International Journal of Elementary Education
Volume 6, Number 3, Tahun 2022, pp. 422-430
P-ISSN: 2579-7158 E-ISSN: 2549-6050
Open Access: https://doi.org/10.23887/ijee.v6i3.48810

Jarimatika Method: Effectiveness in Increasing Motivation to Learn Multiplication Counting Operations with Creative Songs

Anggun Ika Rahayu[1*], Ratnasari Dyah Utami[2]

[1,2] Muhammadiyah University of Surakarta, Surakarta, Indonesia

ARTICLE INFO

Article history:
Received June 24, 2022
Accepted August 12, 2022
Available online August 25, 2022

Kata Kunci:
Jarimatika, Perkalian, Lagu Kreatif

Keywords:
Jarimatika, Multiplication, Creative Song

ABSTRAK

Guru sangat direkomendasikan untuk melaksanakan pembelajaran yang interaktif dan menyenangkan, penyampaian materi yang membosankan akan membuat proses belajar mengajar sulit dipahami oleh siswa, sehingga berdampak pada hasil belajar matematika akan lebih rendah. Penelitian ini bertujuan untuk menganalisis efektivitas metode jarimatika berbasis lagu kreasi untuk meningkatkan motivasi operasi hitung perkalian siswa. Penelitian merupakan penelitian jenis kuantitatif dengan desain eksperimen. Subyek penelitian ini merupakan siswa kelas 4 di sekolah dasar. Metode pengumpulan data penelitian dengan kuisioner dan tes. Instrumen penelitian kuisioner dengan pertanyaan untuk variabel motivasi belajar. Analisis data dengan analisis dekskriptif dan analisis komparatif. Hasil penelitian menunjukan bahwa setelah menggunakan metode jarimatika berbasis lagu kreasi terhadap motivasi belajar operasi hitung perkalian, motivasi belajar siswa kelas eksperimen rata-rata kenaikannya 24, sedangkan kenaikan kelas kontrol 28. Analisis komparatif menghasilkan bahwa penggunaan metode jarimatika berbasis lagu kreasi terhadap motivasi belajar operasi hitung perkalian efektif. Analisis komparatif hasil sig. 2-tailed kelas kontrol dan eksperimen 0,151 tidak signifikan. Sig 2-tailed sebelum perlakuan pada kelas eksperimen dan kelas kontrol 0,035. Sebelum dan sebelum perlakuan pada kelas eksperimen hasil sig. 2-ekor 0,000. Sig. 2-tailed motivasi belajar sebelum dan sebelum kelas kontrol 0,000. Selisih motivasi kelas kontrol dan eksperimen sig. 2-ekor 0,047. Secara keseluruhan hasilnya signifikan. Kesimpulannya dengan metode jarimatika berbasis lagu kreasi terhadap motivasi belajar operasi hitung perkalian efektif dalam peningkatan motivasi terhadap operasi perkalian.

ABSTRACT

Teachers are highly recommended to carry out interactive and fun learning, delivering boring material will make the teaching and learning process difficult for students to understand, so that the impact on mathematics learning outcomes will be lower. This study aims to analyze the effectiveness of the song creation-based jarimatika method to increase students' motivation for multiplication counting operations. This research is a quantitative type of research with an experimental design. The subjects of this study were 4th grade students in elementary schools. Methods of collecting research data with questionnaires and tests. The research instrument is a questionnaire with questions for learning motivation variables. Data analyses consist of descriptive analysis and comparative analysis. The results showed that after using the creative song-based jarimatika method on the motivation to learn multiplication counting operations, the experimental class students' learning motivation increased by an average of 24, while the increase in the control class was 28. Comparative analysis resulted that the use of the song creation-based jarimatika method on the motivation to learn arithmetic operations effective multiplication. Comparative analysis of sig. 2-tailed control and experimental class 0.151 is not significant. Sig 2-tailed before treatment in the experimental class and the control class 0.035. Sig. 2-tailed learning motivation before and before the control class 0.000. The difference in motivation between the control and experimental classes is sig. 2-tail 0.047. It can conclude that the song-based jarimatika method of creation on the motivation to learn multiplication arithmetic operations is effective in increasing motivation for multiplication operations.

1. INTRODUCTION

The ideal condition in learning is the existence of good motivation so that students have good motivation in learning. This is because of the importance of motivation in a person. Student learning motivation is obtained during the learning process. Learning activities to obtain achievement by giving rise to encouragement is called motivation. There is a significant positive motivation effect. Student learning outcomes are influenced by motivation related to student achievement, various motivational factors that come from students in the form of the environment. Existenceinteractions related to the

*Corresponding author.
E-mail addresses: a510180222@student.ums.ac.id (Anggun Ika Rahayu)

influence of motivation and achievement in learning mathematics, differences in learning styles will be the same as motivation for achievement (Bhowmik et al., 2020; Indriani, 2016; Lestari, 2017; Palittin et al., 2019). There is an influence on student achievement with the influence of motivationIn the learning process the teacher is able to increase students' learning desire, especially in mathematics subjects, one of which is the multiplication arithmetic operation material because it needs encouragement in learning. Learning activities are in accordance with what is desired and are able to achieve learning goals by being driven by everything that is in students with motivation. The position of motivation in learning as the right direction of learning activities and motivation can increase positive activities in learning. So that learning motivation can improve the quality of mathematics learning.

