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Metacognitive awareness levels of pre-service teachers

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Abstract

The effectiveness of teachers' use of their metacognitive skills is closely related to the success of the learning process. Nowadays, it is imperative for students to use self-regulatory and metacognitive skills to cope with the changes happening around the world. This study seeks to determine if the metacognitive awareness levels of pre-service teachers vary when they are grouped according to gender and year level. The sample size of this study is 120 pre-service teachers enrolled in a teacher education program at a state university in the Philippines. Two instruments were utilized in this study which are the Personal Information Form and the Metacognitive Awareness Inventory (MAI) adapted from Schraw and Dennison (1994). Generally, results show that pre-service teachers' metacognitive awareness levels were high. Independent sample t-test result shows that there is a significant difference between the pre-service teachers' metacognitive awareness when they are grouped according to their gender. Similarly, a statistically significant difference was also found when they were grouped according to year level using one-way ANOVA. The results of this study suggest that teacher training programs should be organized with the objective of promoting the enhancement of metacognitive awareness knowledge and skills of pre-service teachers. Having high metacognitive awareness can improve the learning experience of the students; thus, it minimizes the difficulties that they may encounter. For the increased validity of the study, it is recommended to use a qualitative research approach.

Keywords: Metacognition, Metacognitive awareness, Pre-service teachers, Self-regulation, Metacognitive skills

1. Introduction

The paradigm shifts in education in the 21st-century demand more than the usual teaching and learning outcomes, and it requires vast knowledge and the application of skills to meet those standards. The shift from face-to-face classes to online classes brought so many expectations for the teachers and the learners. Nowadays, it is imperative for students to use self-regulatory and metacognitive skills to cope with these changes. Metacognition refers to one's knowledge concerning one's own cognitive processes and products or anything related to them [1]. Metacognition has been reported to have an influence the on academic performance of students [2]. Some researchers contend that metacognition correlates significantly with students' academic performance or achievement [3]; while others view that explicit metacognitive training can enhance students' metacognition. Metacognition is a regulatory system that helps a person understand and control his or her own cognitive performance and it allows people to take charge of their own learning [1,4]. An incredibly significant structure that influences learning processes is metacognitive awareness which is described as being aware of one's own cognitive process [5]. Additionally, the knowledge of cognition and regulation of cognition are its main components. According to Schraw et.al [6], knowledge of cognition is knowing one's cognition in general and has three subcomponents which are declarative, conditional, and procedural knowledge. On the other hand, the regulation of cognition consists of the series of activities that guides people to monitor and control their own learning processes [7]. In addition, [8] define knowledge of cognition as understanding their own cognition and how much a learners are aware about their own learning style. Furthermore, Thomas and McRobbie [9] describe regulation of cognition as the skills that the learners need to utilize to control their process of learning and achieve their goals.

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Critical thinking and metacognitive awareness are essential in the modern era to grasp how science education has progressed [10] Moreover, Tongco and Fajardo [11] firmly stands with the idea that metacognitive skills are essential to the students to be successful learners especially in learning Science. Metacognitive awareness plays a vital role in online learning since it demands students to remain focused on and regulate their own learning processes [12].

Technology is advancing significantly across a variety of sectors; therefore, individuals who can't control their own learning processes lag behind [13]. By fostering metacognitive awareness, teachers can assist students to meet their need to regulate their own thinking. Metacognitive awareness plays a vital role in planning and evaluating the learning process, as well as in conducting self-assessment [14]. Additionally, Dumbford and Miller [15] predicted that online learning would continue beyond the pandemic and will eventually be the new norm for most schools given the abrupt switch in many universities from face-to-face classroom learning to online learning and some studies show that metacognitive strategies have a strong positive relationship with online learning performance and are crucial for academic achievement.

