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Addressing Learning Loss in Mathematics: A Research-Based Intervention

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Abstract

This study aimed to investigate the "learning loss" resulting from recent academic disruptions. This study used a classroom action research, utilizing peer tutoring as the primary intervention amidst various psychological factors. The pretest identifies ten least-mastered mathematics skills, including simplifying numerical expressions, operations on integers, converting fractions to decimals, ordering rational numbers, and solving word problems. Challenges are also noted in approximating volume and area, understanding angles, and interpreting graphical data. Focus group discussions highlight the positive feedback for the intervention and factors contributing to learning loss, such as limited study time, connectivity issues, social media distractions, poor study habits, and math difficulties. Implementing tutorial intervention before the post-test effectively addresses learning loss and significantly reduces learning gaps.

Keywords: Learning loss, Mathematics, Intervention

INTRODUCTION

Scholars have expressed concern regarding the consequences of the global academic interruptions that have profoundly impacted the worldwide education system, leading to substantial distractions. Specifically, there is a growing interest in investigating whether there has been a loss of learning during this period, as an observed phenomenon of learning loss has been noted. The initial findings from research provide evidence of the academic challenges experienced by students, and academic regression is observed across many subjects, educational levels, and geographic regions. The assertion posits that although there is a dearth of extensive and empirically grounded studies about the phenomenon linked to the pandemic, the veracity may not be doubted (Donnelly & Patrinos, 2021).

Moreover, international media has previously devoted significant attention to the "learning losses" that may have been experienced. Frequently, these reports use research that has endeavored to forecast or evaluate student achievement in mathematics by employing widely used assessment tools like the NWEA Map Test (Kuhfeld et al., 2020). Evidence was discovered that students made little or no progress while learning from home, which suggests losses are even larger in countries with weaker infrastructure or more extended school closures. Losses are up to 60% larger among students from less-educated homes, confirming worries about the uneven toll of the recent health emergency on children and families. The learning loss effect reflects the cumulative impact of knowledge learned rather than transitory influences on the day of testing (Engzell, Frey, & Verhagen, 2021).

A meta-analysis conducted by Storey & Zhang (2021) fills that gap by exploring existing research on the impact of COVID-19 on learning in reading and mathematics. It analyzed 30 eligible studies and found significant learning loss during the pandemic compared to previous years. Meta-regression results indicated an average loss of 0.21 standard deviations ($p = 0.006$). Moderator analysis revealed no statistically significant differences in group comparisons. Marginal means showed greater losses in reading than math, more significant losses for younger students compared to older students, and more pronounced adverse effects on U.S. students than those from other countries.

Undoubtedly, the closure of schools during the pandemic has led to significant declines in academic achievement globally, with evidence spanning from March 2020 to March 2022 revealing pronounced learning loss. Studies show heightened educational disparities, particularly affecting students or schools of lower socio-economic status. Notably, 11 out of 20 studies found more significant learning loss in lower-achieving students who struggled academically before the pandemic, and the impact varied by country. In another study in the USA, high school students from low-income communities suffer a learning loss of 0.4 standard deviations after a one-year school closure. In contrast, children from high-income neighborhoods initially remain unscathed (Agostinelli *et al.*, 2022).

In Baden-Württemberg, Germany, the initial wave of the COVID-19 pandemic, causing disruptions to regular classes in the spring of 2020, led to significant learning loss, particularly for low-achieving students where schools were closed for two months; the implementation of distance learning resulted in reduced learning time, coupled with organizational and technological challenges for teachers. Low-achieving students in mathematics showed a learning backlog requiring future attention. While school characteristics had a minor role in mediating learning loss, lower socio-cultural capital was positively associated with more extensive learning loss in mathematics compared to the three previous years (Schult *et al.*, 2022).

Khalil (2022) revealed notable variations in Saudi Arabia relative to mathematics teachers' perception of learning loss. They highlighted challenges related to teachers, students, and families that hindered the effective treatment of learning loss. Based on the study's result, proposed recommendations emphasize the need to enhance teachers' awareness of learning loss, share successful treatment experiences, explore treatment realities in different educational stages, and adopt teaching models for addressing learning loss in mathematics. Teachers consistently applied methods supporting the affective aspect of managing learning loss, and

their satisfaction with these practices was rated as 'average with diverse treatment mechanisms employed in teaching practices.

