Jurnal Tadris Matematika (JTMT)
Jurnal of Tadris Matematika (JTMT)
Volume 5, Issue 2, 2024
E-ISSN : 2745-9551
P-ISSN : 2745-956X
https://journal.uiad.ac.id/index.php/Jtm

A Comparative Study of Problem Based Learning and Guided Discovery Learning: Unveiling Effects on Students' Mathematical Problem-Solving Abilities

Elwan Stiadi[1], Fitriani [2], Nader U-Sin[3], Amanda Pradhani Yanwar[4]
[1]Universitas Bengkulu, Indonesia
[2]Ahmad Dahlan Islamic University, Indonesia
[3]Principle of Ban Lanchang School, Pattani, Thailand
[4]King Mongkut's Institute of Technology Ladkrabang, Thailand
E-mail korespondensi: elwanstiadi@unib.ac.id
DOI: 10.47435/jtmt.v5i2.2988

Submission Track:
||Accepted: June 21, 2024.||Approved: September 28, 2024||Published: December 30, 2024

Abstract

The aim of this research is to identify whether there are significant differences in mathematical problem solving abilities between students taught using the PBL model compared to students taught using the GDL model. This quasi-experimental study was carried out with eighth-grade students at SMPN 6 Bengkulu City during the 2021–2022 academic year. Two experimental groups were randomly selected from a total of eight classes. After conducting normality and homogeneity tests, class A, consisting of 31 students, was assigned the Problem Based Learning (PBL) model, while class C, with 30 students, was assigned the Guided Discovery Learning (GDL) model. The study employed both descriptive and inferential data analyses. Descriptive analysis was used to illustrate the students' problem-solving abilities before and after the interventions. To assess the effectiveness of the PBL and GDL learning models on students' mathematical problem-solving skills, a t-test for two independent sample means was applied. The findings indicate that, on average, the problem-solving abilities of students taught using the PBL and GDL models are comparable.

Keywords: *Guided Discovery Learning; Problem Based Learning; Problem solving Ability*

1. Introduction

Problem solving ability is an important thing that students have in learning mathematics. This is in accordance with what is stated by the National Council of Teacher Mathematics which stipulates that there are 5 (five) process skills that must be mastered by students through learning mathematics, namely: (1) problem solving; (2) reasoning and proof; (3) connection; (4) communication; and (5) representation (Maulyda, 2020). Based on this, one of the focuses in learning mathematics is problem solving ability. In addition, the importance of problem solving is a means for a person to use previously acquired knowledge, skills, and understanding to meet the demands of unusual circumstances. So solving math problems is important in learning mathematics (Carson, 2007; R. Pratiwi & Musdi, 2021).

The importance of problem solving abilities to be improved is also due to the low problem solving abilities of students in Indonesia at this time. The low ability of Indonesian students to solve mathematical problems can be seen from the results of a 2011 Trends in International Mathematics and Science Study (TIMSS) survey placing Indonesia in 38th place out of 44 countries with a score of 386, below the standard score set at 500 (Mullis et al., 2016). This shows that there was a decrease in the previous score in 2007, which was 411 (Mullis et al., 2016). In addition, the low ability of students' mathematical problem solving can be seen based on the results of the Program for International Student Assessment (PISA), Indonesia in 2012 was ranked 64 out of 65 countries participating in the competition.(OECD, 2013). In the 2018 PISA results for the mathematics category, Indonesia is at level 1 with a rating of 7 from the bottom (73) and an average score of 379 (Stiadi et al., 2022).

In addition, the low problem-solving abilities of students, especially at the junior high school level, can be seen based on the results of research related to the TIMSS level reasoning questions, students' ability at low criteria is 58.33%, medium is 33.33% and high is only 8.33% (Susanto et al., 2021). In addition, other studies also state that the problem-solving ability of students at the SMP/MTs level is relatively low (Nugraha & Basuki, 2021).

One alternative solution to improve students' mathematical problem solving abilities is through the application of learning models that can involve students' activeness and provide opportunities to improve this. It is also explained in the Minister of Education and Culture Number 22 of 2016 concerning Process Standards for Elementary and Secondary Education which states that "To encourage students' abilities to produce contextual work, both individually and in groups, it is highly recommended to use a learning approach that produces work based on problem solving." Some of the recommended learning is problem-based learning (PBL) and discovery learning.

