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Interleaved Practice in Remediating Basic Arithmetic Proficiency in Grade One

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Abstract. Mastery of basic arithmetic in grade one is a crucial stage in developing complex mathematical operations. During this stage, learners begin to acquire concepts that are necessary for the foundation of numeracy. Hence, the learners' difficulty in attaining the basic skills of addition and subtraction must be improved; thus, this action research was conducted to minimize learning gaps. This study utilized a one-shot pretest-post-test quasi- experimental quantitative design to examine the effectiveness of interleaved practice as a remedial intervention strategy for enhancing proficiency in addition and subtraction operations among grade one pupils. Specifically, this determined 1) the level of performance of grade one learners in the basic operations of addition and subtraction using: a. traditional blocked practice and b. interleaved practice, 2) a significant difference in the mean scores between the learners under traditional blocked practice and those under interleaved practice, and 3) a significant mean gain between the pretest and posttest scores of learners between traditional blocked practice and interleaved practice. The grade one low-performing learners were selected through their second-trimester grade in Mathematics and the keen observations and feedback of Mathematics teachers during their class activities with the limited sample sizes of 15 for interleaved practice and 15 for traditional blocked practice. The researcher utilized Wilcoxon's Signed Rank Test and Man- Whitney U-test. Results have shown a significant improvement in the performance of the grade one pupil using both interleaved and traditional blocked strategies. Moreover, both interleaved and traditional blocked practices show an approximate equivalency of performance in terms of improving the skills of the learners. Thus, interleaved practice is an effective strategy to substitute the traditional blocked practice in remediating arithmetic skills in grade school. Still, further studies are recommended to test the long-term effect of the interleaved practice in remediating basic arithmetic operations.

Keywords: Interleaved practice; Traditional blocked practice; Arithmetic proficiency; Remediation

1.0 Introduction

The acquisition of fundamental arithmetic skills, particularly in grade one, is a pivotal milestone in a child's mathematical journey. At this crucial stage, students begin to grasp the foundational concepts that will shape their mathematical proficiency in the later years. During this time, children begin to form foundational understandings of number concepts, operations, and mathematical relationships that will influence their future mathematical proficiency (Nunes, Bryant, & Barros, 2012). Among these foundational skills, mastery of basic operations such as addition and subtraction stands as a cornerstone of mathematical understanding. Mastery of these basic arithmetic operations is essential for building a solid mathematical foundation. These skills serve as building blocks for more complex mathematical concepts, including multiplication, division, fractions, and algebra (Ginsburg, 2009).

It is common for students to encounter challenges in grasping these fundamental operations. Some students may struggle with basic arithmetic concepts due to various factors such as learning differences, limited exposure to mathematical concepts, or insufficient instructional support (Skelton et al. 2016). Addressing these factors through targeted interventions and supportive teaching practices is crucial for promoting mathematical understanding and reducing anxiety toward mathematics among primary school children. Traditional teaching methods often rely on repetitive practice and drill exercises to reinforce arithmetic skills. While these methods may benefit some students, they may not adequately address the diverse learning needs of all students, particularly those requiring remedial intervention or support (Dunn, et.al, 1995). Thus, exploring alternative instructional approaches that can better accommodate individual differences and promote equitable learning outcomes for all students is a must.

As educators strive to meet the individual needs of their students, innovative teaching strategies are continuously being explored to enhance learning outcomes. One such innovative approach is the interleaving strategy, which diverges from traditional blocked practice by mixing different types of problems within the same practice session. Unlike blocked practice, where students repeatedly solve the same type of problem consecutively, interleaving exposes students to a variety of problem types in a randomized order. Research in cognitive psychology has shown that interleaving promotes deeper learning, enhances retention, and improves the transfer of learned skills compared to blocked practice. The study by Rohrer and Taylor (2007) provides empirical evidence from classroom settings supporting the effectiveness of interleaved practice in promoting understanding, enhancing recognition, and application of learned skills compared to blocked practice. These findings align with research in cognitive psychology, which suggests that interleaving encourages more robust learning processes and facilitates greater generalization of knowledge across different contexts.