Haser *et al.* (2022) discovered that in Turkey, Mathematics learning loss was attributed to factors such as students' reduced participation, teachers' constrained utilization of effective teaching methods, the socio-economic status of families, and a lack of collaboration between families and teachers due to variations in teaching practices and underscored prevailing disparities across schools, classrooms, and students.

Asakawa & Ohtake (2021) highlighted the academic performance of fifth- and sixth-grade primary school students in Japan, drawing upon data from the "Manabi Nara" initiative, which sheds light on the dynamics of academic outcomes during class disruptions. Initial findings indicate a decline in math scores immediately following the closures, followed by a noteworthy improvement six months later. A distinctive observation emerges, revealing that students with lower academic achievement levels experienced a more pronounced enhancement in their math scores, a phenomenon ascribed to heightened motivation and transformative shifts in their attitudes toward mathematics. In contrast, students with disadvantaged living conditions declined math scores, motivation, and attitude, particularly prominent among those in the bottom 25% of fourth-grade academic performance during school vacations. These insights contribute to our understanding of the nuanced impacts of pandemic-related disruptions on academic trajectories, emphasizing the need for targeted interventions and support mechanisms for vulnerable student populations.

Bielinski *et al.,* (2020) analysis demonstrated variations in estimated score loss by assessment and grade level. Younger students exhibited more significant losses in both Reading and Math, while older students showed more significant losses in CBM Reading. Overall, students at all levels are anticipated to begin the school year behind their usual post-summer break performance.

This documented learning loss has prompted research to address competency gaps, and this study aims to fill the existing gap by introducing a peer tutorial intervention aligned with the directives of D.O. 34 s. 2022. Learning remediation and intervention are crucial components within this framework, recognizing the need for contextualized strategies in the Philippine context. The early reviews did not mention any attempt to recover learning loss competencies. Notably, with a 20-month school closure, the Philippines presents a unique challenge, being the longest compared to the 35 countries studied by (Patrinos *et al.*, 2022).

Therefore, considering various psychological factors after two years of remote learning, the necessity for students to engage in collaborative and dynamic learning to address learning

setbacks, and recognizing the established positive impacts of peer tutoring on academic performance, examining the influence of peer tutoring on learning during the post-pandemic era, though unprecedented, can yield insights that may guide educational practices, policies, and interventions. This, in turn, can help alleviate the consequences of learning setbacks and enhance the educational outcomes of students in the face of sudden disruptions.

METHOD

Action research is a highly suitable method for addressing and documenting learning losses, given its systematic inquiry within the teaching-learning environment, aimed at gathering insights into students' learning processes (Gay *et al.,* 2006). It fosters the refinement of teaching practices and the creation of conducive learning environments for a deeper understanding of classroom dynamics. It increases the likelihood that a particular curriculum, instructional strategy, intervention, or technology will positively impact student outcomes (Jenkins & Dix, 2004).

In compliance with No. 24 of D.O. 34 s. 2022, as part of the Learning Recovery and Continuity Plan (LRCP), the school leadership implemented a 40-minute intervention program daily across all grade levels during the three-day in-person classes three times a week. The initial intervention is through pre-assessments using a digital survey platform, Google Form, at the start of the 2nd quarter academic year 2022-2023, 8 November, which serves as the data that validates learning losses that involve 17 students in a class. The assessments consisted of a 50-item examination in 7th-grade mathematics, covering the full range of competencies, which is a diagnostic tool for evaluating the knowledge and skills of incoming Grade 8 pupils in mathematics as the subject of the research. Pretest results necessitate an intervention program through one-on-one in-person peer tutorials, as its main strategy involves a series of sequential processes beginning with the formation of students into pairs or dyads. Subsequently, the teacher in charge engaged in a discourse on mathematical principles. Dyads were allowed to engage in collaborative study and interactive exercises in the form of game-like drills, wherein the dyads, with a knowledgeable classmate serving as the tutor, responded to mathematical inquiries. A post-test was administered upon completion of a reasonable period since the issuance of the said order using a standardized examination to validate the efficacy of peer tutoring in addressing learning loss and assessing the intended learning outcomes. Before conducting a targeted group discussion to identify factors contributing to learning loss, consent was sought from parents of students experiencing difficulties. Hence, learning loss.