Universal science plays a role in developing students' thinking power which focuses on problem solving in the role of building students' thinking power. Meanwhile, according to the branch of science plays a role in the development of science. However, in reality, giving boring material will make the teaching and learning process difficult for students to understand, so the impact on mathematics learning outcomes will be lower. Giving the lecture learning method is applied to the learning process in schools. Lecture is a learning method with a group of listeners to achieve learning objectives (Mukrimah, 2014; Siagian, 2016). The cause of the low quality of learning is that learning resources and media have not been utilized optimally, a good method is problem solving. An increasing number of studies have been conducted to explore how the sequential relationship between problem solving phases affects team performance outcomes. Previous studies identified that explore this use of community problem solving provide some useful insights into the design, application, and tangible benefits of the educational approach. Problem solving skills in the education system, constant argumentation between education and practice is very important and can be summarized in the discussion of skills and knowledge. Each side offers a varied perspective, based on their experience, for discussion (Dindar et al., 2022; Donaghy et al., 2022; Elaby et al., 2022). Collaborative problem solving in which team members go back and forth between different cognitive and affective phases as they interact with the problem state and with each other.

This also happens in elementary schools, the conditions in schools based on the results of fourth grade observations at SDN 2 Alastuwo most students have difficulty in multiplication counting operations. So that it has an impact on students' learning motivation, when tested working on multiplication questions directly students have difficulty understanding and calculating multiplication. Mathematics learning in the classroom is still teacher-centered so that there is a dominance of the teacher in the class and students tend to be passive in learning. Based on research using 2 groups as research objects before applying the Jarimatika method in learning, it can be concluded that the Jarimatika method is effective in improving students' mathematics learning outcomes. Furthermore, based on research using the Jarimatika method, it shows that increasing student motivation with the Jarimatika method in calculating multiplication (Indiastuti, 2021; Maruyama & Kurosaki, 2021; Muslihah & Tiawati, 2021). Students have the opportunity to learn in a way that suits their learning level, they can improve their math learning, the impact is greater for students with lower baseline scores, they can improve their math learning.

This is due to several factors, including conventional learning methods and the anxiety in students when learning mathematics. Mathematics anxiety significantly reduces students' mathematical performance. Moreover this condition depends on several factors such as self-concept of mathematics school students have anxiety and worry and tension when they study mathematics. Mathematics anxiety is defined as feelings of tension, helplessness, mental disorganization, and increased physiological reactivity when individuals deal with mathematics (Commodari & La Rosa, 2021; Martinez, 2022). This condition depends on several factors such as mathematical self-concept. Worldwide about 380 million primary school-age children do not attain a minimum level of proficiency in mathematics. Many children do not master numbers and the four basic operations. Interventions that included training for school management committees and distribution of math workbooks were scaled up by the government. Enhanced interventions aim to help students improve their math learning through their extra-curricular remedial activities, once children have the opportunity to learn in a way that suits their learning level, they can improve their math learning. Contribution to mathematical outcomes, increasingly challenging mathematics to previously learned skills and knowledge. We have analyzed mathematics achievement outside of certain courses and courses (Berkowitz et al., 2022; Maruyama & Kurosaki, 2021). Mathematics learning anxiety involves performing mathematical operations, manipulating numbers, or acquiring mathematical concepts in class, whereas math test anxiety is specifically related to exam situations.

Therefore, it is important to conduct research on student motivation in multiplication counting operations with song-based arithmetic because of the pleasant atmosphere during learning and learning activities, thereby reducing students' anxiety or fear of mathematics. In order to create a comfortable atmosphere for students, special attention is needed in the learning process so that there is motivation

that grows in learning. Providing opportunities for students to be active in learning will improve student learning outcomes. One way is to use creative songs. Using creative songs is effective in improving students' ability to describe objects. The ability possessed by students after the learning experience process is called learning outcomes. Visualization in the counting process is obtained using the Jarimatika method with a fun process, and does not burden the child. The method is easy for students to accept and can increase students' enthusiasm for learning (Hasibuan, 2015; Himmah et al., 2021; Rauf et al., 2021). Evaluation is determines learning outcomes so that there is data to evaluate students' abilities. Giving the Jarimatika method will provide innovation and new enthusiasm for students in the mathematics learning process. Counting fingers complete arithmetic operations of addition, subtraction, multiplication and division with fun.

