INDONESIAN JOURNAL OF EDUCATIONAL RESEARCH AND REVIEW
Volume 5 Nomor 3 2022, pp 577-587
E-ISSN: 2621-8984; P-ISSN: 2621-4792
DOI: http://dx.doi.org/10.23887/ijerr.v5i3.52312

Learning Independence Towards Mathematics Learning Outcomes Based on Education Level

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Abstrak

Kemandirian belajar sangat berpengaruh dalam meningkatkan hasil belajar siswa. Namun saat ini masih banyak siswa yang kurang memiliki sikap mandiri dalam belajar sehingga berdampak pada hasil belajar siswa yang rendah. Penelitian ini bertujuan untuk menganalisis tingkat kemandirian belajar terhadap peningkatan hasil belajar matematika berdasarkan jenjang pendidikan. Jenis penelitian ini yaitu meta-analisis. Penelitian ini menggunakan metode meta-analisis, dimana data dikumpulkan dari hasil penelitian yang relevan yang memuat nilai-nilai uji fisher, uji-t, uji korelasi, jumlah partisipant, dan ketuntasan klasikal. Dalam penelitian ini pengumpulan data dan instrumen penelitian diambil dari jurnal yang relevan. Teknik pengumpulan data yang dapat dilakukan dalam penelitian ini adalah dengan pendapat mencari artikel yang sesuai dengan kriteria yang telah ditentukan. Data dianalisis menggunakan software JASP dengan input nilai effect size dan standard error dari masing-masing data. Hasil analisis data menunjukkan adanya pengaruh yang signifikan antara kemandirian belajar terhadap hasil belajar matematika pada semua jenjang SD, SMP, SMA, dan PT sebesar 20% (kategori cukup), selain itu pada jenjang SD sebesar 17% (kategori rendah), di tingkat SMP sebesar 22% (kategori cukup), di tingkat SMA sebesar 25% (kategori cukup) dan tingkat PT sebesar 11% (kategori rendah). Sehingga dapat disimpulkan bahwa pengaruh kemandirian belajar terhadap hasil belajar siswa pada jenjang SMA lebih tinggi dibandingkan pada jenjang SD, SMP, dan PT.

***Kata kunci*:** *Kemandirian Belajar, Hasil Belajar, Pembelajaran Matematika*

Abstract

Learning independence is very influential in improving student learning outcomes. But at this time, many students still need an independent attitude in learning, which impacts low student learning outcomes. This study aims to analyze the level of learning independence towards improving mathematics learning outcomes based on educational level. This type of research is meta-analysis. This study uses a meta-analysis method, where data is collected from relevant research results, including the Fisher's test, t-test, correlation test, number of participants, and classical completeness. Data collection and research instruments were taken from relevant journals in this study. The data collection technique that can be carried out in this study is by looking for articles that match the predetermined criteria. Data were analyzed using JASP software with each data's input effect size and standard error values. The results of data analysis showed that there was a significant influence between learning independence on mathematics learning outcomes at all levels of SD, SMP, SMA, and PT by 20% (sufficient category), besides that at the SD level by 17% (low category), at the SMP level by 22% (enough category), at the high school level by 25% (good category) and PT level by 11% (low class). So the effect of independent learning on student learning outcomes at the SMA level is higher than at the SD, SMP, and PT levels.

Keywords: Learning Independence, Learning Outcomes, Mathematics Learning

History:
Received : August 19, 2022
Revised : August 23, 2022
Accepted : October 19, 2022
Published : October 25, 2022

Publisher: Undiksha Press

1. INTRODUCTION

Education is a step for an individual to explore his potential, both intelligence and skills and education is the first step for a person to know the world at large and seek relationships with associations or groups in the world of education and make a person an individual who has a high social attitude with the education taken. Quality in education in general is an important factor that influences the quality of learning (Afiani, 2017; Macharia & Pelser, 2014). Education is believed to be a place that is able to build students' intelligence and personality in a better direction. Education is one of the media that shape the character of the nation. The educational institution itself has a very large and necessary role in providing reliable resources and ready to face future challenges (Moh Ghoizi Eriyanto et al., 2021;

Mohamad et al., 2018). Especially in the world of education Mathematics is an exact science that plays an important role in the progress of human civilization. There are many benefits in learning mathematics, including (1) helping to solve problems in life, (2) improving the ability to think logically, (3) improving visualization and abstraction skills, (4) providing a basis for development in various fields of science and, (5) being able to solve problems independently (Artemenko et al., 2021; Hasibuan et al., 2018). This is in line with the importance of mathematics, therefore mathematics subjects are studied starting from elementary, middle, to college levels.