RESULTS AND DISCUSSION

Table 1 presents the ten least mastered skills in mathematics during a diagnostic examination to analyze the possibility of learning loss. Specific questions have an equal frequency of errors and hence receive an identical ranking. Among the items assessed, it is noteworthy that numbers 17, 22, and 29 show the highest frequency of errors, accounting for 15 out of a total of 17 errors. These competencies encompass the ability to estimate measurement values (precisely volume), approximate measurement values, and ascertain the angle created by crossing lines. Following a framework, students must comprehensively grasp the fundamental principles encompassing numbers and number concepts, measurement, geometry, probability, data analysis, patterns, functions, and algebra. Proficiency in computing problem-solving, representing ideas and concepts, and establishing connections between mathematics and other domains is crucial. To effectively navigate the field of mathematics, it is essential to first acquire proficiency in fundamental competencies before progressing to more complex ones.

Table 1. The Result Pretest of the Top Ten Least Mastered Skills

Item Number	Frequency of Error	Ranking	Quarter	Learning Competency
5	14	4	1	Simplify Numerical Expression; Operations on Integers
10	12	6	1	Change Fractions to Decimals.
11	12	6	1	Determine the order of Rational Numbers.
12	12	6	1	Solve word problems involving rational numbers.
17	15	1	2	Find the approximate values of measurement (volume).
19	12	6	2	Find the approximate values of measurement (Area).
22	15	1	2	Approximate values of measurement
29	15	1	3	Determine the angle formed by the intersecting lines.
39	13	5	3	Determine the special angle pair formed by intersecting lines.
49	12	6	4	(Graphics) Interpret data using graphical representation.

Storey & Zhang (2021) pointed to differences due to different means of measuring losses, with students demonstrating more significant loss when assessed using standardized assessments such as the Ohio Third-Grade English Language Arts assessment or the Italian National Institute for Evaluation of Education System (INVALSI) assessment) and benchmark

assessments (such as DIBELS or PIRLS) in 14 comparisons to formative assessments (i.e., i-Ready) or computer-adaptive assessments (NWEA MAP).

The abilities encompassed in this set of assessments involve simplifying numerical expressions, which entails performing operations on integers, converting fractions to decimals, ascertaining the correct order of operations, and resolving word problems that require rational numbers. Given the context that students were back to face-to-face learning after a period of online learning. In their investigation, Schult *et al.*, (2022) qualified that students were significantly affected, resulting in learning loss, as they spent less time learning mediated by teachers' difficulties in remote learning environments.

Other reasons were noticed by Faradiba *et al.* (2022), such as that students with issues in metacognition have difficulty understanding online math tasks. If students do not realize or underestimate their cognitive limitations, learning loss is predictable because it's hard to see one's ignorance or, worse, underestimate one's incompetence. Aside from the fact that distance learning presents challenges in teaching and learning, including student disengagement, students' metacognitive skills are crucial to online math learning.

Table 2. The Results of Pretest Scores

Score	Frequency	Percentage
1-5	0	0
6-10	1	5.88%
11-15	2	11.76%
16-20	5	29.41%
21-25	3	17.65%
26-30	3	17.65%
31-35	0	0
36-40	2	11.76%
41-45	1	5.88%
46-50	0	0
Total	17	100%
Mean		23.59
Percentage Mastery		47.18

Table 2 reveals the score distribution among seventeen (17) students. Notably, seven (7) individuals scored 25 points or higher. Out of the entire participant pool, seven (7) students completed the pre-diagnostic test, constituting 41.18%. Following the standard of fifty percent of the overall score as the passing threshold of seventy-five percent, the class's average score stands at 23.59, which falls short of the minimum passing score of 25. Consequently, the % of students who have achieved mastery stands at 47.18%.

The results suggest that the pandemic affects students' learning independence in mathematics, which could have been affected by the sudden shift from face-to-face to online

teaching. Still, the transition from traditional to digital learning may not have taken its due course relative to its abruptness. Research findings validate that students with high learning independence perform better than those with low learning independence (Muhammad & Sagita, 2021). Moreover, it can negatively impact students who refuse and fail to develop their independence in learning, especially in math.

