



# Improving Metacognition Skills through Implementing ASICC-Based Student Worksheets on the Body's Defense System

Titik Ernawati<sup>1</sup>, Denis Agustin<sup>2</sup>, Nurul Agustini<sup>2</sup>, Ericka Darmawan<sup>3</sup>, Budhi Utami<sup>1</sup>, Poppy Rahmantika Primandiri<sup>1,4</sup>, Agus Muji Santoso<sup>1,4\*</sup>

<sup>1</sup> Biology Education, Universitas Nusantara PGRI Kediri, Kediri, Indonesia

<sup>2</sup> State of Senior High School 3 Kediri, Kediri, Indonesia

<sup>3</sup> Biology Education, University of Tidar, Magelang, Indonesia

<sup>4</sup> Research Centre of Biodiversity, Universitas Nusantara PGRI Kediri, Kediri, Indonesia  
agusmujisantoso@unpkediri.ac.id

**Abstract.** The body's defense system material is considered difficult by students because it contains abstract concepts. Based on the results of the preliminary study, students' metacognitive skills have not been trained. ASICC is a learning model that is proven to be able to improve high-level thinking skills. However, the development of ASICC-based student worksheets to improve metacognitive skills has never been carried out. This research aims to apply ASICC-based student worksheets to improve metacognitive skills. A development studies-type research design was used in this research. The research was carried out at SMAN 3, Kediri City (East Java), which consisted of two main stages, namely the preliminary study and prototyping stages. Metacognition skill score data was obtained from the pre-test and post-test results. This study reported that there was an increase in metacognitive skills in the moderate category (0.39). In learning, student activities are more structured, starting with identifying problems, reflecting on themselves in learning, searching for key information, interpreting results, and formulating ideas. The worksheet can stimulate increased metacognitive skills.

**Keywords:** Student Worksheets, Body Defense System, Metacognition Skills, ASICC.

## 1 Introduction

Currently, there are still many problems faced in the education sector in Indonesia. One of them appears in educational results, which are only visible through the ability to memorize facts, concepts, and theories. It was found that many students presented a good level of memorization of the material received, but in reality, students still did not understand in depth the concept of the material received. It makes students' understanding low because students cannot capture the information conveyed by the teacher. If students can use their metacognition skills, the information conveyed will be easy to capture, understand, and remember in the long term [11].

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According to [5], metacognition skills greatly determine a student's success in planning tasks, monitoring, and evaluating the learning process. Apart from that, metacognition skills are students' knowledge and skills to understand, manipulate, and control their thinking and cognitive processes in the learning process [11]. In line with the opinions of [4] and [12], students' metacognitive skills are also influenced by their argumentation abilities and weak thinking skills in the learning process. Based on the opinion above regarding metacognitive skills, it can be concluded that metacognitive skills are skills that a student must have to understand knowledge, manipulate, monitor, and evaluate their thinking and cognitive processes in the learning process.

Based on the results of interviews with biology teachers at SMAN 3 Kediri, the majority of students still use memorization methods during the learning process, which makes it difficult for students to understand and remember the learning material. mainly related to the mechanism of the body's maintenance system, which contains abstract concepts. This is in line with the opinion of [6]. In the material on body protection systems, many new terms are found that are still unfamiliar and difficult for students to understand. Students' inability to think creatively when solving problems is a sign that they are learning in the wrong way, which can impact their metacognition abilities [9].

Apart from that, the reason researchers chose materials for the body's protection system is because these materials contain combined concepts and combinations of materials for the circulatory system, respiratory system, bacteria, and viruses that cause infectious diseases such as HIV and tuberculosis (TBC). With the habit of SMAN 3 Kediri students using the rote method, this can make it difficult for students to understand the combined concepts contained in the body protection system material.

Based on the results of observations that are known at SMAN 3 Kediri, students' metacognitive skills are classified as weak. It is proven by the students' answers to the questions given that they are still not able to answer using their own sentences or those understood in books, and the grammar (language) is not correct because there are still many words that are abbreviated.