PBL is a set of teaching models that use problems as a focus to develop problem-solving, material, and self-regulation skills (Eggen & Kauchak, 2012; Tefera et al., 2024) This is in line with what is stated by Akinoğlu & Tandoğan (2007a);Wijnia et al. (2024), argues that the PBL model can change students from passive to active to obtain information, students can be free to learn and solve problems on their own and PBL also changes an educational program from teaching to learning. According to Samford University (Fani & Indarini, 2023; Tan, 2004) PBL is a learning strategy that can encourage students to develop critical thinking skills, and solve problems that can be used and beneficial throughout students' lives.

The selection of the Discovery Learning model pair is used because Discovery-Learning also focuses on problem solving. This is in line with opinion (Abdisa & Getiner, 2012) which states that Discovery Learning is a learning through problem solving under the supervision of the teacher and the teacher provides material illustrations for students to learn by themselves/independently.

But not all students can make discoveries independently. This is in line with opinion (Onikarini et al., 2019) states that pure Discovery Learning is not appropriate to be applied in learning, this is because not all students are able to make discoveries, this means that there are students who still need guidance to be able to find other concepts. In addition, the limited time in learning also affects, because the time needed by students to find a concept is not fast. So it takes help or guidance from the teacher to be able to find a concept. Therefore, in this study the Guided Discovery Learning model will be used.

According to (Eggen & Kauchak, 2012); (Wibowo, 2019) Guided Discovery Learning is a teaching approach in which the teacher gives students examples of specific topics and guides students to understand the concept. Eggen and Kauchak's opinion explains that Guided Discovery Learning emphasizes providing examples of concepts for students to learn later with the help of the teacher as needed. Meanwhile Guided Discovery Learning according (Onikarini et al., 2019) is a student-centred approach, which combines didactic instruction with an assignment-based approach to students. From Lavine's opinion it shows that the special feature of guided discovery learning is the existence of guidance from the teacher to students in the form of instructions. According to (Astuti et al., 2018) *guided discovery learning* can stimulate curiosity, as well as improve students' problem-solving skills and creative thinking.

Empirically, previous research shows that PBL is effective in improving critical thinking and problem solving skills because it gives students the freedom to explore and solve problems independently (Akinoğlu & Tandoğan, 2007b; Wijnia et al., 2024b). However, in some situations, this model may be less than optimal if students still need explicit direction in understanding new concepts. On the other hand, the GDL model offers a more structured approach, with the teacher's role as a facilitator who provides concrete examples and guidance to help students discover concepts gradually (Eggen & Kauchak, 2012; Wibowo, 2019). The implications of these studies show that although both are effective in improving problem solving abilities, there are differences in the way each model facilitates students' learning processes. Based on these implications, further studies are needed to compare the effectiveness of the two, as suggested by previous research which revealed the importance of comparative testing between PBL and GDL models to understand the most appropriate approach in improving students' mathematical problem solving abilities (Nugraha & Basuki, 2021; Susanto et al., 2021).

In connection with that, both PBL and GDL aim to improve problem-solving skills, PBL focuses more on problem solving, while GDL places more emphasis on student discovery of concepts. By understanding these differences, educators can choose the approach that best suits their learning goals. Besides that, both emphasize student involvement in the learning process, but in different ways. PBL encourages students to be active in solving problems, while GDL emphasizes the teacher's role as a facilitator in guiding students towards concept discovery. This comparison helps in understanding how both models can promote student engagement effectively. In connection with that, the researcher wants to examine "Comparison of the Effectiveness of Guided Discovery Learning and Problem-Based Learning in terms of Student's Mathematical Problem Solving Ability".

2. Method

This study is quasi-experimental research. This study was conducted in the eight grade at SMPN 6 Bengkulu city for the 2021/2022 academic year. Two experimental groups were selected randomly from the population, then tested for normality and homogeneity. So, a sample of class A consisted of 31 students who received the PBL model treatment and class C consisted of 30 students who received the GDL model treatment. The research instrument was a problem solving ability test consisting of 5 essay questions for the pretest and posttest which had been validated by experts and with a high level of reliability, which was equal to 0.72. In addition, another instrument is the observation sheet of the learning implementation.

