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Independent Learning in A Classroom-Based Curriculum: Cognitive Strategies and Students' Self-Confidence in Learning Mathematics

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Abstract: Independent learning is active, initiative and responsible student learning independently. Independent learning can be done in various contexts, where the teaching module is a learning guide. Independent learning requires self-confidence and cognitive strategies in achieving learning goals, and this is difficult to develop in a classroom-based curriculum. On this basis, the aim of this research is to analyze students' cognitive strategies and self-confidence, and determine the influence of cognitive strategies on students' self-confidence in classroom-based independent learning. To achieve the research objectives, the research location was SMAN 8 Malang City with 28 classes consisting of science, social studies and language programs. Meanwhile, the sample was class 12 of the science program which was chosen randomly. To obtain data about students' cognitive strategies and self-confidence, document, questionnaire and interview techniques were used. The data obtained was then analyzed using an interactive and quantitative qualitative approach with regression tests. Based on the results of the analysis, it was found that the use of cognitive strategies was relatively high, while the strategies used were repetition, organization and elaboration respectively. Students' self-confidence is also high, but students lack the courage to express opinions, lack self-concept, and lack responsibility. Simultaneously, this cognitive strategy influences self-confidence, with an influence level of 33.8%, but what has a significant influence is organizational strategy. So it can be said that independent learning is less suitable in implementing a class-based curriculum.

Keywords: classroom-based curriculum, cognitive strategies, independent learning, learning mathematics, self-confidence.

▪ INTRODUCTION

Independent learning is a process, method and educational philosophy, where students acquire knowledge, develop and evaluate their abilities independently (Kemendikbud, 2017; Setyowati & Widana, 2016; Sukowati, Sartono, & Pradewi, 2020). Independent learning is a need for every individual who is responsible for achieving predetermined learning goals (Effendi, 2019, 2020; Madrazo & Dio, 2020). Therefore, independent learning is freedom to be responsible in determining the learning process and goals to be achieved (Ahdhianto, Marsigit, Haryanto, & Nurfauzi, 2020; Jati & Soebagyo, 2023; Kemendikbud, 2017; Psycharis & Kotzampasaki, 2019; Surya, Putri, & Mukhtar, 2017). Apart from being philosophically different, independent learning does not require class-based learning, learning together in the same class, because they have their own curriculum (Effendi, 2019; Jingna, 2012). However, students who study independently, especially studying mathematics, still need learning modules as study guides, and in certain cases still need teacher assistance to make their learning a success (Effendi, 2019, 2020; Herlianti, Linuwih, & Dwijananti, 2015).

In learning mathematics, students are directed to be able to discover and construct mathematical concepts from real problems through a scientific approach (Abu Bakar &

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Ismail, 2020; Hendriana, Johanto, & Sumarmo, 2018; Mulyono, 2021). For this reason, it is highly recommended to use constructive learning with discovery learning, problem project-based learning, and using a scientific approach (Kemendikbud, 2017; Kopzhassarova et al., 2016; Kulsum & Kustono, 2017; Mulyono, 2021; o'donoghue, 2017). Learning mathematics independently includes various contexts and situations, where students are able to interpret, develop their own knowledge and skills, and reflect (Kulsum & Kustono, 2017). Therefore, independent learning is not isolated learning, but can collaborate in certain learning communities with activities and achieving learning goals independently (Kemendikbud, 2017; Kulsum & Kustono, 2017; Madrazo & Dio, 2020; I. D. Pratiwi & Laksmiwati, 2016). Learning mathematics can foster an attitude of independence and self-confidence because students must be involved actively and individually in mastering the specified learning competencies (Hendriana et al., 2018; Herlianti et al., 2015; Mulyono, 2021; O'donoghue, 2017; I. D. Pratiwi & Laksmiwati, 2016). Such self-confidence can support students' success in learning (Jati & Soebagyo, 2023; Moneva & Valle, 2020; Nilasari et al., 2020; Psycharis & Kotzampasaki, 2019; Vandini, 2016).

Self-confidence can be influenced by the learning strategies used, such as cognitive learning strategies (Lohbeck & Moschner, 2022; Sukowati et al., 2020; Surya et al., 2017). Cognitive strategy is the ability to relate new knowledge to previous knowledge, and seek meaning from that knowledge (Schnaubert, Krukowski, & Bodemer, 2021; Sukowati et al., 2020). Apart from being the highest cognitive domain, cognitive strategies are also mental processes that can be used to obtain or manipulate information (Lohbeck & Moschner, 2022; Schnaubert et al., 2021; Sukowati et al., 2020). This cognitive strategy is divided into three, namely repetition strategy, elaboration strategy and organizational strategy, where they have the same function, namely seeking meaning from new knowledge in different ways (Lohbeck & Moschner, 2022; Sukowati et al., 2020). If this strategy is used, students will be more self-confident because apart from being able to make connections, students can also find meaning in what they are learning. Therefore, self-confidence greatly influences a person's achievement or performance (Gita Andriani, 2023; Moneva & Valle, 2020; Psycharis & Kotzampasaki, 2019). Thus, students who have high self-confidence will be able to complete their assignments well, and vice versa (Gita Andriani, 2023; Hendriana et al., 2018).

