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**MEDIATING EFFECT OF METACOGNITION TOWARDS THE
RELATIONSHIP BETWEEN EMOTION REGULATION AND
SELF-EFFICACY AMONG PRE-SERVICE TEACHERS**

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Abstract:

Pre-service teachers are playing important role in educational transformation. As the front liner in education, self-efficacy to cope with stressful environment is crucial to provide high quality teaching. Metacognition enables pre-service teachers to evaluate own capability rationally. It is an important emotional regulation tool to engage pre-service teacher in cognitive re-appraisal process. This research aims to identify the effect of metacognition towards the relationship between emotion regulation and self-efficacy among pre-service teachers. 238 pre-service teachers from an Institute of Teacher Education responded to Metacognitive Awareness Inventory (MAI), Emotion Regulation Questionnaire (ERQ) and General Self-Efficacy (GSE). Based on the result, there is a significant mediating effect of metacognition towards the association between emotion regulation and self-efficacy. Development in metacognition will strengthen the relationship between emotion regulation and self-efficacy among pre-service teachers.

Keywords:

Metacognition, Emotion Regulation, Self-Efficacy, Pre-Service Teachers

Introduction

In conjunction with the Fourth Industrial Revolution (IR 4.0), innovation of artificial intelligence and human-machine interface deliver a new model in Malaysia educational system (Muhammad et al., 2020). Education 4.0 focuses on developing skills and abilities that cannot be replaced by artificial intelligence (Shahroom & Hussin, 2018). Development of metacognition is crucial in Education 4.0 because the ability to monitor and regulate own thinking cannot be automated (Mohamad et al, 2018). Research among teachers in west Malaysia shows that teachers are low in emotional intelligence. The mean value for emotional intelligences according to Malaysian Emotional Quotient Inventory (MEQI) was 64.36 %. Lack of emotion regulation causes teacher respond passively to negative emotion from job-related stress (Norah, Iskandar, Ridzauddin, 2017). Lack of emotion regulation ability leads to low self-efficacy to deal with stressful working environment. A study was conducted in Malaysia secondary schools to measure teacher's self-efficacy. Result shows that Malaysia teachers have below average self-efficacy ($m=6.43$) compared to the average TSES ($m =7.1$) Researcher explain that respondents were lack of confident to analyse complex teaching task and understand the needs of these tasks (Rahimah, Abu, Ismail & Rashid, 2014). Perceived control over activity induces positive achievement activity. According to Pekrun, positive achievement emotion is positively correlated to self-efficacy. Metacognition facilitates the cognitive appraisal process to obtain perceived control and value over activity (Pekrun R. & Stephens E. J., 2010).

The importance of metacognition is observed in the perceived control and value over activity according to Pekrun's Theory of Control Value of Emotion. However, it is being viewed as intrusive skills and neglected from the teacher preparation. Hence, pre-service teachers failed to understand the influence of metacognition in emotion regulation process and development of self-efficacy. They are not motivated to practice metacognitive skills in teacher preparation because they do not understand the importance of integrate metacognition in learning and teaching (Dike, Mumuni, & Worokwu C., 2017). This situation causes researcher to focus on the impact of metacognition towards pre-service teacher's emotion regulation and self-efficacy. Metacognition empowers pre-service teachers the ability to control own response towards emotional experience while facing difficulties. This promotes their self-efficacy while facing challenges in future teaching profession because they are confident that they can make a different or improvement in difficult situation. Development of regulation in cognition and emotion increases pre-service teachers' internal locus of control. They believe that their fate is determined by themselves instead of external factors. Pre-service teachers with higher internal locus of control are more self-efficacious because they believe that they could control the solve problem process and overcome challenges (Koschmieder & Aljoscha, 2021). Ability to aware and regulate cognition enable pre-service teachers to regulate negative emotion in stressful environment. Emotional regulation adjusts the inductions of pre-service teacher's emotion state. It improves pre-service teachers' self-efficacy because they belief that they are capable to control and change the difficult situation (Koschmieder & Aljoscha, 2021).

The purpose of this research is to examine the relationship between metacognition, emotion regulation, and self-efficacy. Implication of Pekrun's Theory of Control Value of Achievement Emotion is assessed in this research. Hypothesis was developed as "There is significant mediating effect of metacognition on the relationship between emotion regulation and self-efficacy among pre-service teachers."