Considering that learners may encounter difficulty in understanding some lessons, it is vital to promote effective and lasting learning for students to know their own learning, track their learning process and use appropriate learning techniques to deal with these challenges. Thus, teachers should encourage and help the students in assessing themselves on where they encounter difficulties, monitor their progress and plan for actions that may help to improve their learning styles. Additionally, educators should know how to use appropriate teaching strategies and methods so that successful learning will take place [16]. Teachers should plan, oversee, and evaluate the learning process while taking into consideration the variances among the students. In the preparation of a class, teachers are expected to accurately use their metacognitive knowledge and skills, decide on the appropriateness of a teaching method and be flexible in adjusting it to become an effective approach, and assess the learning experience of the learners. In other words, the effectiveness of teachers' use of their metacognitive skills is closely related to the success of the learning process. If the teacher has poor metacognitive awareness, they may struggle in helping the students to attain successful regulation of their learning process. Thus, teachers should have a high metacognitive awareness. In line with this, the preliminary objective of this study is determining the prospective teachers' levels of metacognitive awareness.

This study attempted to answer the following questions, namely:

- What are the metacognitive awareness levels of pre-service teachers?
- Are there significant differences among the pre-service teachers' metacognitive awareness levels when they are grouped according to:
  - Gender, and
  - Year level?

2. Material and methods

A quantitative research approach, specifically a descriptive and survey method is utilized in determining the pre-service teachers' metacognitive awareness levels. According to Cohen and Manion [17], a survey method's objective is to describe a situation that occurred before or that is currently happening.

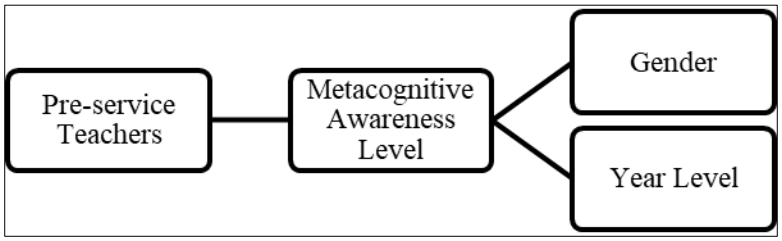

Figure 1 Research Paradigm

The figure above shows the conceptual framework of the study. The pre-service teachers, who are the subject of the study, will be tested to check their metacognitive awareness level. Becoming conscious of one's own thought processes is known as metacognition. The awareness of one's thinking and the techniques one employs is known as metacognition. It permits them to be more aware of what they are doing, why they are doing it, and how the skills they are gaining may be applied differently in other contexts. The researchers will also find if there is a significant difference among the pre-service teachers' metacognitive awareness levels when they are grouped according to their gender and their year level.

2.1. Respondents

Based on the Table 1, the respondents were 120 pre-service teachers from first year (*n*=30), second year (*n*=30), third year (*n*=30), and fourth year (*n*=30) levels. In this study, the respondents consist of 45.8% male and 54.2 % female enrolled in an undergraduate program teacher-education course in a state university in the Philippines. Additionally, majority of the respondents were 16-20 years old (*n*=76) and 24.2 % were under the Outcomes Based Teacher Education Curriculum (OBTEC) program.

Table 1 Profile of the Respondents

Characteristics	Level	f	%
Age	16-20	76	63.3
	21-25	39	32.5
	26-30	2	1.7
	31-35	2	1.7
	36-above	1	0.8
Gender	Male	55	45.8
	Female	65	54.2
Year Level	Freshman	30	25
	Sophomore	30	25
	Junior	30	25
	Senior	30	25
Course	OBTEC	29	24.2
	BFE	5	4.2
	BEE	3	2.5
	BSciEBio	16	13.3
	BSciEChem	6	5.0
	BSciEPhysics	14	11.7
	BME	13	10.8
	BMSEE	20	16.7
	BSPsych	2	1.7
	BSSE	5	4.2
	BVE	4	3.3
	BECED	1	0.8
	BPHE	1	0.8
	BLIS	1	0.8

2.2. Data Collection

The data are collected by using a Google form which includes the consent form, personal information form, and Metacognitive Awareness Inventory (MAI). It was conducted from November 24 to 28, 2020.

