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Self-regulated learning with mathematics learning outcomes in terms of students' interest in learning mathematics

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ABSTRACT. Nowadays mathematics is still considered difficult, so it needs more attention because mathematics is the basis of other sciences. One of the factors that influence Mathematics Learning Outcomes (MLO) is Self-Regulated Learning (SRL). SRL plays a role in the process of planning and managing student academic assignments. Interest in Learning Mathematics (ILM) also has an important role in learning mathematics. The purpose of this study was to determine the effect of each SRL aspect on mathematics learning outcomes and to determine the effect of SRL on MLO in terms of the student's ILM level. The author uses mixed methods with a sequential exploratory research design that begins with a qualitative phase using descriptive qualitative research and then a quantitative phase using a correlation test. SRL aspects include task analysis, self-motivated belief, self-control, monitoring, self-consideration, and self-reaction. The results of this study are that there is an influence between SRL aspects on MLO, except for the task analysis aspect. SRL with MLO also does not have a significant effect when viewed from the ILM level.

Keywords: interest in learning mathematics; learning mathematics; mathematics learning; mathematics learning outcomes; self-regulated learning.

Aprendizagem autorregulada com resultados de aprendizagem de matemática em termos de interesse dos alunos em aprender matemática

RESUMO. Hoje em dia a matemática ainda é considerada difícil, por isso precisa de mais atenção porque a matemática é a base de outras ciências. Um dos fatores que influenciam os Resultados de Aprendizagem em Matemática (MLO) é a Aprendizagem Autorregulada (SRL). O SRL desempenha um papel no processo de planejamento e gerenciamento de tarefas acadêmicas dos alunos. O interesse em Aprender Matemática (ILM) também tem um papel importante na aprendizagem da matemática. O objetivo deste estudo foi determinar o efeito de cada aspecto da SRL nos resultados de aprendizagem da matemática e determinar o efeito da SRL na MLO em termos do nível de ILM do aluno. O autor utiliza métodos mistos com um desenho de pesquisa exploratória sequencial que começa com uma fase qualitativa usando pesquisa qualitativa descritiva e, em seguida, uma fase quantitativa usando um teste de correlação. Os aspectos da SRL incluem análise de tarefas, crença auto-motivada, autocontrole, monitoramento, auto-consideração e auto-reação. Os resultados deste estudo são de que há uma influência entre os aspectos da SRL na MLO, exceto para o aspecto da análise da tarefa. O SRL com MLO também não tem um efeito significativo quando visto a partir do nível de ILM.

Palavras-chave: interesse em aprender matemática; aprendizagem matemática; aprendizagem; aprendizagem autorregulada; matemática; resultados da aprendizagem da matemática.

Aprendizaje autorregulado con resultados de aprendizaje de matemáticas en términos del interés de los estudiantes por aprender matemáticas

RESUMEN. Hoy en día las matemáticas todavía se consideran difíciles, por lo que necesitan más atención porque las matemáticas son la base de otras ciencias. Uno de los factores que influye en los resultados del aprendizaje de las matemáticas (MLO) es el aprendizaje autorregulado (SRL). La SRL juega un papel en el proceso de planificación y gestión de las tareas académicas de los estudiantes. El interés por aprender matemáticas (ILM) también juega un papel importante en el aprendizaje de matemáticas. El propósito de este estudio fue determinar el efecto de cada aspecto de SRL en los resultados del aprendizaje de matemáticas y determinar el efecto de SRL en MLO en términos del nivel ILM del estudiante. El autor utiliza

métodos mixtos con un diseño de investigación exploratoria secuencial que comienza con una fase cualitativa utilizando investigación cualitativa descriptiva y luego una fase cuantitativa utilizando una prueba de correlación. Los aspectos de SRL incluyen análisis de tareas, creencias automotivadas, autocontrol, seguimiento, autoconsideración y autorreacción. Los resultados de este estudio son que existe influencia entre los aspectos de SRL sobre MLO, excepto el aspecto de análisis de tareas. SRL con MLO tampoco tiene un efecto significativo cuando se ve desde el nivel ILM.

