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The Role of Metacognitive Strategies in Academic Writing Skills in Higher Education

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Abstract. Many students still experience difficulty with academic writing as part of meeting their academic demands. The purpose of this study was to test the validity of the metacognitive writing strategy instrument and to test the effectiveness of metacognitive writing strategies in improving academic writing skills in tertiary institutions. In total, 500 students from three universities in West Java, Indonesia participated in this study. The method used in this research was factorial design analysis. Confirmatory factor analysis was used to answer the problem formulation. The data collection instruments used were the metacognitive academic writing strategy questionnaire and academic writing tests on several topics. The research findings show that, first, the questionnaire instrument using metacognitive strategies in the writing process was proven to be valid because it was able to assess the students' metacognitive awareness. Second, metacognitive strategies make a significant contribution to the students' academic writing abilities. Metacognitive strategies act as high-level constructs and positive correlations were found between the dimensions of the strategies. The dimensions of metacognition found to correlate with and contribute to one another were the declarative, procedural, conditional, planning, monitoring, evaluation, information management, and debugging strategies. From the comparison of the proposed models, the second model (the eight-component correlation model) was determined to be better at improving academic writing ability than the first model. The second model described all components as significantly contributing more comprehensively than the first model. This research concludes with the implication that academic writing ability can be improved by increasing students' metacognitive awareness and reflective abilities in relation to their own writing process.

Keywords: academic writing skills; higher education; language learning; metacognitive strategies

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1. Introduction

Students are not only required to study; they are also required to produce academic writing. Academic writing skills demand multidimensional abilities. Not only are language skills needed in such a form of writing, but the students are also required to be able to develop and organize their ideas into their writing (Guo, 2022; Hancock & Karakok, 2021). However, this demand is not often accompanied by a strategy that can improve their academic writing skills when in the tertiary environment. Academic writing skills are of concern to educational practitioners, especially students, lecturers, and researchers, due to the importance of communicating their ideas through writing. Each writer engages in a different strategy when writing, as each individual's writing style is different. However, academic writing is not the same as literary writing, because there are academic requirements that must be met (Dirrigl & Noe, 2019; Keith et al., 2020). Thus, academic writing skills need to be taught correctly using the right strategies in universities. The teaching of writing skills receives attention only in language study programs in tertiary institutions, yet there are not many of these programs. It is therefore not surprising that there are still many students who attend training outside the classroom in order to meet the demands of academic writing.

In language teaching, teachers or lecturers pay too much attention to grammar material and often forget to pay attention to aspects of language skills, such as writing, speaking, reading, and listening (Henry & Austin, 2021; Kim & LaBianca, 2018). Self-regulation in writing skills is a very important aspect that is a part of predicting a student's academic writing ability. Based on self-regulation among students who are still lacking metacognitive abilities, self-regulation and writing skills require metacognitive strategies to help students attain good writing skills. One alternative when teaching academic writing is to provide writing instructions oriented towards the processes and trends of academic writing in tertiary institutions (Cutri et al., 2021; Wale & Bogale, 2021). These instructions can be used as a modification of the standard academic writing teaching instructions. Writing academically is a skill that requires complex cognition and stages such as planning, transcription, and revision (Khojasteh et al., 2021; Saqr et al., 2021). Academic writing skills are taught by inviting the students to engage in the writing process using metacognitive strategies. However, students may face obstacles when trying to achieve these goals. The development of the student's academic writing skills depends on their ability to understand, plan, and determine the writing goals and to reflect on the results of their writing to improve the quality of their writing overall (Farahian & Avarzamani, 2018; Teng, 2022).

This research differs from previous research in that previous research has not explored metacognitive strategies in the context of academic writing, especially at the tertiary level. In addition, previous research has not yet explored its relationship with the other dimensions in metacognition that also contribute to writing ability. The findings of this study can facilitate the understanding of students in the metacognitive strategies of academic writing. Teachers can obtain an overview of alternative academic writing strategy instructions. In addition, this research can enable the determination of the potential transfer of educational psychology theory such as self-regulation from the aspect of metacognition to the

pedagogy of academic writing skills. Accordingly, this metacognition functions as a determining aspect in improving the quality of writing skills. The objectives of this study were to:

1. empirically validate the questionnaire instrument on metacognitive strategies for academic writing and
2. investigate the effect of metacognitive strategies on students' academic writing abilities in tertiary institutions.