2.3. The Instrument

2.3.1. Personal Information Form

The student's information form seeks to know the following information: name which is optional, age, gender, year level, and course. It is completed by the respondents with a consent form by utilizing a Google form.

2.3.2. Metacognitive Awareness Inventory (MAI)

The Metacognitive Awareness Inventory or MAI was adapted from Schraw and Dennison [5]. It was modified to determine the extent of students' procedural, declarative, conditional knowledge, as well as the extent of utilization of information management strategies, debugging strategies, planning, comprehension monitoring and evaluation. The Metacognitive Awareness Inventory has sixteen (16) items. It has two major categories; the knowledge of cognition and the regulation of cognition. Knowledge of cognition has three (3) sub-categories with five strands each; procedural, declarative and conditional knowledge. Regulation of cognition has five (5) sub-categories: information management strategies, debugging strategies, planning, comprehension, monitoring and evaluation. It is four-point rating scales which ranges from 4- strongly agree, 3-agree, 2-disagree and 1-strongly disagree. Based on the study of Akin, et al. [18] the result can be interpreted as low if the student has a mean score below 2.50 and high if it is above that mean score. This instruments' internal consistency was 0.742 which is computed using Cronbach's alpha coefficient.

2.4. Data Analysis

In determining the prospective teachers' metacognitive awareness levels, this study used the following statistical treatments: percentage frequency distribution, and descriptive statistical analysis such as arithmetic mean and standard deviation. The data were also analyzed using independent samples t-test, one-way analysis of variance (ANOVA) and Tukey's test. The analysis was performed using the IBM Statistical Package for the Social Sciences (SPSS). The significance level for all of the statistical decoding was set at 0.05.

3. Results and discussion

Table 2 shows the descriptive statistics for the Metacognitive Awareness Inventory scores.

Table 2 Descriptive statistics for MAI

MAI Components	N	Min	Max	$\bar{X}$	SD
Knowledge of Cognition	120	2.50	4.00	3.49	0.35
Declarative Knowledge	120	2.50	4.00	3.38	0.48
Procedural Knowledge	120	2.00	4.00	3.48	0.50
Conditional Knowledge	120	2.00	4.00	3.60	0.46
Regulation of Cognition	120	2.50	4.00	3.39	0.36
Planning	120	1.50	4.00	3.32	0.60
Information Management Strategies	120	2.00	4.00	3.49	0.52
Comprehension Monitoring	120	2.00	4.00	3.34	0.60
Debugging Strategies	120	2.50	4.00	3.43	0.53
Evaluation	120	1.00	4.00	3.35	0.59
MAI Total	120	2.72	4.00	3.44	0.30

As presented in Table 2, respondents' levels of metacognitive awareness were found highly aware in terms of total mean score ($\bar{X}$=3.44) and high level of awareness in the two primary components namely knowledge of cognition ($\bar{X}$=3.49) and regulation of cognition ($\bar{X}$=3.39). The conditional knowledge ($\bar{X}$=3.60) mean score was found higher than the procedural ($\bar{X}$=3.48) and declarative knowledge ($\bar{X}$=3.38). The highest and lowest mean score were obtained from information management strategies ($\bar{X}$=3.49) and planning ($\bar{X}$=3.32), respectively. This result is supported by the studies conducted by Young and Fry [19] and Alkan and Erdem [20], which both shows that the pre-service teachers'

knowledge levels on their own cognition when using strategies in order to control their cognition were high. Additionally, Koc and Kuvac [16] also found that the metacognitive awareness levels of prospective teachers were high.

A t-test for independent groups was utilized in examining the differences between the male and female respondents and their corresponding metacognitive awareness levels. The results are presented in Table 3.