Referring to the problems experienced by students at SMAN 3 Kediri, one appropriate solution is to use student worksheets. Student worksheets are a teaching medium whose use can open up opportunities for students to better understand and construct a concept, be active and creative, develop students' thinking and problem-solving skills, and contribute to basic science skills in the learning process [2]. To strengthen students' use of worksheets, researchers chose to implement an ASICC-based learning model.

The ASICC-based learning model consists of the stages of adapting, searching, interpreting, creating, and communicating. Based on the description of the ASICC-based learning model, student learning activities are directed at solving problems that can hone students' metacognitive skills both individually and in groups in more structured learning, and the teacher only serves as a facilitator [15] and [19].

Apart from that, according to [15], the ASICC-based learning model can direct students to reflect on themselves to understand learning objectives and collect key information from various information media such as books, the internet, journals, magazines, and others so as to hone students' metacognitive abilities. Apart from that, the implementation of the ASICC-based learning model is able to encourage students

to improve their 21st century skills [6]. In line with the opinion of [18], ASICC-based learning can help students hone their analytical skills, exchange ideas, learn from each other, and teach other students who do not yet understand the material [16].

It was proven in previous research by [20] that the ASICC learning model can help improve students' metacognitive skills. The ASICC learning model can also be used as a reference in applying learning media to biology subjects [8].

According to [15], students' reasoning aspects, critical thinking skills [10] and [13], and argumentation skills [1] have increased after implementing the ASICC-based learning process. These three aspects are closely related to students' metacognitive skills. So the learning process needs to continue to be empowered by applying the ASICC learning model, especially in the biology learning process, to strengthen students' metacognitive skills.

Based on the background above, the aim of this research is to improve metacognitive skills through the application of ASICC-based student worksheets on the body's defense system. The hope is that the designed student worksheets can be used as a benchmark for improving students' metacognitive skills and as a reference for teachers to develop student worksheets on other material in biology subjects.

## 2 Method

The method in this research includes design research type development studies, which consist of two stages, namely the preliminary study stage and the prototyping stage, using a formative evaluation flow, namely self-evaluation, expert review, one-to-one, small group, and field tests [17]. The research was carried out at SMAN 3 Kediri in March–July 2023. The research subjects were class XI-MIPA 1 students, totaling 33 students. The instruments in this research consisted of interview results, validation of expert and practitioner discussants, preparation of prototypes, and student-written tests (pre- and post-test). The data analysis used is quantitative and descriptive, obtained from the results of written tests. The written test is assessed according to the assessment rubric from [3] to determine students' metacognitive skills, which are shown in Table 1.

**Table 1.** Rubik for assessing students' metacognition skills from Corebima (2008).

Score	Assessment criteria
Score 7	Answers in their own sentences, the order of presentation of answers is coherent and systematic, logical with correct grammar (language), equipped with reasons (analysis, evaluation, or creation), and the answer is correct.
Score 6	Answers are in their own sentences; the order of presentation of answers is coherent, systematic, and logical with less correct grammar (language), which is equipped with reasons (analysis, evaluation, or creation), and the answer is correct.
Score 5	Answers in their own sentences, the order of presentation of answers is less/not coherent and systematic, less/not logical with less correct grammar (language),

Score	Assessment criteria
	which is equipped with reasons (analysis/evaluation/creation), and the answer is correct.
Score 4	The answer is not in its own sentence; the sequence of presentation of the answer is coherent and systematic, logical with correct grammar (language), equipped with reasons (analysis, evaluation, or creation), and the answer is correct.
Score 3	Answers in their own sentences, the order of presentation of answers is less/not coherent and systematic, logical with less correct grammar (language), less equipped with reasons (analysis/evaluation/creation), and the answer is correct.
Score 2	Answers in their own sentences, the order of presentation of answers is less/not coherent and systematic, less/not logical with less correct grammar (language), which is equipped with reasons (analysis/evaluation/creation), and less correct answers.
Score 1	Answers in their own sentences, the order of presentation of answers is lacking/not coherent and systematic, lacking/not logical with incorrect grammar (language), not equipped with reasons (analysis/evaluation/creation), and answers are incorrect.
Score 0	No answer at all.

