Learning Journals as Metacognitive Tools for Developing Students' Metacognitive Skills

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Abstract

Metacognition plays a vital role in the teaching-learning process. Students' metacognitive skills can be taught by immersing students in metacognitive activities. The aim of this study is to investigate the developmental change of the students' metacognitive skills using the learning journals. The study was a one group pre-test - post-test design utilizing the Metacognitive Awareness Inventory (MAI) developed by Schraw and Dennison in 1994 and the researcher-made learning journal (LJ) used to analyze the developmental change in the students' metacognitive skills. Paired t-test was employed to assess the students' metacognitive skills at the beginning and at the end of the study. Results indicated a positive developmental change in the students' metacognitive skills during the experimentation. Significant difference ($p<0.05$) was observed between the pre-test and post-test scores of the students' Metacognitive Awareness Inventory (MAI) as the students scored significantly higher in the post-test ($\mu_{posttest} = 43.614$) as compared to the pre-test ($\mu_{pretest} = 39.629$). Further, the students were able to identify the strategies and even name sources that they can apply in their learning process. The learning journal was found as an effective tool to enhance students' metacognitive skills. These findings suggest that students must be taught metacognition and be given enhancement using learning journals to develop metacognitive skills.

Keywords: *teaching-learning process, metacognition, reflection*

1. Introduction

In the world of diverse learning environments, students are facing the situations on choosing the useful information and monitoring their self-learning process. This is an issue that educators should pay attention to. Metacognition ranks first among the factors affecting schooling outcomes (Yi Shen & Liu, 2011). Wang, Haertel and Walberg (1990) describe metacognitive skills as the ability of individuals to associate messages with prior knowledge, draw inferences, and monitor or assess the personal performance demonstrated in the learning process. It is a high-level cognitive process and the ultimate goals of the instructions are to deliver knowledge and develop students' abilities to plan, monitor and reorganize learning strategies (Gagne, 1985, Yi Shen & Liu, 2011). Learners, on the other hand, need to deploy several metacognitive processes to understand what they are learning, modify their plans, goals, strategies and efforts in response to changing contextual conditions. Depending on the learning condition, learners may reflect on their learning and modify aspects of the learning context (Azebedo, 2005).

Metacognition is the awareness and understanding of one's own thinking processes and plays an important role in developing effective learning and training. Students fail to become active and independent due to lack of metacognitive awareness and strategies (Turner, 1989). Azebedo (2005) noted that students' metacognitive skills can be nurtured through proper arrangements of learning instruction.

Instructions and strategies that can activate students' metacognitive processes are helpful for improving students' learning condition. Learning process can be facilitated if students notice their use of metacognitive processes or learn to control these processes (Yi Shen & Liu, 2011). Several studies show that enhanced academic performance resulted from students' knowledge of metacognitive strategies (Millis, 2016; Chatzipanteli et al., 2015; Balbio, 2013; Zare & Mohammadi, 2011). If students know how to reflect on how they learn, they become better learners.

Early researches on development of metacognition showed that it appears to improve with age (Schneider, 2008; Kuhn & Dean, 2004; Schneider & Lockl, 2002; Schraw & Moshman, 1995). In children, cognitive knowledge appear first followed by accuracy of their cognition, consolidation of skills and dramatic improvements in monitoring and regulation and planning. Slower to develop are monitoring and evaluation of cognition which sometimes remain not fully developed in many adults. The last to appear is the construction of metacognitive theories. These allow the integration of cognitive knowledge and cognitive regulation (Schraw and Moshman, 1995).

Weil et al. (2013) indicated that metacognitive ability improves with age over the course of adolescence which is similar to the findings of Stel and Veenman (2014). They pointed out that at the age of around 15 years it appears to be relevant point in terms of the developmental trajectory of metacognitive skills. However, Sperling, Howard, Miller and Murphy (2002) developed a self-report instrument for measuring general metacognitive knowledge regulation. The researchers found that there was a slight tendency for younger students to earn higher metacognition scores than the older students. They speculated that it is possible that metacognition is domain-general among younger students, but gradually becomes more domain-specific for older students.