Table 3 Independent samples t-test results of the components of MAI in terms of gender

MAI Components	Gender	N	Min	Max	X	SD	t	df	p
Knowledge of Cognition	Male	55	2.67	4.00	3.42	0.37	-1.800	118	0.074
	Female	65	2.50	4.00	3.54	0.32			
Regulation of Cognition	Male	55	2.50	4.00	3.28	0.38	-3.152		0.002
	Female	65	2.70	4.00	3.48	0.32			
MAI Total	Male	55	2.72	4.00	3.35	0.31	-2.962		0.004
	Female	65	2.78	4.00	3.51	0.27			

As illustrated in Table 3, the total mean scores acquired by the female pre-service teachers ($\bar{X}$=3.51) are higher than the male pre-service teachers ($\bar{X}$=3.35). This difference is determined as statistically significant ($t_{total\ (118)}$ = -2.962; p < .05). The mean scores on the KOC and ROC components differ by the gender of pre-service teachers ($t_{KoC\ (118)}$ = -1.800, $t_{RoC\ (118)}$ = -3.152; p< .05).

Table 4 Independent samples t-test results of the sub-components of MAI in terms of gender

	MAI Components	Gender	N	$\bar{X}$	SD	t	df	p
Knowledge of Cognition	Declarative Knowledge	Male	55	3.42	0.46	0.931	118	0.354
		Female	65	3.34	0.50			
	Procedural Knowledge	Male	55	3.36	0.52	-2.476		0.015*
		Female	65	3.58	0.46			
	Conditional Knowledge	Male	55	3.49	0.50	-2.458		0.015*
		Female	65	3.69	0.39			
Regulation of Cognition	Planning	Male	55	3.20	0.64	-1.821		0.071
		Female	65	3.40	0.55			
	Information Management Strategies	Male	55	3.48	0.58	-0.268		0.789
		Female	65	3.51	0.48			
	Comprehension Monitoring	Male	55	3.17	0.68	-2.983		0.003*
		Female	65	3.49	0.49			
	Debugging Strategies	Male	55	3.30	0.52	-2.227		0.028*
		Female	65	3.52	0.53			
	Evaluation	Male	55	3.21	0.69	-2.397		0.018*
		Female	65	3.46	0.53			

*p<.05

Table 4 shows that total mean scores obtained by both genders on the sub-component conditional knowledge ($\bar{X}_{male}$=3.49, $\bar{X}_{female}$=3.69) was higher than the declarative knowledge ($\bar{X}_{male}$=3.42, $\bar{X}_{female}$=3.34) and procedural knowledge ($\bar{X}_{male}$=3.36, $\bar{X}_{female}$=3.58) under the knowledge of cognition. The difference is found statistically significant on both procedural knowledge ($t_{procedural\ knowledge}$ (118) = -2.476; p<.05) and conditional knowledge ($t_{conditional\ knowledge}$

(118) = -2.458; p < .05) while no statistically significant difference was found on declarative knowledge ($t_{\text{declarative knowledge}}$ (118) = -2.458; p > .05).

In the regulation of cognition sub-components, it was found that the highest total mean scores by female pre-service teachers was in debugging strategies ($\bar{X}_{female}$=3.52, SD=0.53**)** while the highest total mean score by the male pre-service teachers was found in information management strategies ($\bar{X}_{male}$=3.48, SD= 0.58).The lowest total mean scores obtained by female pre-service teachers was found in planning($\bar{X}_{female}$=3.52, SD=0.55 **)** while the lowest total mean score obtained by the male pre-service teachers was found in comprehension monitoring ($\bar{X}_{male}$=3.17,SD=0.68). Statistically significant differences were found in comprehension monitoring knowledge ($t_{\text{comprehension monitoring}}$ (118) = -2.983; p<.05)**,** debugging strategies ($t_{\text{debugging strategies}}$ (118) = -2.227; p<.05) and evaluation ($t_{evaluation}$(118) = -2.397; p<.05). Earlier study conducted by Veloo, Rani, and Hariharan [21] found that female college students were applying more metacognitive strategies than male students. Similarly, Bogdonavic [3] also found that the female students metacognition was higher than male. However, when [8] investigated the gender differences in metacognitive skills, it revealed insignificant gender differences. Also, results of some studies shows that there is no significant difference in the metacognitive awareness levels of male and [22,23]. In contrast, the studies conducted by Pajeres and Valiente [24] and Liliana and Lavina [25] found significant difference between male and female respondents.