This research focused on exploring the relationship between the dimensions in metacognitive strategies and academic writing. In this research, we propose two structural models for use when analyzing the relationship between the dimensions in metacognitive strategies and academic writing skills. The first model is a model that describes the cognitive strategies that are correlated with the eight aspects of academic writing. The second model is a second-order one-factor model that investigates the role of metacognitive strategies in academic writing. The second model is a type of competitive hierarchical model. Based on the second model, metacognition is defined as a general factor that explains the relationship of the eight components in the metacognitive strategy.

2. Literature Review

2.1 Metacognition

Metacognition is a multidimensional and general domain ability. Metacognitive ability was originally developed from the theory of thought approach (Cutri et al., 2021; Khojasteh et al., 2021). Theory of mind is the basis for developing metacognitive abilities. Metacognitive abilities can compensate for lacking abilities using the domain of knowledge and self-regulation, enabling individuals to improve their cognitive abilities (Gioia et al., 2023; Phillips Galloway et al., 2020). Metacognition can be defined as the ability to think as well as the executive processes that are used to optimize cognitive abilities as learners. Metacognition has two functions, namely the evaluation function and the control function. Through the metacognitive ability, the supervisory function and the control function are carried out. This metacognitive knowledge and experience can be used as a form of cognitive control. The individual's level of knowledge depends on their cognitive processes and other factors, including age, talent, language skills, and motivation, which greatly influence academic ability (Khojasteh et al., 2021; Saqr et al., 2021). The level of knowledge possessed by individuals includes task knowledge and strategy knowledge. Task knowledge is an individual's understanding of the nature and objectives of the task, while strategic knowledge includes the knowledge of how to complete the task effectively. Metacognitive knowledge consists of several types of knowledge, including declarative knowledge, procedural knowledge, and conditional knowledge.

Factors that refer to declarative knowledge are individual, intellectual, and information-processing abilities. Procedural knowledge is the ability of individuals to apply their knowledge when using the right strategy. This knowledge helps the individual in using the strategy at the appropriate time and in relation to the right task (Lamb et al., 2019; Roald et al., 2021). Metacognitive experience is the ability to use previously acquired knowledge to process newly

received tasks or information. Metacognitive experiences involve several aspects, including evaluation, effort, solutions, difficult tasks, familiar tasks, and self-confidence (Hadianto et al., 2022; Yung & Cai, 2020). This metacognitive experience forms a tool that individuals can use to increase their awareness when completing tasks properly. Furthermore, metacognitive feelings can be used as an aspect of self-regulation (Sarid et al., 2021; Teng, 2020). Metacognitive abilities are defined as metacognitive strategies or metacognitive regulations, which include planning, problem-solving, error-checking, and controlling for obstacles (Hadianto et al., 2021a; Teng, 2022).

In light of the above, metacognition consists of two important factors. First, metacognition consists of monitoring and controlling cognitive functions. Second, the systems contained in metacognition include dominance relations. The metacognitive system facilitates the absorption of information, and the absorption of this information is what causes the difference between individual control and monitoring abilities. The stages that are involved in the ability to control and monitor are acquisition, retention, and retrieval (Gioia et al., 2023; Wale & Bogale, 2021). Therefore, metacognition is the individual awareness when managing the process of monitoring and controlling when doing tasks. The ability to reflect is the ability to combine planning and monitoring as well as assessing whether there are parts that are less than optimal or that have met the criteria. Thus, metacognitive ability is a person's ability as seen from various aspects, namely knowledge, experience, and skills. The three components of knowledge, experience, and metacognitive skills are always related to and influence each other when students are engaged in tasks. For example, the student's knowledge contributes to their metacognitive experiences, feelings, and ability to evaluate their writing skills; in the end, then, the results of the assessment influence the use of metacognitive strategies to support their writing skills for the better (Navarro et al., 2022; Perry et al., 2019).