Interleaving improves mathematics learning not only by improving discrimination between different kinds of problems, but also by strengthening the association between each kind of problem and its corresponding strategy (Rohrer, Dedrick, & Burgess, 2014). Another study that explores the application of interleaved practice (contextual interference) in motor skill learning demonstrated its benefits in improving the acquisition and retention of complex motor skills. Results replicated previous findings of contextual interference research by showing significant outcomes of block interaction between acquisition trials, retention, and transfer. The random group performed better on both retention and transfer than the blocked group (Goode & Magill, 1986).

In the investigation done among tertiary students, whether continuously alternating between topics during practice or interleaved practice, results have shown the improvement of memory and the ability to solve problems in undergraduate physics. It was concluded that in a domain that entails considerable amounts of problem-solving, replacing conventionally arranged with interleaved homework can (despite perceptions to the contrary) foster longer-lasting and more generalizable learning (Samani, & Pan, 2021). In the review paper Optimizing Learning in College, perspectives on Psychological Science discusses various learning strategies, including interleaving, and their practical applications in educational settings (Putnam, Sungkhasettee, & Roediger, 2016). These mean that the interleaving strategy is now one of the strategies considered to help students retain what was learned which needed more exploration.

Furthermore, interleaving is grounded in cognitive psychology theories such as interference theory and desirable difficulties, which proposes that interspersing varied but related learning tasks leads to increased cognitive engagement and deeper encoding of information. While the benefits of interleaving have been observed across various educational domains, its application in teaching fundamental arithmetic to young learners remains an area warranting exploration. Hence, this action research aims to explore the effectiveness of employing the interleaving strategy as a remedial intervention to enhance arithmetic proficiency among grade one students in the context of addition and subtraction. By integrating interleaving into remedial interventions, this study further seeks to provide educators with evidence-based strategies to support students who struggle with addition and subtraction.

Through an examination of the effects of interleaving on arithmetic proficiency, this research endeavors to contribute valuable insights into effective teaching methodologies for early mathematics education. By empowering educators with evidence-based practices, this study further aimed to foster a supportive learning

environment where all students can develop a strong foundation in arithmetic skills, setting them on a path toward mathematical success in their academic journey.

2.0 Methodology

2.1 Research Design

The research study utilized a one-shot pretest-posttest quasi-experimental quantitative design to investigate the effectiveness of interleaved practice as a remedial intervention strategy for enhancing arithmetic proficiency in grade one pupils. To determine the significant difference in the performance between those exposed to the traditional blocked practice, teacher-made pre-post-tests and worksheets on the basic operations were designed.

2.2 Research Participants

All participants were grade one pupil from all sections in a private basic education Institution in Mandaue City, Cebu, Philippines. Selected participants were identified through the learner's second-trimester grade in mathematics and from the feedback of the mathematics teachers. Only the low-performing pupils who did not meet the standard grade were selected. Participants were chosen through purposive sampling technique. Thirty pupils were selected, and each were randomly assigned between two groups. Half of the pupils were assigned to the control group and the other half for experimental group to ensure an unbiased comparison between instructional methods. The control group of fifteen assigned learners were taught using the traditional blocked practice, while the experimental group of fifteen assigned learners used the interleaved practice. The low-performing grade one pupils received remediation for twenty (20) sessions. The control group received thirty (30) minute practice per session focusing solely on addition or subtraction operations using the traditional blocked practice method. The experimental group received thirty (30) minute practice per session involving mixed addition and subtraction problems utilizing the interleaved practice method through worksheets and exit slip activities. The worksheets and exit slips were checked by three credible validators to ensure the validity of the instruments.

2.3 Data Gathering Procedure

Upon the approval of the study and issuance of its ethical clearance from the Institutional Research Committee of Sacred Heart School- Ateneo de Cebu, consent was sought from the Grade School administration and parents of the selected grade one participants. With the granted consent, the selected grade one learners were assigned to control and experimental groups. Then, learners were oriented toward the study, its procedure, advantages, and disadvantages. After the preliminary was done and approval was received, the selected learners took the researcher-made pretest. The pretest was the same for both the control and experimental groups. Then, the learners underwent twenty (20) sessions of remediation using the assigned strategy in their group. At the end of the whole remediation session, the selected pupils took the researcher-made posttest. The pretest and posttest were the same for both groups.

2.4 Data Analysis

The pretest and posttest scores of the grade one pupils were initially analyzed by determining the mean scores. This was done to determine the pupils' performance before and after receiving the remediation in each respective group. For the difference between pretest and posttest of each group, Wilcoxon's signed rank test was used. Then, Mann- Whitney U Test was employed to determine the significant difference between the posttest mean score of the pupils remediated through traditional blocked practice and those that were remediated through interleaved practice. This analysis was selected since the values do not conform to a normal distribution. Rank biserial correlation test was also utilized to identify the effect size for both groups.

