Multicultural Education

Volume 12, Issue 7, 2026

Expert Assessment and Validation: Metacognitive Instruments in Preparing Student Final Project Research Proposals

Wardani Rahayu, Erwin Sulaeman, Tian Abdul Aziz, Meiliasari, Yuliatri Sastra Wijaya

Article Info

Article History

Received:
April 21,2026

Accepted:
July 23,2026

Keywords :
Expert Judgement,
Validation,
Metacognitive Instrument,
Assessment

DOI:
10.5281/zenodo.21510863

Abstract

The difficulty in preparing the final research project is a challenge for students as a learning experience that can affect metacognitive progress. The low quality of student scientific work can encourage the completion of studies not on time. This need triggers the development of student perception instruments in measuring metacognitive.The purpose of this study was to validate the metacognitive instrument in the preparation of research proposals as a student's final project using expert judgment. This study used a descriptive qualitative approach. Data collection was done by observation method, checking the validity of data by triangulation.Three experts participated in this research and served as validators and provided suggestions for improvement based on the knowledge and experience of the expert. Expert agreement levels were calculated via Fleiss Kappa statistics. The results showed that the level of expert agreement was 0.51 in the moderate agreement category, this level of agreement is not satisfactory. Thus, the recommendations obtained were: the elimination of three dimensions, the elimination of three indicators, and the addition of 12 items, as well as the improvement of language on items that measure the dimensions of planning and critical self-reflection.

Introduction

Metacognitive is part of higher-order thinking skills that involve more active control over thinking processes in learning (Tachie, 2019). Metacognitive must be taught so that students can gain deeper insight into understanding reflection and perception and being able to overcome all their weaknesses in learning (Hitchcock, 2017), measure skills (Mehrdad et al., 2012), and student knowledge (Adams et al., 2013). Metacognitive allows students to choose and find strategies explicitly (Jaleel & P., 2016), by thinking about students' understanding of task demands (Liu & Su, 2018), available cognitive resources (Li, 2020), and own experience in solving problems (Szabo et al., 2020). Marantika (2021) emphasized that meta-cognition is an important component of effective learning because it allows individuals to plan, monitor, and regulate their cognitive performance.

Empirical studies carried out by Al-Gaseem et al., (2020); García et al., (2015)showed that metacognitive skills are very important. Students can control and manage thoughts and put them in the right direction(Sieberer-Nagler, 2015). Students who can plan, monitor, and evaluate their learning process are said to have good metacognitive abilities (Fauzi & Sa'diyah, 2019). According to Bush et al., (2012), the role of lecturers is very important in helping students to improve their metacognitive abilities.Nunaki et al., (2019) state that the role of the lecturer can improve students' metacognitive skills by providing direction and explaining to students how to think about what students are doing. In addition, lecturers must also help students identify how students can improve learning and become better students. Muijs & Bokhove (2020) claimed that metacognitive development can be developed when students study educational content.

Research activities are one of the final assignments for students at each level of undergraduate, master, and doctoral programs (Walkington, 2015).This is inseparable from the ability to compose and write scientific papers (Mack, 2018). Reality shows that many students have difficulty in taking final project courses so that they cannot complete their education on time. The quality of student scientific work is still low. This learning is an inseparable component of cognitive processes and learning experiences that affect students' metacognitive development(Chao et al., 2016).This encourages the need for an evaluation of students' perceptions of metacognition in the preparation of the final research project. Therefore, this need triggers the need for measurement instruments.

Metacognitive instruments have been widely developed, especially in mathematics learning such as research conducted byJacobse dan Harskamp (2012) in the adaptation of the Self-Report instrument (Ericsson and Simon 1993) to measure metacognitive activity in solving mathematical problems. Veenman and van Cleef (2019) adapted two Motivated Strategies for Learning Questionnaire (MSLQ; Pintrich and De Groot 1990) instruments and Inventory Learning Styles (ILS; Vermunt 1998). Amin dan Sukestiyarno (2015) developed an adaptation instrument of the MAI (Sperling et al., 2002) to analyze metacognitive skills in high school students. One of the

dimensions of metacognitive instruments is knowledge of cognition and regulation of cognition (Händel et al., 2013; Mastrothanais et al., 2018; Schraw & Moshman, 1995), commonly used in evaluating educational contexts.Furthermore, how are the dimensions of metacognitive instruments developed in the preparation of student research final assignments? In the early stages of developing this instrument, it is necessary to carry out construct validity by expert judgment (Farooq et al., 2020; Nurrohmah et al., 2018; Chong et al., 2021; Md Ghazali, 2016; Mohajan, 2017; Taherdoost, 2016, 2018) so that there is a match between the items and constructs being measured. This assessment process can be carried out by expert judgment who are experts and professionals in their fields (Decaigny, 2014). In addition, this instrument has a match between respondents and items (Benini et al., 2006; Nurrohmah et al., 2018).
This study aimed to validate metacognitive instruments in the preparation of research proposals as a student's final project using expert judgment. At the end of this study, it is expected that the quality of the proposed instrument will be known to perfect the instrument before the empirical test.