Palabras clave: aprendiendo; aprendizaje autorregulado; aprendizaje matemático; interés en aprender matemáticas; matemáticas; resultados del aprendizaje de matemáticas.

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Introduction

Mathematics is a general science that is the basis of modern technological progress (Munahefi et al., 2022). Mathematics plays an important role in various disciplines and develops human thinking. The rapid development in the field of information and communication technology today is based on the development of mathematics in the fields of number theory, algebra, analysis, opportunity theory and discrete mathematics (Subarianto et al., 2019). A strong mastery of mathematics early on is necessary to master and create technology in the future. Mathematics is also needed so that students can have the ability to obtain, manage, and utilize information to survive in dynamic, uncertain, and competitive circumstances (Aini, 2022). Therefore, teaching and learning activities, especially in mathematics, need to be paid more attention to considering how important mathematics is for students later (Lestari, 2015). The level of acquisition of student mathematics learning outcomes (LMO) is influenced by several factors, one of which is self-regulated learning (SRL).

Taub et al. (2022) argues that student SRL is an important part of a student's academic success after high school, especially when it is a specific exercise that includes complex themes such as calculus and physics. SRL in learning is not a mental ability or academic performance skill, but rather a process of directing itself to transform mental abilities into academic skills (Zimmerman, 1990). SRL theory exists to develop three learning principles namely metacognition, motivation, and essential action (Brenner, 2022; Winne & Perry, 2000; Zimmerman, 2008). The metacognition learning procedure is one of the learning methods that aims to find out the difficulty points of students in SRL. Metacognitive learning is one of the learning methods that aims to find out the difficulties in student independent learning activities (Brenner, 2022). Motivating learning is learning that is ready to face difficult problems. Learning with essential actions is learning that solves a problem with SRL seen as thoughts, feelings, and treatment created by oneself that will be carried out and adjusted systematically to stamp the desired personal thing (Jiang et al., 2022). This is in line with the opinion of Kerlin (1992) who revealed that SRL refers to planning and monitoring cognitive and affective processes that involve successfully completing academic tasks. In addition to SRL, one of the elements that is no less important in learning mathematics is the interest in learning students.

Simbolon (2014) states that interest is a person's tendency to pay greater attention to something they are interested in and participate in activities carried out with pleasure. Interest is a fixed tendency to pay attention and reminisce about some activity. Activities that a person is interested in, are noticed continuously accompanied by a sense of pleasure (Sudarsana, 2014). Based on the opinions above, it can be concluded that interest is one aspect of a person's behavior that tends to be more of a positive thing. But in reality, many students are unhappy, feel compelled or just carry out an obligation.

According to Nabillah and Abadi (2020), one of the driving factors for learning outcomes is students' interest in learning. Students' interest in lessons is a force that will encourage students to learn (Heriyati, 2017). Students who have a high interest in learning will be able to learn and practice well, so that students will be easier to be trained to think critically, creatively, meticulously and logically which makes students able to perform well in learning (Sirait, 2016). Unlike students who have low interest in learning, their attitude is only accepting the teachings that the teacher gives and is only moved to want to learn but it is difficult to be able to continue to persevere because there is no driver (Fansuri et al., 2022). Students who do not have an interest in the lesson will show a less sympathetic attitude, lazy and not passionate about following the teaching and learning process (Prastika, 2020). Interest is closely related to a person's personality and the functioning of the psyche which includes cognition, emotion as well as conation or will (Akrim, 2022; Sirait, 2016).