Learning is a process that involves changes in students' self-confidence (Surya et al., 2017). In learning, many components are involved, becoming one unit, interrelated and relevant to each other, namely teachers, students, materials, media, methods, curriculum and evaluation(Effendi, 2019). Learning methods will be effective if students have high self-confidence (Gita Andriani, 2023; Nilasari et al., 2020). In general, curriculum and classroom-based mathematics learning has not focused on developing the reasoning power and thinking processes of individual students, but has tended to introduce or memorize formulas and concepts orally, where the teacher is the center of learning activities without paying attention to students' characteristics and understanding (Abu Bakar & Ismail, 2020). If so, then mathematics becomes difficult to teach and learn, and has an impact on students' self-confidence becoming low (Hendriana et al., 2018; Jati & Soebagyo, 2023; Moneva & Valle, 2020; Nilasari et al., 2020).

The curriculum must serve students who have different abilities or academic potential, making it easier for teachers in the learning process (Effendi, 2019; Jingna,

2012). As a form of learning service for different students, it is necessary to provide Independent Learning Activity Guide (ILAG) in implementing a class-based curriculum. ILAG is a learning scenario that students can use as a guide to develop their independent learning strategies in order to achieve learning mastery (Kemendikbud, 2017).This ILAG is very likely to increase learning independence, because students oriented, where students are actively involved in mastering competencies through learning (Ahmady & Shahbazi, 2020; Hendriana et al., 2018; Kemendikbud, 2017; Lin, Tseng, & Chiang, 2017; Madrazo & Dio, 2020). Based on the description above, there are many problems associated with independent learning in the implementation of a classroom-based curriculum , there are at least three issues that must be known, namely: 1) what are the cognitive strategies of students who study independently in implementing a class-based curriculum, 2) what is the self-confidence of students who study independently in implementing a class-based curriculum, and 3) is there an influence of cognitive strategies on the self-confidence of students who learn independently in implementing a classroom-based curriculum.

▪ METHOD

Research Approach

The approach used to answer the cognitive strategies and self-confidence of students who learn independently in implementing a classroom-based curriculum is to use descriptive qualitative (Creswell, 2007; Leavy, 2016; Mcdonagh, 2004; Saldaña, 2016). Meanwhile, to find out the influence of cognitive strategies on the self-confidence of students who study independently in implementing a class-based curriculum, is to use a quantitative approach, with regression analysis assisted by IBM SPSS 21 (Field, 2013).

Participants

This research took place at SMAN 8, Malang City, East Java, Indonesia. This high school is one of 102 public and private high schools in Malang City, which uses ILAG in its mathematics learning. For more than 4 years there has been no evaluation, especially those related to self-confidence and cognitive strategies used by students in learning. Therefore, the population of this study was students from 28 classes consisting of science, social studies and language at SMA N 8 Malang City, Indonesia. Meanwhile, the sample was class 12 of SMAN 8 science program, with random sampling technique.

Research Design and Procedures

Based on the research objectives and approach used, the research design used is explanatory, namely determining and describing cause and effect relationships between variables (Creswell, 2007; Leavy, 2016; Saldaña, 2016). This research was conducted over one semester, with three stages, namely the initial stage, research stage, and final stage (Creswell, 2007). Activities carried out in the initial stage are; 1) reviewing literature related to the research topic, 2) observing the school, to ensure that the school uses independent learning, and 3) determining the research problem. After that, the activities at the research stage are: 1) designing research, 2) designing instruments, 3) observing learning in class, 4) collecting research data, and 5) analyzing data. Meanwhile, in the final stage, hold discussions with the research team, revise and make a report.

Instruments

Data collection techniques used to obtain data to answer problems are document techniques, questionnaires and interviews (Creswell, 2007; Mcdonagh, 2004; Saldaña, 2016). Interviews with teachers to cross check documents about independent learning using ILAG, interviews were also conducted with students to cross check the results of cognitive strategy and self-confidence questionnaires (Leavy, 2016).The questionnaire is closed with a Likert Scale with answer choices and scores: 1 = strongly disagree, 2 = disagree, 3 = agree, and 4 = strongly agree (Creswell, 2007; Leavy, 2016). In this case there are two questionnaires, namely the cognitive strategy questionnaire and the self-confidence questionnaire. The cognitive strategy questionnaire consists of 16 question items, namely 5 items for repetition strategies, 5 items for elaboration strategies, and 6 items for organizational strategies. This questionnaire was adapted from the Motivated Strategies for Learning Questionnaire (MSLQ) (Creswell, 2007) with indicators as in the following table. Meanwhile, the self-confidence questionnaire was developed based on indicators and descriptors such as the following table (Jati & Soebagyo, 2023; Surya et al., 2017).

Table 1. Indicators of cognitive strategy for learning mathematics

No.	Strategies	Matematics Learning Strategy Indicator
1.	Repetition *(P)*	P_1 = Often practice with similar questions P_2 = Marks important concepts P_3 = Make use of time to study mathematics P_4 = Discussing problems with classmates P_5 = Find the latest information on online sites
2.	Elaboration *(E)*	E_1 = Find out the important parts of the notebook E_2 = When you don't understand, find out the problem E_3 = Have an organized place to study E_4 = Have a study schedule with classmates E_5 = Take some online math tests
3.	Organization *(O)*	O_1 = Connecting material with other lessons O_2 = Create tools to organize material O_3 = Create an agenda and determine targets O_4 = Follow every study schedule O_5 = Has a competitive spirit with friends O_6 = Search for questions on online sites

Table 2. Self-confidence indicators and descriptors

No	Indicators	Descriptors
1.	Acceptance of yourself	Confidence in your abilities
2.	Ability to build relationships	Have a positive self-concept
3.	Ability to take risks	Think rationally, realistically and measurably
4.	Self-expression	Dare to express your opinion
5.	Effective decision making	Have a sense of responsibility

Data Analysis

The data analysis technique used to answer the cognitive strategies and self-confidence of students who learn independently in implementing a class-based curriculum is qualitative descriptive analysis. Actually, qualitative data analysis takes

place since data collection (Creswell, 2007; Mcdonagh, 2004). Meanwhile, the qualitative analysis model used in this research is an interactive model with stages of data collection, data reduction, data display, and conclusion/drawing/verification (Miles, Hubberman, & Saldana, 2016).