Method
This study used a descriptive qualitative approach. Qualitative data collection was carried out by the observation method. Checking the validity of the data was done by triangulation from Miles and Huberman to analyze content validity through expert judgment assessment. (Nowell et al., 2017).

Participants
The instrument was validated by three experts who had metacognitive experience, educational measurement, educational evaluation, and research and had experience guiding undergraduate, postgraduate, or doctoral students. All experts had more than five years of experience in education.

Instrument
The validation instrument is arranged in a draft manuscript containing five columns so that it can be arranged as in Table 1 below.

Table 1. Meta-Cognitive Instrument Script Draft

Dimension	Indicators	Item Number	Answer Options	Suggestions for improvement
Knowledge of Cognition	Declarative Knowledge Procedural Knowledge Conditional Knowledge	1, 2 3 4, 5, 6		
Regulation of Cognition	Planning Information Management Strategies Comprehension Monitoring Debugging Strategies Critical Self-Reflection	7, 8, 9, 10, 11, 12 13, 14, 15 16, 17 18, 19, 20 21, 22, 23, 24, 25, 26, 27		
Teacher's Encouragement and Support	Teacher's Encouragement Teacher Support	28, 29, 30, 31, 32 33, 34, 35, 36, 37		
Student-Teacher Discourse	Guidance	38, 39, 40, 41, 42		
Total		42		

Dimensions consist of Knowledge of Cognition, Regulation of Cognition, Teacher Encouragement and Support, and Student-Teacher Discourse. It contains 11 indicators, the choice of expert answers consists of three options, namely: Agree (3), Neutral (2), and Disagree (1).Meanwhile, the fifth column contains suggestions and improvements to expert suggestions. The metacognitive instrument proposed to be validated in this first stage, where the initial statement items were arranged based on the metacognitive content were 42 items.
Data Analysis
Data analysis used a descriptive qualitative approach by checking qualitative data using data triangulation, as well as analyzing other supporting data using Kappa Fleiss statistics. This statistic is to assess the level of expert agreement among three or more raters who independently assess a series of items using a certain number of instruments with ordinal categories (Nurrohmah et al., 2018). Fleiss Kappa is an advanced version of the Cohen Kappa statistic, which can be used to measure the approval level of multiple raters in several categories (Hassan et al., 2019).

$$\kappa = \frac{\Pr(\alpha) - \Pr(e)}{1 - \Pr(e)} \quad \text{...} (1)$$

The formula is used to measure the difference between the level of agreement $\Pr(\alpha)$ and agreement by chance $\Pr(e)$.

A negative Kappa value indicates disagreement and a positive value indicates agreement. Based on Brennan and Prediger, the Kappa value of 0.7 indicates that the level of agreement is reliable (Xie et al., 2018). In addition to Brennan and Prediger's interpretations, another common interpretation is defined by Landis and Koch (Nurrohmah et al., 2018; Warrens, 2015). This divides the Kappa interpretation values into six ranges as shown in Table 2.

Table 2 Kappa Value Interpretation

Value	Interpretation
$\kappa \leq 0$	No agreement
κ between 0.01 and 0.20	Slight agreement
κ between 0.21 and 0.40	Fair agreement
κ between 0.41 and 0.60	Moderate agreement
κ between 0.61 and 0.80	Substantial agreement
κ between 0.81 and 1.00	Almost perfect agreement

The minimum value assumed by this coefficient is 0 and the maximum value is 1. The scale generated by Landis and Koch (Warrens & Pratiwi, 2016), which quantitatively agrees on strength between observers, is used for the interpretation of Fleiss values. In this study, the writer defines that if the Kappa value meets the criteria of substantial agreement and has reached 0.7, there is a satisfactory agreement between the experts. This means that the expert assessment has ended and there is no additional round.