This Mathematics Education Song learning media is very suitable to be used as building material for fifth grade students. The developed mathematics song media meets the criteria of being feasible, effective, and practical which can be used as good teaching materials. Able to contribute to PAUD mothers in creating poetry and song lyrics related to mathematical concepts. Song lyrics as learning media are in very valid and practical criteria so that they are suitable for use in learning, especially mathematics (Andiarna & Kusumawati, 2020; Fitriatien et al., 2020; Nur Asmah & Kurniawati, 2020; Suraningsih & Izzati, 2020). Research on the use of creative songs as a support for the success of the Jarimatika method, especially in multiplication counting operations, does not seem to have been applied in depth. Students are fully involved in learning the material for multiplication arithmetic operations that can increase motivation so that it has an impact on student learning outcomes. Therefore, in this study the researchers used creative songs to make it easier for students to understand and apply the Jarimatika method. Based on these problems, the researchers conducted research on "Jarimatika Method: Its effectiveness in increasing motivation to learn multiplication counting operations with the song Kreasi".

2. METHOD

The type of research in this study is quantitative. The research design used is an experimental design. In this study, the researcher wanted to know the effectiveness of using creative songs to increase students' motivation in multiplication counting operations. The subjects of this study were fourth grade students SDN 02 Alastuwo as the experimental class and SDN Purwosuman 1 as the control class as many as 30 students. The reason the researcher chose class IV at SDN 02 Alastuwo as the experimental class was because the data on the results of observational learning in the class were unsatisfactory, due to low motivation. This has an impact on the lack of student activity, thus encouraging research in the classroom. Data collection methods and instruments used a questionnaire for learning motivation variables. The indicators of the Jarimatika method include: (1) the accuracy of the objectives and learning methods; (2) learning materials according to methods, (3) teacher skills in using methods, (4) in accordance with students' thinking abilities. The indicators of motivation in learning are show in Table 1.

Table 1. Instrument grid

Indicator	Learning Motivation Indicator	Item number	Amount
There is a desire and desire to succeed	Attendance at school.	1	1
	Steps to take to make it work	2, 3, 4	3
There is a drive and a need to learn	Desire to learn	5, 6, 7, 8	4
Be patient in the face of the task	Completing assignments/homework	9, 10	3
	Efforts to overcome the difficulty of doing the task	11, 12, 13	2
Independent in learning	independence in action	14, 17	2
	Making plans	15, 16	2
Happy to find and solve problems in problems	Happy to do the questions	18, 19	2
	Tenacious in solving problems	20	1
Amount			**20**

The validity test used was the Kolmogrov-Smirnov test, and the Levene test for normality and homogeneity tests. Then the data that were normally distributed were compared with the difference test with the t-test (paired sample t-test and independent sample t-test) for the final results. Calculations using SPSS 25. The data analysis method used is descriptive and comparative data analysis. Descriptive data

analysis was used to describe the learning motivation of the control class and the experimental class. While the comparative analysis to compare whether there are differences in learning motivation between the control class and the experimental class.

3. RESULT AND DISCUSSION

Result

Research results on the effectiveness of usingSong-based Jarimatika method on motivation to learn multiplication counting operationsis show in Figure 1.

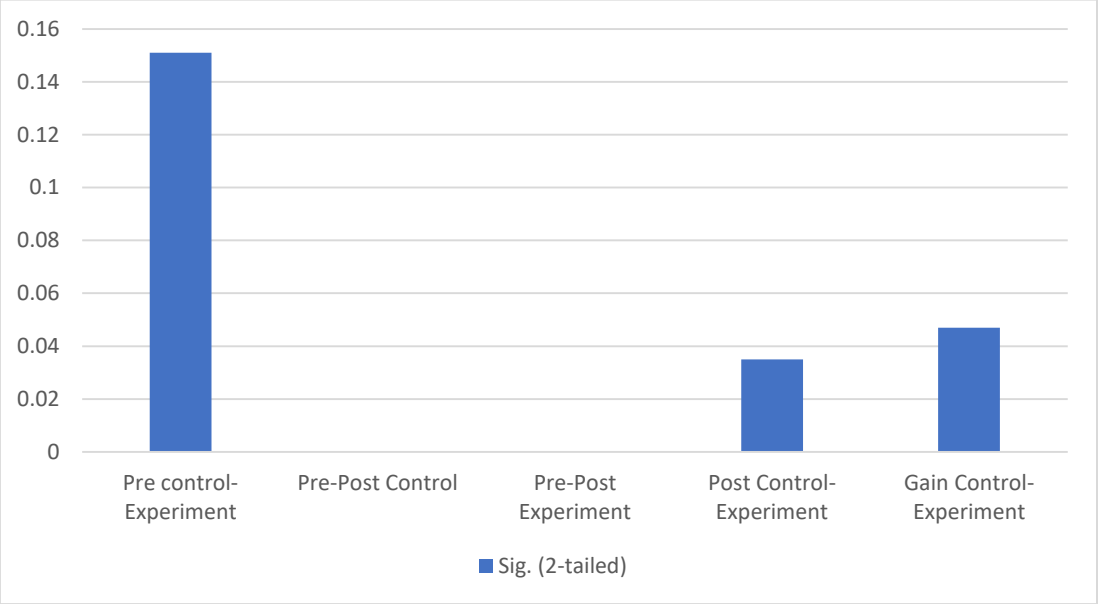

Figure 1. T-test Results on the Effectiveness of Use Song-Based Jarimatika Method

Based on the Figure 1, the descriptive analysis of early learning motivation is the same, from both classes. Students' learning motivation in the control class was significant before being given treatment. The experimental class before and after being treated usingSong-based Jarimatika method on motivation to learn multiplication counting operationsshow significant changes. The final result of students' learning motivation in the control class and experimental class students was significant. Significant results of learning motivation in both classes, there is a significant difference between the two classes. Before the treatment in both classes the results of learning motivation were the same.

