

An Integrated Learning Model for Enhancing Idea Fluency and Decision-Making Skills in Elementary Education

I Wayan Widian^{a,*}, Ida Bagus Gede Surya Abadi^a, Ni Nyoman Rediani^b, I Gusti Ngurah Puger^c, & Ni Kadek Septiari^a

^aPrimary Teacher Education, Universitas Pendidikan Ganesha, Indonesia

^bPrimary Teacher Education, Universitas Musamus, Indonesia

^cGuidance and Counseling Education, Universitas Panji Sakti, Indonesia

Abstract

This study investigates the effects of the SMART Technique Feedback Framework (X_1), Metacognitive Learning Design (X_2), and Student Learning Readiness (X_3) on elementary school students' Decision-Making Ability (Y), with Fluency of Ideas (M) as a mediating variable. A quantitative explanatory design with a single mediation model was employed. The participants consisted of 268 elementary school students selected through proportional purposive sampling. Data were collected using a four-point Likert scale measuring feedback quality, metacognitive learning design, learning readiness, fluency of ideas, and decision-making ability. The data were analyzed using Partial Least Squares–Structural Equation Modeling (PLS-SEM) with SmartPLS software. The results indicate that the SMART Technique Feedback Framework has a significant positive effect on Fluency of Ideas ($\beta = 0.589$; $p < 0.05$) and Decision-Making Ability ($\beta = 0.194$; $p < 0.05$). Metacognitive Learning Design also significantly affects Fluency of Ideas ($\beta = 0.394$; $p < 0.05$) and Decision-Making Ability ($\beta = 0.284$; $p < 0.05$). Student Learning Readiness shows a significant positive influence on Fluency of Ideas ($\beta = 0.321$; $p < 0.05$) and Decision-Making Ability ($\beta = 0.168$; $p < 0.05$). Furthermore, Fluency of Ideas significantly influences Decision-Making Ability ($\beta = 0.427$; $p < 0.05$) and mediates the relationships between all independent variables and the dependent variable. The structural model demonstrates moderate predictive power, with R^2 values of 0.594 for Fluency of Ideas and 0.561 for Decision-Making Ability. These findings confirm the importance of SMART-based feedback, metacognitive learning design, and learning readiness in strengthening higher-order thinking skills in elementary education.

Keywords: SMART Feedback, Metacognitive Learning, Learning Readiness, Fluency of Ideas, Decision Making.

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1. Introduction

The development of 21st-century education requires students to master higher-order thinking skills (HOTS) (Kosasih et al., 2022; Kwangmuang et al., 2021), especially the ability to generate ideas fluently, think reflectively, critically evaluate alternatives, and make appropriate decisions in both learning contexts and real-life situations. At the elementary school level, these skills are an important foundation for developing sustainable academic competencies and life skills (Raditia et al., 2022). The ability to generate ideas fluently will enable students to generate ideas to produce new innovations (Lansing-stoeffler & Daley, 2023a; Li et al., 2022), fluent thinking helps flexibility of thinking (D. Kim & Runco, 2022), thinking fluently helps produce many choices (Luthfia, 2024; Purwati & Alberida, 2022; Setiawan et al., 2024), the ability to make decisions must also be supported by the ability to think fluently (Kivijärvi, 2024; Lansing-stoeffler & Daley, 2023b; Wang et al., 2024). Meanwhile, the ability to make decisions will develop self-confidence Colakkadioglu & Celik, 2016; Pignault et al., 2023), making decisions will improve critical thinking skills (Anggraini et al., 2022; Heidari & Ebrahimi, 2016; Yusal & Nurazmi, 2024). So, it can be said that fluent thinking and decision-making are two crucial skills that a person must master. Therefore, it's crucial to create learning that develops these abilities.

Several innovations that have been carried out by educators to develop these abilities, including the RICOSRE model, have proven effective and are recommended as an alternative to improve students' decision-making skills, the PjBL

* Corresponding author.

E-mail address: wayanwidiana85@undiksha.ac.id

model is effective in developing creative thinking skills (Pangestu et al., 2024), PBL is an effective pedagogical strategy in developing creativity (Lelapary, 2022; Pudma et al., 2024). In addition to learning models, learning media have also been developed to combine these variables, including Canva-based learning media for creativity (Zakiyah, 2024). Digital learning towards creativity (Minar et al., 2024). Despite the use of several innovations, field results show a different story. Several reports indicate that Indonesian students' higher-order thinking skills have not yet developed optimally. Based on assessments by the Ministry of Education and Culture, many students still experience difficulties when asked to generate diverse ideas, evaluate options accurately, or make decisions that are truly based on logical considerations. In the field, teachers also often find that students lack flexibility in adjusting their thinking when faced with more complex problems. Low fluency of ideas, an indicator of creative thinking ability, ultimately affects students' ability to make mature decisions. Empirical findings show that although students' originality ability reached 70.9%, their ability to generate ideas fluently (59.6%), think flexibly (55.64%), and present adequate details (50%) still falls in the moderate to low category (Sudirtha et al., 2022). This imbalance suggests that students' creativity has not fully developed, which can impact their ability to make the best choices when faced with various decision-making situations.

Students' suboptimal fluency of thinking and decision-making abilities do not emerge suddenly; rather, they are shaped by various interrelated factors. One instructional factor that has been shown to play a significant role in directing and shaping the quality of students' thinking processes is teacher feedback (Molin et al., 2021a). Feedback is not merely a response to students' work but an integral component of the learning process (Molin et al., 2021b; Playfoot et al., 2025; Williams, 2024). It helps students understand what they have done well, what aspects require improvement, and what steps they should take next. Within the learning context, feedback serves as a "bridge" that connects students' current abilities with the competencies they are expected to achieve.