Independence in learning mathematics will be created if students actively review everything that is done, evaluate and then design the learning that is passed, and are willing to be active in the learning process (Asmar & Delyana, 2020; Clark, 2015). Independence in learning mathematics is an ability that is based on a sense of independence, a sense of responsibility, self-confidence, initiative, and self-motivation with or without the help of others to master certain competencies, both in aspects of knowledge, skills, or attitudes that can be used to solve mathematics learning problems without difficulty (Asih & Ramdhani, 2019; Saputra & Fahrizal, 2019). Independent learning is a person's perception towards himself, which is formed through experience and interaction with environment, so increase student learning independence, which will have an impact on ability and learning outcomes (Mulyono, 2021; Rismalasari et al., 2021).

The results of learning mathematics will be in line with learning independence if in learning independence students can control themselves and are responsible for improving mathematics learning outcomes by looking at the final grades. The results of learning mathematics aim to find out the level of success that can be achieved by students after following the learning method where the success rate is then expressed by grades (Mesaric & Sebalj, 2016; Sumantri & Satriani, 2016) . The result of learning mathematics is a change in behavior in students, which is observed and measured in the form of changes in knowledge, behavior, attitudes, and skills after learning mathematics (Mulyanto et al., 2018; Purnamasari et al., 2017). The results of learning mathematics are influenced by student factors, namely learning independence and critical thinking skills. In educators, learning outcomes can also be used to evaluate and see the achievement of predetermined learning goals. However, sometimes the learning outcomes obtained are still not optimal because learning activities do not run smoothly (Khasanah & Lestari, 2021; Puspitarini & Hanif, 2019). The results of learning mathematics depend on the learning independence, character, and habits of the students themselves.

Research on the effect of learning independence on mathematics learning outcomes has been widely carried out, such as the elementary school level (Egok, 2016; Riyanti, 2021; Siagian et al., 2020). Previous study has examined the independence of learning outcomes at the elementary school level with a total sample of 43 students obtained t-count 2.029 (Siagian et al., 2020). Furthermore, there are study that conducted at the junior high school level (Isnaeni et al., 2018; Rismalasari et al., 2021; Safitri & Pujiastuti, 2020). According to previous study related to learning independence in junior high school level learning outcomes with a sample of 57 students with an f-count score of 0.985 (Musa et al., 2021). There are also research on the effect of learning independence on mathematics learning outcomes at the high school level (Assagaf, 2016; Astuti et al., 2018; Mulyanto et al., 2018). Other research conducted similar research with the number of samples taken as many as 43 students with a classical value of 16% (Julaecha & Baist, 2019). Meanwhile, in research at the College level (Setiawan et al., 2017; Suryani et al., 2020). Those researches show the effect of learning independence on mathematics learning outcomes with a sample of 24 students with r-count score of 0.583.

Based on these things, in this study researchers will analyse the influence of learning independence on student mathematics learning outcomes. The purpose of this study is to describe the level of influence of learning independence on improving mathematics learning outcomes based on education levels, namely elementary, junior high, high school, and university whether it has a significant influence or has no effect at all.

2. METHODS

This study used a meta-analysis method that reviewed several results from national journals, with the range of journal sources taken were publications from 2014-2022 with the keywords "learning independence", and "learning outcomes", from search results obtained by journals as data sources. Meta-analysis is quantitative because it uses the calculation of numbers and statistics for research purposes, namely to compile and produce information from much data that is unlikely to be done by other methods (Asror, 2018).

