media display is shown in Figure 10.

Figure 10. SIPEDA (Blood Circulation System) Media.

This student worksheet was developed with attention to the format and content of the lesson, including the layout, images, and interesting text. The layout is neat and uncluttered, with visual cues such as small tables to aid comprehension. The color red was chosen to match the characteristics of the circulatory system material. It presents clear images of the circulatory organs that are appropriate for the cognitive level of sixth graders and relevant to the material. The type and size of the text were chosen to be easy to read, thereby facilitating optimal learning comprehension.

The developed LKPD was deemed highly practical for testing on a wider scale. These findings are in line with the results of a study (Ramayani et al., 2024), which showed a practicality level of 88.30% on average with a Very Practical criterion. Thus, the LKPD product in this study is also classified as Very Practical, with a score above the average of 85%.

Conclusion

Based on the results of research and development in grade VI at SD Muhammadiyah 16 Surakarta, CCM-based LKPD to minimize misconceptions in human circulatory system material proved to be highly valid and practical. Thus, this LKPD product can be tested on a wider scale. Based on the research conducted, the conclusions of this study can be described as follows:

1. It is known that IPAS learning is still separated into science and social studies, misconception detection has never been specifically conducted, and the CCM model has never been applied. Learning still uses simple media, such as PowerPoint, YouTube, and makeshift teaching aids, while the LKPD used is a ready-made LKPD without clear instructions. In addition, students still often confuse the large and small blood circulation systems. This condition shows a lack of variety in learning models and the quality of the LKPD used, so it is important to minimize misconceptions and strengthen students' understanding of the concepts.
2. The results of the validity test by two validators, namely subject matter experts and media experts, showed that CCM-based LKPD products obtained an average total score of 85% with a Very Valid criterion. Meanwhile, the results of the media expert validity test showed an average total score of 87.5% with a Very Valid criterion.
3. The results of the practicality test by sixth-grade practitioners at SD Muhammadiyah 16 Surakarta obtained an average total score of 85% with a Very Practical criterion without revision. Thus, the results of this research and development produced CCM-based LKPD that is Very Valid and Very Practical and can be tested on a wider scale.

The implication of this study is that although the CCM-based LKPD is Valid and Practical, it is necessary to establish hypotheses that require empirical testing in the future with a control group and a pre/post-test design to test the effectiveness of this LKPD.

Acknowledgements

The researchers would like to express their deepest gratitude to Mrs. N, a sixth-grade teacher, and the sixth-grade students at SD Muhammadiyah 16 Surakarta for their advice, support, and assistance in facilitating the research process from start to finish. Thank you for all the prayers, support, and tremendous motivation for the researcher. As a result, the CCM-based LKPD developed by the researcher received a rating of Very Valid and Very Practical. Therefore, this LKPD can be tested on a wider scale.

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