The independent samplet t test showed that the value of Sig (2-tailed) was 0.151 > 0.05. The control class before and after being given the motivation treatment was not the same, through the Paired Sample t Test it showed a Sig (2-tailed) value of 0.000 <0.05. The motivation of the experimental class before and after treatment was different by showing a 2-tailed Sig value of 0.000 <0.05. The two classes of learning motivation after treatment are not the same, it is known from the results of the independent sample t test which shows the value of Sig (2-tailed) of 0.035 < 0, 05. The two classes before and after being given motivational treatment obtained different results through the independent Samples t Test, the significance value of Sig (2-tailed) was 0.047 <0.05. Hypothesis test results based on test resultsThe song-creating-based jarimatika method on the motivation to learn multiplication arithmetic operations has a significant and effective effect on the experimental class.

Discussion

Based on research results the effectiveness of the song-based Jarimatika method on students' motivation to learn multiplication arithmetic operationsbased on descriptive analysismotivation-based Jarimatika method creation song to learn multiplication counting operations, The motivation of both classes increased. While the comparative use ofSong-based Jarimatika method on motivation to learn multiplication counting operationseffective to increase students' learning motivation. Previous research that supports this result is that there are several studies of arithmetic as a way to improve numeracy skills.One of the interventions focused on elementary students' multiplication reasoning. The increasing adoption of educational games in construction pedagogy has had a significant impact on student learning.

have been found to support students learning how to solve complex construction problems. The results indicate that students generally show the expected pattern. These findings support the claim that students engage in complex higher order thinking processes and skills, which develop based on the type of construction project.

The moderated mediation model showed that while ability, enjoyment and cognitive load significantly predicted performance, (a) personalization did not affect word problem performance, enjoyment or cognitive load, and (b) the three different abilities did not moderate this relationship. Findings are discussed based on three principles of personalization (depth, grain size, possession) and complexity in various steps of solving mathematical problems. The reason behind the use of games in learning comes from reports of students' strong motivation and involvement during the activities. An environment like Math Garden allows children to practice exercises tailored to their particular math abilities and can maximize their math skills. In an experiment investigating whether the learning environment should also consider the differential impact of cognitive load on children's math performance depending on verbal working memory capacity. This shows that the existence of a fun method in learning mathematics has a positive impact on students (Castronovo et al., 2022; de la Peña et al., 2021; de Mooij et al., 2020; Van de Weijer-Bergsma & Van der Ven, 2021). So because of that finger-based song-based creative learning methods on the motivation to learn multiplication arithmetic operations can increase students' learning motivation. The significant influence on students' multiplication counting ability raises several implications that the use of Jarimatika can be encouraged to be an alternative to improve students' ability to work on number multiplication problems and also to make learning more fun by using various methods (Dewi et al., 2020; Idham Sumirat, 2017; Tarigan, 2019).

Before the treatment in the two classes, the learning motivation was the same, while the motivation after and before the control class was found to be different in the motivation to learn usingSong-based Jarimatika method on motivation to learn multiplication counting operationsin the control class. This fits the theory that math is not easy, which is why children are often afraid. Math is fun when done with different experiments. Jarimatika experiment, from the experiment was born the method of counting fingers. Therefore, there are differences in motivation from the beginning of learning without the Jarimatika method and after the Jarimatika method. The Jarimatika method is effective, fun for students because it is interesting. Besides that,fun because students have never been given the Jarimatika method for counting, especially multiplication calculations. Students find it easier to do multiplication with the Jarimatika method because multiplication with large numbers can be simplified into multiplication of several small numbers which is easier to understand (Aryani, 2020; Minsih & Astuti, 2015; Salsinha et al., 2019). Jarimatika is one of the most popular and fastest growing computing techniques. Jarimatika is very easy to apply because children experience counting with their own fingers. Therefore, this method becomes more attractive when used as a learning method, because students continue to learn very actively, depending on the level of cognitive development. Working in groups and hands-on practice and play are characteristics of elementary school-age children. Therefore, the results of the current study not only suggest that aspects of conceptual rational number knowledge can be improved by game-based training but also that in-game metrics provide important indicators for learning (Burhaein, 2017; Nyoman Sukajaya et al., 2015). The motivation to learn before the treatment is the same, this is because there is no fun method in the learning method, after thatSong-based Jarimatika method on motivation to learn multiplication counting operationsin the control class students' motivation can increase.