2.2 Metacognition, Self-Regulation, and Writing Skills

Metacognition is the same as the individual's ability of self-regulation in learning or also called self-regulated learning (SRL). In its application, SRL uses three aspects of regulation simultaneously, specifically personal, behavioral, and environmental. Self-regulation is an individual's ability to use cognitive and affective strategies to anticipate anxiety in the learning process (Henry & Austin, 2021; Kim & LaBianca, 2018). In addition, self-regulation includes an individual's adaptive abilities when using individual motor skills strategies. Self-regulation requires the adaptive ability to use strategies that are appropriate to the context of the task. If the individual is able to maintain strategic control over these three aspects of regulation, they already have good metacognitive abilities. The components of SRL, namely personal processes, environment, and behavior, all help with understanding information, setting goals, using strategies, and evaluating and modifying appropriate strategies so that students can optimally understand the learning material (Alfaifi, 2022; Davies & Greenwood, 2020). Individuals who have good self-regulation abilities can use different metacognitive strategies to control and optimize their potential and environment in order to support their learning process. Such individuals are able to optimize

their internal abilities and external environment as resources to support their learning. This self-regulation of students' learning can be explained as their ability to plan, monitor, and control their abilities during learning by optimizing their thoughts, feelings, and actions. The SRL strategy is also believed to be able to improve individual cognitive, metacognitive, behavioral, and motivational regulation (Hall et al., 2018; Keith et al., 2020).

This metacognitive strategy can help students in conveying ideas in their writing. Several previous studies have confirmed that metacognition and self-regulation contribute to the quality of student writing. The instructions contained in metacognition have an influence on the student's academic writing skills while also contributing to the writing quality. Other findings in the context of second language learning show that this metacognitive strategy can improve and change the student's beliefs and perceptions of writing activities and optimize their participation in the writing process, both individually and collaboratively (Cutri et al., 2021; Wale & Bogale, 2021). These findings are in accordance with the theory that metacognitive strategies in the writing process are related to the student's self-efficacy beliefs. Students who have superior language skills will make a positive contribution to their metacognitive knowledge and writing abilities. From the previous findings, it was found that this metacognitive strategy consists of a feedback guide and a guide to understanding one's own abilities. Research was conducted on 200 students in Korea to investigate the effect of metacognition on writing quality (Farahian & Avarzamani, 2018; Teng, 2022). It was found that metacognitive awareness helped students in controlling their abilities and maintaining them at a high level throughout their writing process. With metacognitive awareness, students can thus maintain the quality of their writing process so that it remains at the highest level from the planning stage to the final revision stage.

2.3 Language Learning Strategies, Self-Regulated Learning, and Metacognition

Learning strategies are defined as methods used to improve cognitive abilities to achieve the established learning goals. Learning strategy is also referred to as a tool that assists students to develop their academic abilities. Learning strategies cover several aspects, ranging from determining the right technique, selecting the materials, allocating time, and creating an atmosphere and clear learning climate, all of which are intended to help students achieve their learning goals. The learning strategy cannot be separated from SRL, because by using learning strategies, teachers and students can control the processing of knowledge material and information so that student understanding is optimal (Festas et al., 2022; Santelmann et al., 2018). The learning strategy in the context of language learning is initially to analyze the character and behavior of the learner in order to determine the most effective strategy. Through the right strategy, language learners will be able to confirm new information using their existing schemata to build more complex structures. The learning strategy used by these students is one of the characteristics of beginner and expert learners. This is explained in metacognitive theory, stating that the majority of effective learners will use metacognitive strategies by planning, organizing, and assessing, which will assist the learners in controlling the executive functions in their learning. Language

learners who are already reliable also use cognitive strategies to carry out analysis, reason, and transfer and infer information in order to effectively achieve their learning goals (Saqr et al., 2021; Wale & Bogale, 2021). Learning strategies contribute to the process and interaction of the social and psychological aspects of language learning.

Recently, researchers have paid attention to individual writing strategies and their potential in relation to students' writing skills. In agreement with findings of previous research, developing an assessment of writing strategies enables one to determine more about the strengths and weaknesses of said writing strategies (Gioia et al., 2023; Wang & Xie, 2022). The assessment included several aspects, namely cognition, metacognition, behavior, and the regulation of motivation. These dimensions include seven interconnected strategies: understanding text, planning, monitoring, assessing, providing feedback, controlling effective writing, and motivation. These are all factors that significantly contribute to writing skills. In addition to the metacognitive strategies involved in the writing process, there are other aspects that contribute to writing skills, namely metacognitive knowledge and experience. Knowledge and regulations also contribute up to 65% of students' writing abilities (Perry et al., 2019; Wale & Bogale, 2021). The current study investigated the relationship between metacognition and writing ability. These aspects were explored, as they have not been studied previously. Due to the limited research exploring academic writing, this study explored the dimensions involved in the metacognitive strategies of academic writing and investigated their role in improving academic writing skills.

