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EFFECTIVENESS OF THE CONCEPT OF MULTIPLICATION GROUPING AND NAPIER'S BONE TO IMPROVE MEMORY IN THE IMPLEMENTATION OF THE MERDEKA CURRICULUM

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Abstract
This study evaluates the effectiveness of the multiplication grouping concept using Napier's bones to enhance memory, particularly in the context of implementing the independent curriculum post-COVID-19 pandemic. Employing a Posttest-only design, the research involved 609 students across 20 classes in four schools that had adopted the independent curriculum. The results of the T-test analysis rejected the null hypothesis, indicating that the multiplication grouping concept and Napier's bones significantly improved memory retention. These findings support the conclusion that the joint implementation of the independent curriculum using this method can be considered effective. Therefore, it is recommended to incorporate the multiplication grouping concept and Napier's bones as references in teaching, both inside and outside the classroom, to facilitate a more efficient understanding and operationalization of multiplication.
Keywords: *multiplication grouping; napier bones; memory; implementation of the independent curriculum*

Abstrak
Penelitian ini mengevaluasi efektivitas konsep pengelompokan perkalian menggunakan tulang Napier untuk meningkatkan daya ingat, khususnya dalam konteks penerapan kurikulum mandiri pasca pandemi COVID-19. Dengan menggunakan desain Posttest-only, penelitian ini melibatkan 609 siswa di 20 kelas di empat sekolah yang telah menerapkan kurikulum mandiri. Hasil analisis T-test menolak hipotesis nol, menunjukkan bahwa konsep pengelompokan perkalian dan tulang Napier secara signifikan meningkatkan retensi memori. Temuan ini mendukung kesimpulan bahwa implementasi bersama kurikulum mandiri dengan menggunakan metode ini dapat dianggap efektif. Oleh karena itu, disarankan untuk memasukkan konsep pengelompokan perkalian dan tulang Napier sebagai referensi dalam pengajaran, baik di dalam maupun di luar kelas, untuk memfasilitasi pemahaman dan operasionalisasi perkalian yang lebih efisien.
Keywords: pengelompokan perkalian; tulang napier; memori; kurikulum merdeka

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Introduction

The curriculum in Indonesia has changed 11 times, even now it is the implementation of a new curriculum called the independent curriculum. Some of the reasons for implementing the independent curriculum include that this curriculum is much more concise, simple and more flexible to be able to support learning loss recovery due to the Covid-19 pandemic, and this curriculum is also expected to improve the quality of education in Indonesia as a whole (Setiawati, 2022b)

The independent curriculum pays more special attention to literacy and numeracy (Fahlepi, 2022), this is quite reasonable because the results of the PISA survey state that one of the subjects categorized as difficult is mathematics where less than one person has good abilities in mastery.

Jean Piaget is one of the figures who studies cognitive development who develops pradigma learning mathematics with a constructivist approach, which believes that increasing knowledge is the result of learning construction from students, not something "fed" from others, and cognitive development occurs gradually with different thinking styles, depending on each individual. In line with Wardani, (2022) that a child not only receives material instantly but children are guided and directed to find material concepts according to the abilities of each student. This is reinforced by Sasmi dan Rahman, (2022) who suggest that children can adapt and interpret their knowledge according to their cognitive development, both guidance and the results of constructing their understanding. At the stage of concrete operations with an age range of 8-11 years which has the main characteristics of development, clear / logical rules and conservation enter the B-phase. The ability that appears at that stage is the ability in the thinking process to operate the rules of logic, although it is still related to concrete objects and must be captured by the five senses. So it is very natural that the gap must be bridged by a way, one of which is the use of teaching aids in presenting the material.