In this study, data collection and research instruments were taken from relevant journals by the criteria that had been determined. Meanwhile, the subject of this study is the independence of learning mathematics learning outcomes based on the level of education from elementary, middle, high school, and college. The data collection techniques that can be carried out in this study are consist of (1) Looking for articles that match the predetermined criteria. (2) Coding and tabulation in Microsoft Excel including the year of publication, author's name, type of research, learning methods, media/software, material, level, class, N grade, f-count, t-count and r-count. (3) Calculate the effect size (ES) and standard error (SE) values. (4) Simulate and analyze data using JASP software. (5) Analyze the results that have been found from the articles that are references and (6) Take a conclusion from the results of the research on the results of the meta-analysis (Mandailina et al., 2021). The category on the level of influence is determined by the value of the Effect size (ES) and Error Standard (SE) of the JASP software based on the value category (Watrianthos, 2019). ES value categories show in Table 1.

Table 1. Classification of Glass's effect size

Effect size (ES)	Category
$0 < ES \leq 0.2$	Low Effect
$0.2 \leq ES < 0.8$	Sufficient Effect
$ES \geq 0.8$	Effects Are Very Sufficient

For publication bias, the criteria are if the p-value rank-test is greater than 0.001 (p-value > 0.001), that the data used in this study is indicated to be biased, besides that it can be determined using the Rosemthal equation namely: 5k + 10 < NR with k is the amount of data while NR is the value of file-safe N (Negara et al., 2022).

3. RESULTS AND DISCUSSION

Results

Data Selection Results

Here are the search results based on the number of data that have been found as many as 71 standard data. The data that have been obtained in this survey is the value of the fisher test (F), the student test (t), the correlation test (r), and the amount of data (N). Learning methods and levels can be processed or data analyzed under certain conditions. From the data that has been collected there is a value of F and a value of t, then two values need to be converted to values of r and values of ES and SE using formula. The conversion results are in

Table 2. As for the brief mention of the names of the levels of education as follows. 1.) Elementary school (ES) 2. Junior high school (JHS) 3. High school (HS) 4.College (C). Education level data trend graph is show in Figure 1.

Table 2. Effect Size (ES) and Standard Error (SE)

Name	Level of Education	N	SE	ES
Study 1	ES	43	0.150	0.158
Study 2	ES	220	0.154	0.392
Study 3	ES	153	0.164	0.405
Study 4	ES	21	0.232	0.479
Study 5	ES	318	0.156	0.395
Study 6	JHS	154	0.232	0.481
Study 7	JHS	72	0.304	0.550
Study 8	JHS	41	0.154	0.162
Study 9	JHS	34	0.888	0.930
Study 10	JHS	61	0050	0.224
Study 11	JHS	151	0.119	0.345
Study 12	JHS	60	0.148	0.132
Study 13	JHS	96	0.028	0.168
Study 14	JHS	80	0.390	0.623
Study 15	JHS	30	0.023	0.151
Study 16	JHS	41	0.045	0.162
Study 17	JHS	75	0.960	0.974
Study 18	JHS	30	0.326	0.568
Study 19	JHS	222	0.065	0.068
Study 20	JHS	30	0.870	0.919
Study 21	JHS	30	0.008	0.192
Study 22	JHS	57	0.210	0.457
Study 23	JHS	30	0.012	0.110
Study 24	JHS	31	0.303	0.548
Study 25	JHS	44	0.347	0.587
Study 26	JHS	478	0.414	0.643
Study 27	ES	266	0.204	0.451
Study 28	JHS	30	0.260	0.508
Study 29	HS	60	0.022	0.132
Study 30	HS	120	0.046	0.214
Study 31	HS	75	0.214	0.462
Study 32	HS	20	0.240	0.487
Study 33	HS	35	0.160	0.399
Study 34	HS	36	0.725	0.174
Study 35	HS	43	0.160	0.399
Study 36	HS	52	0.481	0.690
Study 37	HS	51	0.670	0.813
Study 38	HS	148	0.980	0.987
Study 39	HS	90	0.031	0.176
Study 40	HS	69	0.320	0.564
Study 41	HS	30	0.773	0.868
Study 42	HS	76	0.364	0.602
Study 43	HS	75	0.014	0.118
Study 44	C	24	0.667	0.218