Questionnaire data obtained from respondents is scored and the percentage is calculated to determine the category, namely Very High, High, Medium, Low and Very Low (Creswell, 2007; Leavy, 2016; Saldaña, 2016).To determine whether students use repetition, elaboration or organization strategies, it is based on the highest questionnaire score of the three strategies.

Meanwhile, the data analysis used to determine the influence of cognitive strategies on the self-confidence of students who study independently in implementing a class-based curriculum is using a multiple linear regression test assisted by IBM SPSS 21 (Field, 2013). In general, the multiple linear regression equation is: $SC=\alpha+\beta\_1 P+\beta\_2 E+\beta\_3 O$, where self-confidence (SC) is the dependent variable, α is a constant, β_i is the regression coefficient of the independent variable, and the independent variable is the repetition strategy (P), elaboration strategy (E), and organizational strategy (O). To find out whether repetition strategy, elaboration strategy, and organizational strategy jointly influence self-confidence, use the ANOVA test. Meanwhile, the t-test was used to determine the partial effect of repetition strategy, elaboration strategy, and organizational strategy on self-confidence (Leavy, 2016). The coefficient states the percentage of strength of cognitive strategies in influencing self-confidence, by looking at the value R^2, where $0 \leq R^2 \leq 1$ (Field, 2013).

Before testing the hypothesis, the data must meet the requirements, namely normal distribution, no multicollinearity, linearity, and a minimum of 30 data. Based on the results of the residual normality test using the Kolomogrov Sminov statistical test (Table 3), it was found that the data was normally distributed, with asymp. sig. (2-tailed) = 0.81 is greater than 0.05 (Field, 2013; Moradi, 2021)

Table 3. Description of normality test results: One-sample kolmogorov-smirnov test

Unstandardized Residual		
N		40
Normal Parameters	Mean	.0000000
	Std. Deviation	1.62665718
Most Extreme Differences	Absolute	.101
	Positive	.101
	Negative	-.082
Kolmogorov-Smirnov Z		.638
Asymp. Sig. (2-tailed)		.810

From the results of the multicollinear test (Table 4), it was found that between the independent variables, namely P, E, and O, there was no multicollinearity, this was based on the VIF (Variance Inflation Factor) values of P, E, and O being less than 10, and the Tolerance was greater than 0.1 (Field, 2013).

Table 4. Description of multiple linear regression test results

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
(Constant)	3.932	2.891		1.360	.182		
P	.128	.183	.103	.697	.490	.838	1.194
E	.161	.178	.156	.904	.372	.619	1.615
O	.335	.139	.423	2.412	.021	.599	1.670

Meanwhile, based on the results of the linearity test (Table 5), it was found that the variables in this study had a linear relationship, this can be seen from the sig value. deviation from linearity (0.644) is greater than 0.05 (Field, 2013; Leavy, 2016).

Table 5. ANOVA Table: description of linearity test results

			Sum of Squares	df	Mean Squares	F	Sig.
Unstandardized Residual * Unstandardized Predicted Value	Between Groups	(Combined)	94.195	36	2.617	.872	.656
		Linearity	.000	1	.000	.000	1.000
		Deviation from Linearity	94.195	35	2.691	.897	.644
	Within Groups		9.000	3	3.000		
	Total		103.195	39			

▪ RESULT AND DISSCUSSION

Students' Cognitive Strategies in Independent Learning

Cognitive strategies are often referred to as learning strategies in solving problems. This strategy is a tendency, so that each student only has one cognitive strategy, whether a repetition strategy, elaboration strategy, or organizational strategy. Based on the results of the analysis, it was found that the strategy most used by students who study independently in implementing the class-based curriculum is the repetition strategy (57.5%), then the organizational strategy (37.5%), and the least is the elaboration strategy (5%). This percentage is in accordance with the level of complexity of the three cognitive strategies, especially those related to students' independent learning abilities. But overall the cognitive strategies used by students in independent learning are in the high category (74.68%).

Table 6. Scores, categories, and number of students based on cognitive strategy

No	Strategy and indicator	Score (%)	Category	Number of Student (%)
1.	Repetition *(P)*	77.25	High	57.5
2.	Elaboration *(E)*	70.5	High	5
3.	Organization (*O)*	76.28	High	37.5
Total		74.68	High	100.0