Several impacts of feedback have been widely documented in the literature. First, feedback can increase metacognitive awareness, namely students' ability to monitor and control their own thinking processes (Molin et al., 2020). When teachers provide specific guidance on thinking patterns or problem-solving strategies, students are encouraged to evaluate their approaches and consider more effective options. Second, feedback can strengthen learning motivation, especially when delivered constructively and encourages students to view challenges as opportunities for growth, rather than failures (Apoko, 2024; Mahara & Hartono, 2024). Third, clear and structured feedback can increase the fluency of ideas (Janesarvatan & Asoodar, 2024), because students gain a better understanding of how to develop ideas sequentially, logically, and in a varied manner. Another impact is that feedback can also improve the quality of decision-making, because students learn to weigh options based on strong reasons and more complete information (Cagna et al., 2024). Thus, feedback not only helps students correct mistakes but also plays a strategic role in shaping their thinking, generating ideas, and making more informed decisions. This demonstrates that the quality of teacher feedback interaction is a crucial element that needs to be optimized if learning objectives are to be directed toward developing higher-order thinking skills. However, learning practices in elementary schools generally still place feedback only in the form of right-wrong explanations or superficial corrections, without providing structured information regarding aspects that need to be improved, strategies that can be used, or the direction of competency development.

In addition to the feedback provided during the learning process, the learning model used by teachers also has a significant influence on students' decision-making abilities. The learning model determines not only how material is delivered but also how students interact, think, and process information (Irviana, 2020). When learning models allow students to discuss, explore various possibilities, or solve problems independently, they become accustomed to making decisions based on more thoughtful consideration. Conversely, if learning is too teacher-centered and students simply receive information without opportunities to think critically, their decision-making abilities will be severely limited. In other words, the right learning model not only helps students understand the material but also trains them to weigh options, analyze risks, and select the most effective strategies in various situations.

In addition to pedagogical factors, students' learning readiness also plays a significant role in determining the quality of their cognitive processes. Students who are well-prepared to learn, from a motivational, cognitive, and emotional perspective, are more likely to absorb information, generate alternative ideas, and evaluate choices more thoroughly (Shen, 2024). Readiness to learn can strengthen the influence of learning interventions on idea fluency and, ultimately, decision-making ability (Gedik & Akyol, 2022). Within the framework of the relationship between these variables, idea fluency is seen as a crucial cognitive component because it serves as the initial stage in the decision-making process. Someone who is able to generate more ideas tends to have more alternatives to analyze before deciding on the best choice (Banani & Aman, 2022).

Although various previous studies have highlighted the role of feedback, metacognitive strategies, and student learning readiness, most of these studies have examined these three variables separately and have not yet placed them within a

unified conceptual framework. In fact, in learning practice, these three factors interact and collectively influence how students process information and make decisions. To date, studies that simultaneously examine these three factors within a single structural model, particularly by placing Fluency of Ideas as a mediator, are still very limited, especially in the context of Indonesian elementary education, which has unique learning characteristics and has not been widely explored. Based on this gap, this study aims to analyze the influence of the SMART Technique Feedback Framework, Metacognitive Learning Design, and Student Learning Readiness on Decision-Making Ability, with Fluency of Ideas as a mediator. Through a comprehensive evaluation of the measurement model and structural model, this study seeks to provide a significant theoretical contribution to enriching understanding of the factors influencing higher-order thinking skills.

This research gap is further exacerbated by the limited number of studies utilizing a comprehensive analytical approach such as Partial Least Squares Structural Equation Modeling (PLS-SEM) to evaluate complex relationships between variables. This method, however, possesses significant capabilities in uncovering patterns of direct and indirect relationships, thus providing a more in-depth understanding of students' cognitive processes. This is where the novelty of this research lies: the simultaneous testing of three key learning variables: SMART feedback, metacognitive learning design, and learning readiness with Fluency of Ideas as a mediator in the PLS-SEM model in elementary education something that has not been widely explored in the literature. In addition to its theoretical contributions and methodological novelty, the results of this study are also expected to provide practical implications for elementary school teachers in designing more reflective, adaptive, and in-depth cognitive development-oriented learning. Thus, this research not only fills this gap in the literature but also contributes significantly to efforts to improve the quality of Indonesian education.

2. Methods

2.1. Research Design and Procedures

This study uses an explanatory quantitative design with a non-experimental approach to test the causal relationship in a single mediation model. This design was chosen because the study aims to explain how the SMART Technique Feedback Framework (X_1), Metacognitive Learning Design (X_2), and Student Learning Readiness (X_3) influence Decision-Making Ability (Y) through the mediating role of Fluency of Ideas (M). All constructs in the model are latent with reflective indicators, so the analysis was conducted using Partial Least Squares-based Structural Equation Modeling (PLS-SEM) through SmartPLS software (Firdaus et al., 2020). The research procedure was carried out through four main stages: instrument development and validation, instrument pilot testing, data collection on the target population, and analysis of the measurement and structural models. The research instruments were developed based on theoretical studies and previous research in the areas of learning, self-regulation, and higher-order thinking skills. All indicators were compiled on a four-point Likert scale and validated through expert judgment to ensure content relevance, clarity of wording, and construct suitability (Trisnayanti et al., 2020).

The validated instrument was then pilot tested to obtain empirical evidence regarding its validity and reliability. The pilot test results were used to revise or refine items that did not meet the criteria, ensuring the instrument was suitable for use in the main data collection stage. Data collection was conducted offline with elementary school students engaged in learning using SMART-based feedback and a metacognitive approach. The entire process was conducted with due regard for research ethics, including school approval, data confidentiality, and voluntary participation from respondents. Data analysis involved two stages. First, a measurement model analysis was conducted to assess convergent validity, discriminant validity, and construct reliability. All indicators showed very high outer loading values, AVE was in the excellent range, and construct reliability met the standards. Second, a structural model analysis was conducted to examine the relationships between variables, including calculating R-square, effect size (f^2), predictive relevance, and path significance using bootstrapping. An indirect effect test was used to confirm the role of Fluency of Ideas as a mediator in the relationships between X_1 , X_2 , and X_3 with Y .