Name	Level of Education	N	SE	ES
Study 45	C	67	0.071	0.266
Study 46	C	63	0353	0.592
Study 47	C	87	0.050	0.224
Study 48	C	52	0.167	0.408
Study 49	C	30	0.320	0.563
Study 50	C	35	0.220	0.468
Study 51	ES	91	0.258	0.507
Study 52	JHS	102	0.582	0.761
Study 53	ES	334	0.228	0.477
Study 54	HS	36	0.227	0.475
Study 55	HS	41	0.499	0.162
Study 56	HS	57	0.452	0.670
Study 57	JHS	23	0.646	0.224
Study 58	HS	25	0.520	0.714
Study 59	JHS	78	0.604	0.115
Study 60	JHS	30	0.827	0.897
Study 61	PT	30	0.152	0.389
Study 62	HS	83	0.868	0.927
Study 63	JHS	27	0.263	0.510
Study 64	C	24	-0.604	0.218
Study 65	HS	43	0.105	0.324
Study 66	JHS	123	0.250	0.091
Study 67	JHS	65	0.788	0.882
Study 68	JHS	54	0.387	0.140
Study 69	JHS	150	0.636	0.796
Study 70	JHS	17	0.287	0.267
Study 71	JHS	30	0.712	0.834

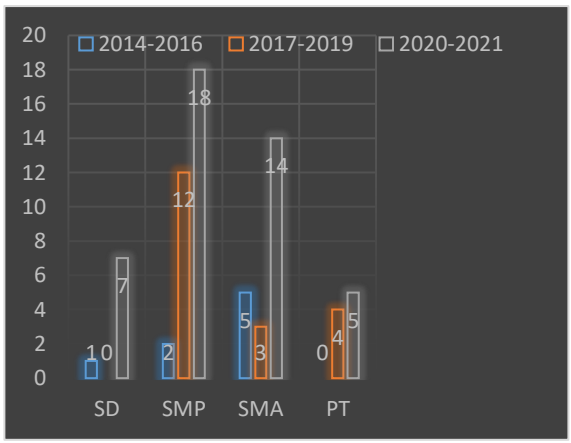


Figure 1. Education Level Data Trend Graph

From Figure 1, it can be seen the amount of data collected from 2014-2016 at the elementary, junior high, high school, and college levels with elementary school levels as much as (N) of 1, junior high schools as many as (N) of 2, high schools (N) of 5 while for higher education levels (N) of 0 or without data. Meanwhile, in 2017-2019 at the elementary (N) of 0, junior high school as many as (N) of 12, high school (N) of 3, and universities as many as (N) of 4. In 2020-2022, data collection was carried out at the elementary level as

many as (N) of 7, junior high school (N) of 18, high school (N) of 14, and at the college level as many as (N) of 5. So that the data collected from 2014-2022 is 71 with the most data being junior high school data as much as (N) of 32, high school (N) of 22, universities (N) of 9, and elementary schools (N) of 8.

Hypothesis Testing

In addition, researchers conduct hypothesis tests and publication bias tests. About the data already collected. The JASP Software meta-analysis contained in the conclusion is the z and p values as well as the coefficient table. The hypothesis is: (1) Hypothesis 1: Learning independence affects mathematics learning outcomes based on educational levels including elementary to tertiary education; (2) Hypothesis 2: There is no publication bias from the data used in the study. Hypothesis test in the first stage, a heterogeneity test is carried out to see whether the data category uses fixed or random effects. The results are show in Table 3.

Table 3. Fixed and Random Effects

	Q	df	P
Omnibus test of Model Coefficients	25.706	1	<0.001
Test of Residual Heterogeneity	74.011	70	0.349

In Table 3 the JASP output obtained on learning outcomes as well as the independence of learning mathematics has been analyzed, it is seen that the data is heterogeneous with a magnitude of Q = 25.706 and a p-value of <0.001. Furthermore, the estimation of learning outcomes and learning independence is seen in Table 4.