After assessing using the assessment rubric above, to find out the student's category in metacognition skills, an analysis was carried out using the N-gain formula. The results of the analysis were categorized into three N-gain value criteria adapted from [7], which are shown in Table 2.

$$N - Gain = \frac{\text{Posttest Score} - \text{Pretest Score}}{\text{Maximal Score} - \text{Pretest Score}} \times 100$$

**Table 2.** N-Gain Assessment Categories from Hake (2002).

N gain Score	Category
$g \geq 0.7$	High
$0.3 \leq g < 0.7$	Medium
$g < 0.3$	Low

### 3 Results and Discussion

The stages in this research consist of the preliminary study and prototyping stages. At the prototyping stage, a formative evaluation flow consisting of self-evaluation, expert review, one-to-one, small group, and field testing is implemented in the development of student worksheets. At the preliminary study stage, an analysis of student problems and material was carried out by interviewing biology teachers at SMAN 3 Kediri.

Based on the results of interviews with biology teachers, problems were found in the biology learning process. Teachers had not implemented the use of student worksheets on body defense system material like other materials. Apart from that, the body's

defense system material is considered difficult by students because it contains abstract concepts. So students use a lot of memorization methods during the learning process, which makes it difficult for them to understand and remember in the long term. So the metacognition skills of SMAN 3 Kediri students have not been trained.

In the next stage, the initial design of student worksheets was carried out based on the results of interviews with biology teachers at SMAN 3 Kediri, accompanied by supervisors, by implementing ASICC-based questions consisting of the adapting, searching, interpreting, creating, and communicating stages. Entering the prototyping stage uses formative evaluation, which consists of: 1) self-evaluation; the researcher carries out an independent evaluation with colleagues and supervisors regarding the design of student worksheets. After evaluation, the researcher made improvements according to the supervisor's input. The results of improvements at the self-evaluation stage are called prototype 1. 2) expert review: the researcher asks for help from expert discussants and practitioners to validate and provide suggestions regarding the student worksheets that have been designed. The results of improvements at the self-evaluation stage are called prototype 1. 2) expert review: the researcher asks for help from expert discussants and practitioners to validate and provide suggestions regarding the student worksheets that have been designed. The validation results from expert discussants and practitioners can be categorized as very valid, as shown in Table 3 below.

**Table 3.** Validation results from expert discussants and practitioners.

No	Assessment Indicators	Score		
		Expert Dis- cussant	Practitioner 1	Practitioner2
	Feasibility Aspects Contents	24	24	20
	Language	17	19	16
	Identity and Assignment	8	7	7
	Writing, Images, and Symbols	23	24	19
	Stimulus	14	14	12
	Problem Identification	16	15	14
	Problem Identification	16	16	15
	Total	118	119	103
	Average	16.86	17.00	14.71
	Validation (%)	95%	96%	83%

Based on the validation results above, researchers made improvements in accordance with the suggestions given by expert discussants and practitioners. 3) One-to-one, the results of the previous stage of improvement were tested on class XI-MIPA 2 students at SMAN 3 Kediri, totaling 3 people with different abilities, to find out the difficulties experienced by students and ask for suggestions for improvement. The corrected student worksheet is called prototype 2 and has been declared valid.

The next stage 4) In a small group, the researcher conducted a trial with 8 class XI-MIPA 3 students to find out the weaknesses, strengths, and effectiveness of student