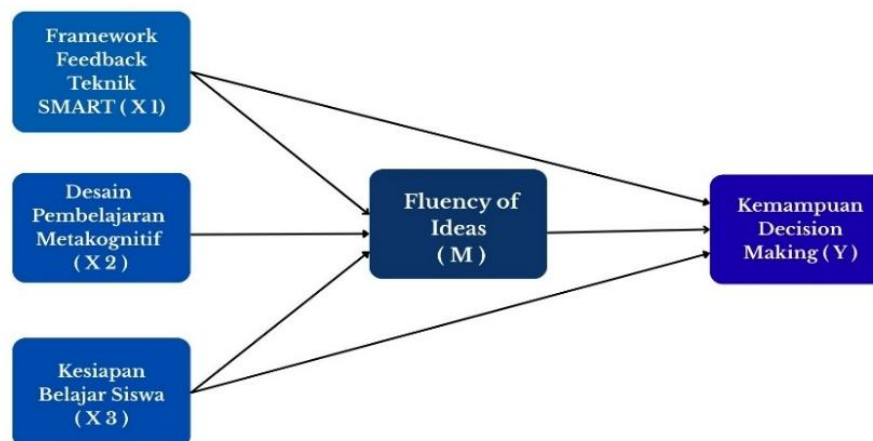


Fig 1. Conceptual Framework of the Research

The research hypotheses in this study are formulated to examine both the direct and indirect relationships among the investigated variables. First, it is hypothesized that the SMART Technique Feedback Framework (X_1) influences Fluency of Ideas (M). Similarly, Metacognitive Learning Design (X_2) and Student Learning Readiness (X_3) are each hypothesized to influence Fluency of Ideas (M). Furthermore, this study proposes that the three independent variables SMART Technique Feedback Framework (X_1), Metacognitive Learning Design (X_2), and Student Learning Readiness (X_3) each have a direct influence on Decision Making Ability (Y). In addition, Fluency of Ideas (M) is hypothesized to influence Decision Making Ability (Y). Finally, this research examines the mediating role of Fluency of Ideas (M) in the relationship between the independent and dependent variables, proposing that SMART Technique Feedback Framework (X_1), Metacognitive Learning Design (X_2), and Student Learning Readiness (X_3) influence Decision Making Ability (Y) through Fluency of Ideas (M) as an intervening variable.

2.2. Participants

The participants in this study were 268 elementary school students in Bali Province from grades IV, V, and VI, who were attending regular learning at their respective schools. The selection of this number was based on methodological considerations of PLS-SEM analysis which requires a minimum sample size of 10 times the largest number of paths to the endogenous construct. In this research model, the Fluency of Ideas (M) construct has three entry paths, while the Decision Making (Y) construct has four entry paths, so the minimum sample requirement is around 30–40 respondents. Thus, the number of 268 participants is in the very adequate category, providing strong estimation stability and increasing the model's ability to produce accurate path coefficients. A purposive sampling technique was used to determine participants who were appropriate for the research objectives. The inclusion criteria included: (1) active students who participated in the learning process with the application of feedback based on the SMART Technique Feedback Framework and metacognitive activities; (2) able to understand and fill out the research instrument independently; (3) attending regular learning in grades IV, V, or VI; and (4) willing to participate voluntarily. All students with diverse academic characteristics are still included so that data variability reflects the dynamics of student abilities in real learning contexts.

2.3. Data collection

Data collection in this study was conducted using a four-point Likert scale-based questionnaire (1 = strongly disagree to 4 = strongly agree) developed to measure five main constructs, namely the SMART Technique Feedback Framework (X_1), Metacognitive Learning Design (X_2), Student Learning Readiness (X_3), Fluency of Ideas (M), and Decision-Making Ability (Y). The instrument was developed based on relevant theoretical studies and adjustments to indicators from scales that have been used in previous educational research. All items were adapted to the context of secondary school learning so that they are easily understood by students and able to reflect the aspects to be measured.

Primary data collection was conducted through an online questionnaire using Google Forms, allowing for broader and more flexible distribution based on students' circumstances and device availability. The use of an online format also

minimized data entry errors and ensured responses were automatically recorded. Before beginning the questionnaire, students were given a written explanation of the research objectives, benefits, data confidentiality, and the instrument completion procedures. Only students who voluntarily agreed to participate through informed consent were allowed to continue completing the questionnaire. The implementation of the questionnaire was carried out with due regard to research ethics principles, including providing information regarding the research objectives, guaranteeing data confidentiality, and obtaining consent from the school and parents for participation. All responses were collected anonymously to ensure participant comfort and honesty in providing answers. The number of participants, reaching 268 students, provided sufficient analytical power in testing the measurement model and structural model. This large sample size allowed for the estimation of the relationship between the SMART Technique Feedback Framework (X_1), Metacognitive Learning Design (X_2), Student Learning Readiness (X_3), Fluency of Ideas (M), and Decision Making (Y) to be carried out with a high level of accuracy, and produced reliable and representative findings regarding learning conditions in elementary schools.

A research instrument grid was developed to ensure a clear relationship between constructs, indicators, and statement items. This grid served as the basis for developing questionnaire items and was reused during the content validation stage by experts.