According to Muhamad dan Herdian (2021) that the group work method can affect learning motivation by 52.71%, so that if applied in multiplication material, it is expected to also improve student memory. Based on the results of interviews with elementary school teachers in phase B, it was stated that multiplication material was included in the material that was quite difficult to convey and understand with a percentage of 66.67% and the results of the average score of students were 64.25 (under KKTP). Even though in terms of concepts, this multiplication material is included in the easy category because it is formed from repeated additions. This situation is in accordance with Jayadi, (2022) research that learners find it difficult for multiplication because they do not understand the concept of multiplication well, just try to memorize. When a teacher in his class always applies one lesson one multiplication in his delivery without being accompanied by other techniques, it is certain that students will consider mathematics subjects to be very difficult subjects to understand. Research (Merdja & Pendy, 2020) This study aims to assess the effectiveness of Napier's rod as a teaching tool in improving the learning outcomes of third-grade students in an elementary school. Using a quasi-experimental design, the t-test analysis revealed that the average score in the experimental group (71.20) was higher than that in the control group (65.54). The t-test results indicated statistical significance ($p < 0.05$) for both groups, with the calculated t-value being less than the critical t-value. This suggests that Napier's rod is more effective in enhancing students' learning outcomes and actively engaging them in the learning process.

One way to change the pradigma that mathematics subjects are included in the difficult category is to use the right techniques and learning media. According to

Siburian and Galung (Siburian & Galung, 2022) that teaching aids in the form of pictures can be used to explain learning concepts from abstract material to be real and clear, thus stimulating the senses of sight, thoughts, feelings, and attention of students. Learning media in the form of teaching aids that are considered effective in strengthening memory are napier bones because their use will indirectly train students' memory, this is in line with Novitasari and Fathoni, (2022) that the use of napier media can attract attention in learning so that this willingness can improve student memory.

The problem-solving approach that will be implemented uses two ways, namely multiplication grouping techniques to memorize them and learning media in the form of napier bone tools for calculating operations. When the two problem solving are carried out, it is

expected to improve the memory of students so that their numeracy skills will also increase. Basically, the technique of grouping multiplication comes from Jean Piaget's cognitive theory which in the stages of concrete operations must be based on clear or logical rules. Where Juwantara, (2019) this development explains how children group existing objects. The multiplication grouping technique can be seen in the picture below:

Figure 1. Multiplication

From figure 1, it can be seen that the memorization of multiplication is divided into three, including easy, medium and difficult categories. Multiplication with easy levels can be mastered without having to be memorized, multiplication with medium levels can be mastered if the multiplication of mathematics is smooth and multiplication with difficult levels can be mastered through memorization but the number becomes small.

Learning media in the form of napier bone props is the result of the findings of a mathematician who discovered a logarithm named John Napier where the shape is composed of 10 basic number cards, including: 1, 2, 3, 4, 5, 6, 7, 8, 9, and 0 so that some call it multiplication of 10 basic numbers. The shape of the napier bone props can be seen in the picture below:

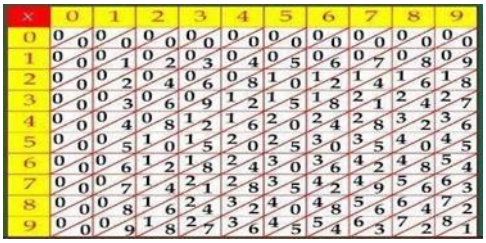

Figure 2. Napier Bone Props

When viewed from the results of multiplication, all columns in Napier's bones show the concept of multiplication from 0 to 9. However, tens of results are stored on the top left and units are stored on the bottom right. So this prop can indirectly strengthen the memory of multiplication which can later strengthen the operation of calculating multiplication itself.