Several researchers offer evidence that metacognition is teachable (Dignath et al., 2008; Kramarski & Mevarech, 2003; Schraw, 1998). Dignath et al. studied how primary school students learn self-regulated learning strategies and provided a list with the most effective training

characteristics at the end of their research. It means that they successfully taught metacognitive skills to their subjects. Kramarski and Mevarech (2003) proved that metacognitive skills are teachable when their study showed that students exposed to metacognitive training scored higher in metacognitive questionnaire than those who are not. O'Donnell, Dnsereau, Hall and Rocklin (1987) revealed that students receiving the training exhibited significantly better learning outcomes. College students adjust their study strategies to meet the cognitive demands of testing (Ross and Green, 2006). Gunter, Easters and Schwab (2003) proposed that metacognition-based instructional methods can nurture students' ability to monitor their own cognitive processes. Metacognitive support can enhance effective learning and help students to prepare for future learning even in changing environments.

Teachers can conduct activities in the classroom to promote metacognition. Millis (2016) used activities leading to students to consider their knowledge levels, their learning processes and their ability to monitor and adjust attempts at problem-solving. She emphasized that metacognition skills can be taught by immersing students with metacognitive activities. Schraw (2001) argued that metacognitive knowledge is multidimensional, domain-general in nature, and teachable. He presented four instructional strategies and these include promoting general awareness, improving self-knowledge and regulatory skills, and promoting learning environments that are conducive to the construction and use of metacognition.

Several researches are conducted to determine the effectiveness of a learning journal in developing students' metacognitive behavior (Knox, 2017; Henter & Indreica, 2014; Swanson, 2014). A learning journal is similar to a learning log, diaries or reflective journal where students reflect upon their learning, identify their strengths and weaknesses, and comment on how they will deal with their difficulties. According to Dr. Mitchell (2015), with greater awareness of how students acquire knowledge, they learn to regulate their behavior to optimize learning and they begin to see how their strengths and weaknesses affect how they perform. Henter and Indreica (2014) recommended reflective journal writing as a tool to develop students' metacognitive skills. Olson and Johnson (2012) suggested that writing journals should become a weekly routine in order to meet its purpose, along with a descriptive feedback offered each time by the teacher.

This study was conducted to examine the development of students' metacognitive skills through the use of learning journals. It compared the metacognitive skills of the students at the start of the study, determined the developmental change between the students' metacognitive skills at the beginning and at the end of the study and showed the developmental change of students' metacognitive skills.

2. Methodology

The participants in the study were the second, third and fourth year students from the School of Education of Emilio Aguinaldo College-Cavite School Year 2017-2018. Reflection through learning journals was used as the metacognition strategy in this study. Likewise, the metacognitive skills of students were measured using the Metacognitive Awareness Inventory (MAI) of Dr. Schraw and Dr. Dennison. MAI is a 52-item questionnaire answerable by true or false and was originally developed by Dr. Schraw and Dr. Dennison in 1994. The 52 questions covered the knowledge about cognition and regulation of cognition. The use of MAI was sought and approved by Dr. Sperling-Dennison.

The learning journal encourages students to reflect on what they learn and how they learn. It was designed by the researcher and was used in her previous study. It is composed of six questions to encourage students' metacognition. The instrument was validated by the following experts: Dean and Associate Dean of the College of Engineering, Architecture and Technology of the De La Salle University-Dasmariñas, the Cluster Head of the Mathematics Department of the De La Salle Health Sciences Institute, and the Coordinator of the Mathematics Learning Area of Our Lady of Pilar Montessori Center.

Data Analysis

The study is a one group pretest-posttest design. Paired t-test was used to determine if there is a developmental change between the students' metacognitive skills at the beginning and at the end of the study. Learning journals of the students were used to analyze the developmental change of students' metacognitive skills.

Research Procedure

Orientation was conducted to the students followed by the administration of the pretest of Metacognitive Awareness Inventory (MAI). The Learning Journals were given at the end of every lesson as an assignment to be submitted the following meeting to give students time to reflect on the lesson discussed. Learning Journals were collected, read and returned to the students the following meeting. The comments were written on the learning journals as a way of informing them that they have been read and to motivate them to accomplish the next learning journal honestly. Learning Journals were also scanned to be used for the analysis of the students' metacognitive skills development.

