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The Development of Concept Attainment Model (CAM)-Based Student Worksheets (LKPD) on Cell Concepts for Eleventh Grade Students at SMA Negeri 10 Gowa

Pengembangan Lembar Kerja Peserta Didik (LKPD) Berbasis *Concept Attainment Model* (CAM) pada Materi Sel untuk Siswa Kelas XI SMAN 10 Gowa

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Abstract

This study was motivated by students' low conceptual understanding of cell concepts, particularly membrane transport, due to the abstract nature of the material and the lack of teaching materials that encourage independent concept discovery. This study aimed to develop a student worksheet based on the Concept Attainment Model (CAM) and to examine its validity, practicality, and effectiveness in biology learning for Eleventh Grade students at SMAN 10 Gowa. This study employed a Research and Development (R&D) method using the ADDIE model, which consists of analysis, design, development, implementation, and evaluation stages. The research subjects consisted of 31 Eleventh Grade students. The instruments used in this study included expert validation sheets, teacher and student response questionnaires, and learning outcome tests. The results showed that the CAM-based student worksheet was categorized as highly valid, highly practical, and effective. The implementation of the worksheet helped students identify concept characteristics through examples and non-examples, increased active participation, and strengthened conceptual understanding. Therefore, the Concept Attainment Model-based student worksheet is feasible for use as an alternative teaching material for biology learning on cell concepts in senior high schools.

Penelitian ini dilatarbelakangi oleh rendahnya pemahaman konsep peserta didik pada materi sel, khususnya transpor antar membran, akibat sifat materi yang abstrak dan bahan ajar yang belum mendorong penemuan konsep mandiri. Penelitian ini bertujuan mengembangkan Lembar Kerja Peserta Didik berbasis Concept Attainment Model serta menguji kevalidan, kepraktisan, dan keefektifannya pada pembelajaran biologi kelas XI di SMAN 10 Gowa. Metode yang digunakan adalah Research and Development dengan model ADDIE yang meliputi analisis, desain, pengembangan, implementasi, dan evaluasi. Subjek penelitian berjumlah 31 peserta didik kelas XI. Instrumen meliputi lembar validasi ahli, angket respons pendidik dan peserta didik, serta tes hasil belajar. Hasil penelitian menunjukkan LKPD berbasis CAM berkategori sangat valid, sangat praktis, dan efektif. Penerapan LKPD membantu peserta didik mengidentifikasi ciri konsep melalui contoh dan noncontoh, meningkatkan keterlibatan aktif, dan memperkuat pemahaman konseptual. Dengan demikian, LKPD berbasis Concept Attainment Model layak digunakan sebagai bahan ajar alternatif pada pembelajaran biologi materi sel di sekolah menengah atas.

Article Information

Keywords: ADDIE; CAM; student worksheets

Kata kunci: ADDIE; CAM; Lembar Kerja Peserta Didik

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A. INTRODUCTION

Education plays a very important role in improving the quality of human resources and advancing civilization. Through education, individuals not only acquire knowledge but also develop the thinking skills, attitudes, and abilities required in life. An effective learning process is key to achieving these educational goals, in which interactions among students, teachers, and teaching materials must be optimized (Triwiyanto, 2021).

In the learning process, teaching materials are important components that function as guides for teachers and students in achieving learning objectives. One form of teaching material that is widely used is the Student Worksheet (LKPD) (Magdalena et al., 2020). Student worksheets can help increase student engagement, develop thinking skills, and facilitate a more structured understanding of concepts. Student worksheets also serve as a teaching material that can minimize teacher dominance and encourage students to become more active in constructing their knowledge through systematic and independent learning activities (Kinanti et al., 2024). Therefore, the development of innovative Concept Attainment Model (CAM)-based student worksheets that meet students' needs is essential in supporting effective learning (Hasanah & Lailatun, 2023). The advantages of the Concept Attainment Model lie in its ability to increase student engagement, deepen conceptual understanding, and develop more independent and reflective learning skills (Mardliyah & Muhsin, 2019). Moreover, the use of constructivist-oriented learning models in student worksheets has been proven to help students understand concepts through processes of observation, classification, and independent concept discovery (Mahbubah et al., 2021). Thus, the use of the Concept Attainment Model in developing student worksheets is expected to create a more meaningful and interactive learning experience that meets the demands of 21st-century skills. 21st-century learning requires students to possess critical thinking, communication, collaboration, and problem-solving skills, which can be developed through contextual and student-centered learning (Haerullah et al., 2025).