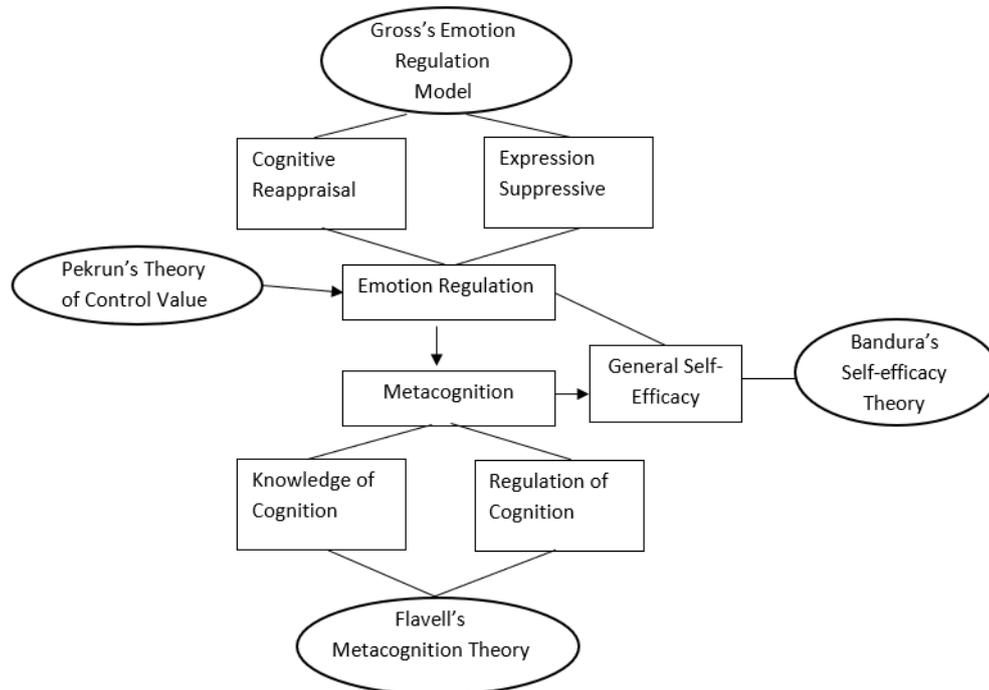


Figure 1: Theoretical Framework

Metacognitive skills are interrelated with emotion regulation and self-efficacy through Control-Value Theory of Achievement Emotion. Declarative knowledge provides pre-service teacher the understanding of self and comprise information from the situation. They reappraisal the emotional experience from declarative knowledge (Flavell J. H., 1979). In related to theory of control value of achievement emotion, pre-service teachers' perception on control and value over achievement activity is facilitated by knowledge of cognition. They examine their cognitive process to obtain the perception. They perceive high control and value on the achievement activity when they can aware and regulate own thinking process. Empowerment of metacognition improve their achievement emotion and self-efficacy to meet the achievement. Conditional knowledge aware pre-service teacher of their own thought while interacting with others. While regulation of cognition monitors individual thought in suppressive expression. It regulates their emotional response towards the environment via suppressing the emotional experience (Flavell J. H., 1979). Procedural knowledge guides pre-service teacher to apply the cognitive reappraisal process more automatically. Pre-service teacher knows the process of re-evaluate the problem and able to apply the skills. Conditional knowledge provides information on when and how to apply the declarative and procedural knowledge while re-evaluating the situation. Regulation of cognition redirect pre-service teacher's attention to the problem despite the emotion experience. (Flavell J. H., 1979).

Self-efficacy is influence by four factors as suggested by Bandura (1977). Experience mastery increases when pre-service teacher knows the process of problem-solving task. Self-efficacy developed when pre-service teachers are equipped with the procedural knowledge because they are familiar with the procedure to complete the tasks. In related to Theory of Control Value of achievement. Experience mastery provides pre-service teachers experiences in achievement activity. These experiences developed their perception on control over own achievement. They have higher positive activating emotion (achievement emotion) because their experiences

indicate that they can success in the same tasks. Directing cognition to mastery experience improves pre-service teachers' achievement emotion and self-efficacy in teacher preparation. Regulation of cognition assists pre-service teachers to focus on their mastery experience instead of the difficulty of tasks.