Results and Discussion

The initial development stage of the metacognitive instrument was carried out through content validation assessments by three expert judgments. The three experts have given their responses to the proposed metacognitive instrument. To measure Kappa scores, where expert responses are arranged to produce agreement on each dimension, indicator, and statement item on the proposed metacognitive instrument. Table 3 shows the results of expert approval for the assessment of metacognitive instruments.

Table 3. The result of the Assessment instrument

Result	Total Score
All experts have the same rating	3
Two experts have the same rating	24
All experts have different rating	0

In Table 3, the level of agreement between the experts was calculated. The level of agreement was calculated using the Fleiss Kappa Statistics which can measure agreement between raters in several categories. This level of agreement was carried out to determine the need for further expert assessment.

In the previous section, it has been explained that there are eight indicators with 42 items (N = 42), three experts (n = 3), and three rating values (k = 3). With this information, we can calculate the Kappa value by calculating the probability of agreeing with $\Pr(\alpha)$ the probability of agreeing by chance $\Pr(e)$. The probability of agreement indicates the level of agreement between experts regardless of whether the agreement occurred by chance (Xie et al., 2018). By implementing the calculation $\Pr(\alpha)$, it was obtained that $\Pr(\alpha)$ the value is 0.52381. In addition, the writer also measured the level of agreement that may be obtained by chance. By implementing the calculation $\Pr(e)$, it was obtained that the value $\Pr(e)$ is 0.02129. The two levels of agreement are needed to measure the level of agreement between experts by applying the Kappa value (1) as follows:

$$\kappa = \frac{0.52381 - 0.02129}{1 - 0.02129} = 0.513451 \quad \text{..............................} (2)$$

Based on the results of these calculations, the level of agreement between experts indicated by the Kappa value k was 0.51. This value is not satisfactory to meet the Brennan and Prediger benchmarks of 0.70 as well as the substantial agreement between Landis and Koch (Nurrohmah et al., 2018). Finally, the writer stated that the level of expert agreement on the assessment of the proposed metacognitive instrument in the Moderate Agreement category is not satisfactory, so it is still necessary to carry out the next round of Delphi (Akhanova et al., 2021; Hepworth & Rowe, 2018). However, there are some suggestions and suggestions for improvement from experts that need to be finalized.

Content Validation by Expert Judgement

The results of the metacognitive instrument assessment showed that all experts had a substantial agreement about the proposed instrument. However, to improve the quality of the instrument, the writer removed irrelevant statement items and modified the addition of several items based on the recommendations of experts. Based on the results of a study conducted by experts, there was one indicator that is given a rating of 1 (disagree) by all experts. This means that the proposed statement items had not been accepted by all experts. In addition, the other seven indicators were given a rating of 2 by the experts, which means they did not completely agree with the items proposed in the statement.

In the "Information Management Strategies" indicator, three proposed items were prepared, in which all the experts assessed disagreeing with the proposed item because the item was deemed unable to measure the context of the indicator in depth.Therefore, the experts gave suggestions by adding four other points, namely: 1) I write the proposals in order; 2) I ask myself if I understand the directions given by the lecturer to me; 3) I develop a system for storing and organizing articles that becomes the reference for my research, and 4) I criticize any new information by comparing it with related information from different sources.

The addition of this second statement item was decided by the writer to replace the previous statement item, namely: "I ask myself when what I read is related to what I already know." This is done by the writer because the context of the statement of the item had the same context and was clearer with the context of the statement item proposed by the expert. So that the total items became four statement items.

The “Planning” and “Critical Self-Reflection” indicators were given a linguistic assessment of the editorial points of their statements. The “Planning” indicator consisted of six items, in which the experts provided suggestions to replace the word “think” to “make”. This suggestion was given because the use of the word "think" was less operational and could be interpreted that the preparation of a proposal as a student's final project if only thought about but not done will not be able to complete the final project. Therefore, the redaction of the statements based on the expert's suggestions are: 1) I “make” a list of things that need to be studied before I write a proposal; 2) I “make” a review of several articles to determine the state of the art and research problems; 3) I “make” a review of several articles that support the selected research problem, and 4) I “make” the type of research and its methodology according to the research objectives.The other two points, namely: points five and six, are not changed or modified. The experts did not modify the additions to the items or indicators so that none of the statement items were eliminated.

The “Critical Self-Reflection” indicator consisted of seven statement items, in which five statement items were given linguistic suggestions on non-operational words. Such as changing the word "think" to "make" and the word "look for" to "study". This suggestion was intended so that the editorial statements of the items could be easily understood by the respondents, while the other two items were not changed by editorial statements. The following were five modified statements, namely: 1) I “make” my research ideas carefully; 2) I “study” the literature to correct errors in the research proposal; 3) I "remake" whether the research methodology used is correct; 4) I "remake" whether the data analysis used is correct; and 5) I "remake" whether the discussion is in-depth.