Table 4. Coefficients Output

T	Estimate	Standard Error	z	p
Intercept	0.202	0.040	5.070	< .001

In Table 4 on coefficients, it can be seen that the z value is 5.070 and the p value is <0.001 which means it is smaller than the significance value of 5% (0.05). This means that the hypothesis is accepted, so in this case the true effect size will not be equal to 0, so in other words, overall mathematics learning based on learning independence has a significant influence on student learning outcomes by 20%, while 80% is influenced by other factors. Furthermore, a publication bias test was carried out. This test is carried out in order to see whether the data that has been collected can be used as a representative of the population. This test can be seen by using the values in the output of Rank Correlation and Regression test. Which based on the results using JASP obtained results as show in Table 5 and Table 6.

Table 5. Rank correlation test for Funnel plot asymmetry

	Kendall's τ	P
Rank test	0.615	<0.001

Table 6. Regression test for Funnel plot asymmetry ("Egger's test")

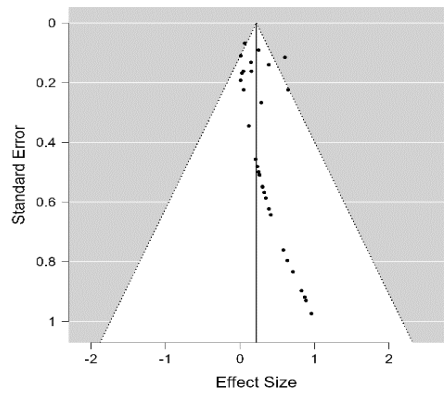
	Z	P
Sei	2.007	0.045

In Table 5 related to Rank correlation and regression, you can see Kendall's value on learning independence and learning outcomes worth 0.615 which determines the magnitude of the correlation coefficient between effect size and variance. In Table 6 the value of z which is the magnitude of the regression coefficient is worth 2.007 and the p-value of 0.045 is less than the value of 0.05 which indicates that the 2nd hypothesis is reject in other words did not identify the publication of bias. Finally, the author tested the moderator variable to see the level of influence of several other variables such as the year of publication, the number of participants, and the level of education. As for obtaining results according Table 7.

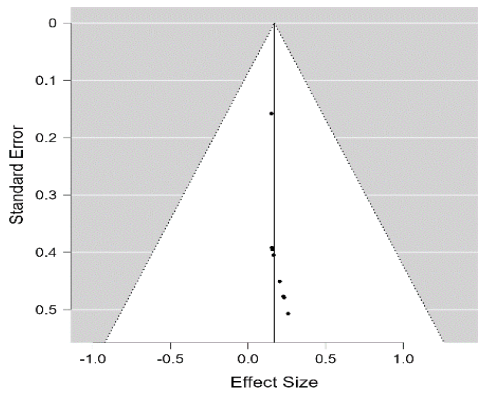
Table 7. JASP Output Based on Moderator Variables

Variable	Interval	N	RE Model	Forest Plot	Category
Year	2014-2016	8	0.13	0.13 [-0.01, 0.26]	Low
	2017-2019	19	0.15	0.15 [0.02, 0.27]	Low
	2020-2022	44	0.26	0.26 [0.14, 0.38]	Enough
Data	≤ 50 participation	32	0.25	0.25 [0.10, 0.39]	Enough
	≥ 50 participation	25	0.20	0.20 [0.11, 0.32]	Enough
	≥ 100 participation	14	0.21	0.21 [0.07, 0.35]	Enough
Levels	ES	8	0.17	0.17 [-0.05, 0.39]	Low
	JHS	32	0.22	0.22 [0.12, 0.32]	Enough
	HS	22	0.25	0.25 [0.08, 0.41]	Enough
	C	9	0.11	0.11 [-0.20, 0.42]	Low