Table 1. Research Instrument Grid SMART Engineering Feedback Framework (X_1)

Indicator	Indicator Description	Item Code
Specific	Feedback that provides precise and detailed direction regarding learning performance.	X1-1, X1-2
Measurable	Clarity of success criteria that can be measured by students.	X1-3
Achievable	Feedback that is realistic and appropriate to the student's abilities.	X1-4
Relevant	The relevance of the feedback to the learning objectives being studied.	X1-5
Time-bound	Timeliness of feedback delivery so that it can be followed up immediately.	X1-6

Table 2. Research Instrument Grid Metacognitive Learning Design (X_2)

Indicator	Indicator Description	Item Code
Learning planning	Students' ability to design learning strategies and goals.	X2-1, X2-2
Monitoring the thinking process	Student awareness in assessing progress and mistakes while learning.	X2-3
Evaluation of learning outcomes	Reflection on the effectiveness of the learning strategies used.	X2-4, X2-5

Table 3. Research Instrument Grid Student Learning Readiness (X_3)

Indicator	Indicator Description	Item Code
Initial motivation	Students' mental readiness to engage in learning.	X3-1
Cognitive readiness	Prerequisite knowledge and prior skills related to the material.	X3-2, X3-3
Emotional readiness	Emotional stability and a positive attitude towards learning activities.	X3-4

Table 4. Research Instrument Grid Fluency of Ideas (M)

Indicator	Indicator Description	Item Code
Fluency of ideas	The ability to generate many ideas in a limited time.	M1, M2
Variations of ideas	The ability to create diverse alternative solutions.	M3
Flexibility of thinking	The ability to move quickly between concepts or points of view.	M4

Table 5. Research Instrument Grid Decision Making Ability (Y)

Indicator	Indicator Description	Item Code
Identification of problems	The ability to recognize the core of a problem before making a decision.	Y1
Alternative analysis	The ability to objectively assess various solution options.	Y2, Y3
Decision selection	The ability to choose the most effective solution based on available information.	Y4
Evaluation of decisions	The ability to re-evaluate decisions that have been made.	Y5

All collected data will be stored anonymously and used solely for research analysis. This data collection procedure was designed to ensure that students' responses represent their authentic perceptions of the learning process and their higher-order thinking skills, as measured by each research instrument.

2.4. Data analysis

Data analysis in this study was conducted using the Partial Least Squares Structural Equation Modeling (PLS-SEM) method with the help of SmartPLS software version 4.0. The initial stage of analysis began with the data screening and data cleaning process for 268 responses to ensure there were no missing data, inconsistent answer patterns, or outliers that could interfere with model estimation. All data that met the eligibility criteria were then analyzed further through two main stages, namely the evaluation of the measurement model (outer model) and the evaluation of the structural model (inner model). The use of PLS-SEM was chosen because it is suitable for models with reflective latent constructs, a large number of structures, and research objectives that are oriented towards predicting and testing the mediation mechanism of Fluency of Ideas in the relationship between the SMART Technique Feedback Framework, Metacognitive Learning Design, Student Learning Readiness, and Decision-Making Ability.

The first stage of the measurement model evaluation structure (outer model) serves to assess the validity and reliability of the structure in each construct. Convergent validity is reviewed through the outer loading value, which is all in the range of 0.976 - 0.990, far above the minimum limit of 0.70, so that all structures meet the criteria for convergent validity. The AVE value for all constructs is also very high, namely 0.958 - 0.974, indicating that each structure is able to explain the variance of the structure very well. Construct reliability is obtained through the Cronbach's Alpha and Composite Reliability values, which are all above 0.990, so that each construct shows very strong internal consistency. Furthermore, discriminant validity is assessed using the Fornell-Larcker criteria, and the results show that the AVE root of each construct is greater than the correlation value between constructs. This confirms that each structure has good discriminatory ability and there is no overlap between the measured constructs. The second stage of the structural model evaluation (inner model) is to assess the causal relationship between latent variables according to the research hypothesis. Significance testing was carried out using a bootstrapping procedure of 5,000 subsamples, which produced path coefficients, t-statistics, and p-values. The results of the analysis showed that all structural paths were significant at $p < 0.05$. The SMART Technique Feedback Framework, Metacognitive Learning Design, and Student Learning Readiness were shown to have a significant effect on Fluency of Ideas (M) and Decision Making (Y), with the strongest contributions being given by structures X1 and X2. The $M \rightarrow Y$ path was also significant, confirming that Fluency of Ideas plays an important mediator in strengthening students' structural decision-making abilities.

The predictive ability of the model was evaluated using the R-square value. The Fluency of Ideas (M) construct had an $R^2 = 0.594$, meaning the three exogenous constructs were able to explain 59.4% of the variance in students' idea fluency. Meanwhile, the Decision Making (Y) construct had an $R^2 = 0.561$, indicating that the model was able to explain 56.1% of the variation in students' ability to take the constructs. Both R^2 values were in the moderate category, so the model had adequate explanatory power. In addition, the effect size (f^2) was analyzed to see the magnitude of the influence of each exogenous construct on the endogenous construct. X1 had a strong effect on M (0.854), while X2 and X3 had moderate effects. Meanwhile, the direct effects of X1, X2, and X3 on Y were in the small to moderate category, and M had a significant contribution to Y with an f^2 value of 0.169. Additional evaluation was conducted through the Goodness of Fit (GoF) index, which was calculated based on the average AVE and R-square. The calculation results showed a GoF value of 0.746, which is in the large GoF category. This value indicates that the model has a very good fit, both in terms of structural quality and the strength of the structural relationship between variables. Thus, the PLS-SEM model used was proven to be feasible and able to explain the mechanism of the influence of the SMART Technique Feedback Framework, Metacognitive Learning Design, and Student Learning Readiness on Decision-Making Ability through the mediating role of Fluency of Ideas comprehensively.

3. Result and Discussion

3.1 Evaluation of Measurement Model (Outer Model)

Evaluation of the measurement model was conducted to assess the validity and reliability of the research constructs consisting of the SMART Technique Feedback Framework (X₁), Metacognitive Learning Design (X₂), Student

Learning Readiness (X₃), Fluency of Ideas (M), and Decision Making (Y). Testing was conducted through convergent validity, discriminant validity, and construct reliability.

3.2 Convergent Validity

Convergent validity was tested using the outer loading value of each indicator against the latent construct. An indicator is considered to have convergent validity if its outer loading value is ≥ 0.70 . The results of the convergent validity test for all constructs in this study are presented in Table 6.