According to Idigo (2010), interest relates to planning or mastering historical knowledge of the subject matter that allows students to cope with more advanced subject matter or learning tasks. Interest is needed to solve, answer and understand questions with difficult categories. It explained that the math interest test at the high school level is related to the skills expertise of mathematics prerequisites at the junior high school level which allows three junior high school students to complete higher advanced mathematics learning from high school (Anigbo & Idigo, 2015). Spurring interest in learning in every learning is important, especially in the implementation of mathematics learning which for some students is less in demand (Sirait, 2016). A student will demonstrate expertise in different procedures and stages when the student organizes his learning appropriately which are substantially the stages known to the entire SRL model (Pachón-Basallo et al., 2022).

According to Goolsby (2013) and Idigo (2010) the mathematics interest test can be used as an aspect of achievement in mathematics subjects, especially at the junior high school level. Most of the factors of low student ILM which include student factors, teacher factors, government factors, infrastructure problems, learning strategies, and so on have been identified in a reading material as correlated causes (Akinoso, 2011; Goolsby, 2013; Okonkwo, 1998). Student interest in learning has a significant influence on learning outcomes, or in other words, student learning outcomes can be improved through increasing student interest in learning (Nurhasanah & Sobandi, 2016).

According to Young et al. (2003) learning outcomes are students' self-assessment, and observable, proven, and measurable changes in ability or achievement experienced by students as a result of learning experiences (Németh & Long, 2012). LMO is the success rate in mastering mathematics. LMO is the ability that children have after going through mathematics learning activities (Abdurrahman, 1999). The learning outcomes of each student differ from one student to another (Ruliyanti, 2014). Clemons (in Fasikhah & Fatimah, 2013) also argues that learning outcomes have a complex relationship between individual abilities, self-perception, parenting style, socioeconomic status, assessment of tasks, expectations for success, cognitive strategies, self-regulation, gender, performance, individual attitudes towards school and others. These factors contribute to each other's SRL students.

Research Issues

Bungsu et al. (2019) and Suhendri (2011) stated that SRL is one of the important elements in studying mathematics. Based on previous research (Aryani & Hasyim, 2018; Fasikhah & Fatimah, 2013; Handayani & Sholikhah, 2021; Sholiha et al., 2022) it is known that SRL has a significant influence on student LMOs. Students with high SRL levels have a high LMO. In contrast to students with relatively low SRL levels, they have a relatively low LMO as well. However, it does not rule out the possibility that there could be no relationship between SRL and LMO if reviewed from the student's ILM.

Research Focus

This research will focus on how much influence each aspect of SRL has on student LMO as well as the influence of SRL with LMO in terms of student ILM. Aspects of SRL that are variables in this study include task analysis, self-motivational beliefs, self-control, monitoring, self-consideration, and self-reaction.

Research Objectives and Questions

Based on the problems described above, researchers want to conduct research to determine the influence of each aspect of SRL which includes task analysis, self-motivational beliefs, self-control, monitoring, self-consideration, and self-reaction to student LMO. In addition, this study also aims to determine the influence of SRL with LMO in terms of the ILM of high, medium and low-level students.

Research Methodology

This study used mixed method research with exploratory sequential research design. This research is carried out sequentially (gradually), where researchers first start by exploring and analyzing qualitative data then use the findings in the qualitative phase to develop instruments and analyze them quantitatively

(Isnaini, 2019). In the qualitative phase using qualitative descriptive research. Hadari argues that descriptive method means a problem-solving process that is studied by describing a state of the subject and object of research in a person, institution, or society in the present era based on visible facts, or as it is (Prabowo & Ristiana, 2022; Zulaikha et al., 2014). Descriptive research is research that contains a number of topics that are presented systematically, containing facts, properties and interactions of the reality under study. Qualitative descriptive methods are used to explore the interconnectedness between variables, namely the variables SRL, LMO, and student interest in learning.

In the quantitative phase a correlational test is carried out. Correlational research is a study carried out with the aim of knowing whether or not there is a correlation between at least two variables (Arikunto, 2010). The variables used for this correlational test are the SRL, LMO, and ILM variables of students ranging from low to high levels.