There are two data analyses used in this study, namely descriptive data analysis and inferential analysis. Descriptive analysis was used to describe data on students' problem-solving abilities before and after the treatment. The completeness criterion for the problem-solving ability variable is at least 75 based on the Minimum Mastery Criteria *(KKM)*. The problem-solving ability data are then categorized based on the criteria used. The categorization is presented in Table 1 (Nugroho et al., 2023).

Table 1. Criteria for Completeness of Problem-Solving Ability

Learning outcomes	Category
Score≥ 75	Pass
Score< 75	Not pass

Inferential data analysis is used to statistically prove the proposed hypothesis and answer the formulated problems. To find the differences in the effectiveness of the learning model with PBL and GDL on students' mathematical problem-solving abilities, the t-test of two independent sample means is used to compare the means of two different samples.

The hypothesis is:

$H_0 : \mu_1 = \mu_2$

$H_1 : \mu_1 \neq \mu_2$

Note :

μ_1 : *the average problem-solving ability of classes taught using PBL*

μ_2 : *the average problem-solving ability of classes taught using GDL*

The basis for making a decision to measure whether there is a difference in the average of the two groups is to compare t count with t table. If the value of t count $>$ t table, then H_0 is rejected. On the other hand, if the value of t count $<$ t table, then H_0 is accepted. This study uses SPSS with criteria if significance value (2-tailed) > .05, then H_0 is accepted.

3. Results and Discussions

Descriptive Analysis

The results of the descriptive analysis included the pretest and posttest data for both classes which were used to find a comparison between the PBL and GDL models on students' mathematical problem-solving abilities. The data on problem-solving ability test results for the experimental classes with the PBL and GDL models can be seen in Table 2.

Table 2. Descriptive Analysis on Students' Mathematical Problem-Solving Ability Test Results

Descriptive statistics	PBL		GDL	
	Pretest	Posttest	Pretest	Posttest
Means	11.83	64.50	10.67	64.83
Variance	58.51	145.43	52.99	193.94
Standard Deviation	7.65	12.06	7.28	13.93
Minimum	0	40	0	40
Maximum	25	90	25	90
Number of Completed Students	0	11	0	11
Completeness percentage	0 %	35.48%	0%	36.67%

Based on Table 2, the average value of the pretest on students' mathematical problem-solving abilities with the PBL model is 11.83 which then increased as 64.50 during the posttest. For the class with the GDL model, the average value of the pretest is 10.67 and increased as 64.83 during the posttest. The completeness percentage of the pretest at the class with the PBL model is only 0% or no students reached *KKM*. During the posttest, the completeness percentage at the class with the PBL model increased to 35.48% or 11 out of 31 students fulfilled *KKM*. In addition, the completeness percentage of the pretest at the class with the GDL model is only 0% or no students reached *KKM*. During the posttest, the completeness percentage increased to 36.67% or 11 out of 30 students fulfilled *KKM*.

Inferential Data Analysis
Assumption test
Pretest data

The pretest data are first tested for normality and homogeneity tests. The normality test uses the Kolmogorof-Smirnov test with SPSS. The normality test results can be seen in Table 3.

Table 3. Pretest Normality Test Results on Mathematical Problem-Solving Ability

Mark Pretest	***Sig.***	***Information***
PBL	*.080*	*Normal*
GDL	*.056*	*Normal*

Table 3 shows that the significance values of the pretest at the PBL and GDL classes respectively are .080 and .056. Both values are more than .05 so that it can be concluded that both classes are normally distributed.

The homogeneity test uses the Levene's test with SPSS. The results of the homogeneity test can be seen in Table 4.

Table 4. Pretest Homogeneity Test Results on Mathematical Problem-Solving Ability

		Levene Statistic	df1	df2	Sig.
Value_Pretest_Ability_Solving_Problem	Based on Mean	.076	1	56	**.784**
	Based on Median	.051	1	56	.823
	Based on Median and with adjusted df	.051	1	55.479	.823
	Based on trimmed mean	.069	1	56	.793

Based on Table 4, the significance value of 'based on the mean' is .784 > .05 so that the pretest data for both classes are homogeneous.

Posttest data

The posttest data are first tested for normality and homogeneity test. The normality test uses the Kolmogorof-Smirnov test with SPSS. The normality test results can be seen in Table 5.