Declarative knowledge provides information on vicarious experience from observing other's experiences and its consequences (Bandura, 2006). In related to theory of control value of achievement emotion, pre-service teachers' perception of value over achievement activity increases when they observed others achieved success with the same activity they are engaging. Various experience increases the perceived value of achievement emotion. Declarative knowledge helps them to relate own situation with others' successful achievement. Their self-efficacy improves when they notice that they are on the same track as the successful peers. Regulation of cognition helps pre-service teacher to evaluate their cognition realistically despite being influence by emotion experience while receiving verbal persuasion. In related to epistemic emotional model, cognitive incongruent occurs when pre-service teachers experience cognitive disequilibrium from unauthentic verbal persuasion and reality (Bandura, 2006). Metacognition enables them to make reality judgment on verbal persuasion. Reality judgement on verbal persuasion improves the accuracy in self-evaluation. Realistic self-efficacy reduces epistemic emotion hence pre-service teachers feel more control over the achievement.

Lastly, regulation of cognition hindrance pre-service teacher from somatic and negative emotion states while facing stressful environment (Bandura, 2006). In related to theory of control value of achievement emotion, negative deactivating emotion demotivate pre-service teachers' motivation in achievement activity. Regulation of cognition facilitates cognitive reappraisal process. It redirects pre-service teachers' focus on the achievement instead of ruminating on the potential failures. In related to epistemic emotion model, surprise interrupted the ongoing cognitive process and redirect the cognitive process to unexpected information. Regulation of cognition helps pre-service teachers to control their own cognition to concentrate on the on-going tasks.

Flavell's metacognitive theory, Gross's emotion regulation theories, and Bandura's self-efficacy theory are independent theories to explain the variables in this research. Researcher uses Control-Value Theory of Achievement Emotion to identify the interdependent relationships between variables.

Method

Quantitative research was used to identify the mediating effects of metacognition on the relationship between emotion regulation and self-efficacy. Correlation research is limited to correlation coefficient, odds ratio, and regression coefficient between two variables only. Researchers increase the possible relations among variables by including metacognition as the third variable to this correlation. Mediation is an indirect effect on the causal effect of independent variable on dependent variable. Independent variable affects dependent variable because independent variable affects mediator and mediator, in turn, affects dependent variable. Mediating effect of metacognition is a popular method in psychology field because it tested the potential relationship by independent variable effects on dependent variable.

Sampling Method

238 pre-service teachers from an Institute of Teacher Education participated in the research via convenient sampling method. 55 respondents were male pre-service teachers, and 183 respondents were female pre-service teachers.

Instruments

Metacognitive Awareness Inventory (MAI) was used to measure respondents' metacognition. There are 52 items with 5-point Likert-scale in this inventory. These items are divided into 2 components: knowledge about cognition and regulation of cognition. Knowledge about cognition assess participants understanding of own cognition. There are 3 sub-components in this component: declarative, procedural, and conditional knowledge. Regulation of cognition assess participants ability to control own cognition. There are 5 sub-components in this component: planning, information management strategies, comprehension monitoring, debugging strategies and evaluation. Internal consistency coefficient of MAI was $\alpha=.95$ and stability coefficient of MAI was $\alpha=.90$ (Schraw and Dennison, 1994).

Emotion Regulation Questionnaire (ERQ) was used to evaluate two emotion regulation strategies: Cognitive Reappraisal Facet and Expressive Suppression Facet. There are 10 items with 7-point Likert-scale in ERQ. The internal consistency coefficient of ERQ was $\alpha=.73$ and stability coefficient of ERQ was $\alpha=.69$ (Gross, J. J. & John O. P, 2003).

General Self-Efficacy Scale (GSE) was used to assess general sense of self-efficacy and predict the capability to cope with difficulties in life. It measures self-efficacy by 10 items with Likert-4 scale. The internal consistency coefficient of GSE was $\alpha=.76$ to $.90$ and stability coefficient of GSE was $\alpha=.80$ (Schwarzer and Jerusalem, 1995).