2.5 Ethical Considerations

A clearance to conduct research was requested from the grade school principals, the Institutional Research Committee, and the data protection officer before the commencement of the study. A reply slip from a written consent form sent to the parents explaining the nature and objectives of the study, the data needed from the pupils, and the process of conducting it was sought. Participation in this study was invitational and voluntary. The pupils were given an orientation on the processes of the study and the liberty to decide to be

part of the study and to withdraw their participation anytime if they decided to do so. Furthermore, to ensure confidentiality and to reduce research bias, a list per section was linked in codes, and questionnaire and answer sheets were kept with utmost confidentiality and were free from any information that would identify the research participants. The identity of the participants was concealed in all reports- written and verbal. All the information obtained about the participants was handled and kept in confidence. Measures were taken to ensure the confidentiality of participant data, including anonymizing data during analysis and storing of all research-related documents. Furthermore, all raw data were deleted upon the culmination of this research by the Data Privacy Act of 2012.

2.6 Limitations and Delimitations

The study acknowledges potential limitations, such as sample size constraints, variations in implementation fidelity, and external factors influencing outcomes. Delimitations may include focusing exclusively on grade one pupils, specific arithmetic skills (addition and subtraction), and instructional interventions (traditional blocked practice and interleaved practice). By employing a rigorous research methodology, the study aims to provide robust evidence on the effectiveness of instructional interventions for enhancing arithmetic proficiency in grade one pupils, thereby informing educational practice and policy.

3.0 Results and Discussion

This section presents and discusses the results, and the findings based on the data gathered. Table 1 shows the Wilcoxon Signed Rank Test result between the pretest and posttest scores of interleaved practice. Table 2 shows the Wilcoxon Signed Rank Test result between the pretest and posttest scores of Traditional blocked practice. Table 3 shows the result Mann- Whitney U Test results to determine the significant difference between the posttest mean score of the pupils remediated through traditional blocked practice and those that were remediated through interleaved practice.

Table 1. *Difference between the Pretest and Posttest Scores of Interleaved Practice*

Test type	Mean	t	p-value	Interpretation
Pretest	5.87	-3.40	<.0001	With Significant Difference
Posttest	14.40			

Note: *Significant if p<0.05; Effect size= -0.88 (strong negative difference)*

The results indicated a statistically significant difference between the pretest and posttest scores of pupils exposed to interleaved practice, as reflected by a Z value of -3.4078 and a p-value of less than 0.00064. Since the p-value is well below the 0.05 threshold, the null hypothesis of no difference was rejected. The mean scores increased from 5.87 during the pretest to 14.4 in the posttest, demonstrating a substantial improvement. Additionally, the effect size of -0.88 suggests a strong and meaningful difference, reinforcing that interleaved practice contributed to a significant enhancement in performance. These findings align with broader research on interleaved practice. The study by Rohrer et al. (2020) highlights the benefits of interleaved practice in fostering deeper learning and adaptability by forcing students to select appropriate strategies for each problem rather than relying on repetitive patterns. Additionally, interleaving naturally incorporates the spacing and retrieval effects, both of which are known to enhance long-term retention and problem-solving skills.

Furthermore, a meta-analysis conducted by Brunmair and Richter's (2019) quantified the overall effectiveness of interleaved practice across various domains. Their analysis revealed a small positive effect for mathematical tasks, suggesting that interleaving is beneficial for procedural knowledge but may vary depending on implementation and task design. On the other hand, Van der Haar et al. (2023) revealed that interleaved practice increased short-term retention scores by 0.29 standard deviations but showed no significant improvement in cumulative assessments over the academic year. The study suggests that interleaved practice may have mixed impacts depending on the test type and retention interval. These studies collectively highlight the effectiveness of interleaved practice in enhancing procedural knowledge, fostering flexible strategy use, and promoting long-term retention across various age groups and mathematical domains. The present study contributes to this body of research by providing evidence that interleaved practice can be successfully applied in early elementary education

to remediate and enhance basic arithmetic skills. This convergence of findings emphasized the potential of interleaved practice as a versatile and impactful instructional strategy that educators can leverage to improve mathematical literacy and adaptability in young learners. Similarly, the time-tested traditional blocked method has shown dependable results as shown in the table below.