Ethical Considerations

The Emilio Aguinaldo College-Cavite Internal Ethics Review Board (IERB) granted the permission to conduct the data gathering to the Education students of EACC provided that the institutional protocol on the conduct of research survey was observed. The participants' profiles were kept confidential and must not be disclosed to the public. The objectives and procedure of the study were also discussed to the participants.

3. Results and Discussion

Students Metacognitive Skills at the Start of the Study

Table 1. Students Metacognitive Skills Level

Percentile	Mean Value	Description
P100	41.61 – 52.00	Very High
P80	31.21 – 41.60	High
P60	20.81 – 31.20	Average
P40	10.41 – 20.80	Low
P20	0.01 – 10.40	Very Low

The computed mean of the students at the start of the study is 39.630 which refers to high level of metacognitive skills.

The 52 questions in the Metacognitive Awareness Inventory are divided into two major parts: the knowledge about cognition and the regulation of cognition. The knowledge about cognition refers to questions about students' knowledge about themselves, the learning strategies and conditions when these strategies are most useful. Meanwhile, the regulation of cognition deals with students' way of planning, using of strategies, monitoring and correcting comprehension errors and evaluating their learning.

Table 2. Analysis of Students' Pretest in Metacognitive Awareness Inventory

	No. of Questions	Mean	%
Knowledge about Cognition	(17)		
Declarative Knowledge	8	5.429	68
Procedural Knowledge	4	2.929	73
Conditional Knowledge	5	4.143	83
Regulation of Cognition	(35)		
Planning	7	5.457	78
Information Management Strategies	10	7.500	75
Comprehension Monitoring	7	5.257	75
Debugging Strategies	5	4.529	91
Evaluation	6	4.243	71

As shown in Table 2, the students' conditional knowledge is high (P80) and average (P60) in declarative and procedural knowledge. In this aspect of metacognition, the results show that students know what learning strategy to use, how to use it, when and why is there a need to use it.

The regulation of cognition shows that students' debugging strategies are high (P80), while information management strategies and evaluation is at an average level (P60). It suggests that before the study, students already had skills in organizing and processing information, assessing and analyzing the effectiveness of strategy used and in correcting performance errors.

Declarative knowledge and evaluation have the lowest mean in the knowledge about cognition and regulation of cognition. The results accord with the findings of Schraw and Moshman (1995) which states that slower to develop are monitoring and evaluation of cognition which sometimes remain not fully developed in many adults.

Developmental Change of Students' Metacognitive Skills

The developmental change of the students' metacognitive skills at the beginning and at the end of the study is based on the results of the pretest and posttest of the Metacognitive Awareness Inventory (MAI).

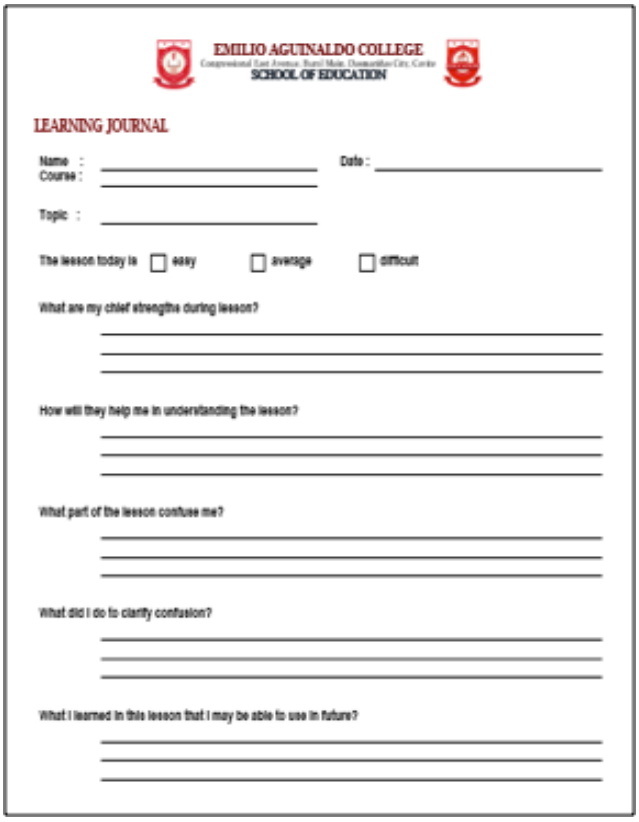
Table 3. T-test on the difference between the Pretest and Posttest of the Metacognitive Awareness Inventory

	N	Mean	SD	Mean Diff	t	t-test df	Sig. (2-tailed)
Pretest	70	39.629	6.787	-3.985	-7.169	69	0.000
Posttest	70	43.614	5.616				

The computed p-value was .000 ($p < .05$) indicating that there is a significant difference between the pretest and posttest scores of the students. The negative sign associated with the t-ratio implies that the metacognitive scores were higher on the posttest. The result also shows a higher mean in the posttest ($\mu posttest = 43.614$) compared to the pretest mean ($\mu pretest = 39.629$).