Table 6. Convergent Validity Test Results through Outer Loading

	M	X1	X2	X3	Y
M1	0.990				
M2	0.987				
M3	0.988				
M4	0.983				
X1_1		0.977			
X1_2		0.979			
X1_3		0.985			
X1_4		0.980			
X1_5		0.976			
X1_6		0.976			
X2_1			0.976		
X2_2			0.981		
X2_3			0.982		
X2_4			0.980		
X2_5			0.981		
X3_1				0.980	
X3_2				0.982	
X3_3				0.983	
X3_4				0.980	
Y1					0.988
Y2					0.984
Y3					0.986
Y4					0.983
Y5					0.988

Based on the results in Table 6, all indicators in the constructs of Fluency of Ideas (M), SMART Technique Feedback Framework (X1), Metacognitive Learning Design (X2), Student Learning Readiness (X3), and Decision-Making Ability (Y) show very high outer loading values, ranging from 0.976 to 0.990. All of these values are well above the minimum limit of 0.70, so all indicators are declared to meet the convergent validity criteria. Thus, it can be concluded that each question item is able to represent the latent construct very well, and the measurement model used in this study has very strong quality. This very high convergent validity also provides a solid foundation for continuing the analysis at the next stage, such as reliability testing, discriminant validity, and structural model analysis (inner model).

3.3 Discriminant Validity

Discriminant validity was tested using the Fornell-Larcker criterion, namely the AVE root value must be higher than the correlation between constructs. Results of the Discriminant Validity Test is show in Table 7.

Table 7. Results of the Discriminant Validity Test (Fornell–Larcker)

Construct	M	X1	X2	X3	Y
M	0.987				
X1	0.576	0.979			
X2	0.386	-0.021	0.980		
X3	0.318	-0.014	0.014	0.981	
Y	0.702	0.431	0.447	0.305	0.986

Based on Table 7, it can be seen that the AVE root value for each construct M, X1, X2, X3, and Y is greater than the correlation value between the other constructs. Thus, all variables in this study are declared to meet discriminant validity according to the Fornell–Larcker criteria.

3.4 Reliability Test

Construct reliability was evaluated based on Cronbach's Alpha, Composite Reliability (rho_c), and AVE values as indicators of internal consistency. The results of the reliability tests are shown in Table 8.

Table 8. Cronbach's Alpha and Composite Reliability

Construct	Cronbach's Alpha	Composite Reliability (rho_c)	AVE
M	0.991	0.993	0.974
X1	0.991	0.993	0.958
X2	0.990	0.992	0.960
X3	0.987	0.991	0.963
Y	0.993	0.994	0.972

Based on Table 8, all constructs in the research model showed Cronbach's Alpha and Composite Reliability values well above the minimum limit of 0.70. This indicates that all variables are reliable, with a very strong level of internal consistency. Furthermore, the Average Variance Extracted (AVE) values for all constructs were above 0.50, further confirming that each construct was able to explain the indicator variance very well. Thus, all research variables met the reliability criteria and were suitable for use in further analysis using PLS-SEM.

3.5 Structural Model Evaluation (Inner Model)

Structural model evaluation aims to assess the strength of the relationships between latent variables, the model's predictive power, and test research hypotheses. Evaluation results include R-squared values, effect size (f^2), hypothesis testing, and goodness of fit (GoF). SmartPLS path diagram is shown in Figure 2.

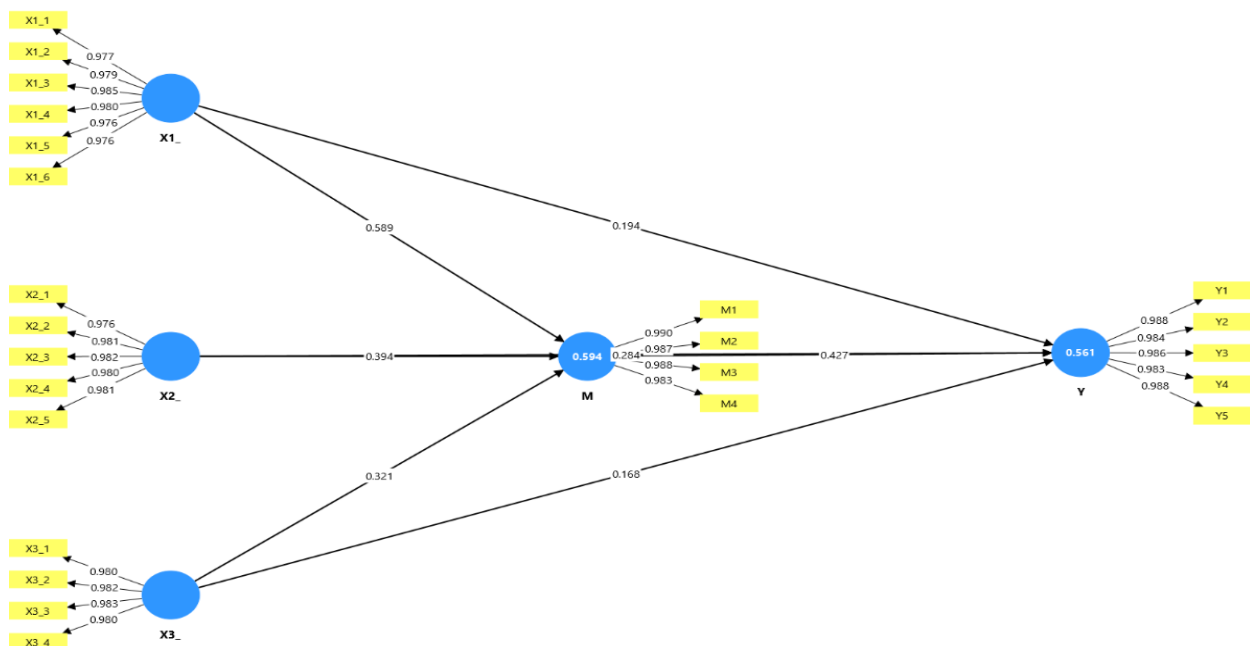


Fig 2. SmartPLS path diagram

3.6 R-square value

The R-square value is used to determine how much the exogenous variables can explain the endogenous variables in the research model. The results of the R-square calculation are shown in Table 9.