Subject of Research

This study used cluster random sampling data collection techniques. Random Sampling is one of the sampling methods where each member of the population is given the same opportunity to be selected as a sample (Arieska & Herdiani, 2018). The population in this study was all students at the junior high school level in Indonesia. However, according to researchers, the population is too wide so that researchers use a cluster system in 2 provinces, namely Banten Province and Yogyakarta Special Region Province. Based on the results obtained, the researchers only took 200 respondent data which included 100 respondents from junior high school students in Banten Province and 100 respondents from junior high school students in Special Region of Yogyakarta Province.

The research took place in the even semester of the 2021/2022 school year. Subject research consists of 2 different grades and provinces. The first school is a junior high school with a medium grade in Banten Province, while the second school is a junior high school with a high grade in Special Region of Yogyakarta Province. The two provinces have significant differences. Banten Province is known by various nicknames, one of its nicknames is the city of a thousand industries and a manufacturing center on the island of Java with many international companies' inseparable from environmental problems (Sigit et al., 2017). This is likely to affect the learning climate of students who should be calm to become noisy with industrial activities. Unlike Special region of Yogyakarta Province which is commonly referred to as the city of students. Many Indonesians from various regions go to D. I Province. Yogyakarta to study, starting from the level of primary, secondary, to higher education, so that the learning climate in Yogyakarta is more supportive of the learning process. In Table 1 such students are categorized according to the ILM level taking into account the average ($\bar{x}$) and standard deviation (σ).

Table 1. Categorization.

Component	Category	Formula	Interval
ILM	Low	$X < \bar{x} - \sigma$	X < 2.19
	Mid	$\bar{x} - \sigma \leq X < \bar{x} + \sigma$	2.19 < X < 3.97
	High	$\bar{x} - \sigma \leq X$	3.97 < X

Data collection instruments

Data collection using non-test evaluation instruments. Non-test evaluation instruments are a type of assessment of students by not using the form of tests, but rather forms of observation, interviews, questionnaires, and analyzing existing documents (Hutapea, 2019). Researchers used questionnaires containing statements regarding students' SRL, LMO and ILM. The questionnaire has been validated by mathematics education lecturers and improvements have been made. The SRL questionnaire consists of six aspects as found in the Table 2.

The non-test instrument consists of 33 statements with details of 24 items of positive statements and 9 items of negative statements with a score scale. The scoring scale used is if on a positive statement the answer is always worth 4, often worth 3, rarely worth 2 and never worth 1. Inversely proportional to negative statements, the score for an answer is always worth 1, often worth 2, rarely worth 3, and never worth 4.

Table 2. SRL questionnaire grids.

Component	Aspect	Indicators	Item	
			Positive	Negative
Planning	1. Task Analysis	Setting Purpose	1.2	7
		Planning Learing Strategies	4,5	-
	2. Self-Motivational Beliefs	Self-efficacy	6.8	3
		Intrinsic Motivation	9	-
		Self-esteem	10	15
		Self-expectation	12	16
Implementation	3. Self-Control	Self-instruction	11	20
		Attempts to learn	13, 14	23
		Finishing strategy	17	30
		Seeking the right help	18	-
	4. Monitoring	Monitoring in carrying out plans	19, 21	-
		Self-record	22	-
		Self-experimentation	24	27
Evaluation	5. Self-Consideration	Self-evaluation	25	31
		Be aware of the causes	26	-
	6. Self-Reaction	Plan failure	23	-
		Self-satisfaction	28	-
		Milieu	29	-
		Defensive	23, 33	-

The data tested were each student's SRL, LMO, and level of interest in learning. The validity test is the accuracy between the collected data and the data that actually occurs in the object under study (Christina & Kristin, 2016; Sugiyono, 2012). Test the validity of the instrument using statistical software with correlation tests on each SRL item. Based on the calculation results, it was obtained that out of 33 statements there were 24 valid statements and 9 invalid statements. Invalid statements are not tested in the study.