Table 3. Post-test Results

Score	Frequency	Product (Raw Score x No. of Students)	Percentage
1	0	0	0
2	1	2	5.88%
3	1	3	5.88%
4	3	12	17.65%
5	2	10	11.76%
6	3	18	17.65%
7	2	14	11.76%
8	1	8	5.88%
9	2	18	11.76%
10	2	20	11.76%
Total	17	109	100%
Mean			6.41
Percentage of Mastery			64.1

Following the intervention, a post-test was administered to evaluate the attainment of the learning objectives. During the post-test, the researchers assessed the competencies targeted in the intervention. The findings of the 10-item post-test are displayed in Table 3; among the sample of seventeen (17) students, a majority of twelve (12) achieved scores of 5 and higher, representing 70.59% of the entire cohort. In contrast, five (5) students scored four and below, representing 29.41% of the participants. The average score obtained is 6.41, while the level of expertise achieved is 64.1% in terms of percentage. This finding reveals positive learning outcomes, as indicated by the strong performance of some participants in the post-test assessment. It can be inferred that peer tutorials had a positive impact on the academic performance of the students. The results of this study suggest that peer tutorials have proven to be efficacious, as demonstrated by a notable improvement in learning outcomes.

According to Donnelly & Patrinos (2022), the shutdown of schools has resulted in learning loss. However, implementing tutoring services is one potentially effective strategy for mitigating learning setbacks during closures and promoting academic recovery and advancement. The efficacy of tutoring has been established, particularly in closures, as evidenced by online experiments that have demonstrated its cost-effectiveness in offering high-quality education across diverse settings.

In addition, it is worth noting that both reciprocal and non-reciprocal peer tutoring methods resulted in much greater academic improvements for those who demonstrated below-average performance on curriculum-based measurement (CBM). The students who participated in peer tutoring underwent training to acquire the skills necessary for tutoring basic math facts. The study's findings revealed that both forms of peer tutoring yielded similar improvements in fundamental mathematical knowledge (Menesses & Gresham, 2009).

The overall severe learning loss due to the pandemic found by our study and the trends in learning loss suggested by our metaregression and marginal means analyses point to real-world implications for educational practice and policy. Education systems and school districts require ongoing support to provide services needed to assist students in recovering their learning losses. Evidence-based interventions, such as targeted paraprofessional-led tutoring programs for students of all ages and grade levels, have been proven to lead to large and significant learning gains for students in reading and mathematics (Baye *et al.*, 2019; Neitzel *et al.*, 2021; Slavin *et al.*, 2009), contributing to sustainable recovery.

Table 4. Comparison of Results of Pretest and Post-test

	Pretest (50 items)	Post-Test (10 items)	% Change
Mean	23.59	6.41	29%
Transmuted Mean	75%	81%	6%
Percentage of Mastery	47.18%	64.1%	16.92%
No. of Students passed	7	12	29%

Table 4 presents a comparative analysis of the pretest and post-test outcomes, indicating a mean change of 6%. Additionally, the percentage of mastery showed a notable increase of 16.92%. In comparison, the number of students who achieved a passing grade experienced a substantial rise of 29% due to the peer one-on-one tutorial intervention, a strategy to bridge the gap caused by the learning loss. Alegre *et al.* (2020) underline that peer tutoring has reported academic benefits across many educational levels, from Preschool to Higher Education. The result confirms that peer tutoring in Mathematics reports similar academic benefits.

Moreover, the intervention result is affirmed by Firdaus *et al.* (2021), who examined the impact of the peer-tutorial method and self-efficacy on students' mathematics learning results compared to the lecture approach. They provide further support for earlier research that has demonstrated the effectiveness of peer tutorials. The findings indicate that the peer tutor method yields superior learning outcomes compared to the lecture method. Furthermore, it is noteworthy that an interaction exists between the learning method and self-efficacy concerning

the learning outcomes. Specifically, students with higher self-efficacy demonstrate more remarkable learning outcomes when instructed through the peer tutor method than those who receive instruction through the lecture method.