The other five indicators had not been fully agreed upon by the experts, because most of the experts disagreed, namely: expert 1 and expert 3, while only one expert, namely: expert 2 indicated agreeing on the proposal of metacognitive instrument items.Table 4 is presented more clearly to show the indicators and their constituent items that still require further identification. So that each indicator with its constituent items requires further modification as recommended by the following experts.

Table 4. The Indicators that Need Modification

Indicators	Proposed Addition of Items
Declarative Knowledge	I know the difficulties in writing a proposal
	I am aware that to write a proposal, I need to review related previous courses
Procedural Knowledge	I know the steps required in writing a proposal
	I have succeeded in writing other proposals before and I will also use the writing strategy in writing my final project proposal
	I write a final project proposal using an unplanned strategy.
Conditional Knowledge	I know that the strategy I use in writing my final project proposal is effective
Comprehension Monitoring	I compare other people's final project proposals to help me in writing my own.
	I ask myself whether I have written the proposal according to the applicable guidelines.
Debugging Strategies	I ask the lecturer when I don't understand something in proposal writing
	I look for other ways when I find it difficult to understand new information

	I study references when I don't understand something in the process of writing a proposal. I discuss with colleagues the implementation of research

Declarative Knowledge Indicator

The result of expert modification shows that the original Declarative Knowledge indicator consisted of two statement items. The assessment from Expert 2 agreed while expert 1 and expert 3 did not agree, then additional two statement items were proposed by expert 1 and expert 3 so that the total items became four statements. This is done the importance of declarative knowledge refers to facts or information stored in students' memory which is considered static (Jiamu, 2012; Ten Berge & Van Hezewijk, 1999; Wuryaningrum et al., 2020). Declarative knowledge, also referred to as conceptual, proportional, or descriptive knowledge, describes things, events, or processes; attributes; and their relationship with each other (Saks et al., 2021).

Procedural Knowledge Indicator

The assessment of the experts on the Procedural Knowledge indicator was carried out by adding statement items, where one statement item was submitted to the expert appraiser so that it was deemed insufficient to measure the indicator. Expert 1 and expert 3 appraisers disagreed, while expert 2 agreed, so the expert assessment agreement was to provide advice by adding three statement items. This indicator originally consisted of one statement item, which was: "I write a final project proposal using an unplanned strategy" and it was felt that the item was represented by the expert input statement item, so the writer decided to replace the statement item "I am aware of what strategy which is used when I write a research proposal" and replace it with "I write a final project proposal using an unplanned strategy".

This improvement proposal was made because this type of knowledge refers to the knowledge that students have about skills and strategies to know what to do (Gamero et al., 2021; Lauritzen, 2012). However, procedural knowledge refers to the performance and creation of movements, knowing what to do and when to choose the most appropriate action depending on different situations refers to how to do it (Saks et al., 2021). Thus, the number of statement items became four items based on the suggestions and proposals of the expert appraisers.

Conditional Knowledge Indicator

In this indicator, the previous point proposal consisted of three statement items. After the expert assessment had been carried out, there was an additional one-item statement. This was based on the agreement of two experts, namely: expert 1 and expert 3 who disagreed and recommended the addition of one statement item that was deemed important to measure the respondent's knowledge.As for the editorial statement, "I know that the strategy I used in writing the final project proposal is an effective strategy".

Conditional Knowledge requires teacher encouragement to decide when and why to perform tasks as an integral part of independent learning (Amolloh et al., 2018; Schneider & Artelt, 2010). Achievement in Conditional Knowledge, therefore, depends on effective preparedness to know facts and procedures about when and why to use knowledge (Amolloh et al., 2018). Therefore, in cases where teacher encouragement is properly prepared for increased student motivation, self-directed learning, increased reflection, and increased meta-cognitive skills that are important for student achievement (Muijs & Bokhove, 2020). Conditional Knowledge requires the application of critical thinking and problem-solving skills that demonstrate deeper mastery of what is taught and how to teach which requires concrete experience, reflective observation, abstract conceptualization, and active experimentation (Nahil, 2015).