The result supports the earlier studies of Weil, et al., (2013) and Stel and Veenman (2014) who stated that metacognitive ability improves with age over the course of adolescence which is a relative period of development.

The Learning Journal used in the study consists of six questions to help students reflect and monitor their learning process.



EMILIO AGUINALDO COLLEGE
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LEARNING JOURNAL

Name :
Course :
Date :
Topic :
The lesson today is ☐ easy ☐ average ☐ difficult
What are my chief strengths during lesson?
How will they help me in understanding the lesson?
What part of the lesson confuse me?
What did I do to clarify confusion?
What I learned in this lesson that I may be able to use in future?

Figure 1. The Learning Journal used by the students in the study.

As shown in Figure 1, the first question allows the students to evaluate the day's lesson using the easy, average, or difficult scale. Identifying students' strengths and weaknesses (question number 2 and 4 respectively), and how these affect their learning (questions number 3 and 5) are comprehension questions which allow students to think about what they know and do not know, what they learned and what still confuse them after the day's lesson. Moreover, the fifth question is a strategy question which is used in answering the third research objective. It deals with how the students handle confusion on the topic after class discussion. Through this question, students will identify their learning techniques and name resources to be used to clarify confusion.

Table 4 shows the summary of students' responses. Last question in the learning journal is a forward-looking and significant question. The students will value the acquired learning if they realize its importance. Six learning journals were used by each student in the duration of the experimentation period in both classes. The responses in question number 5 were tallied as to what strategies they used when they are confused in the lesson discussed. Asking the teacher whenever they are confused is the most frequent answer of the students with a total of 161 which is 25% of the total responses. Searching the internet or online lessons followed with a total of 155 responses, which is 24% of the total respondents. The third is reading, browsing or reviewing notes or pictured slides with 127 responses, or equivalent to 20% of the total respondents.

Table 4. Summary of the Students' Responses in their Strategies in Handling Confusion