Table 5 Students' Feedback on Peer Tutorial Intervention

Areas for Feedback	Positive (+)	%	Negative (-)	%
On understanding mathematical concepts	15	88.24	2	11.76
On bridging learning loss	15	88.24	2	11.76

Table 5 presents the results of the Focus Group Discussion regarding the employed intervention. Students have demonstrated positive feedback concerning their understanding of mathematical concepts during one-on-one peer tutorials, effectively bridging the compromised learning experienced during remote learning. This is supported by the comparative analysis between the pretest and post-test results. Layug *et al.* (2021) found that conferences with parents and students are the most used intervention among grade 7 mathematics teachers. However, the most effective intervention is the one-on-one tutorial, with a score of 3.89 on the 5-point Likert scale, indicating a 97.89% effectiveness rate.

The cooperative learning technique has been extensively documented to yield consistent beneficial outcomes in various domains, including self-concept, attitudes toward mathematics, self-esteem, and social integration (Alegre *et al.*, 2020; Moliner & Alegre, 2020). Studies conducted by Reyes & Castillo (2015) and Garba *et al.* (2019) have shown promising results regarding the effects of peer tutoring on students. Therefore, considering the need for students to engage in cooperative and active learning methodologies, along with the proven positive effects of peer tutoring on academic achievement and other psychological variables, a study examining the impact of peer tutoring on students' mathematics performance can provide. Valuable insights for educators to implement best practices in helping students overcome their learning losses.

Table 6. Unrecovered Learning Loss *(N=5)*

Factors to Learning Lo	Frequency	%
Limited Study Time,	5	100
Connectivity Issues,	5	100
Social Media Distractions	5	100
Poor Study Habits,	5	100
Difficulties in Math	5	100

Table 6 depicts that despite efforts to implement peer-to-peer interventions to address learning loss, not all students could benefit equally. Individual learning needs and circumstances varied, impacting the effectiveness of the intervention. Remote learning affects structured study time and challenges establishing a consistent study routine. Not all students have equal access to reliable internet and devices for online learning, which can lead to disparities in access to educational resources and virtual classrooms. Access to social media platforms can lead to distractions and make it challenging for some students to focus on academic tasks. Math education often requires hands-on learning and interactive problem-solving. Transitioning to virtual formats may have caused the intervention to fail and require another approach.

Solihat *et al.* (2022) cite Gyamerah's research, highlighting that although internet access is widely available, inadequate infrastructure presents a substantial obstacle to students' active participation in learning. This statement is in keeping with the argument that online education can worsen pre-existing disparities if not properly addressed. Students who do not have equitable opportunities from educators are subjected to the same academic demands. Continuing this learning pattern is detrimental to students' motivation to engage in the learning process, mostly due to the inadequate amount of time dedicated to studying and the restricted opportunities for interaction with teachers, resulting in learning loss.

Contemporary research endeavors cannot overlook the undeniable correlation between the detrimental effects of social media consumption and addiction and its impact on academic procrastination and students' academic performance. These studies reveal a noteworthy positive association between social media addiction and academic procrastination, with academic achievement being entirely influenced by the presence of academic procrastination. Learning loss will inevitably occur in unusual circumstances, such as the recent worldwide epidemic (Caratiquit & Caratiquit, 2023).

Math is essential in education. There is a perception that most students detest math due to instruction, learners' cognitive, emotional, and psychomotor qualities, subject matter, and learning environment. Data on mathematics-related expectancies, task value, self-efficacy, epistemology, goal orientation, interest, and anxiety prove it. Math is hated by 88% of students, while only 6% like it. Math disliking was mainly due to teacher and subject difficulty. 20% found mathematics difficult, 54% medium, and 10% easy. Nearly 42% cannot handle textbook questions. Many students learn math unquestioningly and have low adaptive self-efficacy and epistemological views. Given the negative factors and attitudes in mathematics as intensified by the pandemic, peer intervention, while serving it, is supposed to recover learning loss; full

recovery is not guaranteed as mediated by the factors mentioned in this data (Gafoor & Kurukkan, 2015).

CONCLUSIONS

Implementing early intervention strategies in instances of learning loss is of utmost importance, as it can yield remarkable outcomes and facilitate the more efficient restoration of compromised math competencies. Learning loss is apparently attributed to how students experienced the sudden impact of school closures due to the constraints of remote learning. This is highlighted by various circumstances, including network challenges that result in limited participation in online classes, limited study time, social media distractions, poor study habits, and difficulties in math. While the flexibility of online learning is acknowledged, it may not be the optimal approach for courses that necessitate direct engagement and in-person interaction (Franchi, 2020, as cited in Barrot *et al.*, 2021). The high preference for in-person mathematics instruction (Krishnan, 2016) and real-time face-to-face instruction inevitably contribute to a better learning outcome.