To determine if there is a significant difference between the year level of the pre-service teachers and their levels of metacognitive awareness and its main components, one-way analysis of variance test was used. Based on Table 6, 4th year or senior pre-service teachers has the highest levels of awareness in the MAI total ($\bar{X}$=3.58, SD=0.22) and its primary components; knowledge of cognition ($\bar{X}$=3.55, SD=0.28) and regulation of cognition ($\bar{X}$=3.61, SD=0.28).

Table 5 One-Way ANOVA test results of the components of MAI in terms of year level

MAI Components	Year Level	N	Min	Max	$\bar{X}$	SD
Knowledge of Cognition	1st	30	2.50	4.00	3.39	0.39
	2nd	30	3.00	4.00	3.54	0.31
	3rd	30	2.67	4.00	3.47	0.39
	4th	30	2.50	4.00	3.55	0.28
Regulation of Cognition	1st	30	2.60	3.70	3.30	0.29
	2nd	30	2.50	4.00	3.30	0.41
	3rd	30	2.50	4.00	3.33	0.37
	4th	30	3.00	4.00	3.61	0.28
MAI Total	1st	30	2.72	3.80	3.35	0.27
	2nd	30	2.75	4.00	3.42	0.32
	3rd	30	2.75	4.00	3.40	0.38
	4th	30	3.13	2.72	3.58	0.22

Consequently, Table 6 displays the results of one-way analysis of variance test for the sub-components of MAI when they are grouped according to their year level.

The highest total mean score was obtained by the 4th year students ($\bar{X}_{4th\ year}$=3.58, SD=0.22). In particular, in knowledge of cognition, they acquired the highest mean score in sub-component conditional knowledge ($\bar{X}_{4th\ year}$=3.72, SD=0.36) and lowest in declarative knowledge ($\bar{X}_{4th\ year}$ =3.37, SD=0.43). In the regulation of cognition, the highest mean score in the sub-components information management strategies ($\bar{X}_{4th\ year}$ =3.67, SD=0.42) and comprehension monitoring ($\bar{X}_{4th\ year}$ =3.67, SD= 0.42) and lowest in planning ($\bar{X}_{4th\ year}$ =3.50, SD= 0.51).

Table 6 One-Way ANOVA test results of the sub-components of MAI in terms of year level

	MAI Components	**Year Level**	**N**	**X̄**	**SD**
Knowledge of Cognition	Declarative Knowledge	1st	30	3.33	0.48
		2nd	30	3.48	0.50
		3rd	30	3.35	0.49
		4th	30	3.37	0.43
	Procedural Knowledge	1st	30	3.38	0.57
		2nd	30	3.55	0.44
		3rd	30	3.43	0.50
		4th	30	3.57	0.47
	Conditional Knowledge	1st	30	3.47	0.54
		2nd	30	3.60	0.42
		3rd	30	3.62	0.47
		4th	30	3.72	0.36
Regulation of Cognition	Planning	1st	30	3.32	0.65
		2nd	30	3.20	0.69
		3rd	30	3.25	0.52
		4th	30	3.50	0.51
	Information Management Strategies	1st	30	3.50	0.51
		2nd	30	3.37	0.51
		3rd	30	3.45	0.62
		4th	30	3.67	0.42
	Comprehension Monitoring	1st	30	3.07	0.64
		2nd	30	3.38	0.54
		3rd	30	3.27	0.65
		4th	30	3.67	0.42
	Debugging Strategies	1st	30	3.42	0.46
		2nd	30	3.30	0.58
		3rd	30	3.35	0.56
		4th	30	3.63	0.49
	Evaluation	1st	30	3.18	0.58
		2nd	30	3.27	0.70
		3rd	30	3.35	0.57
		4th	30	3.58	0.39

Table 7 displays the results of the pre-service teachers' ANOVA and Tukey's tests on the main components, along with their overall levels of metacognitive awareness when they are grouped according to their year level.