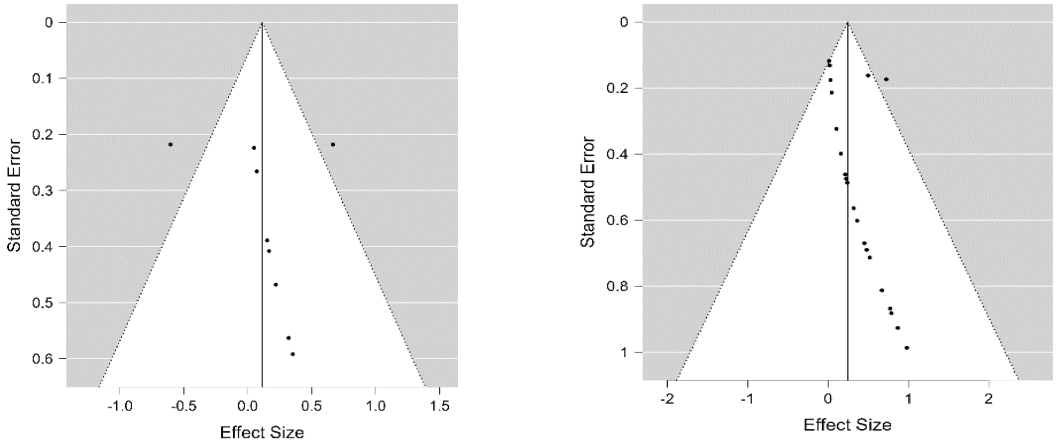
Base on Table 7 shows that the influence of learning independence on learning outcomes in mathematics learning is realized by JASP output from the 2014-2016 publication year of 13% while in 2017-2019 it is 15% and in 2020-2022 it is 26% so that in the 2020-2022 interval it is significantly more dominant. At the interval, participants with data ≤50 obtained a value of 25% and ≥50 of 20% while in participants≥100 of 21% so that a significant value was obtained which was more dominant in the participant ≤50 with 25% of the sufficient category. The education level (elementary, junior high, high school, and college) with scores at the elementary level of 17%, at the junior high level of 22%, at the college level of 11%, and at the high school level with an estimate of 25% is quite adequate and significantly more dominant. So this shows that learning independence towards learning outcomes in mathematics learning is very influential in being used at the high school level. The results of plotting the publication of data distribution based on the whole and by the level of education is show in Figure 2.



Junior high school data



Elementary school data



College data Senior high school data

Figure 2. Funnel Plot

Based on Figure 2 show the results of the plotting of publications, it can be seen that there is no bias research marked by no research that is lost by being marked with an open circle, which means that the entire circle is closed or declared not indicated publication bias. So based on the picture above, learning independence on mathematics learning outcomes at the high school level with a percentage of influence of 0.25 or changed in decimal form worth 25%.

Discussion

Based on the results of JASP software calculations and initial hypothesis testing that learning independence has a significant positive effect on mathematics learning outcomes, it can be interpreted that student learning independence improves mathematics learning outcomes this is in line with opinions (Akbar, 2017; Asih & Ramdhani, 2019). Independence plays a very important role in learning, especially in learning mathematics by having the same understanding as (Delima & Cahyawati, 2021; Rismalasari et al., 2021). It is because learning independence is the ability of students to carry out learning activities with encouragement and without coercion.

Learning independence also plays a very important role in the process of improving mathematics learning outcomes. This is in line with the opinion that learning independence is very necessary for students' needs towards their learning outcomes because with learning independence students can have a sense of responsibility in learning and there will be an attitude of initiative, creative and active in learning without relying on others (Fitriyani et al., 2021).

The implications of this study provide an overview related to learning independence towards mathematics learning outcomes based on education level. So this research is expected to be able to broaden the knowledge of educators and can be used as a reference for educators especially in learning mathematics to improve student learning outcomes. However, this research is still very limited because it is only based on meta-analysis of existing journals. Therefore it is hoped that future research will be able to deepen and broaden the scope of research by conducting direct research in the field by involving students and teachers in the classroom.

4. CONCLUSION

Simulation showed a significant influence between learning independence on mathematics learning outcomes in general, including the sufficient category by judging from

the percentage of overall data. And at the elementary, middle, high school, and college levels significantly dominate the high school level with sufficient categories compared to other levels of education. In more significant years the publication interval was dominant in 2020-2022 with the category sufficient in previous years. Meanwhile, at intervals participants with data of 50 obtained values that belong to sufficient categories compared to other intervals.

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