Classroom learning activities are a form of educational instruction conducted by educational institutions within the formal education system. This learning process involves academic communication and interaction between teachers, as educators, and students, as learners, intending to achieve established educational objectives (Alamsyah et al., 2022). Thus, teachers are responsible for planning, implementing, evaluating, and analyzing learning outcomes, and then acting on the results of those evaluations. In addition, teachers are expected to be able to develop instructional models tailored to students' needs so that the learning process can proceed more effectively and optimally (Rivai et al., 2022)

However, various problems in learning are still encountered in practice, particularly regarding the cell concept. Based on observations and interviews with biology teachers and students at SMAN 10 Gowa, it was found that the topic of cells is difficult to understand because it is complex and abstract. The learning media used, such as PowerPoint presentations, posters, and wall magazines, have not been able to help students understand concepts in depth. Students also experience difficulties in connecting learned concepts and are not sufficiently trained in critical thinking skills.

Previous studies have shown that developing student worksheets based on the Concept Attainment Model can improve students' conceptual understanding and learning outcomes. Mahbubah et al. (2021) reported that Concept Attainment Model-based student worksheets on the topic of Phylum Echinodermata achieved the categories of highly valid, highly practical, and highly effective in training students' conceptual understanding. However, these studies have generally not focused specifically on developing Concept Attainment Model-based student worksheets for cell

concept at the senior high school level, particularly regarding concept visualization and critical thinking skills. This indicates a research gap that needs further investigation.

To address this issue, it is necessary to develop innovative teaching materials that can help students understand concepts more meaningfully. One alternative is to develop student worksheets based on the Concept Attainment Model. This model emphasizes the process of concept attainment through the presentation of examples and non-examples, thereby helping students identify, classify, and understand concepts independently through analytical thinking and active concept classification (Mahbubah et al., 2021). In addition, Concept Attainment Model-based student worksheets can be supplemented with engaging visualizations to facilitate the understanding of abstract concepts (Sa'diyah et al., 2015). The development of student worksheets integrated with active learning models has also been proven to improve students' science process skills, curiosity, and 21st-century skills (Haerullah et al., 2025; Tamalene et al., 2023, 2025). Based on the explanation above, this study aims to develop a Concept Attainment Model-based student worksheet on cell concept for eleventh-grade students and to determine the validity, practicality, and effectiveness of the developed student worksheets in supporting the learning process.

B. METHOD

This study was a research and development (R&D) study aimed at producing a product in the form of a Student Worksheet (LKPD) based on the Concept Attainment Model and testing the feasibility of the product (Ramadhan et al., 2025). The ADDIE model was employed in this study because it is one of the most widely used frameworks for instructional development and has proven effective in various educational contexts, ranging from primary to tertiary education. The ADDIE model consists of five stages: analysis, design, development, implementation, and evaluation (Saputro, 2017).

The analysis stage is a process of defining what learners need to study by conducting a needs analysis, identifying problems, and analyzing learning tasks (Arofah & Cahyadi, 2019; Fadhila et al., 2018). The design stage involves preparing the framework and structure of the instructional product. Development is the process of transforming the design into an actual product (Samiha, 2017). Implementation is the stage in which the developed learning system is applied in real classroom settings according to its intended functions. Meanwhile, the evaluation stage in this study was limited to a formative evaluation aimed at identifying aspects requiring revision. Based on expert reviews and field trials conducted during the implementation stage, qualitative and quantitative data analyses were carried out subsequently (Branch, 2009).

The study was conducted at SMAN 10 Gowa with 31 eleventh-grade students as the test subjects. Product validation was carried out by two validators, namely a subject matter expert and a media expert, both of whom had expertise in biology education and experience in developing instructional materials.

The data collection techniques used in this study included observation, interviews, questionnaires, and tests. Observation and interviews were conducted during the preliminary stage to identify learning problems. Questionnaires were used to obtain data regarding the validity and practicality of the product, while tests were administered to measure the effectiveness of the developed worksheets.

The research instruments included validation sheets, teacher and student response questionnaires, and learning outcome test items. The collected data were analysed qualitatively and quantitatively. Qualitative analysis was used to process suggestions and feedback from the

validators, while quantitative analysis was employed to calculate the levels of validity, practicality, and effectiveness of the product in percentage form.