E-ISSN : 2745-9551
P-ISSN : 2745-956X
https://journal.uiad.ac.id/index.php/Jtm

Table 5. Posttest Normality Test Results on Mathematical Problem-Solving Ability

Mark Posttest	*Sig.*	*Information*
PBL	*.130*	*Normal*
GDL	*.179*	*Normal*

Table 5 reveals that the significance values of the posttest at the PBL and GDL classes respectively are .130 and .179. Both values are more than .05 so that it can be concluded that both classes are normally distributed.

The homogeneity test uses the Levene's test with SPSS. The results of the homogeneity test can be seen in Table 6.

Table 6. Posttest Homogeneity Test Results on Mathematical Problem-Solving Ability

		Levene Statistic	df1	df2	Sig.
Value_Posttest_Ability_Solving_Problem	Based on Mean	.860	1	59	**.357**
	Based on Median	.833	1	59	.365
	Based on Median and with adjusted df	.833	1	58.038	.365
	Based on trimmed mean	.863	1	59	.357

Based on Table 6, the significance value of 'based on the mean' is .357 > .05 so that the posttest data for both classes are homogeneous.

After carrying out the normality and homogeneity tests, a hypothesis test using the t-test of two independent sample means was conducted. The t-test of two independent sample means is an assumption test used in this study to find the effectiveness of the learning approaches. The results of this hypothesis test can be seen in Table 7.

Table 7. T-Test Results of Two Free Sample Means

		t-test for Equality of Means		
		t	df	Sig. (2-tailed)
Value_Posttest_Ability_Solving_Problem	Equal variances assumed	.031	59	**.976**
	Equal variances not assumed	.031	58.857	.976

In this analysis, the results of the t test using SPSS show that the significance value is greater than 0.05, which indicates that H0 is accepted. When the significance value or p-value is greater than the significance value (generally 0.05), then the null hypothesis (H0) is not rejected, which means there is no significant difference between the groups tested (Pallant, 2020). Table 7 shows that the significance (2-tailed) value is .976 > .05 so that H_0 is accepted. This can be concluded that the average ability to solve mathematical problems using the PBL model is the same as the average ability to solve mathematical problems using the GDL model. These results are in line with constructivism theory which emphasizes that active learning and student involvement in the process of discovering concepts play an important role in building deeper understanding. These two models, both PBL and GDL, support students' active involvement in the learning process and provide opportunities for them to develop problem solving skills, which is an important aspect in constructivism (Eggen & Kauchak, 2012).

In terms of the results of students' mathematical problem-solving abilities, the PBL and GDL models have the same effectiveness. This happens because both models make students active at the class and learning becomes more meaningful. This is in line with the results of the study by (Nahdi, 2018) which states that there is no difference in students' mathematical problem-solving ability using PBL and GDL.

The PBL model relates learning to problems in daily life (Achsin et al., 2020; Asmara & Zachriwan, 2021). This certainly makes students familiar with problem-solving questions that relate to the problems in daily life that can improve their problem-solving abilities. This is in line with opinion (Andesma & Anggraini, 2019) who said that in the Problem Based Learning (PBL) model, students are usually given complex and realistic mathematical problems that require in-depth solving. Students are expected to use the knowledge and skills they have to identify problems, formulate problem-solving strategies, and find appropriate solutions. This process encourages students to understand mathematical concepts in real and relevant contexts. They can also work together with fellow students to solve problems, promoting teamwork and collaboration.

The GDL model makes students active in finding concepts independently and comprehend them in the learning process (Tarsiyah, 2021). On the other hand, in the Guided Discovery Learning (GDL) model, the teacher provides instructions or questions designed to help students discover mathematical concepts on their own (A. N. Pratiwi et al., 2023). The teacher acts as a facilitator who provides guidance and direction when students explore. This process provides students with the opportunity to strengthen connections between the mathematical concepts learned and their application in various contexts. Students experience an active discovery process, which can increase their understanding of the concept. This results in the students' ability to solve complex or non-routine problem-solving questions. Furthermore, a group discussion is provided in the PBL and GDL models. Students can be actively involved in the group discussion by exchanging opinions to solve the given problems. This activity can make students more active in answering, asking questions and comprehending the answers(Graciella & Suwangsih, 2016).

The main difference between these two models lies in the level of student autonomy in the learning process. In PBL, students are more independent in solving problems, while in GDL, they receive direction from the teacher in discovering concepts. However, both models have the same focus on understanding in-depth mathematical concepts through direct and active experience. So, we can say that the problem-based learning and guided discovery learning models are both effective in improving the problem-solving abilities of class 8 students at SMP Negeri 6 Bengkulu City.