Table 9. R-square (R^2) value

Endogenous Variables	R-square	Adjusted R-square
M (Fluency of Ideas)	0.594	0.589
Y (Decision Making)	0.561	0.555

The adjusted R-square value for variable M (Fluency of Ideas) of 0.589 indicates that three exogenous variables, namely the SMART Technique Feedback Framework (X1), Metacognitive Learning Design (X2), and Student Learning Readiness (X3) are able to explain variable M by 58.9%. Based on the category of Hair et al. (2019), this value is included in the moderate category. Furthermore, the adjusted R-square value for variable Y (Decision Making) of 0.555, indicates that the mediator variable Fluency of Ideas (M) together with the exogenous variables X1, X2, and X3 are able to explain variable Y by 55.5%. This value is also included in the moderate category and indicates that the model has good predictive ability in explaining students' decision-making abilities. Thus, the structural model in this study is stated to have adequate explanatory power, making it suitable for use in testing causal and mediation relationships using PLS-SEM.

3.7 Effect Size (f^2)

Evaluation of the influence of each variable was carried out by looking at the f^2 value. The test results are presented in Table 10.

Table 10. Effect Size (f^2)

Variable →	M	Y
X1 (SMART Engineering Feedback Framework)	0.854	0.046
X2 (Metacognitive Learning Design)	0.383	0.133
X3 (Student Learning Readiness)	0.254	0.051
M (Fluency of Ideas)	–	0.169

Based on Table 10, the following interpretations are obtained: The results indicate that the SMART Engineering Feedback Framework (X1) has the strongest influence on Fluency of Ideas (M) with a coefficient of 0.854, showing that it provides the greatest contribution to enhancing students' idea fluency. Metacognitive Learning Design (X2) also demonstrates a significant effect on Fluency of Ideas (0.383), categorized as medium-strong, while Student Learning Readiness (X3) shows a moderate influence (0.254), indicating a fairly meaningful contribution. In contrast, the direct effects of the three independent variables on Decision Making Ability (Y) are relatively weak: X1 (0.046) and X3 (0.051) fall into the weak category, and X2 (0.133) into the weak-to-moderate category. Meanwhile, Fluency of Ideas (M) has a moderate influence on Decision Making Ability (0.169), highlighting its important role as a mediating variable in improving students' decision-making skills.

3.8 Hypothesis Testing (Bootstrapping)

The results of the hypothesis testing were evaluated based on the path coefficient, t-statistics, and p-values. The complete test results are shown in Table 11.

Table 11. Hypothesis Test Results

Track	Path Coefficient (O)	T Statistics	P Values
X1 → M	0.589	16,344	0.000
X1 → Y	0.194	3,315	0.001
X2 → M	0.394	10,298	0.000
X2 → Y	0.284	5,712	0.000
X3 → M	0.321	8,145	0.000
X3 → Y	0.168	3,591	0.000
M → Y	0.427	6,158	0.000

Based on Table 11, all paths have T-statistics > 1.96 and p-values < 0.05 , so all hypotheses are significantly accepted. The results show that the SMART Technique Feedback Framework (X1) has a significant and positive effect on Fluency of Ideas (M) ($\beta = 0.589$; $t = 16.344$), indicating a very strong influence. X1 also has a direct but relatively small effect on Decision Making Ability (Y) ($\beta = 0.194$; $p = 0.001$). Similarly, Metacognitive Learning Design (X2) significantly and positively influences Fluency of Ideas ($\beta = 0.394$; $t = 10.298$), demonstrating a strong contribution to enhancing idea fluency. X2 also has a significant direct effect on Decision Making Ability ($\beta = 0.284$; $t = 5.712$), highlighting the

importance of metacognitive skills in decision making. Furthermore, Student Learning Readiness (X3) significantly affects Fluency of Ideas ($\beta = 0.321$; $t = 8.145$), meaning that students with higher readiness tend to generate ideas more fluently. X3 also shows a significant but comparatively smaller direct effect on Decision Making Ability ($\beta = 0.168$; $p < 0.001$). Finally, Fluency of Ideas (M) has a significant positive effect on Decision Making Ability ($\beta = 0.427$; $t = 6.158$), confirming its strong mediating role, where higher idea fluency leads to better student decision-making ability.