Based on the table above, many students (57.5%) use the repetition strategy. This strategy is usually used to connect new knowledge with previous knowledge, by studying repeatedly with the same questions, to obtain meaning from what is learned. The same

thing was also conveyed by Schnaubert et al. (2021) and Sukowati et al. (2020), this strategy is even done by reading silently or aloud to memorize it. Students often mark concepts they consider important and discuss them with their classmates. Therefore, the results of this research are in line with the opinions of Batubara (2023), Fan, Luo, Xie, Zhu, & Li (2022), Mainali (2021), Sukowati et al. (2020), dan Tay, Chan, Chong, Tan, & Aiyoob (2024), that repetition strategies are less suitable for independent learning, especially with more complex learning tasks. The organizational strategy is more aspirational and freer in using organizational structures to find the main ideas of the material being studied, but students still need to learn together. As stated by Sheromova et al. (2020), that organizational strategies are more suitable in classroom-based learning. Meanwhile, elaboration strategies are used to connect more deeply and meaningfully. This requires a higher cognitive level, so not many, even only 5% of students use elaboration strategies. Elaboration strategies are also used to move new information from short-term to long-term memory independently. So according to Kusmiyati (2023), Sachdeva & Eggen (2021), dan Sukowati et al. (2020), that elaboration strategies are more suitable for use in independent learning. Elaboration can also be referred to as a process that involves adding meaning, making descriptions or conclusions from the material being studied, making analogies, generalizing, expanding ideas on the material being studied, as well as questioning and searching for answers independently (Lohbeck & Moschner, 2022; Pahmi, Liping Deng, & Marissa Syafwin, 2022; Prihantini, Rostika, & Hidayah, 2021).

Independent learning is a process where students take the initiative to learn on their own, manage their time, manage their own resources, and require cognitive strategies to encourage their learning process to achieve the desired learning outcomes (Aidoo, 2023; Chang & Windeatt, 2024; Rusconi & Squillaci, 2023). The learning process is a process in which students use cognitive, repetition, elaboration, or organizational strategies to assimilate information, process it, and use it to gain a deeper understanding or achieve their learning goals (Rosyadi, Sa'Dijah, Susiswo, & Rahardjo, 2022; Schnaubert et al., 2021; Sheromova et al., 2020; Sutama et al., 2021). Bickerdike, O'Deasmhunaigh, O'Flynn, & O'Tuathaigh (2016), Gita Andriani (2023), dan Madrazo & Dio (2020), state that cognitive strategies influence learning processes and outcomes. Therefore, learning outcomes are the result of interactions between independent learning, the application of effective cognitive strategies, and the learning process. Learning outcomes include better understanding, longer retention, the ability to apply knowledge in different contexts, and achievement of set learning goals, as also stated by Sachdeva & Eggen (2021), Schnaubert et al. (2021), dan Widowati et al. (2021). Based on the description above, the relationship between independent learning, cognitive strategies, learning processes, and learning outcomes, as in the following picture.

Students' Self-confidence in Independent Learning

Students' self-confidence in independent learning is confidence or belief in their ability to learn independently (Gita Andriani, 2023; Moneva & Valle, 2020; C. Pratiwi, Neviyarni, & Solfema, 2018). Students are able to manage time, plan effective learning strategies, solve problems, and achieve learning goals without depending on the help of others (Kusmiyati, 2023; Moneva & Valle, 2020). There are several factors that can influence students' self-confidence in independent learning, namely experience, support,

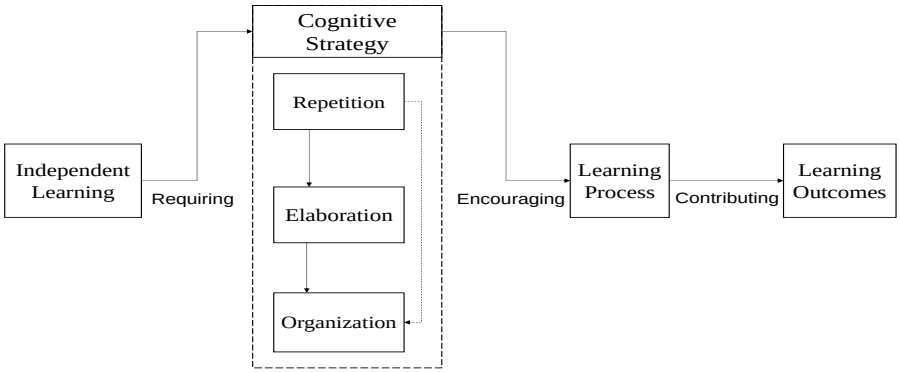

Figure 1. Relationship between independent learning, cognitive strategy, learning process and learning outcomes

metacognitive skills, clear goals, and self-esteem (Jati & Soebagyo, 2023; Moneva & Valle, 2020; Psycharis & Kotzampasaki, 2019). Strong self-confidence in independent learning is important because it helps students become more independent, dare to take risks, and develop the adaptive skills needed to face future learning challenges (Gita Andriani, 2023; Madrazo & Dio, 2020; C. Pratiwi et al., 2018).

Based on the results of the analysis, it was found that students' self-confidence in independent learning was classified as high (71.0%), where 12.5% of students were classified as very high, 67.5% were classified as high, and 20% of students were classified as medium. These students' suboptimal self-confidence is influenced by several indicators, namely they lack the courage to express their opinions, lack a positive self-concept, and lack a sense of responsibility . More details can be described as in the following table.