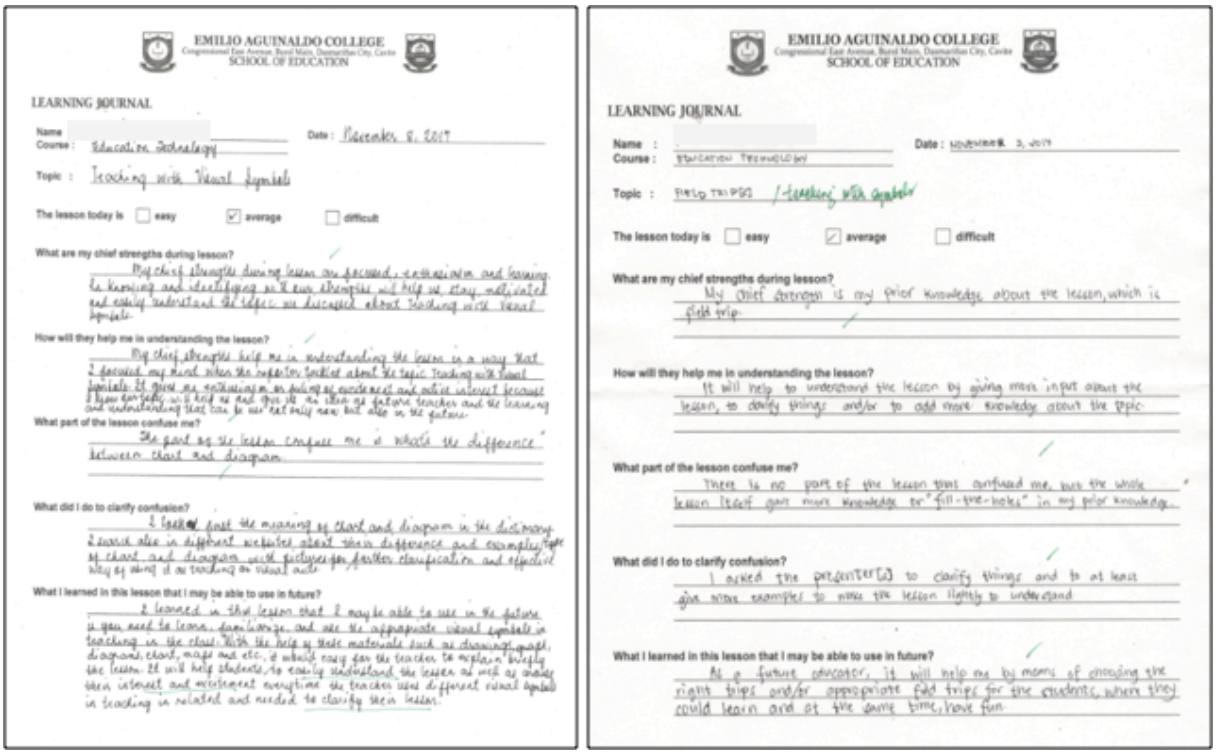
Students' Responses	L. J. # 1 Oct. 9 – 13 Jan. 27 & Feb.3		L. J. # 2 Oct. 18 – 23 Feb. 17 & 24		L. J. # 3 Nov. 6 – 11 Mar. 3 & 10		L. J. # 4 Nov. 13 – 18 Mar.17 & 24		L. J. # 5 Nov 20 – 25 Apr. 7 - 14		L. J. # 6 Nov 27 – Dec. Apr. 21 & 28	
	f	%	f	%	f	%	f	%	f	%	f	%
Search the internet / research on line	14	17.5	23	25.84	20	23.26	34	29.31	32	25.6	32	21.77
Ask for more examples and/ or ask for further explanation	2	2.5	1	1.12	4	4.65	4	3.45	4	3.2	3	2.04
Ask the teacher	10	12.5	19	21.35	21	24.42	36	31.03	34	27.2	41	27.89
Ask the reporter or presenter, classmates, friends	9	11.25	9	10.11	6	6.98	9	7.76	7	5.6	7	4.76
Ask parents, siblings or relatives	0	0	1	1.12	0	0	4	3.45	4	3.2	4	2.72
Read, browse or review notes or pictured slides	16	20.0	16	17.98	21	24.42	20	17.24	22	17.6	32	21.77
Read books or visit library	0	0	1	1.12	6	6.98	5	4.31	15	12.0	12	8.16
Advance reading of the topic	0	0	1	1.12	1	1.16	1	0.86	3	2.4	4	2.72
No confusion / Not Applicable	7	8.75	9	10.11	1	1.16	1	0.86	4	3.2	12	8.16
No answer	13	16.25	5	5.62	5	5.81	2	1.72	0	0	0	0
No learning journal or did not submit	9	11.25	4	4.49	1	1.16	0	0	0	0	0	0
TOTAL	80	100	89	99.98	86	100	116	99.99	125	100	135	99.99

Note. Some students gave more than one strategy per L. J. (Learning Journal).

Remarkable changes in the "no answer" and "no learning journal or did not submit" from L. J. #1 to L. J. #6. The "no answer" 13-5-5-2-0-0 frequency and "no learning journal or did not submit" 9-4-1-0-0-0 frequency show that students improved in terms of accomplishing their learning journals. The frequency of responses in the students' identified strategies in overcoming their confusion regarding the lesson discussed, the first nine rows in Table 4, is evidently increasing which implies that as students undergo the experimentation, they realize and identify gradually what strategies they can apply to clarify their confusion.

The results of the students' responses in the strategies they used are consistent with the earlier findings regarding the comparison of students' pretest and posttest in MAI which shows that the posttest scores of the students are higher than their pretest scores of 3.985 (see Table 3).

The improvement in the students' metacognitive skills are evident on how they accomplish their learning journal (see Figure 2) and Table 4 shows a clearer view of the development of students' metacognitive skills. Earlier studies support these findings that metacognitive skills are teachable if students are exposed to metacognitive trainings (Dignath et al., 2008; Kramarski & Mevarech, 2003; Schraw, 1998).