3. Methodology

3.1 Research Design

This study used factorial design analysis to examine the correlation between various dimensions of metacognitive strategies and their role in academic writing ability. Confirmatory factor analysis was used to address the research problem. The research findings show that the questionnaire instrument using metacognitive strategies in the writing process was proven to be valid, because it was able to assess the students' metacognitive awareness.

3.2 Participants

This research involved 500 university students from West Java, Indonesia. Concerning gender, 60% of the participants were female and 40% male. The average age of the study participants was 22. The participants were in the third to seventh semester range. To test the validity of the writing strategy questionnaire with metacognition, the participants completed the questionnaire to meet the needs of the missing value analysis, homogeneity test, and normality test. This research was conducted on students who had received training in writing using metacognitive strategies that we developed. Furthermore, a survey on the use of metacognitive strategies in academic writing was conducted to determine the validity of the questionnaire developed and to elucidate the role of metacognitive strategies in the students' academic writing abilities. To maintain adherence to research ethics, the participants completed a form on their willingness to participate in the study voluntarily.

3.3 Research Instrument

3.3.1 Questionnaire development

The development of the metacognitive strategy questionnaire was carried out through five stages, including the creation of the questionnaire items, consultation references, trials, a psychometric assessment, and exploratory factor analysis. The questionnaire development was carried out by adapting the metacognitive strategy model (Henry & Austin, 2021; Kim & LaBianca, 2018). The development of the questionnaire was carried out to facilitate the students' reflection on the writing strategy training activities that they received. The questionnaire contained questions related to the role of metacognition in academic writing practice. Questionnaire items which involved the students in the process were developed to improve the quality of the assessment of the questionnaire. For the elaboration of the participant identities and training descriptions as well as the strategies used by the students, 25 questionnaire items were formulated to reveal these aspects. Next, the student responses were analyzed and transcribed to produce 65 items that revealed the metacognitive strategies used in academic writing. The next stage was to confirm the items with the relevant literature. The literature used focused on SRL and metacognitive learning strategies in language learning. We confirmed that all items were created with metacognition and self-regulation theory in mind. The second stage was the validation of the questionnaire item constructs using an appropriate theory. The third stage was the trials. We provided opportunities for the students to check the items that had been produced, specifically whether there were items that were ambiguous. Next, the evaluation stage comprised using a psychometric assessment. In this stage, we involved two experts in the field of language learning strategies to verify the questionnaire items. The experts assessed the questionnaire in terms of the suitability of the items with the construction. Based on the results of the expert analysis, we eliminated three items that did not meet the assessment criteria.

The final stage was exploratory factor analysis. This analysis was carried out on a sample of the participants who responded to the questionnaire. Based on the results of the factor analysis, we eliminated five items whose factor loading value was less than 0.35. From all stages, 57 items (65 - 8) met the minimum case ratio criteria (5:1). In addition, the participants involved in this study met the criteria of linearity, singularity, and homogeneity. A Likert scale was used with a seven-point scale ranging from strongly disagree to strongly agree. This scale helped the students to understand the features demonstrating the nature of writing-training strategies. The metacognitive academic writing strategy questionnaire instrument is a tool used to make it easier for students to convey metacognitive experiences. The questionnaire covers two aspects in general, namely metacognitive knowledge and metacognitive regulation. Metacognitive knowledge consists of several types of knowledge, namely declarative, procedural, and conditional knowledge, while metacognitive regulation consists of five aspects, namely planning, monitoring, information management, debugging, and evaluation. Cronbach alpha analysis was used to verify the internal consistency of the responses to the questionnaire items. The Cronbach alpha values for declarative, procedural, and conditional knowledge were 0.788, 0.795, and 0.740, respectively, while the Cronbach alpha values for the aspects of planning, monitoring,

assessment, debugging, and information management were 0.810, 0.830, 0.882, 0.820, and 0.812, respectively.