4. Conclusions

Based on the results of the hypothesis test, independent sample t test, the significance (2-tailed) value is .976 > .05 so that H_0 is accepted. This can be concluded that the average ability to solve mathematical problems using the PBL model is the same as the average ability to solve mathematical problems using the GDL model.

References

Abdisa, G., & Getiner, T. (2012). The Effect of Guided Discovery on Students ' Physics Achievement. *Latin-American Journal of Physics Education*, *6*(4), 530–537.

Achsin, M., Kartono, & Wibawanto, H. (2020). Analysis of Problem Solving Capabilities in Problem Based Learning Contextual Approaches Based on Metacognitive Awareness. *Unnes Journal of Mathematics Education Research*, *9*(2), 147–155.

Akinoğlu, O., & Tandoğan, R. Ö. (2007a). The effects of problem-based active learning in science education on students' academic achievement, attitude and concept learning. *Eurasia Journal of Mathematics, Science and Technology Education*, *3*(1), 71–81. https://doi.org/10.12973/ejmste/75375

Akinoğlu, O., & Tandoğan, R. Ö. (2007b). The effects of problem-based active learning in science education on students' academic achievement, attitude and concept learning. *Eurasia Journal of Mathematics, Science and Technology Education*, *3*(1), 71–81. https://doi.org/10.12973/ejmste/75375

Andesma, T., & Anggraini, R. D. (2019). Penerapan Pbl Untuk Meningkatkan Kemampuan Pemecahan Masalah Matematis Siswa Kelas X Tkr 1 Smk Muhammadiyah 1 Pekanbaru. *Jurnal Prinsip Pendidikan Matematika*, *2*(1), 12–18. https://doi.org/10.33578/prinsip.v2i1.35

Asmara, A., & Zachriwan, Z. (2021). *Kemampuan Literasi Matematis Mahasiswa Melalui Model ProblemBased Learning Menggunakan Klinometer*. *3*(1), 77–84. https://doi.org/http://dx.doi.org/10.29240/ja.v3i1.3100

Astuti, N. T., Prasiwi, A., & Yusuf, M. I. (2018). *Mengembangkan Kemampuan Berpikir Kreatif dengan Pembelajaran Guided Discovery*. 84–91.

Carson, J. (2007). A problem with problem solving: Teaching thinking without teaching knowledge. *The Mathematics Educator*, *17*(2), 7–14.

Eggen, P., & Kauchak, D. (2012). *Strategi dan model pembelajaran: mengajarkan konten dan keterampilan berpikir* (6th ed.). Permata Puri Media.

Fani, M. S., & Indarini, E. (2023). Penerapan Model Problem Based Learning (PBL) untuk Meningkatkan Kemampuan Berpikir Kritis dan Hasil Belajar Matematika SD. *JIIP - Jurnal Ilmiah Ilmu Pendidikan*, *6*(12), 10132–10138. https://doi.org/10.54371/jiip.v6i12.2413

Graciella, M., & Suwangsih, E. (2016). Penerapan Pendekatan Matematika Realistik Untuk Meningkatkan Kemampuan Representasi Matematis Siswa. *Metodik Didaktik*, *10*(2), 27–36. https://doi.org/10.17509/md.v10i2.3180

Maulyda, M. A. (2020). *Paradigma Pembelajaran Matematika Berbasis NCTM* (1st ed.). CV IRDH.

Mullis, I. V. S., Martin, M. O., Foy, P., & Hooper, M. (2016). *TIMSS 2015 International Results in Mathematics*. Boston College, TIMSS & PIRLS International Study Center. http://timssandpirls.bc.edu/timss2015/international-results/

Nahdi, D. S. (2018). Eksperimentasi Model Problem Based Learning Dan Model Guided Discovery Learning Terhadap Kemampuan Pemecahan Masalah Matematis Ditinjau Dari Self Efficacy Siswa. *Jurnal Cakrawala Pendas*, *4*(1), 50–56. https://doi.org/10.1136/emj.2003.012435

Nugraha, M. R., & Basuki, B. (2021). Kesulitan Kemampuan Pemecahan Masalah Matematis Siswa SMP di Desa Mulyasari pada Materi Statistika. *Plusminus: Jurnal Pendidikan Matematika*, *1*(2), 235–248. https://doi.org/10.31980/plusminus.v1i2.1259

Nugroho, A. D., Suprapto, E., & Vandwinata, E. V. (2023). Peningkatan Hasil Belajar Ipas Siswa Kelas Iv Menggunakan Model Pembelajaran Problem Based Learning. *Pendas : Jurnal Ilmiah Pendidikan Dasar*, *9*(1).