Priyatno (2016) argues that the reliability test is used to test the consistency of measuring instruments, whether the results remain consistent or not if re-measurement is carried out (Hanna, 2019). A questionnaire is declared reliable if the Cronbach alpha value is more than 0.6 (Wiratna, 2014). The data tested is that each SRL item uses statistical software and uses reliable statistics tests. The results of the Cronbach alpha value of 0.881 were obtained, so that each research variable is reliable because the Cronbach alpha value is more than 0.6.

Data analysis techniques

The data analysis technique used is in the form of descriptive analysis which aims to find out the general respondent picture of the results obtained. The overview is presented in the form of categorization on each research variable. Furthermore, an inferential analysis is carried out consisting of a prerequisite test and a hypothesis test. Prerequisite tests include normality tests and *linearity* tests. In the normality test, researchers tested the normal distribution of subjects with the *Kolmogorov-smirnov* and *Shapiro-wilk* tests for dependent variables, namely SRL and student LMO (Lohr, 2021; Pachón-Basallo et al., 2022). After the data is declared normally distributed, the researcher then conducts a *linearity* test. The *linearity* test aims to identify the relationship between free and bound variables whether linear or not (Widana & Muliani, 2020).

Furthermore, if the prerequisite testing has been met, it can be continued with the hypothesis test step. The hypothesis test used is a *simple linear regression* test. This test is carried out to predict the influence between free variables and bound variables in a particular population. This test is carried out with an anova test, that is, by calculating its significance value. Anova is part of a statistical analysis method that is classified as a comparative analysis of more than two averages (Riduwan, 2003; Setiawan, 2019). Free variables with bound variables can have a significant effect if the significance value of the calculation results meets the criteria of more than 0.05, conversely if the significance value is less than 0.05 then there is no significant influence.

Research results

The data obtained are then analyzed descriptively to determine the mean, frequently appearing values (*mode*), middle value (*median*), variance and standard deviation. The results of data analysis in Table 3.

Table 3. Descriptive data analysis.

Category	*Mean*	*Modus*	*Median*	*Varians*	Standard deviation
ILM	3.08	3.00	3.00	0,78	0.887

Furthermore, the categorization of students with high, medium and low categories is carried out based on the categorization table. On Table 4 categorization is carried out for each component, namely ILM, LMO and SRL students.

Table 4. Student categories.

Component	Category	Number of students	Percentage
ILM	High	46	23%
	Mid	120	60%
	Low	34	17%

The data that has been collected is then carried out a prerequisite analysis test, this test includes a normality test and a *linearity* test. Based on Table 5 normality test results using the *Kolmogorov-Smirnov* test had an LMO significance value of 0.094 and an SRL of 0.200 and significance value of *Shapiro-Wilk* LMO of 0.067 and an SRL of 0.675. Based on these significance values, conclusions can be drawn by comparing the value of *Sig.* or *P-Value* with the level of the significance commonly used $\alpha = 0{,}05$.

Table 5. Normality test results.

Component	*Kolmogorov-smirnov*			*Shapiro-wilk*		
	Statstic	*df*	*Sig.*	Statistic	*df*	*Sig.*
MLO	0.058	200	0.094	0.987	200	0.067
SRL	0.034	200	0.200	0.994	200	0.675

Nasrum (2018) argues that if the value of *P-Value* or *Sig.* there is a calculation output on software greater than α then it can be said that the sample data tested in the study came from a normally distributed population and vice versa. All significance values are above the significance level or more than 0.05 so that the sample data comes from a normally distributed population. After the normal distributed data is known, it is continued with the *linearity* test, the results are on Table 6.

Table 6. *Linearity* test results.