3.3.2 *Academic writing ability test*

The students' academic writing ability was carried out in relation to several aspects, such as topic understanding, attention to detail, providing an overview of the problems, and arguing to strengthen their ideas based on knowledge. The academic writing ability test focused on assessing academic writing skills in terms of linguistics, critical thinking skills, and expressing ideas. Through this test, the students were asked to write conceptual articles according to their area of expertise. This was facilitated using pictures to make it easier for students to choose a topic and develop their ideas. Several topics were provided that represented each field of the student study program. Topics given included health, contemporary buildings, slang phenomena, social welfare, culinary arts, and politics. The assessment of the students' academic writing involved assessment aspects adopted from writing assessments in tertiary institutions, such as suitability according to the theme, coherence, cohesion, use of meaning, and grammar. The Cronbach alpha test on the four aspects of the assessment yielded values in the range of 0.820–0.880, indicating that the assessment aspects met the reliability criteria. To maintain the validity of the assessment, we involved experts in the field of writing skills so that the assessment could be accurate. The maximum score for assessing academic writing skills was 20 points, with 5 points for each aspect. Differences in judgment that arose from the experts were discussed and decisions were made based on the majority. Interrater reliability was in the range of 0.75–0.80.

3.4 Procedure

The metacognitive academic writing strategies questionnaire was administered to the students online after they had participated in academic writing training activities using metacognitive strategies. The survey was conducted to reflect on the use of the academic writing strategies that had been followed. Completion of the questionnaire was not limited by time, so the students could take care in completing it. On average, the students took 20 minutes to complete the questionnaire. An academic writing test was carried out after the students had received writing training on the use of metacognitive strategies. The academic writing test was done manually and was handwritten.

3.5 Data Analysis

Data analysis was performed using confirmatory factor analysis. AMOS SPSS software was used to test the theoretical model, inclusive of confirmation factor tests, correlation tests, covariance tests, and residual values or errors. The model used involved a hypothesis using the maximum estimate. The model was also assessed using goodness-of-fit (GFI) statistics and the study sample. This study was based on confirmatory analysis and omnibus fit, which included other statistical analyses, such as chi-square, *p*-value, chi-square ratio χ^2 , degrees of freedom (df), root mean square error of approximation (RMSEA), comparative fit index (CFI), standardized root mean square residual (SRMR), and the Tucker-Lewis Index (TLI). The fit model used in this study had to meet several criteria, namely a GFI value of more than 0.91, an RMSEA value of less than 0.1,

an SRMR value of less than 0.08, and CFI and TLI values equal to or greater than 0.90. The chi-square statistic was used to determine the relevant structural model. Chi-square difference was used to determine the ratio of the difference df. Furthermore, the significance of the p -value was determined to be a more appropriate reference model criterion. The final step was to evaluate the effect of the various dimensions of metacognitive academic writing strategies on the students' academic writing abilities. Linear regression analysis was also used to determine the extent to which the different strategies contributed to the students' academic writing abilities.

4. Results

4.1 Descriptive Statistics and Normality Test

From the results of the descriptive analysis, the average score of the metacognitive strategy dimensions was in the range of 4.24–4.90, with standard deviation in the range of 0.97–1.10. Furthermore, skewness values were obtained in the range of -0.015–0.180 and the kurtosis values were in the range of 0.167–0.630. From the results of the statistical analysis, the data met the normality test criteria. The results of the descriptive statistical analysis described are presented in Table 1.

Table 1: Results of the descriptive statistics and normality test of dimension

Dimension	Metacognitive writing dimension	M	SD	Skewness	Kurtosis
Metacognitive knowledge	DK (6 items)	4.90	1.04	-.015	.530
	PK (5 items)	4.70	1.06	.015	.593
	CK (5 items)	4.52	0.99	.180	.635
Metacognitive regulation	P (9 items)	4.50	1.12	.065	.520
	M (7 items)	4.55	0.98	-.015	.489
	E (8 items)	4.71	1.03	.040	.491
	IMS (7 items)	4.30	1.08	.151	.172
	DS (10 items)	4.32	1.10	.093	.258

Note: declarative knowledge (DK), procedural knowledge (PK), conditional knowledge (CK), planning (P), monitoring (M), evaluation (E), information management strategy (IMS), debugging strategy (DS)

4.2 Exploratory Confirmatory Analysis Results

Exploratory confirmatory analysis uses a benchmark value that must be higher than 0.50 as a condition that the influence between the variables meets the criteria or is acceptable. From the results of the exploratory confirmatory analysis, it was found that the relationship between the variables in the metacognitive strategy was still related. Model fit analysis with the data was performed to check for acceptable model fit.