Table 1: Pilot Test Result

	Internal consistency (α)	Corrected item correlation (α)
MAI	0.955	0.949 to 0.953
ERQ	0.626	0.431 to 0.601
GSE	0.812	0.751 to 0.808

Table 1 indicates the pilot test result of MAI, ERQ and GSE from 30 pre-service teachers. Internal consistency for MAI is $\alpha=0.955$, corrected item correlation (α) for MAI ranged between 0.949 to 0.953. Remove any item from MAI leads to lower internal consistency. Therefore, researcher do not remove any item from the inventory. Internal consistency for ERQ is $\alpha=0.626$, corrected item correlation (α) for ERQ ranged between 0.431 to 0.601. Remove any item from ERQ leads to lower internal consistency. Therefore, researcher do not remove any item from the questionnaire. Internal consistency for GSE is $\alpha=0.812$, corrected item correlation (α) for GSE ranged between 0.751 to 0.808. Remove any item from GSE leads to lower internal consistency. Therefore, researcher do not remove any item from the scale.

Data Collection and Screening

Online survey is used to collect data from pre-service teachers from Institute of Teacher Education. Data collected for this research is used to make inferences about pre-service

teachers' metacognition towards relationship between self-efficacy and emotional regulation. It provides recent descriptive and inferential information on metacognition, emotion regulation, and self-efficacy. Researcher used Google Survey Form to collect data for this research. Survey link was distributed through email and messaging apps to targeted population. Self-report survey was used to collect data on respondent's metacognition, emotion regulation and self-efficacy. There are three instruments includes in one online survey form. Each respondent needs to complete all instruments.

238 cases were responded to survey. However, two outlier cases were removed from the data set after Mahalanobis Distant analysis. Researcher excluded the outlier cases from the study to avoid surge the potential of a Type I or Type II error. The remaining cases to be used to measure hypothesis was 236 cases.

Assessment of Measurement Model

Assessment of Measurement Model was conducted before moderation analysis to ensure model is fit for structural equation modelling. After the process of clearing poor indicators, all constructs have achieved the satisfactory level of AVE result of >0.50 (AVE ERQ =0.506, AVE GSE =0.517, AVE MAI =0.503). Besides, the satisfactory level of CR result of >0.8 is also met (CR ERQ= 0.856, CR GSE =0.865, CR MAI= 0.88). All indicators for formative construct met the VIF values and they are smaller than minimum value of 5 according to Hair (2017) and 3.3 according to Diamantopoulos (2006). Researcher concludes that collinearity does not reach the critical level and the estimation of PLS path model is achieved. All formative indicators are significant in the path model. All inner VIF values for the other independent variables (ERQ and MAI) that need to be assessed for lateral multicollinearity are <5 , therefore no issue for lateral multicollinearity. The SRMR value is 0.043. According to Henseler (2018), the acceptable fit for SRMR is ≤ 0.08 . Therefore, this shows that the model is fit for SRMR. The NFI value is 0.902. According to Bryne (2016), the acceptable fit for NFI is ≥ 0.90 . Therefore, this shows that the model is fit for NFI. The Rms Theta value is 0.133. According to Ronkko and Evermann (2013), Rms Theta ranged between 0.10 to 0.17 is acceptable for model fit in Rms Theta. Therefore, researcher concludes that study model is fit for GoF.

Result and Discussion

Mediating Effect of Metacognitive Towards the Relationship Between Emotion Regulation and General Self-Efficacy

Bias-corrected bootstrapping was used to access the mediating effect of metacognition towards the relationship between emotion regulation and general self-efficacy.

Hypotheses were developed to test on the mediating effect. H1: There is a significant relationship between emotion regulation and general self-efficacy. H2: There is a significant relationship between emotion regulation and metacognition. H3: There is a significant relationship between metacognition and general self-efficacy H4: There is a significant relationship between emotion regulation and general self-efficacy mediated by metacognition.