The criteria for assessing validity, practicality, and effectiveness were determined based on the percentage scores obtained. A product was considered feasible for use if it met the established criteria for validity, practicality, and effectiveness. The validity and practicality criteria were adapted from Akbar (2013) and Riduwan (2015), while the effectiveness criteria referred to Arikunto (2018). The validity category for each aspect and the overall aspects was determined using the following criteria:

Table 1. Validity Criteria

Validity Categories	Criteria
$V > 3.4$	Very Valid
$2.8 < V \leq 3.4$	Valid
$2.2 < V \leq 2.8$	Fairly Valid
$1.6 < V \leq 2.2$	Less Valid
$V \leq 1.6$	Not Valid

Note: V = Average validity score from all validators

If the final average score for each aspect fell within the "valid" category, the instructional material was considered valid and feasible for use (Sri Rahayu, 2024). If the obtained score did not meet the established standard, revisions were made according to the validators' suggestions, and the material was subsequently revalidated until it fulfilled the required criteria (Ulfah et al., 2022).

Table 2. Practicality Level Categories

Validity Categories	Criteria
3.26 – 4.00	Very Practical
2.51 – 3.25	Practical
1.76 – 2.50	Less Practical
1.00 – 1.75	Not Practical

Teaching materials were considered practical if they achieved an average score within the "practical" category. If the obtained score did not meet the predetermined standard, revisions were made to the sections considered inadequate based on the validators' recommendations, and the materials were re-evaluated.

Table 3. Effectiveness Level Criteria

Value	Criteria
$90 \leq TPP \leq 100$	Very Effective
$75 \leq TPP < 90$	Effective
$60 \leq TPP < 75$	Fairly Effective
$40 \leq TPP < 60$	Less Effective
$0 \leq TPP < 40$	Ineffective

Note: TPP = Student Learning Mastery Level

Students were considered to have completed the learning process if their results met the school's predetermined Minimum Learning Competency Achievement Criteria (KKTP) score of 70. Classical learning mastery was achieved if at least 80% of students obtained scores equal to or

higher than the KKTP score. An indicator that students had mastered the material was when their learning outcomes fulfilled the established minimum mastery criteria (Masita & Mattoliang, 2022).

C. RESULTS AND DISCUSSION

The results of this study cover three main aspects, namely the validity, practicality, and effectiveness of the Concept Attainment Model-based student worksheets developed using the ADDIE model. The evaluation results from the two expert validators are presented in Table 4.

Table 4. Validator Assessment Results

Assessment Criteria	Validator I's Score	Validator II's Score	Total	Category
Appearance	3.5	4.0	3.75	Highly Valid
Content	3.0	4.0	3.5	Highly Valid
Technical Quality	3.3	3.6	3.5	Highly Valid
Language	3.0	3.6	3.3	Highly Valid
Ease of Use of the Worksheets	3.0	4.0	3.5	Highly Valid
Average	**3.16**	**3.84**	**3.5**	**Highly Valid**

The validation results showed that student worksheets, based on the Concept Attainment Model, achieved an average score of 3.5, which falls into the "highly valid" category. This indicates that the developed student worksheets have met the validity criteria in terms of content, language, presentation, and design in accordance with the established indicators. This high level of validity is influenced by the alignment of the material with the curriculum as well as the systematic presentation of concepts through the Concept Attainment Model approach, thereby making it easier for students to understand the material.

The practicality of the student worksheets was assessed through surveys of students and teachers, which indicated that the worksheets fall into the "practical" category. This suggests that the worksheets are easy to use in the learning process. This ease of use is supported by clear instructions, an engaging layout, and a structured presentation of the material, enabling students to participate in learning activities independently and more actively.

Table 5. Practicality Results

No	Assessment Criteria	Teachers	Students
1	Presentation	4.0	4.0
2	Language	3.25	3.5
3	Content	3.5	3.5
	Average	**3.58**	**3.66**
	Category	**Very Practical**	**Very Practical**

The results of the practicality analysis show that the student worksheets based on the Concept Attainment Model received an average score of 3.58 from teachers and 3.66 from students, both of which fall into the "very practical" category. This indicates that the student worksheets are easy to use in the learning process. This high level of practicality is influenced by the clarity of the usage instructions, the structured presentation of the material, and the attractive design of the worksheets, making it easier for students to engage in independent learning activities.