Table 2. *Difference between the Pretest and Posttest Scores of Traditional Blocked Practice*

Test type	Mean	t	p-value	Interpretation
Pretest	6.40	-3.407	<.001	With Significant Difference
Posttest	13.40			

Note: *Significant if p<0.05; Effect size= -0.86 (strong negative difference)*

As shown in Table 2, the findings revealed a statistically significant difference between the pretest and posttest scores of students who engaged in traditional blocked practice, as shown by a Z value of -3.4078 and a p-value of less than 0.00064. Since the p-value is below the 0.05 threshold, the null hypothesis was rejected. The mean scores improved from 6.4 in the pretest to 13.4 in the posttest, indicating a substantial gain in performance. The effect size of -0.86 further supports that this difference was strong and meaningful, suggesting that traditional blocked practice had a significant positive impact on students' performance.

In the study, "why do people overestimate the effectiveness of blocked learning?", it was found out that people overestimate the effectiveness of blocked learning due to the immediate memory boost caused by blocked learning and not due to their previously acquired habit to study in blocks. The study pointed out how evaluations for effectiveness are not always accurate. (Krasnoff, 2023) Blocked practice has traditionally been effective for **initial** skill acquisition**,** especially in early stages of learning like basic arithmetic (addition and subtraction) (Rohrer, 2012; Taylor & Rohrer, 2010). It allows focused repetition which can boost confidence and reinforce mastery of procedures, especially for younger learners.

However, while blocked practice resulted in significant immediate gains, some studies caution that its benefits may not sustain over time. Blocked practice tends to encourage rote memorization rather than flexible problem-solving, which might limit students' ability to transfer their skills to much complex problems (Rohrer & Taylor, 2007). Thus, while effective in the short term for basic computational skills, blocked practice might be less beneficial for promoting deeper mathematical understanding compared to more varied practice strategies like interleaving.

In grade one, concepts are taught in traditional blocked practice. This is done to allow sufficient time for mastery since this is the entry level were concepts are still introduced. The result of the test has highlighted the effectiveness of the Traditional Blocked Practice. However, problems such low retention from the next level continues to resurface. Thus, the need of another strategy for intervention.

Table 3. *Difference between Posttest Scores of Interleaved and Traditional Blocked Practices*

Strategy Type	Posttest Mean Score	U-value	p-value	Interpretation
Interleaved Practice	14.40	98	.281	No Significant difference
Traditional blocked practice	13.40			

As shown in Table 3, the results revealed that U value of 98 indicates that the difference between pretest and posttest scores after implementing interleaved practice is not statistically significant. This suggests that interleaved practice has comparable measurable improvement in students' basic arithmetic performance with the traditional blocked practice. Both practices are effective in improving the skills of the learners. Although the results showed no statistical significance, previous research conducted around the world support the idea that somehow interleaved practice yields better results compared to traditional blocked practice.

Herrington (2021) found that interleaved practice resulted in better delayed assessment scores compared to blocked practice, with 75% accuracy for interleaved assignments versus 61.7% for blocked ones. Further evidence supporting the efficacy of interleaved practice comes from a study on subtraction strategies among German third graders, which demonstrated that interleaved instruction fostered greater adaptive use of shortcut strategies compared to blocked practice. Nemeth et al. (2019) found that interleaved practice in elementary school mathematics fosters flexible and adaptive use of subtraction strategies. Specifically, their results suggest that interleaving, when paired with prompts to compare and discriminate between tasks, enhances learners' ability to choose appropriate strategies based on task characteristics.

Braithwaite and Hall (2024) found that while explicit instruction in fraction arithmetic is effective, there is no evidence that explaining the rationales behind mathematical procedures or interleaving practice enhances the effects of such instruction on procedural knowledge. This suggests that explicit teaching methods alone are sufficient for improving procedural understanding, and additional strategies like rationale explanations or interleaved practice may not provide further benefits in this context.

However, despite the absence of statistically significant difference between the two interventions, research articles could not help but highlight the effects of interleaved practice in comparison to the traditional blocked practice. Schorn and Knowlton's (2021) found that interleaved practice benefits implicit sequence learning and transfer. Participants who practiced sequences in an interleaved manner showed better retention and transfer compared to those who practiced in a blocked manner. Even when participants were unaware of the sequences, interleaved practice enhanced their ability to recall and apply the learned patterns.