Research Methods

The research method used in this study is a quantitative type. According to Sugiono, (2018) "in quantitative/positivistic research, which is based on an assumption that a symptom can be classified and the relationship of symptoms is causal (cause and effect), researchers can conduct research by focusing on only a few variables. The pattern of relationships between the variables to be studied is hereinafter referred to as research pradigma" Research pradigma can basically be interpreted as a mindset that shows the relationship between the variables studied while reflecting the type and formulation of problems that need to be answered in research, the

theory used and the analysis techniques needed. An overview of double pradigma with two dependent variables according to Sugiono, (2018) is as follows:

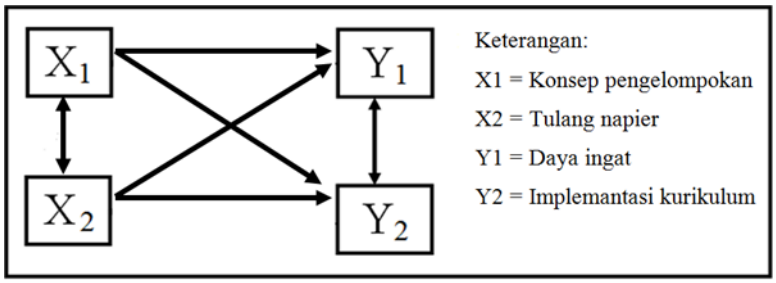

Figure 3. Double Pradigma with Two Dependent Variables

According to Sugiono (2018) for experimental research design using True Experimental design which is Posttest-only control design where there are two groups used for research, the research pradigma can be described as follows:

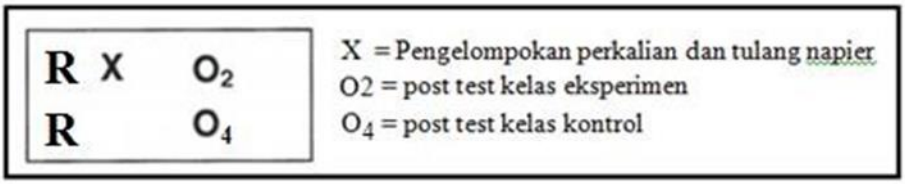

Figure 4. Posttest-only control design

For the sample in this study is 60 teachers (30 schools) in the Garut region who teach in grade 3 or 4 (phase-B), from these samples will be given treatment which becomes an experimental class and other teachers as a control class. For data collection techniques, interviews, tests, observations and questionnaires will be used as instruments. The objectives of each technique are as follows: First, i9nterviews to determine experimental and control classes in a school. Second, tests (questions) to measure the cognitive abilities of students, both experimental and control classes. Third, observation to measure the treatment carried out by teachers to students and the implementation of the independent curriculum.

Results and Discussion

Before the research is carried out, the first step is to determine schools that have implemented an independent curriculum, especially in Phase B (grade 3 and grade 4). 4 schools were involved (3 public schools and one private school), where there were 20 classes with a total of 609 students involved divided from experimental class 303 and control class 306. Followed by assistance and data collection which is further processed in SPSS so that these values can be used as the basis for conclusions in research. The first test is a test by determining the average, the data is as follows:

Table 1. Statistical Groups

	Multiplication an An and napier Bone groupers	N	Mean	Std. Deviation	Std. Error Mean
Memory	Experiment	303	81.8779	11.28741	.64844
	Control	306	69.3627	17.70790	1.01229

From table 1, data was obtained that the number of experimental class students was 303 with an average of 81.87 while the control class was 306 with an average of 69.36. Based on the standard value of devasi, it is obtained that the value of the experimental class is smaller than

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the control class with a value of 11.28, it can show that the variable has relatively homogeous data. For more details, the average data of both classes are as follows:

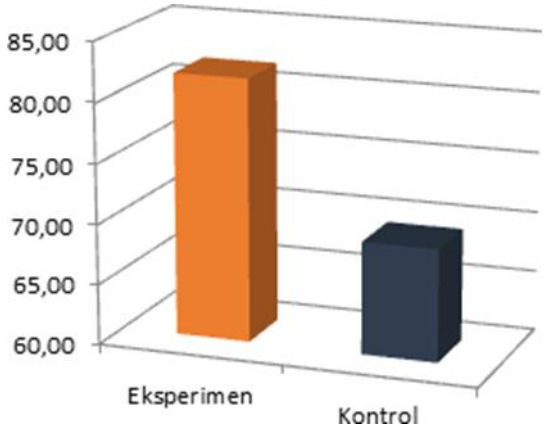

Figure 5 .Average multiplication value

From the bar chart, it can be seen that the increase using the concepts of multiplication grouping and napier bone is greater than that of the control class, where the values are 81.87 and 69.32 respectively. According to Alisnaini et al (2023), the use of napier rod media can be an effective tool to improve the multiplication ability of students, this can be seen through the average multiplication results from the experimental class with the control class.