Before and after the treatment of learning motivation in the experimental class, it appears that the use ofSong-based Jarimatika method on motivation to learn multiplication counting operationsin studying significant differences. Game design projects appear to be a pedagogically meaningful way to engage students in learning that creates knowledge and connects students to formal and informal learning triggers student learning motivation, fosters competence, and enriches the learning environment. Affected by useSong-based Jarimatika method on motivation to learn multiplication counting operationswhich can affect the focus in studying learning materials. Jarimatika has different characteristics from the others, one of which is the visualization of the counting process so that children do work, please children,Jarimatika makes students happy and enthusiastic in following it, thus making students able to balance the right brain and left brain through quick counts and finger movements. So that students are not only skilled in counting but students are able to master the lessons in class, the multimedia-based Jarimatika method experiment was effective in improving elementary students' mathematics learning outcomes (Harahap et al., 2019; Laakso et al., 2021; Nafaikah et al., 2019; Ulum & Hasyim, 2017). The difference in increasing students' learning motivation is influenced by the use of Song-based Jarimatika method on motivation to learn multiplication counting operationswhich can affect student focus so that motivation increases.

The two classes of learning motivation after treatment showed differences. The effectiveness of the process is shown by the adequacy of the implementation of ongoing learning. Actively participates and enjoys demonstrating fingers by counting multiplications. This effectiveness can be seen from the results of the completion of multiplication calculations made by students that are correct after using Jarimatika. No problems were found when calculating multiplication to get good grades. We tested the effectiveness of intervention programs designed to increase children's math motivation while simultaneously strengthening their growth mindset and weakening their gender stereotypes. Pathways analysis showed that students' growth mindset after the intervention predicted their math persistence and achievement directly and indirectly through perceived competence in mathematics. Students in elementary school always have curiosity about what is happening around them. Mathematics helps them to understand solve their problems. Helpful teacher questions from students can help them solve problems. Teacher questions should increase students' motivation, according to problem solving they can activate their critical thinking and predict logical ways to solve problems. Motivation is evident, suggesting that while for younger students extrinsic motivation does not impair (and may even cooperate with) intrinsic interest and academic achievement (Lee et al., 2021; Lemos & Veríssimo, 2014; Malekian et al., 2013). Their problem solving can activate their critical thinking and predict logical ways to solve problems.

A simple fun way that makes it easier for students to count to understand the concept of numbers, symbols with Jarimatika. Learning mathematical communication skills taught to students by means of songs can optimize right brain function better than students in ordinary classes (Berkowitz et al., 2022; Elawati & Utami, 2018; Himmah et al., 2021). The difference in learning motivation is because students no longer experience problems when calculating multiplication so that there is student motivation to learn multiplication with creative songs. There is a significant difference between students' learning motivation between the two classes. Counting is the ability to perform calculations with numbers. Many students encounter grammatical errors made while doing math. This affects students' ability to solve mathematical problems. The use of students' fingers can make it easier for students to perform mathematical operations. Self-regulation involves a series of cognitive and affective processes that share a common characteristic: coordination of information processing and control. Song creation can balance brain function, effective in achieving students' mathematical understanding ability (Himmah et al., 2021; Musso et al., 2019; Prayugo & Efendi, 2017; Ramlah & Hanifah, 2018). When students use hands-on methods, they tend to enjoy learning more, remember better and find hands-on practice more effective for their learning than traditional classroom teaching methods, and especially more efficient than learning just by watching or listening. The teacher also assessed the direct method as the most effective method. Direct learning has been found to be effective for learners with learning difficulties. An informal and open learning environment has proven to be effective for learning mathematics as well. Math classes using course methods improve math achievement, motivation, or progress to more advanced courses (Morales-Chicas & Graham, 2021; Thuneberg et al., 2018).This Mathematics Education Song learning media is very suitable to be used as building material for fifth grade students. The developed mathematics song media meets the criteria of being feasible, effective, and practical which can be used as good teaching materials. Able to contribute to PAUD mothers in creating poetry and song lyrics related to mathematical concepts. Song lyrics as a learning medium are in very valid and practical criteria so that they are suitable for use in learning, especially mathematics (Andiarna & Kusumawati, 2020; Asmah, N & Kurniawati, 2020; Fitriatien et al., 2020; Suraningsih & Izzati, 2020). Therefore, the analysis obtained that the use ofSong-based Jarimatika method on motivation to learn multiplication counting operationseffective to increase students' learning motivation.

The contribution of the results of this study can be used as a learning medium in multiplication counting operations because it has a positive impact on students. Media with song-based arithmetic is more fun than learning done using conventional lectures and assignments. The implication of this research can be useful to add information about the media of creative song-based Jarimatika to increase students' motivation to learn about multiplication operations and to enrich knowledge about the implementation of learning in elementary schools. In addition, it can also be used as input and advice for school principals, teachers and education personnel as well as the surrounding community. The limitation of this research is that there are limitations in the method of data collection, namely not conducting observations and interviews. A useful suggestion for further research is the need for better planning of experimental research time. Experimental research can be carried out over a longer period of time. For researchers who will take or develop similar research related to the application of the Jarimatika method in song-based multiplication creations in order to better learn and understand the Jarimatika method in elementary schools.