Table 7. Description of scores and categories based on self-confidence indicators

No	Self-confidence Indicators	Average (%)	Category
1.	Confidence in your abilities	81.88	Very High
2.	Have a positive self-concept	67.5	High
3.	Think rationally, realistically and measurably	80.63	Very High
4.	Dare to express your opinion	55.0	Medium
5.	Have a sense of responsibility	69.38	High
Total Average		71.0	High

Students' self-confidence has an important role in encouraging effective independent learning, even Gita Andriani (2023), C. Pratiwi et al. (2018), dan Surya et al. (2017),stated that self-confidence is the dominant factor that influences independent learning. This is in line with the opinion of Setyowati & Widana (2016), that if students have confidence in their ability to master the material and achieve their learning goals, then students tend to be more motivated and take the initiative in independent learning. High self-confidence helps students be more willing to take risks, dare to express opinions, be more confident in their abilities and be responsible in solving problems, and be more independent in exploring material in depth (Moneva & Valle, 2020; C. Pratiwi

et al., 2018; Psycharis & Kotzampasaki, 2019). In addition, confident students tend to be more resistant to frustration when faced with difficulties in independent learning, and they see challenges as opportunities to learn and grow. Therefore, Gita Andriani (2023) dan Kusmiyati (2023), remind that adaptive abilities also influence the success of independent learning. Through positive, proactive behavior and self-acceptance, self-confidence helps students develop strong learning independence (Gita Andriani, 2023; Kunhertanti & Santosa, 2018; C. Pratiwi et al., 2018; Surya et al., 2017). Mulyono (2021) and Sheromova et al. (2020) stated that building students' self-confidence is very important in optimizing a sustainable independent learning approach.

Self-confidence is a student's belief in their ability to carry out certain tasks or achieve predetermined learning goals (Kusmiyati, 2023; Moneva & Valle, 2020; Surya et al., 2017).. High self-confidence can motivate students to take the initiative to learn independently, overcome problems, and strive to achieve success. This is the same as the research results from Jati & Soebagyo (2023) dan Setyowati & Widana (2016). The success of the learning process and achieving good learning outcomes can strengthen students' self-confidence, while high self-confidence can also influence the learning process positively (Gita Andriani, 2023; Moneva & Valle, 2020; Setyowati & Widana, 2016). The relationship between independent learning, the learning process, learning outcomes, and self-confidence, as in the following picture.

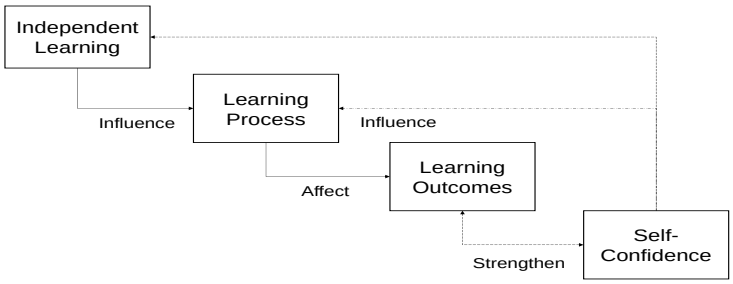

Figure 2. Relationship between independent learning, learning process, learning outcomes, and self-confidence

The Influence of Cognitive Strategies on Students' Self-Confidence in Independent Learning

Based on Table 4 above, the multiple linear regression equation is: SC=3,932+0,128 P+0,161 E+0,335 O. This equation describes the positive relationship of each cognitive strategy independent variable on self-confidence (SC). For every 1 unit increase in repetition strategy (P), elaboration strategy (E), and organizational strategy (O), self-confidence (SC) will increase respectively by 0,128; 0,161; and 0,335. This cognitive strategy regression coefficient states that there is a positive influence of cognitive strategy on self-confidence. The better the cognitive strategies used by students, the higher their self-confidence. But the existence of a positive influence is not necessarily significant. As depicted in Table 4, the significance level (Sig) of the three independent variables, namely Sig.(P) = 0.49; Sig.(E) = 0.372; Sig.(O) = 0.021, and less than 5% is Sig.(O) = 0.021. This means that of the three cognitive strategies, only organizational strategy has a significant influence on self-confidence.

However, cognitive strategies simultaneously or collectively influence self-confidence. This can be seen from the results of the simultaneous test (F-test) Anova in Table 8, where F = 6.144 with Sig. = 0.002 less than 0.05. Based on this, it can be said that cognitive strategies influence self-confidence. This result is the same as the research results of Psycharis & Kotzampasaki (2019) that cognitive strategies have an influence on students' self-confidence which ultimately has an impact on their learning outcomes. Therefore, this cognitive strategy can be used to increase self-confidence and the ability to understand mathematical material.

Table 8. Description of ANOVA results

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	52.580	3	17.527	6.114	.002[a]
	Residual	103.195	36	2.867		
	Total	155.775	39			

Predictors: (Constant). *R. E. O*
Dependent Variable: *SC*

However, the influence of cognitive strategies on self-confidence is only 58.1%, this can be seen in Table 9, where the coefficient of determination (R) is 0.581 with an influence contribution (R Square) of 33.8%. In this case it can be said that 66.2% is influenced by other variables. For example, metacognitive learning strategies, self-efficacy and effective learning (Psycharis & Kotzampasaki, 2019). as well as the ability to appreciate the role of mathematics, flexibility and reflection on students' way of thinking (Abu Bakar & Ismail, 2020; Surya et al., 2017).