According to Alisnaini et al., (2023) also Through the introduction and use of this media, students can develop a better understanding of the concept of multiplication and increase speed and accuracy in doing calculations, so that in this case it can be used as an initial reference that makes the concept effective in improving memory and entering the implementation of an independent curriculum. The next step is the Hypothesis test, where the calculation uses an independent samples test, for the results as follows:

Table 2. Independent Samples Test

	Levene's Test for Equality of Variances		t-test for Equality of Means						
					Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
	F	Sig.	t	Df				Lower	Upper
Power Remember	Equal variances assumed	90.459	.000	15.005	607	.000	20.71791	1.38075	18.00628	23.42954
	Equal variances not assumed			15.093	490.872	.000	20.71791	1.37272	18.02077	23.41505

From this test, it was found that if the sig (2-tailed) value <0.05, Ho was rejected, so that the concept of multiplication grouping and napier bones could improve memory and joint

implementation of the independent curriculum was included in the effective category. This effectiveness can be seen in the Descriptive Statistics table obtained from the N-gain value as follows:

Table 3. Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
N_Gain_Skor	303	.42	1.00	.8325	.17581
N_Gain	303	42.31	100.00	83.2451	17.58136
Valid N (listwise)	303				

From the table, the average N-gain score is 0.83 with the high category and the effectiveness with a value of 83.24 with the effective category. According to Fauziah (2023) that based on the findings and analysis of the data, the N-gain value categorized as effective can be recommended for use and based on these values, the concepts of multiplication grouping and napier bones can be used as a reference or suggested to be used in applications in class and outside the classroom for easier and more precise calculations.

The research approach employing the concept of grouping multiplication and the use of Napier's rod in enhancing students' memory, particularly in Phase B of the Merdeka Curriculum, is substantiated by relevant theories from Alisnaini et al., (2023). According to Alisnaini, the use of Napier's rod is an effective tool to improve students' multiplication skills. In this context, the research findings indicate that the average memory recall scores in the experimental group applying this concept are significantly higher than those in the control group. This aligns with the notion that the introduction and utilization of media, such as Napier's rod, can provide a better understanding of the multiplication concept and enhance the speed and accuracy of students' calculations.

The hypothesis testing conducted in this study, utilizing an independent samples test, yielded results indicating that the grouping multiplication and Napier's rod concept statistically significantly improves students' memory recall. This supports the perspective of Alisnaini et al., (2023) that Napier's rod can be considered an effective tool in enhancing students' multiplication abilities. Further data analysis revealed that both the N-gain score and N-gain values fall within the high and effective categories, in accordance with the criteria for effective mathematics learning outlined by Fauziah (2023). Therefore, the study provides empirical grounds to recommend the incorporation of this concept in the implementation of the Merdeka Curriculum.

While the research contributes positively to the field of mathematics education, it is essential to acknowledge its limitations. Sample size may need expansion, and the intervention duration extended to comprehend the long-term impact of the concept. Additionally, further research could explore additional variables that might influence outcomes, such as students' motivation or learning styles. Consequently, future studies can enrich our understanding of the effectiveness of grouping multiplication and Napier's rod concept in a broader context of mathematics learning.