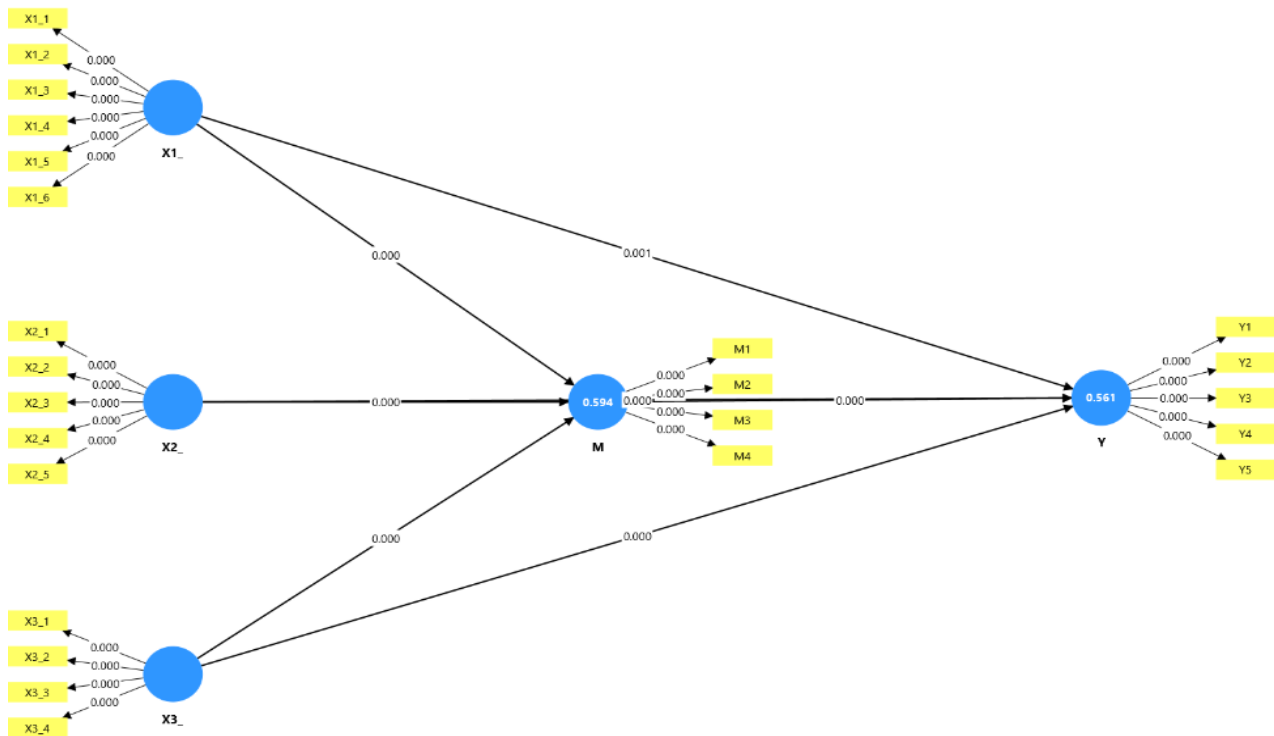


Fig 3. Bootstrapping Results / Path Significance

Based on the test results in Figure 3 and the path significance visualization in Figure 3, all structural paths show T-statistics > 1.96 and P-values < 0.05 . Thus, all hypotheses in the model are accepted. A complete explanation of each path is as follows. The hypothesis testing results show that all proposed relationships are statistically significant. The path $X1 \rightarrow M$ has a p-value of 0.000 (< 0.05), indicating that H1 is accepted and that the SMART Technique Feedback Framework (X1) significantly influences Fluency of Ideas (M). This suggests that SMART-based feedback effectively enhances students' fluency in generating ideas. The path $X1 \rightarrow Y$ also shows significance ($p = 0.001 < 0.05$), confirming that X1 directly affects Decision Making Ability (Y), meaning that SMART feedback improves not only idea generation but also decision-making skills.

Similarly, the path $X2 \rightarrow M$ is significant ($p = 0.000 < 0.05$), supporting H3 and demonstrating that Metacognitive Learning Design (X2) positively influences Fluency of Ideas. Learning designs that emphasize planning, monitoring, and self-evaluation help students produce ideas more fluently. The path $X2 \rightarrow Y$ is also significant ($p = 0.000 < 0.05$), confirming that metacognitive practices directly enhance Decision Making Ability by strengthening students' capacity to evaluate alternatives and select appropriate decisions.

Furthermore, the path $X3 \rightarrow M$ is significant ($p = 0.000 < 0.05$), indicating that Student Learning Readiness (X3) has a meaningful effect on Fluency of Ideas. Students who are cognitively, motivationally, and emotionally prepared tend to generate ideas more quickly and creatively. The path $X3 \rightarrow Y$ is likewise significant ($p = 0.000 < 0.05$), showing that learning readiness directly contributes to better and more structured decision making. Finally, the path $M \rightarrow Y$ is

significant ($p = 0.000 < 0.05$), confirming that Fluency of Ideas (M) significantly influences Decision Making Ability (Y). Students with higher idea fluency are better able to analyze options and choose the most appropriate solutions.

3.9 Goodness of Fit (GoF)

Model feasibility was evaluated using the Goodness of Fit (GoF) value calculated based on the average Average Variance Extracted (AVE) and R-square of the endogenous variables. The calculation results are shown in Table 12.

Table 12. Goodness of Fit (GoF) Results

Construct	AVE	R-square
M	0.974	0.594
X1	0.958	–
X2	0.960	–
X3	0.963	–
Y	0.972	0.561

Based on the calculation results in Table 13, the Goodness of Fit (GoF) value was 0.746. This value falls within the large GoF category, indicating excellent combined performance between the outer model (construct validity and reliability) and the inner model (the strength of the relationship between variables). Therefore, the PLS-SEM model used can be declared to have high feasibility and is able to robustly explain the research phenomena.

This study aims to examine the influence of the SMART Technique Feedback Framework, Metacognitive Learning Design, and Student Learning Readiness on Decision-Making Ability with Fluency of Ideas as a mediator. The results of the PLS-SEM analysis confirmed that all hypotheses were accepted, meaning all structural paths in the model had a significant influence. These findings overall show that the quality of structured feedback, the implementation of metacognitive-based learning, and strong learning readiness are important factors that strengthen students' ability to generate ideas and subsequently make more mature decisions (Parwata et al., 2023). Thus, this study confirms the relevance of an integrative cognitive learning model that positions Fluency of Ideas as a crucial link between the learning environment and students' cognitive performance. One of the key findings is that the SMART Technique Feedback Framework has a significant positive effect on Fluency of Ideas. This indicates that feedback that is specific, measurable, achievable, relevant, and time-bound can provide the clarity students need to understand expected performance standards (Made et al., 2024). This clarity helps students identify gaps between actual performance and learning targets, making it easier for them to adjust their strategies, and encouraging a wider variety of ideas. SMART feedback essentially facilitates divergent thinking, encouraging students to generate alternative ideas, develop new perspectives, and experiment cognitively. Thus, these findings strengthen the argument that feedback quality is a key driver of cognitive creativity in learning contexts (Riddell, 2015).