Comprehension Monitoring Indicator

The statement item on the indicator consists of two items submitted to the expert appraiser, where the results of the expert assessment were disagreed by expert 1 while expert 2 and expert 3 agreed. A recommendation was given by expert 1 to add two statement items, because of the importance of Comprehension Monitoring as a process in which students determine whether they understand what they read. If they realize that they cannot articulate the main idea of the passage, they can take steps to improve their understanding before continuing to read (Bush et al., 2012; WRAY, 1994). The total statement items were divided into four items based on expert suggestions and suggestions.

Debugging Strategies Indicator

In the Debugging Strategies indicator, three statement items were proposed. Furthermore, an expert assessment was carried out where two experts disagreed, namely: expert 1 and expert 2 while expert 3 agreed. Suggestions and recommendations were given by expert 1 and expert 2 by adding four statement items.This was done because these indicators were needed for the process of detecting respondents so that they can cause them to behave unexpectedly, as an action taken after learning influenced by an accurate environment(Coker et al., 2018; Koeman et al., 2017). Therefore, to get in-depth information by adding items as a measuring tool. So that the total statement items became seven items based on suggestions and suggestions from expert assessments.

Expert Judgment Level of agreement

The results of the Kappa Fleiss calculation showed that the assessment carried out by the expert resulted in an agreement in the Moderate Agreement category or the experts gave sufficient approval in the assessment of the proposed instrument.In addition, the expert agreement suggested that the dimensions of Encouragement and Support for Teachers and Student-Teacher Discourse along with their indicators and items should be separated into one different instrument because they do not fit the context being measured. Some of these dimensions and indicators were more likely to measure the supervision of lecturers.

The discussion shows that there were deletions of dimensions, indicators, and items carried out by experts, as well as modifications or recommendations for adding proposed statement items. Therefore, the writer decided to revise and improve the results of the proposed improvements from the expert as a support for a better quality of metacognitive instruments. Although most of the experts still disagreed with the statement items proposed in the metacognitive instrument, there were still some recommendations for the proposed improvement without changing the important characteristics of the instrument. Thus, the finalization in the first stage of this validation could produce the proposed meta-cognitive instrument after modifications are made in Table 5 below.

Table 5. Metacognitive instruments based on expert judgment recommendations

Dimensions	Indicators	Statement Item Number
Knowledge of cognition	Declarative Knowledge	1, 2, 3, 4
	Procedural Knowledge	5, 6, 7, 8
	Conditional Knowledge	9, 10, 11, 12
Regulation of Cognition	Planning	13, 14, 15, 16, 17, 18
	Information Management Strategies	19, 20, 21, 22, 23, 24, 25
	Comprehension Monitoring	26, 27, 28, 29
	Debugging Strategies	30, 31, 32, 33, 34, 35, 36
	Critical Self-Reflection	37, 38, 39, 40, 41, 42, 43
Total		43

The results of the proposed improvements to the metacognitive instrument carried out by expert agreement in Table 5 resulted in 43 statement items. The addition of items lied in the Declarative knowledge indicator, namely: "I know which parts are my weaknesses in the proposal writing process", then on the Procedural knowledge indicator there was another addition of statement items relating to "I know the research standards set by my university well" and "I know the international writing standards well”.Next is the addition of the Conditional knowledge indicator with the statement item "I understand the condition that I can complete all stages of writing a proposal myself". The final result of the third expert assessment was deemed sufficient to provide suggestions, input, and recommendations for the improvement of the overall metacognitive instrument.

Conclusion

Expert assessment on metacognitive instruments in the preparation of student thesis research proposals was proposed in the Moderate Agreement category and it is important to re-finalize in the second stage to perfect the proposed Metacognitive instrument. Meanwhile, the characteristics of the level of agreement of the three experts were in the Moderate agreement category.This characteristic indicated that the expert gave a fair assessment and was not due to coercion, or the undue influence of one expert on another expert, and each expert acted voluntarily and of their own free will.

The finalization of the metacognitive instrument in the first stage was recommended by experts to modify the addition of statement items to each indicator. In addition to language correction, experts were made to edit statement items on the Planning and Critical Self-Reflection indicators.Finally, the finalization in the first stage of expert validation resulted in a meta-cognitive instrument with two dimensions, namely: Knowledge of Cognition and Regulation of Cognition, eight indicators, and 43 statement items.

Recommendations

In addition, the finalization of the second stage of the next instrument will be carried out with the addition of the number of expert appraisers and the category of the rating scale.

Acknowledgements or Notes

The authors would like to express sincere words of gratitude to all participants of the research.