The results of the model fit analysis are presented in Table 2. The results show that the model fit meets the criteria ($\chi^2_{664} = 2489.142$; $df = 840$; $p < .001$; $\chi^2/df = 2.961$; $GFI = 0.923$; $RMSEA = 0.060$; $SRMR = 0.061$; $CFI = 0.920$; $TLI = 0.921$). The results of this analysis prove that the internal structure of the construct meets the validity criteria.

Table 2: Results of the analysis of the fit index of the two models

Model fit index	χ^2	df	<i>p</i>	χ^2/df	GFI	RMS EA	SRMR	CFI	TLI	NFI
Criterion	-	-	< .05	< 3	> 0.9	< 0.10	< 0.08	≥ 0.9	≥ 0.9	> 0.9
Model 1 value	2489.142	840	.000	2.961	0.923	0.060	0.061	0.920	0.921	0.880
Criterion	-	-	< .05	< 3	> 0.9	< 0.10	< 0.08	≥ 0.9	≥ 0.9	> 0.9
Model 2 value	2610.475	860	.000	2.955	0.920	0.058	0.060	0.912	0.910	0.814

Next, an analysis was carried out focusing on the second-order model with one factor. The correlation coefficient of the eight strategies was in the range of 0.72–0.80. This value indicates that the internal structure contained in the questionnaire meets the criteria. From the results of the analysis, it was found that the standard estimated weight of more than 0.50 confirmed that the given effect met the criteria. In addition, the results of the analysis confirmed that metacognition is a general factor and includes eight different aspects, in addition to there being a positive correlation between the variables. Fit analysis was then performed on the second model, as presented in Table 2. From the results of the model fit analysis, the following results were obtained: $\chi^2_{664} = 2610.475$; $df = 860$; $p < 0.001$; $\chi^2/df = 2.955$; $GFI = 0.920$; $RMSEA = 0.058$; $SRMR = 0.060$; $CFI = 0.912$; $TLI = 0.910$). Based on the results of the analysis of the second model, the model meets the criteria of conformity with the data. A comparison of the two models was carried out to determine which model was the most significant. A significant increase was shown from model 1 to model 2. The two models also had chi-square values that differed significantly ($\chi^2[M2] - \chi^2[M1] = 135.42$; $df[M2] - df[M1] = 25$; $p < 0.001$). It can be concluded that the second model increases academic writing skills more significantly than the first model. The second model confirms that metacognition is a hierarchical construction that includes eight metacognitive strategies.

4.3 The Effect of Metacognitive Strategies on Academic Writing Skills

Correlation analysis between the metacognitive components was carried out to determine the role of the eight metacognitive strategy components in academic writing ability. The results of the correlation analysis are presented in Table 3.

Table 3: Correlation analysis results of the eight strategy components

	DK	PK	CK	P	M	E	IMS	DS
DK	1							
PK	0.670	1						
CK	0.589	0.675	1					
P	0.610	0.702	0.710	1				
M	0.620	0.699	0.730	0.750	1			
E	0.681	0.730	0.750	0.710	0.780	1		
IMS	0.515	0.580	0.670	0.690	0.75	0.641	1	
DS	0.532	0.600	0.690	0.640	0.670	0.630	0.700	1

Note: declarative knowledge (DK), procedural knowledge (PK), conditional knowledge (CK), planning (P), monitoring (M), evaluation (E), information management strategy (IMS), debugging strategy (DS)

It was found that the declarative knowledge component has a strong correlation with the procedural knowledge component ($r = 0.670$), and with conditional knowledge ($r = 0.589$), planning ($r = 0.610$), monitoring ($r = 0.620$), evaluation ($r = 0.681$), information management strategy ($r = 0.515$), and debugging strategy ($r = 0.532$). All the correlation values are more than 0.50, which indicates that at least 25% of the variance of one component is contained in the other components. To strengthen the correlation analysis, the data from the results of the regression analysis are presented which contain the correlation between each strategy and academic writing ability, as presented in Table 5 below. Furthermore, the correlation coefficient results presented in Table 4 show that each strategy has a significant correlation with academic writing ability, with the p -values all being above 0.001.