Table 4.55: Hypothesis Testing on Mediation

		Std. Beta	Std. Error	t-value	Confidence Interval (BC)		P Values
					LL	UL	
H1	ERQ -> GSE_	0.078	0.063	1.241	-0.03	0.213	0.215
H2	ERQ -> MAI_	0.411	0.056	7.396	0.271	0.503	0
H3	MAI_ -> GSE_	0.557	0.067	8.365	0.426	0.677	0
H4	ERQ -> GSE_	0.229	0.048	4.767	0.143	0.324	0

Table 4.55 is the path coefficient of ERQ, GSE, MAI and mediating of MAI on ERQ and GSE. Based on the results, H1: there is no significant correlation coefficient between ERQ to GSE ($p = 0.215$, $SD = 0.063$). H2: There is a significant correlation coefficient between ERQ to MAI ($p < .05$, $SD = 0.411$). H3: there is a significant correlation coefficient between MAI to GSE ($p < .05$, $SD = 0.067$). H4: There is a significant relationship between emotion regulation and general self-efficacy mediated by metacognition ($p < .05$, $SD = 0.048$).

The bootstrapping analysis indicates that indirect effect, $\beta = 0.229$ is significant with t-value of 4.767. The indirect effect 95% Boot CI Bias Corrected = 0.143, UL = 0.324, does not staddle a 0 in between shows that there is a mediation. To answer research question, "is there any significant mediating effect of metacognition on the relationship between emotion regulation and self-efficacy among pre-service teachers? Researcher rejects the null hypothesis, there is no significant mediating effect of metacognition on the relationship between emotion regulation and self-efficacy among pre-service teachers. Therefore, researcher concludes that there is a significant mediating effect of metacognition on the relationship between emotion regulation and self-efficacy among pre-service teachers.

According to control-value theory, self-efficacy is a type of cognitive appraisal (Vaughan, 2020). It is influenced by emotion. Metacognitive strategies have impact on pre-service teacher cognitive path on self-evaluation. Ability to engage in cognitive reappraisal enables pre-service teacher to re-visit the cognitive path (Vierhaus, Lohaus & Wild, 2016). Researcher suggests that development in pre-service teachers' metacognitive skills is effective to improve their emotion regulation and self-efficacy. Thinking tools such as mind map should be introduced to pre-service teachers because it serves as a platform for them to re-visit their cognitive path (Hakim, 2018). It provides pre-service teachers awareness of their own thinking. Demonstration of their cognitive path on visual form helps them to gain more autonomy in thinking (Therese, Kate & Katie, 2020).

Cognitive assessment such as self-efficacy has direct influence on performance emotion (Kiuru, et al., 2020). Researcher suggests that positive self-efficacy is crucial for pre-service teachers to achieve job-satisfaction and life satisfaction. When pre-service teachers are confident that they can complete the task, they are more likely to enjoy the process. Pre-service teachers with high self-efficacy have more hope and pride compared to pre-service teacher with low self-efficacy (Vierhaus, Lohaus & Wild, 2016). Seeing the importance of self-efficacy in the well-being of pre-service teacher, teacher education should use reinforcement and affirmation more frequently to improve pre-service teachers' self-efficacy.

Self-efficacy determines pre-service teachers' implication of metacognitive strategies in teacher preparation. Despite the frequency of pre-service teachers engaged in metacognitive strategy, quality of the metacognitive outcome is higher for pre-service teachers with higher self-efficacy (Ozkan & Hatice, 2013). They are engaged in more complicated metacognitive strategies compared to pre-service teachers with low self-efficacy. This is because, pre-service teachers who believe on their own abilities have higher efficacy to try new metacognitive strategies. They are more self-efficacious in recognizing the requirement of learning task and able to plan accordingly. Quality of their efforts and selection of metacognitive strategies are different compared to the low self-efficacious pre-service teachers (Hayat et al, 2020).

Conclusion

The importance of metacognition is observed from its mediating effect towards emotion regulation and general self-efficacy. Researcher aware that metacognition is playing an important role in teacher preparation. It influences pre-service teachers' emotion regulation and self-efficacy in teaching and learning. Teacher education should emphasize metacognitive development among pre-service teachers. Quality teacher preparation produces teachers who are self-efficacious to teach in the future.

Data Availability Statement

Raw data were generated at University of Malaya. Derived data supporting the findings of this study are available from

<https://docs.google.com/spreadsheets/d/1a82qlxHfNQVkJgWasT3DkNWEgZvs324/edit?usp=sharing&oid=101891227156783538079&rtfpof=true&sd=true>

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