SUGGESTIONS

It is imperative to implement early intervention initiatives that can reinforce study habits. Furthermore, ensuring reliable internet connectivity and the availability of devices plays a pivotal role in enhancing the effectiveness of remote learning for a superior online education experience. Initiatives to improve time management skills are crucial in helping students avoid distractions such as social media. Additionally, educators must receive training to adapt their teaching methods to virtual environments, ensuring they can engage students effectively in this digital setting. Regular monitoring and assessment processes should be in place to identify students grappling with academic challenges, enabling tailored support to address their specific needs. Collaboration between educators and parents is essential in nurturing a conducive home learning environment facilitated through consistent communication and resource sharing. Lastly, it is worth considering flexible learning models that accommodate a wide range of student preferences and needs.

REFERENCES

Agostinelli, F., Doepke, M., Sorrenti, G., & Zilibotti, F. (2022). When the great equalizer shuts down: Schools, peers, and parents in pandemic times. Journal of public economics, 206, 104574.https://doi.org/10.1016/j.jpubeco.2021.104574

Alegre, F., Moliner, L., Maroto, A., & Lorenzo-Valentin, G. (2020). Academic achievement and peer tutoring in mathematics: A comparison between primary and secondary education. *Sage Open*, *10*(2), 2158244020929295.

Asakawa, S., & Ohtake, F. (2021). Impact of temporary school closure due to COVID-19 on the academic achievement of elementary school students. *Discussion Papers in Economics and Business*, 21-14.

Barrot, J. S., Llenares, I. I., & Del Rosario, L. S. (2021). Students' online learning challenges during the pandemic and how they cope with them: The case of the Philippines. *Education and information technologies*, *26*(6), 7321-7338. DOI: 10.1007/s10639-021-10589-x

Baye, A., Inns, A., Lake, C., & Slavin, R. E. (2019). A synthesis of quantitative research on reading programs for secondary students. *Reading Research Quarterly*, *54*(2), 133–166. https://doi.org/10.1002/rrq.229

Bielinski, J., Brown, R., & Wagner, K. (2020). COVID slide: Research on learning loss & recommendations to close the gap. *Illuminate Education*, *22*.

Caratiquit, K. D., & Caratiquit, L. J. C. (2023). Influence of social media addiction on academic achievement in distance learning: Intervening role of academic procrastination. *Turkish Online Journal of Distance Education*, *24*(1), 1-19. DOI: 10.17718/tojde.1060563

Donnelly, R., & Patrinos, H. A. (2022). Learning loss during Covid-19: An early systematic review. *Prospects*, *51*(4), 601-609.

Donnelly, R., & Patrinos, H. A. (2022). Learning loss during Covid-19: An early systematic review. *Prospects*, *51*(4), 601-609. DOI: 10.1007/s11125-021-09582-6

Engzell, P., Frey, A., & Verhagen, M. D. (2021). Learning loss due to school closures during the COVID-19 pandemic. *Proceedings of the National Academy of Sciences*, *118*(17), e2022376118. DOI: 10.1073/PNAS.2022376118

Faradiba, S. S., Alifiani, A., & Hasana, S. N. (2022, September). Metacognitive myopia: The main obstacles in mathematics online learning. In *AIP Conference Proceedings* (Vol. 2633, No. 1). AIP Publishing. DOI: 10.1063/5.0102711

Firdaus, D., Budiningsih, I., & Fauziah, S. (2021). The Effect Of Using Peer Tutor Methods And Self-Efficacy On Math Learning Outcomes. *Akademika: Jurnal Teknologi Pendidikan*, *10*(02), 371-382. DOI: 10.34005/akademika.v10i02.1576

Gafoor, K. A., & Kurukkan, A. (2015). Why High School Students Feel Mathematics Difficult? An Exploration of Affective Beliefs. *Online Submission*.