Conclusion

Based on the results of data collection and analysis, it was concluded that the concept of grouping multiplication and napier bones can improve memory in implementing an independent curriculum. This concept can be inserted in the independent curriculum teaching module, with an average score of 81.87. As for the hypothesis test using the t test with the Independent Samples Test, the result is a Sig (2-tailde) value of <0.05 then Ho is rejected, so that the concept of multiplication grouping and napier bones can improve memory and joint implementation of the independent curriculum is included in the category effective. The effectiveness is 83.24% and the increase is in the high category. Based on these results, the use of the concept of grouping multiplication and napier bones when learning about multiplication, especially in grade 3 and grade 4 can help students, especially in memory and multiplication operations.

References

Alisnaini, A., Harliyani, W., Tusakdiah, H., & F. (2023). Upaya Peningkatan Kemampuan Perkaliandengan Menggunakan Media Batang.

Almarashdi, H., & J. (2021). Mathematics distance learning amid the COVID-19 pandemic in the UAE: High school students' perspectives. International Journal of Learning, Teaching and Educational Research, 20(1), 292-307.

Andrillah. (2023). the Effect of Using the Napier Rod Props on the Mathematics Learning Outcomes of Class Iv Student'S of Elementary School.

Aprizal, P., & P. (2018). Development of Napier's Bones Equipment for Improving Student Learning Outcomes in Multiplication Counting Operations at Grade III SDN 13 Sitiung Dharmasraya Regency. In 2nd International Conference on Mathematics and Mathematics Education 2018 (ICM2E 2018), 211–214.

Bandungan. (n.d.). The use of Napier Bones props to enhance learning achievement on Grade 5 Math multiplication.

Berta, T., & H. (2020). Cooperative learning methods in mathematics education–1.5 year experience from teachers' perspective. In Annales Mathematicae et Informaticae (, 52, 269–279.

Fahlevi. (2022). Upaya pengembangan number sense siswa melalui kurikulum merdeka. Sustainable Jurnal Kajian Mutu Pendidikan, 5(1), 11-27.

Fakhroni, A. A., & P. (2023). Efforts to Improve Mathematics Learning Outcomes Using Napier Bone Teaching Aids for Elementary School Students. Interval: Indonesian Journal of Mathematical Education, 1(2), 36-46.

Fauziah, D., Suryana, Y., A. (2023). Efektivitas Metode Habit Forming Terhadap Peningkatkankemampuan Operasi Hitung Perkalian Siswa SD. Pendas : Jurnal Ilmiah Pendidikan Dasar, 8(2), 1406-1415.

Fitri, A., Herman, T., Sa'ud, U. S., Suparman, T., & DS, Y. N. (2023). Analysis of the Implementation of the Independent Curriculum in Mathematics Subjects in Elementary Schools. In 4th Borobudur International Symposium on Humanities and Social Science 2022 (BIS-HSS 2022), 906–915.

Hiebert. (1984). Children's mathematics learning: The struggle to link form and understanding. The elementary school journal, 84(5), 497-513.

Jayadi. (2022a). Analisis Teori Perkembangan Kognitif Piaget Pada Tahap Anak Usia Operasional Konkret 7-12 Tahun Dalam.

Jayadi. (2022b). Meningkatkan Pemahaman Konsep Perkalian dan Pembagian Kelas 3 Melalui Permainan Loncat Katak. JPG: Jurnal Pendidikan Guru, 3(3), 179– 186.

Juwantara. (2019). Analisis Teori Perkembangan Kognitif Piaget Pada Tahap Anak Usia Operasional Konkret 7-12 Tahun Dalam.

Kaiser. (2020). Mathematical modelling and applications in education. Encyclopedia of mathematics education, 553-561.

Merdja, J., & Pendy, A. (2020). Efektifitas Penggunaan Media Batang Napier Dalam Operasi Perkalian Terhadap Hasil Belajar Siswa kelas III SD GMIT Ende 4. Jurnal Cendekia: Jurnal Pendidikan Matematika, 4(2), 593–601.

Muhamad, N., & H. (2021). Pengaruh Metode Pembelajaran Kerja Kelompok Pada PelajaranMatematika Terhadap Motivasi Belajar Siswa Di Masa PandemiCovid-19. Jurnal Pendidikn Universitas Garut, 15(2), 519-527.