Table 4: Correlation analysis of strategies and academic writing skills

Strategy component	Academic writing ability
DK	0.731**
PK	0.780**
CK	0.812**
P	0.801**
M	0.830**
E	0.830**
IMS	0.762**
DS	0.755**

Note: declarative knowledge (DK), procedural knowledge (PK), conditional knowledge (CK), planning (P), monitoring (M), evaluation (E), information management strategy (IMS), debugging strategy (DS)

* $p < .05$, ** $p < .01$

The results in Table 4 describe in detail the correlation between the eight strategies and academic writing skills. From the results of the analysis, it was found that academic writing ability has a strong correlation with the components of declarative knowledge ($r = 0.731$), procedural knowledge ($r = 0.780$), conditional knowledge ($r = 0.812$), planning ($r = 0.801$), monitoring ($r = 0.830$), evaluation ($r = 0.830$), information management strategy ($r = 0.762$), and debugging strategy ($r = 0.755$).

The last analysis conducted was regression analysis, which is presented in Table 5. From the regression analysis, it was found that the eight components in the metacognitive strategy explained 88% of the variance of the students' academic writing ability scores. This confirms that the eight components of metacognitive strategies are a significant predictor of academic writing ability ($p < 0.001$).

Table 5. Results of linear regression (N = 500)

	Unstandardized coefficient		Standardized coefficient	t	p	Variance inflation factor	R2	Adjusted R2	F
	B	Std. E							
Constant	1.520	0.282	-	5.488	.000**	-	0.87	0.868	529.666***
DK	0.098	0.016	0.135	7.310	.000**	3.267			
PK	0.113	0.020	0.140	6.576	.000**	3.846			
CK	0.120	0.025	0.135	6.256	.000**	4.254			
P	0.073	0.015	0.130	5.945	.000**	4.100			
M	0.097	0.018	0.161	6.625	.000**	4.783			
E	0.090	0.015	0.180	7.584	.000**	4.756			
IMS	0.090	0.016	0.140	6.70	.000**	2.658			
DS	0.092	0.015	0.140	7.254	.000**	2.500			

Note: declarative knowledge (DK), procedural knowledge (PK), conditional knowledge (CK), planning (P), monitoring (M), evaluation (E), information management strategy (IMS), debugging strategy (DS)

5. Discussion

The purpose of the current research was, first, to validate the questionnaire instrument reporting on academic writing strategies and to then investigate the role of metacognitive strategies in relation to academic writing skills. The development of the questionnaire instrument was carried out based on the features of metacognition. The results of this study show that the utility of the questionnaire instrument is satisfactory and that it meets the criteria for use when reflecting on the use of metacognitive strategies in academic writing in tertiary institutions. The eight components of metacognitive strategies are different but correlated. The eight components can also be used on a theoretical and empirical basis. Furthermore, upon examining the results of the proposed model comparison analysis between the first model (second-order one-factor model) and the second model (eight-component correlation model), it was found that the fit index of the second model was better than that of the first model. The findings of this study reinforce that metacognition can be used as a theoretical basis, thus explaining how the eight components of metacognitive strategies are significantly correlated with academic writing competence (Festas et al., 2022; Miller et al., 2018). This is also consistent with previous studies which confirm that metacognition consists of an ordered structure and can be used to predict learning strategies (Levrai & Bolster, 2019; Lonka et al., 2019). This study also confirms that metacognition theory is always related to the eight components of metacognitive strategies. These eight components are interconnected during the metacognitive process. The findings of this study are also consistent with the theory that metacognition is a cyclical process that includes self-assessment and the management of cognition (McNamara et al., 2018; Miller et al., 2018).

The eight components in metacognition refer to two factors from metacognitive strategies, namely knowledge and regulation. The components of the metacognitive knowledge dimension include declarative, procedural, conditional, and task knowledge, strategies, and the students' own efforts. The metacognitive regulatory component includes planning, monitoring, and assessing, which define the role of regulation in SRL (Henry & Austin, 2021; Kim & LaBianca, 2018). This study confirms that there is a significant and positive correlation between metacognitive strategies and metacognitive regulation. The strong correlation between the two variables reinforces that students need to implement a report that is qualified in terms of knowledge, metacognitive strategies, skills, and regulations when participating in learning. This is consistent with the theory which states that knowledge and regulatory strategies are able to optimize cognitive use, increase student effort, and help students in completing their academic assignments (Dirrigl & Noe, 2019; Phillips Galloway et al., 2020). Knowledge and regulations, which have a positive relationship, strengthen the theory that this metacognition can be used as a tool to understand one's own cognition and that of other individuals. This metacognition can be used as a guide when looking to understand data and conditions, enabling the right decisions to be made (Wale & Bogale, 2021; Wang & Xie, 2022). A conclusion from this research is that this metacognitive strategy develops the ability of students to become independent learners by developing their academic writing skills as well as increasing their social competence and motivation, and controlling student behavior during the writing process.