Table 9: Description of *R* square test results

Model Summary[b]					
Model	*R*	*R* Square	Adjusted *R* Square	Std. Error of the Estimate	Durbin-Watson
1	.581[a]	.338	.282	169.308	1.647

Based on the description above, the use of repetition strategies, elaboration strategies, and organizational strategies partially has an influence on students' self-confidence in independent learning (Lohbeck & Moschner, 2022; Schnaubert et al., 2021; Sukowati et al., 2020). The repetition strategy can help students understand the material being studied, which ultimately increases self-confidence, especially in dealing with the material (Kunhertanti & Santosa, 2018). By repeating or reviewing information regularly, students will be more prepared and self-confident in remembering and applying the knowledge learned. Elaboration strategies, such as making connections between new concepts and previous ones or explaining material to others, also have a positive impact on students' self-confidence . This elaboration process helps students to deepen their understanding of the material, and feel more confident in their ability to articulate and apply the concepts they are learning (Chang & Windeatt, 2024; Sani et al., 2024; Zhao, 2024). Meanwhile, the use of organizational strategies, such as taking notes, creating a study schedule, or organizing material in a structured manner, also contributes to increasing students' self-confidence in independent learning. By planning and organizing

their learning process well, students feel more organized and self-confident in managing their time and resources to achieve their academic goals (Kunhertanti & Santosa, 2018; Lohbeck & Moschner, 2022; Schnaubert et al., 2021; Sukowati et al., 2020). On this basis, the use of repetition strategies encourages elaboration strategies, elaboration strategies support organizational strategies, which provide students with powerful tools to develop a deep understanding of the material, improve their learning skills, and ultimately strengthen their self-confidence in facing the challenges of independent learning in achieve optimal learning outcomes (Figure 3).

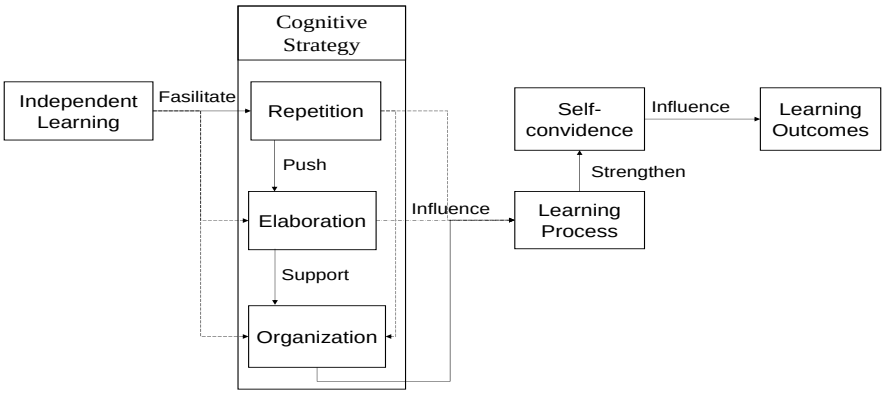

Figure 3. Relationship between independent learning, cognitive strategy, learning process, and learning outcomes

▪ CONCLUSION

Independent learning is active student learning, where students take the initiative, design their learning, and are independently responsible for their knowledge, skills and understanding. Therefore, independent learning is not limited to a formal environment, place and time, but can also be carried out in various contexts, where the teaching module is a learning guide. Therefore, independent learning is difficult to develop in a classroom-based curriculum. Based on this, it is necessary to study students' cognitive strategies and self-confidence in independent learning, and whether there is an influence of cognitive strategies on students' self-confidence in classroom-based independent learning. Based on the results of the analysis, it is stated that the use of cognitive strategies in classroom-based independent learning is high, and the strategies that are widely used are repetition strategies, organizational strategies and elaboration strategies, respectively. Students' self-confidence is also relatively high, but students lack the courage to express their opinions, lack a positive self-concept, and lack a sense of responsibility. Simultaneously, cognitive strategies influence self-confidence at a significance level of 5%, with an influence level of 33.8%. Of the three strategies, only organizational strategy has a significant effect on self-confidence.

The low level of influence of cognitive strategies on self-confidence, apart from independent learning being less suitable in implementing a classroom-based curriculum, is also caused by other factors, namely the use of metacognitive learning strategies, self-efficacy, students' ability to appreciate the role of mathematics, learning flexibility, and students' ability to reflect students' way of thinking. This can be seen from the number of students using repetition strategies compared to organizational and elaboration strategies,

in fact only 5% of students use elaboration strategies. On this basis, learning modules in independent learning must be developed, so that they can increase students' self-confidence and use of intermediate, advanced and expert level cognitive strategies.

▪ REFERENCES

Abu Bakar, M. A., & Ismail, N. (2020). Metacognitive learning strategies in mathematics classroom intervention: a review of implementation and operational design aspect. International Electronic Journal of Mathematics Education, 15(1). https://doi.org/10.29333/iejme/5937

Ahdhianto, E., Marsigit, Haryanto, & Nurfauzi, Y. (2020). Improving fifth-grade students' mathematical problem-solving and critical thinking skills using problem-based learning. Universal Journal of Educational Research, 8(5). https://doi.org/10.13189/ujer.2020.080539

Ahmady, S., & Shahbazi, S. (2020). Impact of social problem-solving training on critical thinking and decision making of nursing students. BMC Nursing, 19(1). https://doi.org/10.1186/s12912-020-00487-x

Aidoo, B. (2023). Teacher educators experience adopting problem-based learning in science education. Education Sciences, 13(11). https://doi.org/10.3390/educsci13111113

Batubara, A. A. (2023). Dependent and independent cognitive style learning model in mathematics subject outcomes. Randwick International of Education and Linguistics Science Journal, 4(2). https://doi.org/10.47175/rielsj.v4i2.701

Bickerdike, A., O'Deasmhunaigh, C., O'Flynn, S., & O'Tuathaigh, C. (2016). Learning strategies, study habits and social networking activity of undergraduate medical students. International Journal of Medical Education, 7. https://doi.org/10.5116/ijme.576f.d074

Chang, H., & Windeatt, S. (2024). Enhancing short academic presentations through extended independent practice using VoiceThread. https://doi.org/10.4995/eurocall2023.2023.16957

Creswell, J. W. (2007). Qualitative inquiry and research design: choosing among five approaches, 2nd edition. Public Administration, Vol. 77.