Furthermore, the study also found that metacognitive learning design significantly increased the fluency of ideas. This finding suggests that learning that emphasizes planning, monitoring, and evaluating thought processes makes students more aware of the strategies they use and more focused in managing problem-solving steps. Students trained in metacognitive skills tend to have greater cognitive flexibility, able to examine their thinking reflectively, and better prepared to generate alternative ideas when facing academic challenges. Metacognitive learning not only increases the number of ideas generated, but also their quality and relevance to the task's objectives. Student Learning Readiness has also been shown to have a significant positive effect on Fluency of Ideas. These findings reflect that students who have cognitive, emotional, and motivational readiness before entering the learning process will be quicker to grasp new information, more focused in completing tasks, and more confident in expressing original ideas. High readiness to learn allows students to respond to tasks spontaneously, generate ideas without hesitation, and remain stable when facing complex cognitive demands. Thus, readiness to learn plays an important foundation in fostering fluency of ideas and cognitive creativity in the context of education (Sutika et al., 2024a).

Overall, the three exogenous variables of SMART feedback, metacognitive learning, and student learning readiness were shown to have a significant influence on decision-making ability. This indicates that students' decision-making process depends not only on their ability to generate ideas but is also greatly influenced by the quality of the learning they receive and their internal state. SMART feedback helps students understand the direction of their learning and weigh options based on clear data. Metacognitive learning strengthens the process of reflection and self-evaluation, which ultimately helps students determine the best choice from various alternatives. Learning readiness provides the mental and motivational stability necessary for this evaluative process. Fluency of Ideas itself has been shown to play a significant role in improving decision-making ability. Students who are able to generate many ideas have a broader base of choices, making the process of comparing options richer and more rational. This ability prevents students from

easily fixating on a single answer and is more open to alternatives that may be more effective. Fluency of Ideas provides space for students to evaluate various possibilities before making a final decision, so that decisions made tend to be more mature and based on comprehensive consideration (Izzah et al., 2021).

The findings of the mediation analysis in this study show that Fluency of Ideas mediates the relationship between SMART feedback, metacognitive learning, and learning readiness with Decision-Making Ability. This indicates that these three learning variables contribute not only directly but also through improving students' ability to generate ideas. This mediation reinforces the understanding that divergent thinking skills are an important cognitive intermediary process in decision-making, where students must first generate alternatives before evaluating and selecting the best decision. In the context of learning in Indonesia, which still often emphasizes memorization, imitation, and single answers, the findings of this study provide highly relevant implications. The application of SMART feedback, metacognitive learning, and strategies to improve learning readiness can open up space for students to develop creativity, critical thinking skills, and independence in assessing various alternative solutions. The learning model developed in this study can be an important foundation for improving higher-order thinking skills (HOTS), which are highly needed in modern curricula and 21st-century competencies (Sutika et al., 2024b).

Although the resulting model demonstrates excellent quality, several limitations should be considered. The use of a cross-sectional design limits the researcher's ability to identify long-term causal relationships, while the use of a self-report instrument may introduce perceptual bias. Furthermore, this study did not include other factors such as creativity, self-efficacy, or the learning environment as moderators that might enhance understanding of the dynamics of the relationships between variables (Trisnayanti et al., 2020). Further research using a longitudinal design or experimental approach is needed to obtain a more comprehensive picture of the learning mechanisms that occur. Practically, the findings of this study emphasize the importance of strengthening teachers' capacity to consistently apply SMART feedback, integrate metacognitive strategies into the learning process, and systematically assess learning readiness. Training and mentoring programs for teachers related to these three aspects can significantly improve students' decision-making abilities. Furthermore, improving the Fluency of Ideas needs to be part of the development of higher-order thinking programs in schools so that students become accustomed to processing ideas from multiple perspectives before making decisions.

4. Conclusion

The results of this study confirm that the SMART Technique Feedback Framework, Metacognitive Learning Design, and Student Learning Readiness have a significant contribution in improving students' decision-making abilities, both through direct and indirect influences with Fluency of Ideas as a mediator variable. The findings of the PLS-SEM analysis indicate that providing more specific, measurable, achievable, relevant, and time-bound (SMART) feedback can encourage students to evaluate the learning process in a more focused manner, clarify goals, and internalize performance standards. This mechanism directly improves their ability to make rational and data-based decisions, while strengthening the fluency of generating ideas (fluency of ideas) which serves as a cognitive foundation in the process of selecting alternative solutions. Metacognitive Learning Design has also been shown to play a significant role in encouraging students to develop awareness of learning strategies, monitor understanding, and evaluate self-performance. These three metacognitive activities not only improve the quality of high-level thinking processes but also significantly strengthen Fluency of Ideas, which ultimately impacts more accurate, systematic, and reflective decision-making abilities. Meanwhile, Student Learning Readiness provides a consistent contribution to the effectiveness of the learning process, where students with high readiness show a tendency to be more adaptive in receiving feedback, activating metacognitive strategies, and producing a variety of ideas flexibly.

Overall, the research model shows that Fluency of Ideas acts as a strong and significant mediator in bridging the influence of exogenous variables on decision-making. This means that the higher the fluency of ideas possessed by students, the greater their ability to analyze situations, compare alternatives, and determine the most effective decision. The resulting structural model also has adequate predictive power, indicating that these three learning aspects can comprehensively explain variations in decision-making abilities at the student level. Thus, this research has important implications for the development of teaching strategies in schools, particularly through the integration of SMART feedback, the implementation of metacognition-based learning designs, and strengthening students' learning readiness as a cognitive foundation. The implementation of these three components is believed to be able to create a learning ecosystem that is more reflective, creative, and focused on improving the quality of student decision-making, which is very essential in facing the demands of 21st-century competencies.

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