Agarwal and Agostinelli (2020) contrast interleaved practice with blocked practice, where students practice one concept at a time, while interleaving, which involves mixing up different types of problems, enhances long-term learning by requiring students to discriminate between problems and select appropriate strategies. They argued that while blocked practice may lead to higher initial performance, interleaved practice results in better retention and understanding over time.

In this paper, the researcher proposes that interleaved practice will be used in remediating arithmetic proficiency among grade one learners. This involves mixing different types of arithmetic problems (e.g., addition and subtraction) within practice sessions. Interleaved practice enhances problem- solving fluency, retention, and adaptability by requiring students to select appropriate strategies for each problem (Rohrer et al., 2020; Nemeth et al., 2019). By incorporating interleaved practice into daily routines, teachers can foster a robust understanding of arithmetic concepts and prepare students for more complex problem-solving scenarios. This approach is supported by research demonstrating its effectiveness in improving long-term learning outcomes across various educational contexts (Agarwal & Agostinelli, 2020). This adaptability is crucial for grade one learners who are still developing their ability to apply learned strategies across different types of arithmetic problems.

4.0 Conclusion

Based on the results, the pupils who were exposed to interleaved practice displayed significant improvements in their performance levels after the intervention. It has comparable statistical effectiveness with the traditional blocked practice as evidenced by the insignificant difference in the post-test and gain scores. Thus, the interleaved practice is as effective when it comes to remediating a pupil's basic arithmetic proficiency in addition and subtraction. It can be concluded that the use of interleaved practice showed a measurable contribution towards arithmetic proficiency on addition and subtraction and is a good alternative strategy to be implemented next school year together with the traditional blocked practice.

As a recommendation, it is suggested to continue implementing the interleaved practice over a longer period to allow more time for its effects to become evident. Also, ensure that the practice methods are applied consistently across all participants to reduce variability. For future research, it is recommended that researchers utilize

assessment tools that are sensitive enough to detect changes in students' performance. Exploring other strategies that would help improve intervention programs in Mathematics is also recommended.

5.0 Contributions of Author

The author solely conducted all aspects of this research, including the conceptualization, data collection, analysis, writing, and finalization of the manuscript.

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7.0 Conflict of Interests

There is no known conflict of interest encountered in this study.

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9.0 References

Agarwal, P. K., & Agostinelli, A. (2020). Interleaving in math: How rearranging practice problems improves learning. American Educator, 44(1), 18–25. https://www.aft.org/ae/spring2020/agarwal_agostinelli

Amatya, B., & Khan, F. (2023). Disaster response and management: The integral role of rehabilitation. Annals of Rehabilitation Medicine, 47(4), 237. https://doi.org/10.5535/arm.23071

Ardiansyah, M., Mirandah, E., Suyatno, A., Saputra, F., & Muazzinah, M. (2024). Disaster management and emergency response: Improving coordination and preparedness. Global International Journal of Innovative Research, 2(4), 831. https://doi.org/10.59613/global.v2i4.129

Bernardo, A. B. I., Cordel, M. O. II, Lapinid, M. R. C., Teves, J. M. M., Yap, S. A., & Chua, U. C. (2023). Contrasting profiles of low-performing mathematics students in public and private schools in the Philippines: Insights from a machine learning. Journal of Intelligence, 10(61). https://doi.org/10.3390/jintelligence10030061

Bly, J. D., Francescutti, L. H., & Weiss, D. (2021). Disaster management: A state-of-the-art review. IntechOpen. https://doi.org/10.5772/intechopen.94489

Boroujeni, S. M. H. (2019). Post disaster needs assessment (PDNA). Journal of Disaster and Emergency Research, 2(2). https://doi.org/10.18502/jder.v2i2.1518

Braithwaite, D. W., & Hall, G. J. (2024). Explaining procedures and interleaving practice in fraction arithmetic. Learning and Instruction, 90, 101854. https://doi.org/10.1016/j.learninstruc.2023.101854

Brunmair, M., & Richter, T. (2019). Similarity matters: A meta-analysis of interleaved learning and its moderators. Psychological Bulletin, 145(11), 1029–1052. https://doi.org/10.1037/bul0000209

Chineka, J., Musyoki, A., Kori, E., & Chikoore, H. (2019). Gender mainstreaming: A lasting solution to disaster risk reduction. Jàmbá: Journal of Disaster Risk Studies, 11(3), 1–6.