Effendi, Moh. M. (2019). Analysis of humanist education on VHS Mathematics Curriculum. https://doi.org/10.2991/iccd-19.2019.89

Effendi, Moh. M. (2020). Content Analysis of SHS Mathematics Curriculum Based on Independent Learning. https://doi.org/10.2991/assehr.k.201017.098

Fan, L., Luo, J., Xie, S., Zhu, F., & Li, S. (2022). Chinese students' access, use and perceptions of ICTs in learning mathematics: findings from an investigation of Shanghai secondary schools. ZDM - Mathematics Education, 54(3). https://doi.org/10.1007/s11858-022-01363-5

Field, A. (2013). Discovering statistics using IBM SPSS statistics. In Statistics (Vol. 58).

Gita Andriani, D. (2023). The effect of self-confidence on students' understanding of mathematical concepts through the implementation of the independent curriculum. Noumerico: Journal of Technology in Mathematics Education, 1(1). https://doi.org/10.33367/jtme.v1i1.3548

Hendriana, H., Johanto, T., & Sumarmo, U. (2018). The role of problem-based learning to improve students' mathematical problem-solving ability and self confidence.

Journal on Mathematics Education, 9(2). https://doi.org/10.22342/jme.9.2.5394.291-300

Herlianti, P. S., Linuwih, S., & Dwijananti. (2015). Independent learning strategy of natural science with 'one day one diary for science' Program. Jurnal Pendidikan Fisika Indonesia, 11(2).

Jati, H. S., & Soebagyo, J. (2023). The influence of self-confidence on the mathematical reasoning ability of junior high school students. Prima: Jurnal Pendidikan Matematika, 7(1). https://doi.org/10.31000/prima.v7i1.7321

Jingna, D. (2012). Application of humanism theory in the teaching approach. Higher Education of Social Science, 3(1).

Kemendikbud. (2017). *Panduan praktis penyusun e-modul pembelajaran.* Kemendikbud.

Kopzhassarova, U., Akbayeva, G., Eskazinova, Z., Belgibayeva, G., & Tazhikeyeva, A. (2016). Enhancement of students' independent learning through their critical thinking skills development. International Journal of Environmental and Science Education, 11(18).

Kulsum, U., & Kustono, D. (2017). Improvement of learning independence and learning outcomes on textile course through hybrid learning model. IOSR Journal Of Humanities And Social Science (IOSR-JHSS, 22(8).

Kunhertanti, K., & Santosa, R. H. (2018). The influence of students' self confidence on mathematics learning achievement. Journal of Physics: Conference Series, 1097(1). https://doi.org/10.1088/1742-6596/1097/1/012126

Kusmiyati, K. (2023). Implementation of the self-organized learning environments learning model to enhace learning outcomes and student independence. Jurnal Pijar Mipa, 18(3). https://doi.org/10.29303/jpm.v18i3.4776

Leavy, P. (2016). Research design (quantitative, qualitative,mixed methods, arts-based, and community-based participatory research approaches). In Revista Brasileira de Linguística Aplicada (Vol. 5).

Lin, Y. W., Tseng, C. L., & Chiang, P. J. (2017). The effect of blended learning in mathematics course. Eurasia Journal of Mathematics, Science and Technology Education, 13(3). https://doi.org/10.12973/eurasia.2017.00641a

Lohbeck, A., & Moschner, B. (2022). Motivational regulation strategies, academic self-concept, and cognitive learning strategies of university students: does academic self-concept play an interactive role? European Journal of Psychology of Education, 37(4). https://doi.org/10.1007/s10212-021-00583-9

Madrazo, A. L., & Dio, R. V. (2020). Contextualized learning modules in bridging students' learning gaps in calculus with analytic geometry through independent learning. Journal on Mathematics Education, 11(3). https://doi.org/10.22342/jme.11.3.12456.457-476

Mainali, B. (2021). Representation in teaching and learning mathematics. International Journal of Education in Mathematics, Science and Technology, 9(1). https://doi.org/10.46328/ijemst.1111

Mcdonagh, D. (2004). Design research: methods and perspectives: brenda laurel (editor). The Design Journal, 7(1). https://doi.org/10.2752/146069204790718510

Miles, M. B., Hubberman, A. M., & Saldana, J. (2016). Qualitative data analysis : a methods sourceboo. SAGE Journal, 30(25).

Moneva, Dr. J. C., & Valle, A. F. S. (2020). Difficulty in Mathematics: Close Assistance and Self-Confidence. Journal of Studies in Education, 10(1). https://doi.org/10.5296/jse.v10i1.16460

Moradi, H. (2021). Quantitative research methods for communication: a hands-on approach. Journal of Education for Teaching, 47(4). https://doi.org/10.1080/02607476.2021.1892451

Mulyono, D. (2021). The influence of learning model and learning independence on mathematics learning outcomes by controlling students' early ability. International Electronic Journal of Mathematics Education, 12(3). https://doi.org/10.29333/iejme/642

Nilasari, A., Effendi, Moh. M., & Putri, O. R. U. (2020). *Analisis self-confidence dan hasil belajar matematika sma dalam kurikulum berbasis unit kegiatan belajar mandiri.* AKSIOMA: Jurnal Program Studi Pendidikan Matematika, 9(2). https://doi.org/10.24127/ajpm.v9i2.2800

O'Donoghue, G. (2017). Starting self-starters: Strategies to support independent learning. In University of Sydney Papers in TESOL (Vol. 12).