To answer the second research objective of determining the role of metacognitive strategies in academic writing skills, results show that each of the eight components of metacognitive strategies correlated significantly with the students' academic writing abilities. It was found that 88% of the variance could be explained by metacognitive strategies in connection to academic writing ability. In addition, the findings also validate that the second-order one-factor model can be used to construct academic writing skills. The research results also support the cognition model of Flower and Hayes (1980), which integrates the planning, monitoring, and evaluation components of the writing process. In addition, the findings of this study are also consistent with the triadic components of personal, behavioral, and environmental effects on self-regulation (Farahian & Avarzamani, 2018; Festas et al., 2022). Writing academically requires the ability to adjust cognitive and other strategies that are relevant to the task so that the results are optimal. This is consistent with the theory that in addition to strong field knowledge in academic writing, metacognitive knowledge is also needed to control the writing process and use strategies appropriately (Yoo, 2019).

In more detail, this study found that there are several dimensions that are most significant and thus contribute the most to improving academic writing ability. These dimensions are metacognitive, procedural, declarative, and conditional knowledge. This is in accordance with the theory which states that students can become strategic learners if they have a good third dimension of knowledge (declarative, procedural, and conditional) (Hadianto et al., 2021b; Sanchez et al., 2019). In addition, the findings of this study also reinforce the finding that if a

learner wants to have good academic writing skills, they must have sufficient knowledge about the strategies used, the use of strategies, and the ability to elaborate on good material. Metacognitive knowledge can encourage students' active participation in terms of using their knowledge to support their writing process, enabling them to determine the most appropriate strategies and improving the quality of their writing. Furthermore, the dimensions of metacognitive regulation can predict academic writing ability and have a significant influence on academic writing ability. Metacognitive regulation helps students to become independent and more skilled at academic writing (French, 2020; Hancock & Karakok, 2021). The planning dimension in the metacognitive strategy includes goal setting, timing, and resource planning in academic writing. This study proves that metacognitive strategies enable students to become more capable of planning and organizing their thoughts to produce quality conceptual writing (Alfaifi, 2022; Keith et al., 2020). Students who plan to write well will have good metacognitive awareness and be oriented towards the quality of their written work.

6. Conclusion and Implications

The metacognitive strategy dimension has a positive relationship with multiple dimensions and has a significant effect on students' academic writing abilities. The development of a self-reporting questionnaire instrument regarding the use of metacognition proved to be valid and met the criteria for assessing students' metacognitive awareness. Furthermore, the metacognitive strategy of academic writing makes a significant contribution to the students' academic writing abilities. From the comparison of the proposed first model (second-order one-factor model) and second model (eight-component correlation model), it was found that the fit index of the second model was better than that of the first model. This research includes the implications that academic writing ability can be improved through increased metacognitive awareness through metacognitive strategies and the students' reflective abilities towards their own writing process. The contribution of this research includes enabling the production of instruments to examine students' metacognitive abilities in the process of academic writing, helping the students so that they have the ability to reflect when correcting deficiencies and choosing the right strategy. This study also provides knowledge of the components of metacognitive strategies that can support academic writing skills.

7. Limitations and Recommendations

This study had several limitations, including the components in the metacognitive strategy that were not fully analyzed, the dimensions of metacognitive experience from the interviews that were not involved, and self-reporting strategies that may not accurately assess metacognitive awareness. Other limitations were that the research involved a genre of writing that focuses only on one type of writing, namely conceptual articles, and the writing test not being accompanied by other ability measurements that might affect it, such as language proficiency tests. Based on the limitations of this study, we recommend a number of aspects for future research, including expanding on the dimensions of metacognitive strategies so that there are no obstacles to optimizing academic writing skills.

Additionally, qualitative data other than self-reported data are needed to strengthen the assessment of metacognitive awareness and more genres of writing need to be included so that the role of metacognitive strategies can be observed for other types of writing. Furthermore, initial writing ability tests should be carried out along with other ability tests that support academic writing skills so that the assessment of the students' initial abilities is accurate. Despite these limitations, this study is one of the most innovative studies investigating the correlation of metacognition with academic writing skills.

8. References

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