Table 7 One-Way ANOVA and Tukey's test results of the components of MAI in terms of year level

		Sum of Squares	***df***	**Mean Square**	***F***	***p***	***sig.dif***
Knowledge of Cognition	Between Groups	0.487	3	0.162	1.351	0.261	-
	Within Groups	13.943	116	0.120			
	Total	14.430	119				
Regulation of Cognition	Between Groups	2.033	3	0.678	5.766	0.001*	1-4 2-4 3-4
	Within Groups	13.633	116	0.118			
	Total	15.666	119				
MAI Total	Between Groups	0.911	3	0.304	3.582	0.016*	1-4
	Within Groups	9.829	116	0.085			
	Total	10.739	119				

*p<.05

As seen on Table 7, the metacognitive awareness total scores of first-year pre-service teachers are statistically significant different from those of fourth-year pre-service teachers. (F (3-116) = 3.582; p < .05). It implies that the 4th year pre-service teachers' metacognitive awareness levels are higher than of the 1st year pre-service teachers. When the two components were further inspected, there is no significant difference found in the knowledge of cognition (F (3-116)= 2.413; p > .05). On the other hand, the regulation of cognition differs statistically significant among fourth-year pre-service teachers and all other year levels (F (3-116)= 5.766; p < .05). Because of this result, it can be interpreted that the senior pre-service teachers' metacognitive awareness levels on the regulation of cognition are higher than all of the remaining year levels.

Table 8 One-Way ANOVA and Tukey's test results of the sub-components of MAI in terms of year level

		Sum of Squares	***df***	**Mean Square**	***F***	***p***	**sig.dif**
Declarative Knowledge	Between Groups	0.417	3	0.139	0.609	0.610	-
	Within Groups	26.450	116	0.228			
	Total	26.867	119				
Procedural Knowledge	Between Groups	0.717	3	0.239	0.964	0.412	-
	Within Groups	28.750	116	0.248			
	Total	29.467	119				
Conditional Knowledge	Between Groups	0.950	3	0.317	1.540	0.208	-
	Within Groups	23.850	116	0.206			
	Total	24.800	119				
Planning	Between Groups	1.550	3	0.517	1.447	0.233	-
	Within Groups	41.417	116	0.357			
	Total	42.967	119				
Information Management Strategies	Between Groups	1.440	3	0.480	1.778	0.155	-
	Within Groups	31.308	116	0.270			
	Total	32.748	119				

Comprehension Monitoring	Between Groups	5.656	3	1.885	5.795	0.001*	1-4 3-4
	Within Groups	37.742	116	0.325			
	Total	43.398	119				
Debugging Strategies	Between Groups	1.942	3	0.647	2.355	0.076	-
	Within Groups	31.883	116	0.275			
	Total	33.825	119				
Evaluation	Between Groups	2.673	3	0.891	2.704	0.049*	1-4
	Within Groups	38.225	116	0.330			
	Total	40.898	119				

*p<.05

Table 8 presents the results of the sub-components of MAI when they are grouped according to year level utilizing ANOVA and Tukey's tests. There are no significant differences in all the sub-components in the knowledge of cognition, ($F_{\text{declarative knowledge}}$ (3-116) = .609; p<.05) ($F_{\text{procedural knowledge(3-116)}}$= .964; p <.05) and ($F_{\text{conditional knowledge (3-116)}}$ = 1.540; p <.05). For the other main component, a statistically significant difference was detected in comprehension monitoring ($F_{\text{comprehension monitoring}}$ (3-116) = 5.795; p<.05) between 4th year and 1st year and 4th year and 3rd year in favor of 4th year. Also, a statistically significant difference was found in evaluation ($F_{\text{evaluation}}$ (3-116) = 2.704; p<.05) between 4th year and 1st year pre-service teachers in favor of 4th year. Based on the result it can be said that 4th year pre-service teachers' comprehension monitoring and evaluation is higher than all other levels. The result found contradicts the studies [26,23] where there is no statistically significant found difference across grade level. On the other hand, the result of this study is supported by the previous studies conducted by researchers such as Memnun and Akkaya [27]) wherein they found that the 4th year and 2nd year pre-service teachers' metacognitive awareness level are higher than of the 1st year. Also, the metacognitive awareness levels of senior pre-service teachers were found higher than sophomores in the study [28]. There is a significant difference between students' metacognitive awareness and year level [29], same result was found in the study [16].