OECD. (2013). PISA 2012 Assessment and Analytical Framework: Mathematics, Reading, Science, Problem Solving and Financial Literacy. In *OECD*. https://doi.org/10.4324/9781003090366

Onikarini, N. L. Y., Suardana, I. N., & Selamet, K. (2019). Komparasi Model Pembelajaran Guided Dan Free Discovery Terhadap Hasil Belajar Siswa Dalam Pembelajaran Ipa. *Jurnal Pendidikan Dan Pembelajaran Sains Indonesia (JPPSI)*, *2*(2), 80–91. https://doi.org/10.23887/jppsi.v2i2.19376

Pallant, Julie. (2020). *SPSS survival manual : A step by step guide to data analysis using ibm spss*. ALLEN & UNWIN.

Pratiwi, A. N., Azizah, M., & Kartinah, K. (2023). Efektifitas Model Guided Discovery Learning Terhadap Kemampuan Pemecahan Masalah Materi Bangun Ruang Kelas V. *Jurnal Kualita Pendidikan*, *4*(1), 60–65. https://doi.org/10.51651/jkp.v4i1.345

Pratiwi, R., & Musdi, E. (2021). Meningkatkan Kemampuan Pemecahan Masalah Matematis Peserta Didik Melalui Model Pembelajaran Problem Based Learning. *Jurnal Edukasi Dan Penelitian Matematika*, *10*(1), 85–91.

Schleicher, A. (2019). *PISA 2018 "Insight and Interpretations."*

Susanto, E., Susanta, A., Maizora, S., & Rusdi, R. (2021). Analisis Kemempuan Siswa Smp/Mts Kota Bengkulu Dalam Menyelesaikan Soal Matematika Timss. *Jurnal THEOREMS (The Original Research of Mathematics)*, *5*(2), 131. https://doi.org/10.31949/th.v5i2.2567

Tan, O.-S. (2004). *Enhancing thinking through problem-based learning approaches*. Cangage Learning.

Tarsiyah, T. (2021). Penerapan Model Guided Discovery Learning Untuk Mempertahankan Hasil Belajar Matematika Siswa Kelas Vii Smp Negeri 1 Pandaan Selama Pandemi Covid-19 Tahun Ajaran 2020 / 2021. *Likhitaprajna Jurnal Ilmiah*, *23*(1), 26–39. https://doi.org/https://doi.org/10.37303/likhitaprajna.v23i1.188

Tefera, A. S., Melaku, E. E., Urgie, B. M., Hassen, E. M., Tamene, T. D., & Gebeyaw, E. D. (2024). Barriers to implementing problem-based learning at the school of medicine of Debre Berhan University, Ethiopia. *BMC Medical Education*, *24*(1), 1–7. https://doi.org/10.1186/s12909-024-05252-1

Wibowo, T. (2019). Metode Diskoveri Terbimbing (Guided Discovery): Konsep dan Aplikasi dalam Pembelajaran Sains MI/SD. *Elementary: Islamic Teacher Journal*, *7*(1), 55–74. https://doi.org/10.21043/elementary.v7i1.4776

Wijnia, L., Noordzij, G., Arends, L. R., Rikers, R. M. J. P., & Loyens, S. M. M. (2024a). The Effects of Problem-Based, Project-Based, and Case-Based Learning on Students' Motivation: a Meta-Analysis. In *Educational Psychology Review* (Vol. 36, Issue 1). Springer US. https://doi.org/10.1007/s10648-024-09864-3

Wijnia, L., Noordzij, G., Arends, L. R., Rikers, R. M. J. P., & Loyens, S. M. M. (2024b). The Effects of Problem-Based, Project-Based, and Case-Based Learning on Students' Motivation: a Meta-Analysis. In *Educational Psychology Review* (Vol. 36, Issue 1). Springer US. https://doi.org/10.1007/s10648-024-09864-3