Component			Sum of Squares	*df*	Mean Square	*F*	*Sig.*
MLO * SRL	Between Groups	(Comgined)	22815.201	67	331.122	1.024	0.446
		Linearity	149.633	1	149.633	0.463	0.431
		Deviation from Linearity	22035.568	66	333.872	1.033	0.431
	Within Groups		42678.799	132	323.324		
	Total		64864.000	199			
ILM * SRL	Between Groups	(Comgined)	46.488	67	0.694	0.831	0.799
		Linearity	2.546	1	2.546	3.049	0.083
		Deviation from Linearity	43.942	66	0.666	0.797	0.847
	Within Group		110.232	132	0.835		
	Total		156.720	199			

Linearity testing using the *anova* test. Based on the test results, the results of the *Sig.* deviation from *linearity* value between learning outcomes with SRL are 0.431 and between learning interest and SRL was 0.847. If the value of *Sig.* deviation from *linearity* is more than 0.05, then the two variables have a linear relationship and vice versa (Widana & Muliani, 2020). Based on this opinion, it can be concluded that there is a relationship between learning outcomes with SRL and interest in learning with SRL.

The purpose of the study was to determine the effect of SRL on LMO; the effect of SRL on ILM and the influence of SRL and ILM on LMO. Data analysis to test the hypothesis in this study used a *simple linear regression* test and a *multiple linear regression* test. A *simple linear regression* test is performed by testing every aspect of the SRL with the student's LMO and ILM.

Based on the Table 7, it is known that not all aspects obtain a significance value of more than 0.05, which implies that only some aspects of SRL have a significant influence on LMO. Aspects of SRL that have an influence are self-motivational beliefs; self-control; monitoring; self-consideration and self-reaction. Meanwhile, the task analysis aspect has no significant influence on LMOs. But in general, SRL has a significant influence on student LMOs.

Table 7. Simple linear regression.

Predictors (Constant)	Model	Df	Mean Square	*F*	*Sig.*
Task analysis	1 Regression	1	162.430	0.497	0.782[b]
Self-motivational beliefs	2 Regression	1	7923.463	27.552	0.000[b]
Self-control	3 Regression	1	2900.874	9.270	0.003[b]
Monitoring	4 Regression	1	5917.525	19.877	0.000[b]
Self-consideration	5 Regression	1	5407.610	18.008	0.000[b]
Self-reaction	6 Regression	1	4191.054	13.677	0.000[b]

b. Dependent Variable: MLO

Effect of each aspect of SRL on student LMO

The Table 8 explains that the R square value is 0.003, which means that the effect of task analysis on LMO is only 0.3%. *R* square of self-motivational beliefs value was 0.122 which means that the influence of self-motivational beliefs on LMO is 12.2%. R square of self-control was 0.45 which means that the influence of self-control on LMO is 4.5%. *R* square of monitoring was 0.091 this means that the monitoring effect on LMO is 9.1%. R square of self-consideration was 0.083 which means that the influence of self-consideration on LMO is 8.3%. R square of self-reaction was 0.065 which means that the influence of self-reaction to LMO is 6.5%.

Table 8. Effect of aspect SRL on student LMO.

No	Aspect	*R* Square	Percentage	Degree of Significance
1	Task analysis	0,003	0,3%	Not significance
2	Self-motivational beliefs	0,122	12,2%	Significance
3	Self-control	0,045	4,5%	Significance
4	Monitoring	0,091	9,1%	Significance
5	Self-consideration	0,083	8,3%	Significance
6	Self-reaction	0,065	6,5%	Significance

Based on Table 9, it is known that the significance value of the influence of SRL on LMOs with low interest in learning is 0.003 or less than 0.05, which implies that students with low ILM, student LMO is influenced by their SRL. As for students with high and medium ILM, the student's LMO is not affected by the SRL.

Table 9. *Simple linear regression* test results.