References

Adams, A., Aldridge, M., Hill, U., Amo, C., Arnold, M., Baker, C., Barela, E., Baron, M., Bauer, J., Bledsoe, K., Booker, C., Bowen, N., Brown-welty, S., Bybee, D., Campbell, D., Caracelli, V., Carman, J., Chouinard, J. A., Culbertson, M., … Greene, A. (2013). *Acknowledgment of Reviewers National Institutes of Health*. *34*(4), 600–603. https://doi.org/10.1177/1098214013503619

Akhanova, G., Nadeem, A., Kim, J. R., Azhar, S., & Khalfan, M. (2021). *Building Information Modeling Based*

Building Sustainability Assessment Framework for Kazakhstan. 1–25.

Al-Gaseem, M., Bakkar, B., & Al-Zoubi, S. (2020). Metacognitive thinking skills among talented science education students. *Journal for the Education of Gifted Young Scientists*, *8*(2), 897–904. https://doi.org/10.17478/JEGYS.707205

Amin, I., & Sukestiyarno, Y. L. (2015). Analysis metacognitive skills on learning mathematics in high school. *International Journal of Education and Research*, *3*(3), 213–222. http://www.ijern.com/journal/2015/March-2015/18.pdf

Amolloh, O. P., Lilian, G. K., & Wanjiru, K. G. (2018). Experiential Learning, Conditional Knowledge and Professional Development at University of Nairobi, Kenya—Focusing on Preparedness for Teaching Practice. *International Education Studies*, *11*(7), 125. https://doi.org/10.5539/ies.v11n7p125

Benini, A., Chataigner, P., Noumri, N., Parham, N., Sweeney, J., & Tax, L. (2006). Expert Judgment: The use of expert judgment in humanitarian analysis - Theory, methods and applications. *Assessment Capacities Project - ACAPS*, *29*(August), 489–497. https://www.acaps.org/sites/acaps/files/resources/files/acaps_expert_judgment_-_full_study_august_2017.pdf%0Ahttps://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.684.1303&rep=rep1&type=pdf

Bush, D., Principal, A., Curriculum, V., Authority, A., Impact, H., & Strategies, T. (2012). Using Metacognitive Strategies to Support Student Self-Regulation And Empowerment. *Education and Training*, *34*(2005), 2–5.

Chao, T., Dede, C., & Star, J. R. (2016). Using Digital Resources for Motivation and Engagement in Learning Mathematics : Reflections from Teachers and Students. *Digital Experiences in Mathematics Education*, 253–277. https://doi.org/10.1007/s40751-016-0024-6

Coker, Z., Widder, D. G., Goues, C. Le, Bogart, C., & Sunshine, J. (2018). *Debugging Framework Applications: Benefits and Challenges*. http://arxiv.org/abs/1801.05366

Decaigny, T. (2014). Inquisitorial and Adversarial Expert Examinations in the Case Law of the European Court of Human Rights. *New Journal of European Criminal Law*, *5*(2), 149–166. https://doi.org/10.1177/203228441400500203

Farooq, A., Khurram, A., Islam, M. U., & Bilal, A. (2020). *Development and Validation of Prospective Teachers ' Metacognitive Abilities Questionnaire (PTMAQ)*. *7*(2).

Fauzi, A., & Sa'diyah, W. (2019). Students' metacognitive skills from the viewpoint of answering biological questions: Is it already good? *Jurnal Pendidikan IPA Indonesia*, *8*(3), 317–327. https://doi.org/10.15294/jpii.v8i3.19457

Gamero, M. G., García-Ceberino, J. M., Ibáñez, S. J., & Feu, S. (2021). Analysis of declarative and procedural knowledge according to teaching method and experience in school basketball. *Sustainability (Switzerland)*, *13*(11), 1–16. https://doi.org/10.3390/su13116012

García, T., Cueli, M., Rodríguez, C., Krawec, J., & González-Castro, P. (2015). Conocimiento y habilidades metacognitivas en estudiantes con un enfoque profundo de aprendizaje. Evidencias en la resolución de. *Revista de Psicodidactica*, *20*(2), 209–226. https://doi.org/10.1387/RevPsicodidact.13060

Händel, M., Artelt, C., & Weinert, S. (2013). Assessing metacognitive knowledge: Development and evaluation of a test instrument. *Journal for Educational Research Online / Journal Für Bildungsforschung Online*, *5*(2), 162–188. http://www.journal-for-educational-research-online.com/index.php/jero/article/view/365%5Cnhttp://www.journal-for-educational-research-online.com/index.php/jero/article/download/365/172