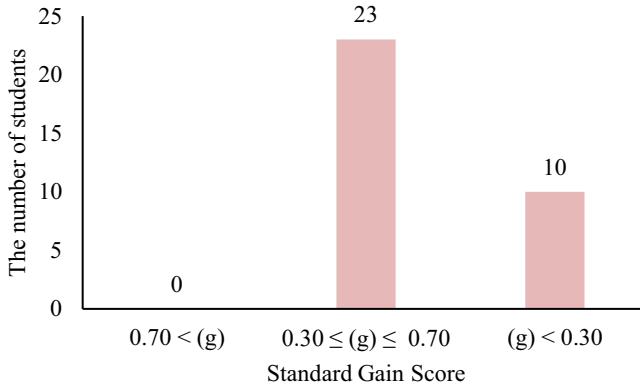
worksheets from the comments given by students. Based on student comments, the researcher improved prototype 2 so that it was declared practical. The results of the improvements are called prototype 3 and are ready to be tested at the next stage. 5) In the field test, the researcher tested student worksheets with the help of 33 class XI-MIPA 1 students. Before carrying out extensive testing activities, researchers asked students to do a pre-test first to determine students' initial understanding and knowledge regarding the material on the body's defense system and metacognition skills.

The pre-test questions consist of five items, in the form of essay questions consisting of (a) understanding the body's defense system, (b) the difference between non-specific and specific body defense systems, (c) the purpose of immunization, and (d) the impact of tuberculosis. not treated immediately, the benefits of giving the BCG vaccine to tuberculosis patients, and (e) students' ideas about how to prevent tuberculosis in the family, school, and community. Most students answered questions according to their initial understanding without opening books or the internet. After working on the pre-test questions, students entered the field test stage by working on prototype 3 in accordance with the direction and guidance of the researcher.

In accordance with the implementation of ASICC-based student worksheets, namely a) adapting, individual students start working on student worksheets by observing videos related to HIV disease, which many Bandung teenagers suffer from. The aim is to stimulate students to be able to reflect on the material they will study. Most students were able to answer the questions given according to the video they observed. After that, students are asked to fill in the type of table, which consists of know, want, learn, and evaluate. b) By searching, individual students can answer the questions provided by searching for key information from various references, such as printed books or the internet. c) Interpreting: students create a small group consisting of 5 to 6 students to discuss an issue related to disease in the body's defense system. The results of the discussion showed that each group was able to solve the problems given well, was able to communicate, and summarized the results of the discussion into answers. d) Creating: Students are asked to design a product in the form of a poster related to the body's defense system. Many students were able to express their ideas on posters. e) When communicating, students are asked to interpret the results in front of other groups. Other groups provide constructive criticism, suggestions, and objections to the group presenting.

In the closing part of the lesson, the researcher asked students to do reflections, study columns, and evaluations. Most students answered according to their knowledge, understanding, and experience during the learning process. Apart from that, to determine understanding and knowledge after implementing the ASICC-based student worksheet, students work on post-test questions. The post-test questions are the same as the pre-test questions.

After all stages were carried out, the researcher assessed the results of the pre-test and post-test using the Corebima rubik. An analysis of the pre-test and post-test scores was carried out using the N-Gain formula. Of the 33 students, it was found that 23 were in the medium category and 10 were in the low category, as shown in Fig. 1. The students' average N-Gain score was 0.39, including the medium category.



**Fig. 1.** Results of N-Gain Analysis of Pre and Post-Test Values

### 3.1 Discussion

The ASICC-based student worksheet in this research is in accordance with the opinions of [16] and [19], namely consisting of the stages of adapting, searching, interpreting, creating, and communicating. The implementation of student worksheets at SMAN 3 Kediri is in line with the opinions of [6] and [18], namely that the ASICC-based learning process can help students hone their ability to analyze and understand the concept of body defense system material.

Based on the ASICC description, student activities at SMAN 3 Kediri are directed and guided to carry out more structured learning activities. Starting with identifying problems, reflecting on learning, looking for key information, interpreting results, and formulating ideas, it has been proven that there is an increase in learning outcomes before and after using ASICC-based student worksheets. Thus, this activity can stimulate students increased metacognitive skills in the body's defense system.

## 4 Conclusion

The implementation of ASICC-based student worksheets at SMAN 3 Kediri was declared valid and made students' learning activities more structured, starting to identify problems, reflect on themselves in learning, look for key information, interpret results, and formulate ideas. This activity is able to stimulate increased metacognitive skills.

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