4. Conclusion

The objective of this study is to determine the pre-service teachers' metacognitive awareness levels and examine if there are significant differences among the metacognitive awareness levels when they are grouped according to gender and year level. Based on the total mean score, the result demonstrates that pre-service teachers have high levels of metacognitive awareness. The pre-service teachers' mean scores for the main components were high for both knowledges of cognition and regulation of cognition. When the sub-components were taken into consideration, it was revealed that conditional knowledge had higher mean scores than procedural and declarative knowledge. Based on the findings, pre-service teachers' knowledge of strategies and methods is lower than their understanding of when and why to apply particular strategies or approaches. The information management techniques component of the regulation of cognition yielded the greatest mean score, while planning produced the lowest mean score. This finding suggests that pre-service teachers are more capable of controlling the sequence of skills and strategies used to process information successfully than they are at selecting the appropriate techniques and identifying cognitive skills. The difference in the levels of pre-service teachers' metacognitive awareness and their gender is statistically significant. The results also demonstrate that while there is no differentiation in the knowledge of cognition, there is in the regulation of cognition. Procedural knowledge and conditional knowledge showed statistically significant differences when the sub-components were evaluated. Statistically significant differences were also found in comprehension monitoring, debugging strategies, and evaluation. When the metacognitive awareness levels of pre-service teachers and year level were inspected to look for differences, there was a statistically significant difference found. Based on this, it can be expressed that 4th year pre-service teachers' metacognitive awareness was higher than the 1st year. There are no differences in knowledge of cognition, but there are in the regulation of cognition. Additionally, a statistically significant difference was found in comprehension monitoring and evaluation when the sub-components were further examined.

Compliance with ethical standards

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Disclosure of conflict of interest

There is no conflict of interest.

Statement of informed consent

Informed consent was obtained from all the individual participants in this study.

References

[1] Flavell JH. Metacognitive aspects of problem-solving. The nature of intelligence. 1976.

[2] Stanton JD, Neider XN, Gallegos IJ, Clark NC. Differences in metacognitive regulation in introductory biology students: when prompts are not enough. CBE—Life Sciences Education. 2015 Jun 1, 14(2):ar15.

[3] Bogdanović I, Obadović DŽ, Cvjetićanin S, Segedinac M, Budić S. Students' metacognitive awareness and physics learning efficiency and correlation between them. European Journal of Physics Education. 2017 Feb 23, 6(2):18-30.

[4] Brown AL. Metacognition, executive control, self-regulation, and other more mysterious mechanisms. Metacognition, motivation, and understanding. 1987:65-116.

[5] Schraw G, Dennison RS. Assessing metacognitive awareness. Contemporary educational psychology. 1994 Oct 1, 19(4):460-75.

[6] Schraw G, Olafson L, Weibel M, Sewing D. Metacognitive knowledge and field-based science learning in an outdoor environmental education program. Metacognition in science education: Trends in current research. 2012:57-77.

[7] Schraw G. Promoting general metacognitive awareness. Instructional science. 1998 Mar, 26(1-2):113-25.

[8] Sperling RA, Howard BC, Staley R, DuBois N. Metacognition and self-regulated learning constructs. Educational research and evaluation. 2004 Apr 1, 10(2):117-39.