Mulenga, E. M., & M. (2020). Is COVID-19 the gateway for digital learning in mathematics education?. Contemporary Educational Technology, 12(2), 269.

Novitasari, A., & F. (2022). Peran Guru dalam Mengatasi Kesulitan Belajar Siswa pada Pelajaran Matematika Sekolah Dasar. Jurnal Basicedu, 6(4), 5969–5975.

Nurvita, N., Sinaga, B., & M. (2017). The Influence of Napier Stem Use Tools on Student Counting Ability in Fourth Grade on Muhammadiyah Private Elementary School (The Napier Rods Against of Student Counting Ability). In 2nd Annual International Seminar on Transformative Education and Educational Leadership (AISTEEL 2017), 413–415.

Priatna, N., LORENZİA, S., & W. (2020). STEM education at junior high school mathematics course for improving the mathematical critical thinking skills. Journal for the Education of Gifted Young Scientists, 8(3), 1173-1184.

Rohaeti, E. E., Bernard, M., & P. (2019). Developing interactive learning media for school level mathematics through open-ended approach aided by visual basic application for excel. Journal on Mathematics Education, 10(1), 59-68.

Safitri, N. D., Darmayanti, R., Usmiyatun, U., & N. (2023). 21st century mathematics learning challenges: Bibliometric analysis of trends and best practices in shinta indexed scientific publications. JEMS: Jurnal Edukasi Matematika Dan Sains, 11(1), 136-152.

Sasmi, N., & R. (2022). Analisis Teori Kognitif Jean Piaget Terhadap Perkembangan Bahasa Pada Anak Usia Sekolah.

Setiawan, A. A., Muhtadi, A., & H. (2022). Blended Learning and Student Mathematics Ability in Indonesia: A Meta-Analysis Study. International Journal of Instruction, 15(2), 905-916.

Setiawati. (2022a). Dampak kebijakan perubahan kurikulum terhadap pembelajaran di sekolah. NIẒĀMULILMI: Jurnal Manajemen Pendidikan Islam, 7(1), 1-17.

Setiawati, F. (2022b). Dampak kebijakan perubahan kurikulum terhadap pembelajaran di sekolah. NIẒĀMULILMI: Jurnal Manajemen Pendidikan Islam, 7(1), 1–17.

Siburian, H. H., & G. (2022). Peningkatan Minat Belajar Anak Usia Dini Menggunakan Alat Peraga Gambar. PEADA': Jurnal Pendidikan Kristen, 3(1), 1–16.

Siburian, H. H., & Galung, J. (2022). Peningkatan Minat Belajar Anak Usia Dini Menggunakan Alat Peraga Gambar. PEADA': Jurnal Pendidikan Kristen, 3(1), 1–16.

Sugiono. (2018). Motode Penelitian Pendidikan. Bandung: Alfabeta.

Tarim. (2009). The effects of cooperative learning on preschoolers' mathematics problem-solving ability. Educational studies in mathematics, 72, 325-340.

Tezer, M., Yildiz, E. P., Bozkurt, S., & T. (2019). The Influence of Online Mathematics Learning on Prospective Teachers Mathematics Achievement: The Role of Independent and Collaborative Learning. World Journal on Educational Technology: Current Issues, 11(4), 257-265.

Tsany, U. N., Septian, A., & K. (2020). The ability of understanding mathematical concept and self-regulated learning using macromedia flash professional 8. In Journal of Physics: Conference Series, 1657(1), 012074.

Wardani. (2022). Pemikiran Teori Kognitif Piaget Di Sekolah.

Whicker, K. M., Bol, L., & N. (1997). Cooperative learning in the secondary mathematics classroom. The Journal of Educational Research, 91(1), 42-48.

Zakaria, E., Chin, L. C., & D. (2010). The effects of cooperative learning on students' mathematics achievement and attitude towards mathematics. Journal of social sciences, 6(2), 272-275.