Cullman, J., et al. (2020). 2020 State of Climate Services: Risk Information and Early Warning Signs. World Meteorological Organization.

Cuthbertson, J., & Penney, G. (2023). Ethical decision making in disaster and emergency management: A systematic review of the literature. Prehospital and Disaster Medicine, 38(5), 622. https://doi.org/10.1017/s1049023x23006325

Department of Science and Technology, & Philippine Council of Mathematics Teacher Education. (2011). Mathematics framework for Philippine basic education. Science Education Institute.

Erman, A., Robbe, S. A. D. V., Thies, S., Kabir, K., & Maruo, M. (2021). Gender dimensions of disaster risk and resilience. https://doi.org/10.1596/35202

Fatoni, F., Panduragan, S. L., Sansuwito, T. B., & Pusporini, L. S. (2022). Community first aid training for disaster preparedness: A review of education content. KnE Life Sciences. https://doi.org/10.18502/kls.v7i2.10356

Firth, J., Rivers, I., & Boyle, J. (2021). A systematic review of interleaving as a concept learning strategy. Review of Education, 9(2), 642–684. https://doi.org/10.1002/rev3.3266

Goode, S. L., & Magill, R. A. (1986). Contextual interference effects in learning three badminton serves. Research Quarterly for Exercise and Sport, 57(4), 308–314. https://doi.org/10.1080/02701367.1986.10608091

Goniewicz, K., Goniewicz, M., Burkle, F. M., & Khorram-Manesh, A. (2020). The impact of experience, length of service, and workplace preparedness in physicians' readiness in the response to disasters. Journal of Clinical Medicine, 9(10), 3328. https://doi.org/10.3390/jcm9103328

Grayshaw, P. D. (2020). Resilient cities: A case study of Tulsa, Oklahoma. In Emerging Issues in Family and Individual Resilience (p. 49). Springer. https://doi.org/10.1007/978-3-030-49799-6_4

Grossman, V. A. (2020). Leadership essentials during a disaster. Journal of Radiology Nursing, 39(3), 156. https://doi.org/10.1016/j.jradnu.2020.04.006

Guilaran, J., & An, N. H. (2020). Mental health and psychosocial support services for disaster responders in Southeast Asia. In Community, Environment and Disaster Risk Management (Vol. 21, p. 117). Emerald. https://doi.org/10.1108/s2040-726220200000021008

Herrington, A. (2021). The effect of interleaved practice in a high school chemistry class. https://tinyurl.com/5n742ptj

Hung, K. K. C., et al. (2022). Health emergency and disaster risk management workforce development strategies: Delphi consensus study. Prehospital and Disaster Medicine, 37(6), 735–744. https://doi.org/10.1017/s1049023x22001467

Hwang, H. (2009). Identifying factors affecting mathematics achievement of students for better instructional design. International Journal of Instructional Technology and Distance Learning.

Jones, L. (n.d.). 1st grade math skills: What your first grader will learn. Komodo Math.

Kapucu, N., & Van Wart, M. (2008). Making matters worse. Administration & Society, 40(7), 711. https://doi.org/10.1177/0095399708323143

Klein, T. A., & Irizarry, L. (2021). EMS disaster response. StatPearls. https://pubmed.ncbi.nlm.nih.gov/32809545/

Kruk, M. (2018). High-quality health systems in the Sustainable Development Goals era: Time for a revolution. The Lancet Global Health, 6(11), e1196–e1252. https://doi.org/10.1016/S2214-109X(18)30386-3

Kwon, G.-H., & Park, J.-H. (2020). Introducing a long-term course in the disaster and safety field. Korean Society of Hazard Mitigation, 20(6), 79. https://doi.org/10.9798/kosham.2020.20.6.79

Ladner, J. T., Grubaugh, N. D., Pybus, O. G., & Andersen, K. G. (2019). Precision epidemiology for infectious disease control. Nature Medicine, 25(2), 206. https://doi.org/10.1038/s41591-019-0345-2

Lorenzoni, N., Stühlinger, V., Stummer, H., & Raich, M. (2020). Long-term impact of disasters on the public health system: A multi-case analysis. International Journal of Environmental Research and Public Health, 17(17), 6251. https://doi.org/10.3390/ijerph17176251