4. CONCLUSION

The effectiveness of the song-based Jarimatika method on students' learning motivation in learning multiplication arithmetic operationsbased on descriptive analysis, it can be seen that after usingSong-based Jarimatika method on motivation to learn multiplication counting operationsoverall the results are significant. In conclusion with the finger-based song-based creative learning method on the motivation to learn multiplication arithmetic operations is effective in increasing students' learning motivation in multiplication operations.

5. REFERENCES

Andiarna, F., & Kusumawati, E. (2020). Pengaruh Pembelajaran Daring terhadap Stres Akademik Mahasiswa Selama Pandemi Covid-19. *Jurnal Psikologi*, *16*(2), 139. https://doi.org/10.24014/jp.v16i2.10395.

Aryani, R. (2020). Pengaruh Metode Jarimatika Terhadap Hasil Belajar Matematika Sekolah Dasar. *Journal for Lesson and Learning Studies*, *1*(1), 237–247. https://doi.org/10.36805/ijpse.v1i1.63.

Asmah, N, S., & Kurniawati, D. (2020). Inovasi Media Pembelajaran Matematika Berbasis Lagu Di Sekolah Dasar. *Riemann Research of Mathematics and Mathematics Education*, *2*(1), 35–47. https://doi.org/10.38114/riemann.v2i1.71.

Berkowitz, M., Edelsbrunner, P., & Stern, E. (2022). The relation between working memory and mathematics performance among students in math-intensive STEM programs. *Intelligence*, *92*(April 2021), 101649. https://doi.org/10.1016/j.intell.2022.101649.

Bhowmik, A. K., McCaffrey, M. S., Ruskey, A. M., Frischmann, C., & Gaffney, O. (2020). Powers of 10: Seeking "sweet spots" for rapid climate and sustainability actions between individual and global scales. *Environmental Research Letters*, *15*(9). https://doi.org/10.1088/1748-9326/ab9ed0.

Burhaein, E. (2017). Indonesian Journal of Primary Education Aktivitas Fisik Olahraga untuk Pertumbuhan dan Perkembangan Siswa SD. *Indonesian Journal of Primary Education*, *1*(1), 51–58. https://doi.org/10.17509/ijpe.v1i1.7497.

Castronovo, F., Stepanik, N., Van Meter, P. N., & Messner, J. I. (2022). Problem-solving processes in an educational construction simulation game. *Advanced Engineering Informatics*, *52*(February), 101574. https://doi.org/10.1016/j.aei.2022.101574.

Commodari, E., & La Rosa, V. L. (2021). General academic anxiety and math anxiety in primary school. The impact of math anxiety on calculation skills. *Acta Psychologica*, *220*, 103413. https://doi.org/10.1016/j.actpsy.2021.103413.

de la Peña, D., Lizcano, D., & Martínez-Álvarez, I. (2021). Learning through play: Gamification model in university-level distance learning. *Entertainment Computing*, *39*(March). https://doi.org/10.1016/j.entcom.2021.100430.

de Mooij, S. M. M., Kirkham, N. Z., Raijmakers, M. E. J., van der Maas, H. L. J., & Dumontheil, I. (2020). Should online math learning environments be tailored to individuals' cognitive profiles? *Journal of Experimental Child Psychology*, *191*, 104730. https://doi.org/10.1016/j.jecp.2019.104730.

Dewi, V. F., Suryana, Y., & Hidayat, S. (2020). Pengaruh Penggunaan Jarimatika Terhadap Kemampuan Berhitung Perkalian Peserta Didik Kelas IV Sekolah Dasar. *EduBasic Journal: Jurnal Pendidikan Dasar*, *2*(2), 79–87. https://doi.org/10.17509/ebj.v2i2.26816.

Dindar, M., Järvelä, S., Nguyen, A., Haataja, E., & Çini, A. (2022). Detecting shared physiological arousal events in collaborative problem solving. *Contemporary Educational Psychology*, *69*(January). https://doi.org/10.1016/j.cedpsych.2022.102050.

Donaghy, P. H., Greenhalgh, C., Griffiths, J., & Verma, A. (2022). The use of community problem solving in undergraduate nurse education: A literature review. *Nurse Education Today*, *116*(April), 105447. https://doi.org/10.1016/j.nedt.2022.105447.

Elaby, M. F., Elwishy, H. M., Moatamed, S. F., Abdelwahed, M. A., & Rashiedy, A. E. (2022). Does design-build concept improve problem-solving skills? An analysis of first-year engineering students. *Ain Shams Engineering Journal*, *13*(6), 101780. https://doi.org/10.1016/j.asej.2022.101780.

Elawati, V. P., & Utami, M. R. (2018). Optimalisasi Fungsi Otak Kanan Melalui Media. *Jurnal Home Page*, 160–166. https://journal.unsika.ac.id/index.php/sesiomadika/article/view/2136.