ILM	Model	*Df*	Mean Square	*F*	*Sig.*
High	Regression 1	1	194.221	0.717	0.402[b]
Mid	Regression 2	1	226.115	0.626	0.430[b]
Low	Regression 3	1	2900.874	9.270	0.003[b]

b. Predictors: (Constant), SRL

Discussion

Based on the results of research it is proven that there is generally a significant influence between SRL and LMO, this is in line with previous research that SRL has a role in achieving optimal learning outcomes or achievements for students (Abror, 2022; Shantiyana, 2019; Zahary, 2015). However, when viewed from every aspect of SRL, there is one aspect that does not significantly affect the LMO, namely task analysis. Thus, the student's process of analyzing every detail of a given math assignment is not a major factor in improving a student's LMO. In addition to task analysis, other aspects of SRL such as self-motivational belief; self-control; monitoring; self-consideration and self-reaction have been shown to have a significant influence on student LMOs.

Self-motivational beliefs have a significant impact on student LMO of 12.2%. Therefore, the higher the student's motivation in learning mathematics, the higher the student's LMO obtained. This is in line with

previous research that learning motivation is an internal factor that influences student LMO (Cleopatra, 2015). The next aspect is self-control. No different from the previous aspect, self-control has a significant influence on student LMO of 4.5%. Although it has a smaller percentage of influence than self-motivational beliefs, of course this remains one of the internal factors of students in obtaining LMO. This statement is in accordance with previous research that a person's ability to regulate himself affects students' mathematics learning achievement (Purnama, 2016).

Parental monitoring has a significant influence on student academic performance, with parental involvement can improve student learning outcomes (Itasari & Sumardi, 2018; Rafiq et al., 2013). Based on the cases that the researchers discussed, monitoring has an influence on student learning outcomes by 9.1% which makes monitoring one of the driving factors for students in achieving good learning outcomes, especially in mathematics. Another aspect of SRL that affects LMOs is self-consideration. Students who have good self-consideration, can definitely solve a problem in a wise way. This is in line with the test results that students' self-consideration has a significant effect of 8.3% on student mathematics learning outcomes. Self-reaction also has an effect on a student's LMO. the results of the calculations of self-reaction researchers had a percentage influence of 6.5% on the LMO of students. Pisani (2017) argues that self-reaction is one of the internal factors that is based on the individual's assessment of himself, how the individual evaluates himself positively or negatively as well as giving appreciation or punishment to oneself. SRL directly has a significant positive influence on student LMO (Meiliati et al., 2018).

When viewed from student learning interests, the LMO of students with high, medium and low ILM is not affected by SRL. In other words, there is no significant influence between SRL and student LMOs. This means that students with high to low interest in learning do not only use independent learning methods, but apply group learning methods so that students' LMO is good. The process of sorting and choosing teacher learning methods is the main factor in determining the right method in applying effective learning, especially mathematics learning. Teachers must be able to adjust student learning methods when the learning methods used at that time are deemed less effective. According to Kayatun and Kresnadi (2014) to improve student learning outcomes, teachers should develop more creativity, including choosing the right method, so that they do not feel bored but fun or impressive.

Final consideration

SRL contributes significantly to a student's LMO. The self-motivational belief aspect contributed 12.2%; self-control by 4.5%; monitoring by 9.1%; self-consideration of 8.3% and self-reaction of 6.5% in SRL to LMO. However, there is one aspect of SRL that does not have a significant effect on LMOs, namely the task analysis aspect which only contributes 0.3%. SRL and LMO have no influence on students who have a low, medium to high interest in learning. This happened because it was based on researchers' calculations about the influence of the three variables, namely obtained SRL and LMO significance values on high ILM of 0.402; Medium ILM of 0.430; and interest in learning mathematics was low at 0.727. It is known that these values are more than 0.05 so it can be concluded that the three variables above do not have a significant influence.

This study discusses the effect of SRL on LMO in terms of student ILM. Researchers can then use this research as a source of data and reference in conducting similar research but developing other variables in the learning process.

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