[9] Thomas GP, McRobbie CJ. Using a metaphor for learning to improve students' metacognition in the chemistry classroom. Journal of Research in Science Teaching: The Official Journal of the National Association for Research in Science Teaching. 2001 Feb, 38(2):222-59.

[10] Gassner L. Developing metacognitive awareness: A modified model of a problem based learning-tutorial. Malmö: Malmö University electronic publishing. 2009 June.

[11] Tongco AA, Fajardo MT. 5e instructional model in blended learning platform: effects on achievement and attitude of high school students in chemistry. Sci.Int.(Lahore).2019, 31(6),947-950.

[12] Lee Y, Choi J, Kim T. Discriminating factors between completers of and dropouts from online learning courses. British Journal of Educational Technology. 2013 Mar, 44(2):328-37.

[13] Karatas K, Arpaci I. The role of self-directed learning, metacognition, and 21st century skills predicting the readiness for online learning. Contemporary Educational Technology. 2021, 13(3).

[14] Akben N. Effects of the problem-posing approach on students' problem solving skills and metacognitive awareness in science education. Research in Science Education. 2020 Jun, 50(3):1143-65.

[15] Dumford AD, Miller AL. Online learning in higher education: exploring advantages and disadvantages for engagement. Journal of computing in higher education. 2018 Dec, 30:452-65.

[16] Koc, I. & Kuvac, M. (2016, August). Preservice teachers' metacognitive awareness levels. European Journal of Education Studies.

[17] Cohen L, Manion L. The interview. Cohen L. & Manion L. Reseacrh Methods in Education: Fourth Edition, London: Routledge. 1994.

[18] Akin A, Abaci R, Cetin B. The validity and reliability of the Turkish version of the metacognitive awareness inventory. Kuram ve uygulamada egitim bilimleri. 2007 May 1, 7(2):671.

[19] Young A, Fry JD. Metacognitive awareness and academic achievement in college students. Journal of the Scholarship of Teaching and Learning. 2008 May, 8(2):1-0.

[20] Alkan F, Erdem E. The relationship between metacognitive awareness, teacher self-efficacy and chemistry competency perceptions. Procedia-Social and Behavioral Sciences. 2014 Aug 14, 143:778-83.

[21] Veloo A, Rani MA, Krishnasamy HN. The role of gender in the use of metacognitive awareness reading strategies among biology students. Asian Social Science. 2014, 11(1):67-73.

[22] Pahayahay G, Cisneros-Pahayahay M. Assessment of Students' Metacognitive Awareness Level in College Algebra. Advanced Science Letters. 2017 Feb 1, 23(2):1130-3.

[23] Limueco J, Prudente M. Predicting progression trends of scientific reasoning skills and metacognitive awareness among secondary level students. In DLSU Research Congress, Manila, June 2018 (pp. 20-22).

[24] Pajares F, Valiante G. Students'self-efficacy in their self-regulated learning strategies: a developmental perspective. Psychologia. 2002, 45(4):211-21.

[25] Liliana C, Lavinia H. Gender differences in metacognitive skills. A study of the 8th grade pupils in Romania. Procedia-Social and Behavioral Sciences. 2011 Jan 1, 29:396-401.

[26] Sapanci A, Güler A. The Mediating Role of Metacognitive Processes in the Relationship between Personality Traits and Academic Achievement of University Students. Sakarya University Journal of Education., 11(3):501-25.

[27] Memnun DS, Hart LC, Akkaya R. A research on the mathematical problem solving beliefs of mathematics, science and elementary pre-service teachers in Turkey in terms of different variables. International Journal of Humanities and Social Science. 2012, 2(24):172-84.

[28] Ozsoy G, Gunindi Y. Prospective preschool teachers' metacognitive awareness. Elementary Education Online. 2011;10(2):430-40.

[29] Baltaci S, Yildiz A, Özcakir B. The Relationship between Metacognitive Awareness Levels, Learning Styles, Genders and Mathematics Grades of Fifth Graders. Journal of Education and Learning. 2016, 5(4):78-89.