Fitriatien, S. R., Ninik Mutianingsih, Restu Ria Wantika, Liknin Nugraheni, & Eko Sugandi. (2020). Pengenalan Konsep Matematika pada Anak Usia Dini melalui Lagu. *Dinamisia : Jurnal Pengabdian Kepada Masyarakat*, *4*(2), 311–321. https://doi.org/10.31849/dinamisia.v4i2.3939.

Harahap, F., Nasution, N. E. A., & Manurung, B. (2019). The effect of blended learning on student's learning achievement and science process skills in plant tissue culture course. *International Journal of Instruction*, *12*(1), 521–538. https://doi.org/10.29333/iji.2019.12134a.

Hasibuan, I. (2015). Hasil Belajar Siswa Pada Materi Bentuk Aljabar Di Kelas Vii Smp Negeri 1 Banda Aceh

Tahun Pelajaran 2013/2014. *Jurnal Peluang*, *4*(1), 5–11. http://www.jurnal.unsyiah.ac.id/peluang/article/view/5853.

Himmah, K., Asmani, J. M., & Nuraini, L. (2021). Efektivitas Metode Jarimatika dalam Meningkatkan Kemampuan Berhitung Perkalian Siswa. *Dawuh Guru: Jurnal Pendidikan MI/SD*, *1*(1), 57–68. https://doi.org/10.35878/guru.v1i1.270.

Idham Sumirat, Trimurtini, W. (2017). Pengaruh Praktik Jarimatika Terhadap Keterampilan Berhitung Perkalian Pada Siswa Kelas Ii Sd. *Jurnal Kreatif : Jurnal Kependidikan Dasar*, *7*(1). https://doi.org/10.15294/kreatif.v7i1.9368.

Indiastuti, T. (2021). Pengaruh Metode Jarimatika Perkalian Pada Pelajaran Matematika Terhadap Hasil Belajar MIN 1 Madiun. *ISEJ: Indonesian Science Education Journal*, *2*(3), 137–143. https://www.siducat.org/index.php/isej/article/view/318.

Indriani, A. (2016). Pengaruh Motivasi Belajar Siswa Kelas V Terhadap Prestasi Belajar Matematika Di Sd Negeri Bejirejo Kecamatan Kunduran Kabupaten Blora. *JIPM (Jurnal Ilmiah Pendidikan Matematika)*, *4*(2), 134. https://doi.org/10.25273/jipm.v4i2.848.

Laakso, N. L., Korhonen, T. S., & Hakkarainen, K. P. J. (2021). Developing students' digital competences through collaborative game design. *Computers and Education*, *174*(August), 104308. https://doi.org/10.1016/j.compedu.2021.104308.

Lee, J., Lee, H. J., Song, J., & Bong, M. (2021). Enhancing children's math motivation with a joint intervention on mindset and gender stereotypes. *Learning and Instruction*, *73*, 101416. https://doi.org/10.1016/j.learninstruc.2020.101416.

Lemos, M. S., & Veríssimo, L. (2014). The Relationships between Intrinsic Motivation, Extrinsic Motivation, and Achievement, Along Elementary School. *Procedia - Social and Behavioral Sciences*, *112*(Iceepsy 2013), 930–938. https://doi.org/10.1016/j.sbspro.2014.01.1251.

Lestari, W. (2017). Pengaruh Kemampuan Awal Matematika dan Motivasi Belajar terhadap Hasil Belajar Matematika. *Jurnal Analisa*, *3*(1), 76. https://doi.org/10.15575/ja.v3i1.1499.

Malekian, F., Akhtar, M., & kakabaraee, K. (2013). Designing Training Math in Fifth Grade (Based on Logical Approach) and the Role of It on Critical Thoughts, Behaviour and Students Academic Motivation. *Procedia - Social and Behavioral Sciences*, *82*, 790–795. https://doi.org/10.1016/j.sbspro.2013.06.350.

Martinez, M. A. (2022). Computer discourse and use as determinants of student math outcomes: performativity and action at work in the lower school grades. *Heliyon*, *8*(2), e08888. https://doi.org/10.1016/j.heliyon.2022.e08888.

Maruyama, T., & Kurosaki, T. (2021). Do remedial activities using math workbooks improve student learning? Empirical evidence from scaled-up interventions in Niger. *World Development*, *148*, 105659. https://doi.org/10.1016/j.worlddev.2021.105659.

Minsih, & Astuti, D. (2015). Peningkatan Motivasi Belajar Matematika Melalui Pada Siswa Kelas V Mi Muhammadiyah Ngasem Kecamatan Colomadu Tahun Pelajaran 2013 / 2014. *Profesi Pendidikan Dasar*, *1*(1), 78–84. http://hdl.handle.net/11617/4870.

Morales-Chicas, J., & Graham, S. (2021). Do I belong in my math class? The importance of perceived racial/ethnic context and math course sequence. *Contemporary Educational Psychology*, *67*, 102012. https://doi.org/10.1016/j.cedpsych.2021.102012.

Mukrimah, S. S. (2014). *Metode Pembelajaran Berdasarkan Pemberian Informasi*. UPI.