Garba, A., Ismail, N., Osman, S., & Rameli, M. R. M. (2020). Exploring peer effect on mathematics anxiety among secondary school students of Sokoto State, Nigeria through photovoice approach. *Eurasia Journal of Mathematics, Science and Technology Education*, *16*(2). DOI: 10.29333/ejmste/112622

Gay, L. R., Mills, G.E., & Airasian, P. (2006). *Educational Research: Competencies for analysis and applications*. Action Research. Pearson.

Haser, Ç., Doğan, O., & Erhan, G. K. (2022). Tracing students' mathematics learning loss during school closures in teachers' self-reported practices. *International Journal of Educational Development, 88*, 102536. https://doi.org/10.1016/j.ijedudev.2021.102536

Jenkins, H. J., & Dix, S. B. 2004. The role of action research in learning support: A case study. *Special Educational Perspectives*, 13(2), 47-68.

Khalil, I. A. (2022). How is learning loss treated in mathematics classrooms at the intermediate stage? A mixed methods study. *Education 3-13*, 1-19. DOI: 10.1080/03004279.2022.2108873

Krishnan, S. (2018). Students' perceptions of learning mode in mathematics. *MOJES: Malaysian Online Journal of Educational Sciences*, *4*(2), 32-41.

Kuhfeld, M., Tarasawa, B., Johnson, A., Ruzek, E., & Lewis, K. (2020). Learning during COVID-19: Initial findings on students' reading and math achievement and growth. *NWEA Brief, Portland, OR*. https://mathforall.edc.org/learning-and-the-pandemic/

Layug, G., Velario, J. P., & Capones, J. (2021). Teachers' Interventions in Improving Numeracy Skills of Grade 7 Students in Baguio City National High School. In *4th International Conference on Advanced Research in Teaching and Education*. from https://www.dpublication.com/wp-content/uploads/2021/08/22-4022.pdf

Menesses, K. F., & Gresham, F. M. (2009). Relative efficacy of reciprocal and nonreciprocal peer tutoring for students at-risk for academic failure. *School Psychology Quarterly*, *24*(4), 266. DOI: 10.1037/a0018174

Moliner, L., & Alegre, F. (2020). Effects of peer tutoring on middle school students' mathematics self-concepts. *Plos one*, *15*(4), e0231410. DOI: 10.1371/journal.pone.0231410

Muhammad, M., & Sagita, A. (2021, October). Description of Mathematical Problem-Solving Skills Reviewed from Student Learning Independence. In *Proceedings of the 1st International Seminar on Teacher Training and Education, ISTED 2021, 17-18 July 2021, Purwokerto, Indonesia*. DOI: 10.4108/eai.17-7-2021.2312408

Neitzel, A. J., Lake, C., Pellegrini, M., & Slavin, R. E. (2022). A synthesis of quantitative research on programs for struggling readers in elementary schools. *Reading Research Quarterly*, *57*(1), 149-179. https://doi.org/10.1002/rrq.379

Patrinos, H. A., Vegas, E., & Carter-Rau, R. (2022). An analysis of COVID-19 student learning loss.

Reyes, M. D., & Castillo, A. C. (2015). Test anxiety and college students' performance on mathematics departmental examination: basis for mathematics achievement enhancement. *Asia Pacific Journal of Education, Arts and Sciences*, *2*(1), 62-69.

Schult, J., Mahler, N., Fauth, B., & Lindner, M. A. (2022). Did students learn less during the COVID-19 pandemic? Reading and mathematics competencies before and after the first pandemic wave. *School effectiveness and school Improvement*, *33*(4), 544-563. DOI: 10.1080/09243453.2022.2061014

Slavin, R. E., Lake, C., & Groff, C. (2009). Effective programs in middle and high school mathematics: A best-evidence synthesis. *Review of Educational Research*, *79*(2), 839-911.

Solihat, A. N., Sadiah, A., & Gumilar, G. (2022, July). Online Learning: Impact on Learning Loss?. In *ICON 2021: Proceedings of the 1st International Conference on Economic and Education, ICON 2021, 14-15 December 2021, Padang-West Sumatra, Indonesia* (p. 113). European Alliance for Innovation. https://doi.org/10.4108/eai.14-12-2021.2318318

Storey, N., & Zhang, Q. (2021). A Meta-analysis of the Impact of COVID-19 on Student Achievement.https://doi.org/10.35542/osf.io/qekw2https://www.deped.gov.ph/wp-content/uploads/2022/07/DO_s2022_034.pdf