Pahmi, P., Liping Deng, & Marissa Syafwin. (2022). Using the capcut application as a learning media. Journal International Inspire Education Technology, 1(1). https://doi.org/10.55849/jiiet.v1i1.37

Pratiwi, C., Neviyarni, N., & Solfema, S. (2018). Contribution self efficacy and independent learning math toward students' mathematics learning outcomes. https://doi.org/10.29210/2018199

Pratiwi, I. D., & Laksmiwati, H. (2016). *Kepercayaan diri dan kemandirian belajar pada siswa SMA Negeri "X".* Jurnal Psikologi Teori Dan Terapan, 7(1). https://doi.org/10.26740/jptt.v7n1.p43-49

Prihantini, P., Rostika, D., & Hidayah, N. (2021). Solve the problem of learning fractions in mathematics trough scaffolding. Journal of Physics: Conference Series, 1987(1). https://doi.org/10.1088/1742-6596/1987/1/012027

Psycharis, S., & Kotzampasaki, E. (2019). The impact of a stem inquiry game learning scenario on computational thinking and computer self-confidence. Eurasia Journal of Mathematics, Science and Technology Education, 15(4). https://doi.org/10.29333/ejmste/103071

Rosyadi, A. A. P., Sa'Dijah, C., Susiswo, & Rahardjo, S. (2022). High order thinking skills: Can it arise when a prospective teacher solves a controversial mathematics problem? Journal of Physics: Conference Series, 2157(1). https://doi.org/10.1088/1742-6596/2157/1/012038

Rusconi, L., & Squillaci, M. (2023). Effects of a universal design for learning (udl) training course on the development teachers' competences: a systematic review. Education Sciences, Vol. 13. https://doi.org/10.3390/educsci13050466

Sachdeva, S., & Eggen, P.-O. (2021). Learners' critical thinking about learning mathematics. International Electronic Journal of Mathematics Education, 16(3). https://doi.org/10.29333/iejme/11003

Saldaña, J. (2016). The coding manual for qualitative researchers (No. 14). Sage.

Sani, R. A., Tanjung, Y. I., Sani, R. A., Nasution, B., Yohandri, & Festiyed. (2024). Science teachers' understanding of culturally responsive teaching on independent

learning curriculum. Jurnal Penelitian Pendidikan IPA, 10(1). https://doi.org/10.29303/jppipa.v10i1.4821

Schnaubert, L., Krukowski, S., & Bodemer, D. (2021). Assumptions and confidence of others: the impact of socio-cognitive information on metacognitive self-regulation. Metacognition and Learning, 16(3). https://doi.org/10.1007/s11409-021-09269-5

Setyowati, D., & Widana, I. W. (2016). *Pengaruh minat, kepercayaan diri, dan kreativitas belajar terhadap hasil belajar matematika.* Jurnal Emasains, V No. 1.

Sheromova, T. S., Khuziakhmetov, A. N., Kazinets, V. A., Sizova, Z. M., Buslaev, S. I., & Borodianskaia, E. A. (2020). Learning styles and development of cognitive skills in mathematics learning. Eurasia Journal of Mathematics, Science and Technology Education, 16(11). https://doi.org/10.29333/EJMSTE/8538

Sukowati, S., Sartono, E. K. E., & Pradewi, G. I. (2020). The effect of self-regulated learning strategies on the primary school students' independent learning skill. Psychology, Evaluation, and Technology in Educational Research, 2(2). https://doi.org/10.33292/petier.v2i2.44

Surya, E., Putri, F. A., & Mukhtar. (2017). Improving mathematical problem-solving ability and self-confidence of high school students through contextual learning model. Journal on Mathematics Education, 8(1). https://doi.org/10.22342/jme.8.1.3324.85-94

Sutama, S., Anif, S., Prayitno, H. J., Narimo, S., Fuadi, D., Sari, D. P., & Adnan, M. (2021). Metacognition of junior high school students in mathematics problem solving based on cognitive style. Asian Journal of University Education, 17(1). https://doi.org/10.24191/ajue.v17i1.12604

Tay, L. Y., Chan, M., Chong, S. K., Tan, J. Y., & Aiyoob, T. B. (2024). Learning of mathematics: a metacognitive experiences perspective. International Journal of Science and Mathematics Education, 22(3). https://doi.org/10.1007/s10763-023-10385-8

Vandini, I. (2016). *Peran kepercayaan diri terhadap prestasi belajar matematika siswa.* Formatif: Jurnal Ilmiah Pendidikan MIPA, 5(3). https://doi.org/10.30998/formatif.v5i3.646

Widowati, C., Purwanto, A., & Akbar, Z. (2021). Problem-based learning integration in stem education to improve environmental literation. International Journal of Multicultural and Multireligious Understanding, 8(7). https://doi.org/10.18415/ijmmu.v8i7.2836

Zhao, R. (2024). An analysis of the role and impact of teacher-student interaction on establishing a student-centred classroom teaching model. Lecture Notes in Education Psychology and Public Media, 40(1). https://doi.org/10.54254/2753-7048/40/20240717