Hassan, N. F., Puteh, S., & Sanusi, A. M. (2019). Fleiss's Kappa: Assessing the concept of technology enabled active learning (TEAL). *Journal of Technical Education and Training*, *11*(1), 109–118. https://doi.org/10.30880/jtet.2019.11.01.14

Hepworth, L. R., & Rowe, F. J. (2018). Using Delphi methodology in the development of a new patient-reported outcome measure for stroke survivors with visual impairment. *Brain and Behavior*, *8*(2), 1–9. https://doi.org/10.1002/brb3.898

Hitchcock, D. (2017). Critical Thinking as an Educational Ideal. *Argumentation Library*, *30*(April), 477–497. https://doi.org/10.1007/978-3-319-53562-3_30

Jacobse, A. E., & Harskamp, E. G. (2012). Towards efficient measurement of metacognition in mathematical problem solving. *Metacognition and Learning*, *7*(2), 133–149. https://doi.org/10.1007/s11409-012-9088-x

Jaleel, S., & P., P. (2016). A Study on the Metacognitive Awareness of Secondary School Students. *Universal Journal of Educational Research*, *4*(1), 165–172. https://doi.org/10.13189/ujer.2016.040121

Jiamu, C. (2012). The great importance of the distinction between declarative and procedural knowledge. *Análise Psicológica*, *19*(4), 559–566. https://doi.org/10.14417/ap.387

Koeman, V. J., Hindriks, K. V., & Jonker, C. M. (2017). Designing a source-level debugger for cognitive agent programs. *Autonomous Agents and Multi-Agent Systems*, *31*(5), 941–970. https://doi.org/10.1007/s10458-016-9346-4

Lauritzen, P. (2012). Conceptual and Procedural Knowledge of Mathematical Functions. *University of Eastern*

Finland, *34*, 172.
Li, H. (2020). Mini Review of Cognitive Load Studies. *Psychology and Psychotherapy Research Study*, *4*(3), 2–3. https://doi.org/10.31031/pprs.2020.04.000587
Liu, H. H., & Su, Y. S. (2018). Effects of using task-driven classroom teaching on students' learning attitudes and learning effectiveness in an information technology course. *Sustainability (Switzerland)*, *10*(11). https://doi.org/10.3390/su10113957
Mack, C. A. (2018). How to Write a Good Scientific Paper Full Book. In *How to Write a Good Scientific Paper*. https://doi.org/10.1117/3.2317707.sup
Marantika, J. E. R. (2021). Metacognitive ability and autonomous learning strategy in improving learning outcomes. *Journal of Education and Learning (EduLearn)*, *15*(1), 88–96. https://doi.org/10.11591/edulearn.v15i1.17392
Mastrothanais, K., Kalianou, M., Katsifi, S., & Zouganali, A. (2018). The use of metacognitive knowledge and regulation strategies of students with and without special learning difficulties. *International Journal of Special Education*, *33*(1), 184–200.
Mehrdad, A. G., Ahghar, M. R., & Ahghar, M. (2012). The Effect of Teaching Cognitive and Metacognitive Strategies on EFL Students' Reading Comprehension Across Proficiency Levels. *Procedia - Social and Behavioral Sciences*, *46*(1987), 3757–3763. https://doi.org/10.1016/j.sbspro.2012.06.142
Metacognitive Awareness and Comprehension Monitoring in Reading Ability of Iranian EFL Learners. (2011). *Profile: Issues in Teachers' Professional Development*, *13*(2), 99–111.
Muijs, D., & Bokhove, C. (2020). Metacognition and Self-Regulation: Evidence Review. *Educational Endowment Foundation*, *May*. https://educationendowmentfoundation.org.uk/evidence-summaries/evidence-reviews/metacognition-and-self-regulation-review/%0Ahttps://educationendowmentfoundation.org.uk/public/files/Metacognition_and_self-regulation_review.pdf
Nahil, M. (2015). University Student's Learning Styles and Their Ability to Solve Mathematical Problems. *International Journal of Business and Social Science*, *6*(4), 121–134.
Nowell, L. S., Norris, J. M., White, D. E., & Moules, N. J. (2017). Thematic Analysis: Striving to Meet the Trustworthiness Criteria. *International Journal of Qualitative Methods*, *16*(1), 1–13. https://doi.org/10.1177/1609406917733847
Nunaki, J. H., Damopolii, I., Kandowangko, N. Y., & Nusantari, E. (2019). The effectiveness of inquiry-based learning to train the students' metacognitive skills based on gender differences. *International Journal of Instruction*, *12*(2), 505–516. https://doi.org/10.29333/iji.2019.12232a
Nurrohmah, I., Sensuse, D. I., & Santoso, H. B. (2018). The expert-judgement validation and finalization of proposed interaction design process maturity instrument: Case study: E-commerce in Indonesia. *Proceedings of the 2nd International Conference on Informatics and Computing, ICIC 2017*, *2018-Janua*, 1–6. https://doi.org/10.1109/IAC.2017.8280647
Saks, K., Ilves, H., & Noppel, A. (2021). *education sciences The Impact of Procedural Knowledge on the Formation of Declarative Knowledge : How Accomplishing Activities Designed for Developing Learning Skills Impacts Teachers ' Knowledge of Learning Skills*.
Schneider, W., & Artelt, C. (2010). Metacognition and mathematics education. *ZDM - International Journal on Mathematics Education*, *42*(2), 149–161. https://doi.org/10.1007/s11858-010-0240-2
Schraw, G., & Moshman, D. (1995). Metacognitive theories. *Educational Psychology Review*, *7*(4), 351–371. https://doi.org/10.1007/BF02212307
Sieberer-Nagler, K. (2015). Effective Classroom-Management & Positive Teaching. *English Language Teaching*, *9*(1), 163. https://doi.org/10.5539/elt.v9n1p163
Szabo, Z. K., Körtesi, P., Guncaga, J., Szabo, D., & Neag, R. (2020). Examples of problem-solving strategies in mathematics education supporting the sustainability of 21st-century skills. *Sustainability (Switzerland)*, *12*(23), 1–28. https://doi.org/10.3390/su122310113
Tachie, S. A. (2019). Meta-cognitive skills and strategies application: How this helps learners in mathematics problem-solving. *Eurasia Journal of Mathematics, Science and Technology Education*, *15*(5). https://doi.org/10.29333/ejmste/105364
Ten Berge, T., & Van Hezewijk, R. (1999). Procedural and Declarative Knowledge: An Evolutionary Perspective. *Theory & Psychology*, *9*(5), 605–624. https://doi.org/10.1177/0959354399095002
Veenman, M. V. J., & van Cleef, D. (2019). Measuring metacognitive skills for mathematics: students' self-reports versus on-line assessment methods. *ZDM - Mathematics Education*, *51*(4), 691–701. https://doi.org/10.1007/s11858-018-1006-5
Walkington, H. (2015). Students as researchers: Supporting undergraduate research in the disciplines in higher education. *The Higher Education Academy*, *online*(online), online. https://www.heacademy.ac.uk/system/files/resources/Students as researchers_1.pdf
Warrens, M. J. (2015). Five Ways to Look at CohenÃ¢Â€ Â™s Kappa. *Journal of Psychology &*