Muslihah, N. N., & Tiawati, L. (2021). Analisis Metode Jari Magic (Jarimatika) dalam Meningkatkan Kemampuan Berhitung Perkalian dan Motivasi Belajar Siswa. *Jurnal Pendidikan*, *1*(1), 29–41. https://doi.org/10.31980/caxra.v1i1.1178.

Musso, M. F., Boekaerts, M., Segers, M., & Cascallar, E. C. (2019). Individual differences in basic cognitive processes and self-regulated learning: Their interaction effects on math performance. *Learning and Individual Differences*, *71*(March), 58–70. https://doi.org/10.1016/j.lindif.2019.03.003.

Nafaikah, A., Mudzanatun, M., & Wakhyudin, H. (2019). Kegiatan Ekstrakurikuler Jarimatika dalam Membangun Keterampilan Berhitung. *International Journal of Elementary Education*, *3*(3), 243. https://doi.org/10.23887/ijee.v3i3.19404.

Nyoman Sukajaya, I., Ketut Eddy Purnama, I., & Purnomo, M. H. (2015). Intelligent classification of learner's cognitive domain using bayes net, naïve bayes, and j48 utilizing bloom's taxonomy-based serious game. *International Journal of Emerging Technologies in Learning*, *10*(2), 46–52. https://doi.org/10.3991/ijet.v10i1.4451.

Palittin, I. D., Wolo, W., & Purwanty, R. (2019). Hubungan Motivasi Belajar Dengan Hasil Belajar Fisika. *MAGISTRA: Jurnal Keguruan Dan Ilmu Pendidikan*, *6*(2), 101–109. https://doi.org/10.35724/magistra.v6i2.1801.

Prayugo, W. F., & Efendi, M. (2017). Pengaruh penggunaan metode jarimagic terhadap kemampuan

berhitung perkalian siswa tunarungu kelas IV. *Jurnal Ortopedagogia*, *1*(3), 175–181. https://doi.org/10.17977/um031v1i32014p175-181.

Ramlah, R., & Hanifah, H. (2018). Menyeimbangkan Fungsi Otak Melalui Teknik Kreasi Lagu dalam Pencapaian Pemahaman Matematis Siswa SMP. *SJME (Supremum Journal of Mathematics Education)*, *2*(1), 17–25. https://doi.org/10.35706/sjme.v2i1.923.

Rauf, U., Munirah, M., & Jam'an, J. (2021). Keefektifan Lagu Kreasi Guru Dalam Meningkatkan Kemampuan Siswa Untuk Mendeskripsikan Benda. *Jurnal Riset Dan Inovasi Pembelajaran*, *1*(3), 38–50. https://doi.org/10.51574/jrip.v1i3.74.

Salsinha, C. N., Binsasi, E., & Bano, E. N. (2019). Peningkatan kemampuan berhitung dengan metode jarimatika di Sekolah Dasar Negeri (SDN) Neonbat Nusa Tenggara Timur. *Transformasi: Jurnal Pengabdian Masyarakat*, *15*(2), 73–84. https://doi.org/10.20414/transformasi.v15i2.1302.

Siagian, M. D. (2016). Kemampuan koneksi matematik dalam pembelajaran matematika. *MES: Journal of Matematics Education and Science2*, *2*(1), 58–67. https://doi.org/10.30743/mes.v2i1.117.

Suraningsih, E., & Izzati, N. (2020). Pengembangan Lirik Lagu Sebagai Media Pembelajaran Matematika Pada Materi Bentuk Aljabar. *Suska Journal of Mathematics Education*, *6*(1), 69–77. https://doi.org/10.24014/sjme.v6i1.9191.

Tarigan, D., & Purti M, N. (2019). Penggunaan Teknik Jarimatika Untuk Meningkatkan Keterampilan Berhitung Peserta Didik Kelas II SD Negeri 101774 Sampali Percut Sei Tuan. *Journal of Chemical Information and Modeling*, *53*(9), 1689–1699. https://doi.org/10.24114/jh.v1i2.1273.

Thuneberg, H. M., Salmi, H. S., & Bogner, F. X. (2018). How creativity, autonomy and visual reasoning contribute to cognitive learning in a STEAM hands-on inquiry-based math module. *Thinking Skills and Creativity*, *29*(July), 153–160. https://doi.org/10.1016/j.tsc.2018.07.003.

Ulum, W. M., & Hasyim, M. (2017). Eksperimentasi Metode Jarimatika Modern Â€Œtontalkogâ€ Berbasis Multimediaâ€ Pada Siswa Sekolah Dasar. *JP2M (Jurnal Pendidikan Dan Pembelajaran Matematika)*, *2*(2), 79. https://doi.org/10.29100/jp2m.v2i2.209.

Van de Weijer-Bergsma, E., & Van der Ven, S. H. G. (2021). Why and for whom does personalizing math problems enhance performance? Testing the mediation of enjoyment and cognitive load at different ability levels. *Learning and Individual Differences*, *87*, 101982. https://doi.org/10.1016/j.lindif.2021.101982.