EMILIO AGUINALDO COLLEGE
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LEARNING JOURNAL

Name :
Course : Education Technology
Date : December 8, 2017

Topic : Teaching with Visual Symbols

The lesson today is ☐ easy ☑ average ☐ difficult

What are my chief strengths during lesson?
My chief strengths during lesson are focused, enthusiasm and learning to learning and identifying will help me stay motivated and easily understand the topic we discussed about Teaching with Visual Symbols.

How will they help me in understanding the lesson?
My chief strengths help me in understanding the lesson in a way that I focused my mind when the instructor talked about the topic Teaching with Visual Symbols. It gave me confidence on asking of questions and active interact because I know confident will help me and give job as I am as future teacher and the learning and understanding that can be use not only now, but also in the future.

What part of the lesson confuse me?
The part of the lesson confuse me is what's the difference between chart and diagram.

What did I do to clarify confusion?
I looked past the meaning of chart and diagram in the dictionary. I would also in different websites about their difference and examples/type of chart and diagram will pictures for further clarification and effective way of using it as teaching as visual aids.

What I learned in this lesson that I may be able to use in future?
I learned in this lesson that I may be able to use in the future if you need to locate, emphasize, and use the appropriate visual symbols in teaching in the class. With the help of these materials such as dictionary, word, diagram, chart, maps and etc. it would easy for the teacher to explain briefly the lesson. It will help students, to easily understand the lesson as well as more their interest and involvement everytime the teacher uses different visual symbols in teaching in related and needed to clarify their lesson.

EMILIO AGUINALDO COLLEGE
SCHOOL OF EDUCATION

LEARNING JOURNAL

Name :
Course : Education Technology
Date : November 3, 2017

Topic : Field Trips / Teaching with Symbols

The lesson today is ☐ easy ☑ average ☐ difficult

What are my chief strengths during lesson?
My chief strength is my prior knowledge about the lesson, which is field trip.

How will they help me in understanding the lesson?
It will help to understand the lesson by giving more input about the lesson, to clarify things and/or to add more knowledge about the topic.

What part of the lesson confuse me?
There is no part of the lesson that confused me, but the whole lesson itself gain more knowledge or "fill-the-holes" in my prior knowledge.

What did I do to clarify confusion?
I asked the professor[s] to clarify things and to at least give more examples to make the lesson lightly to understand

What I learned in this lesson that I may be able to use in future?
As a future educator, it will help me by means of choosing the right trips and/or appropriate field trips for the students, where they could learn and at the same time, have fun.

Figure 2. Samples of Students' Learning Journal

Using one-way ANOVA, further step was done to determine if there is a significant difference in the metacognitive skills of the students at the end of the study when grouped according to their age, gender and program.

Table 5. Students' metacognitive skills at the end of the study

	AGE					GENDER					COURSE				
	Sum of Sqaures	df	Mean Square	F	p	Sum of Sqaures	df	Mean Square	F	p	Sum of Sqaures	df	Mean Square	F	p
Between groups	60.073	3	20.024	0.624	0.602	0.111	1	0.111	0.003	0.953	49.465	4	12.366	0.378	0.824
Within groups	2116.51	66	32.068			2176.47	68	32.007			2127.12	65	32.725		
Total	2176.59	69				2176.59	69				2176.59	69			

When grouped according to age [F (3, 66) = 0.624, p = 0.602], gender [F (1, 68) = 0.003, p = 0.953] and program [F (4, 65) = 0.378, p = 0.824] at the $p < .05$ level, results reveal that there was no statistically significant difference in the metacognitive skills of the students. This suggests that the level of metacognitive skills is the same regardless of age, gender and program.

4. Conclusion

The students' metacognitive skills are high. A positive developmental change in the students' metacognitive skills was observed at the beginning and at the end study. Students were able to evaluate their learning status by reflecting on the questions in their learning journals. They were able to identify strategies and even name sources that they can apply in their learning process.

The students must be taught metacognition and be given metacognitive enhancements such as learning journals to improve their metacognitive skills. Integration of these materials can help students to promote and provide metacognitive strategies that they can use for learning in other domains.

For the future studies, teachers can use other metacognitive tools such as diary, log books, and reflection logs to further enhance students' metacognitive skills.

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