The effectiveness of the student worksheets was measured through an evaluation test consisting of multiple-choice questions administered to the students. The evaluation results show that the majority of students have met the established minimum proficiency criteria, which is a score range of 70-100. This indicates that the developed student worksheets are effective in helping students understand the learning material. This effectiveness is supported by the application of the Concept Attainment Model, which encourages students to actively identify and understand concepts through a systematic learning process.

Table 6. Students' Learning Mastery Classification

Score	Mastery Criteria	Number of Students	Percentage
70-100	Students who achieved mastery	28	90%
0-69	Students who did not achieve mastery	3	10%

Table 6 shows that 28 students met the Minimum Learning Competency Criteria (KKTP) in the test, resulting in a 90% mastery level, while 3 students did not meet the KKTP. These findings indicate that the Concept Attainment Model-based student worksheets fall into the "very effective" category, meaning that they fulfill the effectiveness criteria and can be effectively implemented in the learning process.

The high quality of the Concept Attainment Model-based student worksheets in terms of validity, practicality, and effectiveness is supported by a systematic development process based on students' needs identified through observations and interviews conducted at SMAN 10 Gowa and implemented using the ADDIE model. This quality is supported by a systematic development process based on students' needs identified through observations and interviews conducted at SMAN 10 Gowa and implemented using the ADDIE model.

The high validity of the student worksheets is reflected in the alignment between the content, curriculum objectives, and students' competency targets. Additionally, the structure of the student worksheets is systematically organized, ranging from the presentation of content and examples to activities that guide students in understanding the concepts. The use of communicative and student-friendly language also enhances students' comprehension of the material. The application of the Concept Attainment Model in the student worksheets further supports the validity of the product, as this model presents learning through examples and non-examples that help students identify the characteristics of a concept more clearly (Mahmud, 2016).

The high practicality of the student worksheets indicates that the developed product aligns with classroom learning needs. This is supported by the results of the needs analysis conducted in the early stages, which showed that students experienced difficulties in understanding cell concepts and required more interactive teaching materials. The developed worksheets are equipped with clear instructions for use and structured activity steps, making it easier for students to use them independently. Additionally, the engaging design of the worksheets and the non-monotonous presentation of the material help boost students' interest in learning. From the educators' perspective, these worksheets are also practical because they can be used directly in the learning process without requiring complex adjustments (Agustin et al., 2022; Anggraini & Susilowati, 2022).

The effectiveness of the student worksheets in this study is demonstrated by students' achievement of learning mastery in accordance with the established criteria. This is influenced by the application of the Concept Attainment Model, which encourages students to be active participants in the learning process. Through activities involving the observation of examples and non-examples, students are encouraged to identify, compare, and classify concepts independently,

thereby deepening their understanding. Furthermore, the cell material, which was previously considered difficult and abstract, became more accessible and easier for students to comprehend because it was presented in the form of targeted activities and supplemented with supporting visual aids (Ardy Irawan, 2021).

The success of developing the student worksheets is also attributable to the systematic use of the ADDIE model. During the analysis phase, the researcher identified learning issues through observations and interviews with educators and students. The design and development phases resulted in student worksheets that align with learning needs, while the implementation and evaluation phases ensured that the resulting products could be effectively used in the classroom. Thus, the quality of the resulting student worksheets is the outcome of a structured development process oriented toward user needs.

The findings of this study are consistent with previous research showing that the use of student worksheets based on learning models can improve students' conceptual understanding. However, this study stands out for its application of the Concept Attainment Model to cell-related concepts, thereby providing a more meaningful learning experience through independent concept formation activities (Mahbubah et al., 2021).

Based on the results obtained, it can be concluded that the Concept Attainment Model-based student worksheets fulfilled the effectiveness criteria, as evidenced by the students' test scores. These findings support the theory that effective instructional materials can improve students' conceptual understanding and critical thinking skills. In this study, the Concept Attainment Model facilitated active learning through concept identification and classification activities, thereby strengthening students' understanding of cell concepts (Putri, 2017).

D. CONCLUSION

Based on the research findings, the Concept Attainment Model-based Student Worksheets (LKPD) developed for cell concept, specifically intermembrane transport, were found to be highly valid, very practical, and effective in 11th-grade biology instruction. The use of these student worksheets is able to increase students' active engagement and assist in identifying and understanding concepts through the presentation of examples and non-examples. Thus, the Concept Attainment Model-based student worksheets are suitable for use as an alternative teaching material to improve students' conceptual understanding of cell concepts in high school.

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