Madrigano, J., Chandra, A., Costigan, T. E., & Acosta, J. D. (2017). Beyond disaster preparedness: Building a resilience-oriented workforce for the future. International Journal of Environmental Research and Public Health, 14(12), 1563. https://doi.org/10.3390/ijerph14121563

Merbah, S., & Meulemans, T. (2011). Learning a motor skill: Effects of blocked versus random practice—A review. Psychologica Belgica, 51(1), 15. https://doi.org/10.5334/pb-51-1-15

Mielke, R., & Prepas, R. (2019). When disaster strikes in rural America—Call the midwife! The Journal of Perinatal & Neonatal Nursing, 33(3), 205. https://doi.org/10.1097/jpn.0000000000000417

Munda, N. P., Endrinal, J. R. H., & Nequinto, M. C. (2024). Effectiveness of project COUNTS in improving students' numeracy skills. International Journal of Science, Technology, Engineering and Mathematics, 4(1), 22–41. https://doi.org/10.53378/353038

Nemeth, D., Endres, T., & Prediger, S. (2019). Interleaved learning in elementary school mathematics: Effects on the flexible and adaptive use of subtraction strategies. Frontiers in Psychology, 10, 86. https://doi.org/10.3389/fpsyg.2019.00086

Paton, D., & Johnston, D. (2017). Disaster resilience: An integrated approach. Charles C Thomas Publisher.

Pettet, G., Baxter, H., Vazirizade, S. M., et al. (2022). Designing decision support systems for emergency response: Challeng es and opportunities. IEEE CPS, 30. https://doi.org/10.1109/cps-er56134.2022.00012
Philippine Business for Education. (2023). State of the Philippine education report 2023. https://www.pbed.ph/blogs/47/PBEd/State%20of%20Philippine%20Education%20Report%202023
Putnam, A. L., Sungkhasettee, V. W., & Roediger, H. L. (2016). Optimizing learning in college. Perspectives on Psychological Science, 11(5), 652–660. https://doi.org/10.1177/1745691616645770
Rohrer, D. (2012). Interleaving helps students distinguish among similar concepts. Educational Psychology Review, 24, 355–367. https://doi.org/10.3758/s13423-014-0588-3
Rohrer, D., Dedrick, R. F., & Burgess, K. (2014). The benefit of interleaved mathematics practice is not limited to superfici ally similar kinds of problems. Psychonomic Bulletin & Review, 21(5), 1323–1330. https://doi.org/10.3758/s13423-014-0588-3
Rohrer, D., Dedrick, R. F., Hartwig, M. K., & Cheung, C.-N. (2020). A randomized controlled trial of interleaved mathematics practice. Journal of Educational Psychology, 112(1), 40–52. https://doi.org/10.1037/edu0000367
Samani, J., & Pan, S. C. (2021). Interleaved practice enhances memory and problem-solving ability in undergraduate physics. npj Science of Learning, 6(1). https://doi.org/10.1038/s41539-021-00110-x
Sawchuk, S. (2023, May 1). What is math fact fluency and how does it develop? Education Week. https://www.edweek.org/teaching-learning/what-is-math-fact-fluency-and-how-does-it-develop/2023/05
Schorn, J. M., & Knowlton, B. J. (2021). Interleaved practice benefits implicit sequence learning and transfer. Memory & Cognition, 49(7), 1436–1452. https://doi.org/10.3758/s13421-021-01168-z
Steen, R., Haakonsen, G., & Patriarca, R. (2022). "Samhandling": On the nuances of resilience through case study research in emergency response operations. Journal of Contingencies and Crisis Management, 30(3), 257. https://doi.org/10.1111/1468-5973.12416
Sumarmi, S., Winarni, T., & Sumarni, M. (2022). Transformational leadership and organizational citizenship behavior in the CO VID-19 era: Mediating analysis. KnE Social Sciences, 855–867.
Thrwi, A. M., et al. (2021). The use of technological innovations in promoting effective humanitarian aid. International Journal of Technology and Human Interaction, 18(1), 1. https://doi.org/10.4018/ijthi.293204
Van der Haar, L., Gray-Lobe, G., Kremer, M., & de Laat, J. (2023). The long-term distributional impacts of a full-year interleaving math program in Nigeria. EdWorkingPaper (23-876). https://doi.org/10.26300/t8ht-2r44