Psychotherapy, *05*(04), 8–11. https://doi.org/10.4172/2161-0487.1000197

Warrens, M. J., & Pratiwi, B. C. (2016). Kappa Coefficients for Circular Classifications. *Journal of Classification*, *33*(3), 507–522. https://doi.org/10.1007/s00357-016-9217-3

WRAY, D. (1994). Comprehension monitoring, metacognition and other mysterious processes. *Support for Learning*, *9*(3), 107–113. https://doi.org/10.1111/j.1467-9604.1994.tb00169.x

Wuryaningrum, R., Bektiarso, S., & Suyitno, I. (2020). The effects of knowledge-transforming text on elementary students' declarative, procedural knowledge, and motivation in environmental learning. *International Journal of Instruction*, *13*(1), 567–586. https://doi.org/10.29333/iji.2020.13137a

Xie, Z., Gadepalli, C., & Cheetham, B. (2018). A Study of Chance-Corrected Agreement Coefficients for the Measurement of Multi-Rater Consistency. *International Journal of Simulation: Systems, Science & Technology*, 1–9. https://doi.org/10.5013/ijssst.a.19.02.10

Author Information

Wardani Rahayu
Universitas Negeri Jakarta
Jl. Rawamangun Muka, East Jakarta, Indonesia

Erwin Sulaeman
Universitas Negeri Jakarta
Jl. Rawamangun Muka, East Jakarta, Indonesia

Tian Abdul Aziz
Universitas Negeri Jakarta
Jl. Rawamangun Muka, East Jakarta, Indonesia

Meiliasari
Universitas Negeri Jakarta
Jl. Rawamangun Muka, East Jakarta, Indonesia

Yuliatri Sastra Wijaya
Universitas Negeri Jakarta
Jl. Rawamangun Muka, East Jakarta, Indonesia