

Research Article

Cite this article: Abu-Ghalyoun, O., El-Shara, I., & Ababneh, E. (2025). Mathematics Teachers' Insights on a Program for Addressing Learning Loss in Jordan After the COVID-19 Pandemic. *Educational Process: International Journal*, 18, e2025451.

<https://doi.org/10.22521/edupij.2025.18.451>

Received June 18, 2025

Accepted August 18, 2025

Keywords: Mathematics education, learning loss, remedial education, structured pedagogy

Author for correspondence:

Omar Abu-Ghalyoun

✉ o.abughalyoun@ju.edu.jo

✉ The University of Jordan



OPEN ACCESS

© The Author(s), 2025. This is an Open Access article, distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>), which permits unrestricted re-use, distribution, and reproduction, provided the original article is properly cited.

Mathematics Teachers' Insights on a Program for Addressing Learning Loss in Jordan After the COVID-19 Pandemic

Omar Abu-Ghalyoun , Ibrahim El-Shara , Emad Ababneh

Abstract

Background/purpose. This study examines the effectiveness of Jordan's National Program for Remedial Interventions (NPRI) in mathematics, launched in response to the COVID-19 pandemic, by analyzing its implementation mechanisms, remedial content, and impact on student performance from the perspective of mathematics teachers.

Materials/methods. The study utilized both quantitative and qualitative data gathered from a sample of 342 mathematics teachers who were involved in this program. The research team developed and validated an electronic questionnaire for this purpose.

Results. The results indicated a consensus among teachers on the effectiveness of the remedial program design, which involved daily integration of remedial content with official curriculum lessons. This allowed them to continue teaching the official curriculum while addressing students' learning loss on a daily basis to ensure their progress. Furthermore, it highlighted improvements in the performance and engagement levels of below-average students, as reported by the participating teachers.

Conclusion. This study offers evidence-based recommendations to enhance the NPRI's impact, including teacher training, provision of manipulatives and supporting tools in classrooms, and thoroughly documents Jordan's approach to addressing learning loss in mathematics after the COVID-19 pandemic, which may inspire similar initiatives globally.

1. Introduction

Jordan is a Middle Eastern country with a population of approximately 10 million (United Nations, 2022). The educational system in Jordan comprises two main stages: basic (grades 1-10) and secondary (grades 11 and 12). The basic stage is mandatory for students aged 6 to 15 years. In the secondary stage, students can follow either an academic or a vocational track. Parents can choose to enroll their young children in kindergarten if they are under the age of six (Fayez et al., 2016). Like other countries, the global COVID-19 pandemic has caused unprecedented disruptions in Jordan's educational system. All elementary and secondary schools in Jordan closed for face-to-face teaching on March 15, 2020. Attempts were made to gradually return students to schools, but the increasing number of coronavirus infections prompted the authorities to close schools again shortly after reopening them each time. Therefore, schools' closure continued until mid-August 2021. During the temporary school closure, the Ministry of Education established an online platform to allow students from grades 1 to 12 to attend their classes virtually. The ministry has also broadcast the classes for all subjects through TV channels (Alshoubaki & Harris, 2021). School closures during the COVID-19 pandemic have adversely affected education worldwide (UNESCO, 2021). As widely reported, school closures and the resulting economic crises have deepened the inequality gap, increased the risk of dropout, and contributed to learning loss (GEM-UNESCO, 2020; United Nations, 2022), as well as learning poverty (Azevedo et al., 2020; Azevedo & Montoya, 2021).

Jordan ranked among the top 20 countries with the highest number of school closure days in the period between March 2020 and February 2021 (Avanesian et al., 2021). Consequently, significant learning loss is anticipated for students who were unable to actively participate in distance learning during these closures, particularly in literacy and numeracy skills. Prior to the pandemic, Jordanian students, especially those from underprivileged backgrounds, already exhibited notable weaknesses in these two areas (UNDP, 2020). Based on its responsibility as the highest authority overseeing basic and secondary education in Jordan, the Ministry of Education launched the National Program for Remedial Interventions (NPRI), referred to as the "remedial program" in this study, to address the learning loss caused by the COVID-19 pandemic, particularly in literacy (Arabic literacy) and mathematics. The program, which is scheduled to last three consecutive school years starting with 2022/2023, entails beginning each semester two weeks earlier than usual during this period, developing remedial content in both subjects, and providing comprehensive training to teachers of these two subjects. In mathematics, the remedial program allocated the first 10 minutes of each mathematics period to teaching the remedial content, with the possibility of increasing or decreasing this time according to the needs of the students. More details about the structure of the remedial program and its implementation are provided in the subsequent sections. Despite the importance of this program and its widespread implementation across all schools of the Jordanian Ministry of Education, to the best of researchers' knowledge so far, no previous study has examined any aspect of it to assess its effectiveness or identify its shortcomings, especially since the program will continue for several more years and there is still an opportunity to improve it, particularly if reliable research-based recommendations are available. Two years after launching the remedial program, this study aims to investigate the effectiveness of its design, the quality of its remedial content, and its impact on students' performance from the perspective of mathematics teachers who have been familiar with all of its aspects during this considerable time of real implementation. The following research questions guided the study:

1. What are mathematics teachers' perceptions of the effectiveness of the design of the remedial program?
2. How do mathematics teachers perceive the relevance and quality of the remedial content?

3. How do teachers perceive the impact of the remedial program on students' mathematical performance?

2. Literature Review

2.1. Learning Loss

Prior to the COVID-19 pandemic, learning loss was viewed as a summer vacation phenomenon, with declining academic performance and a widening achievement gap between students (Kuhfeld, 2019). The term "learning loss" has gained increased importance following the COVID-19 pandemic due to the exceptional circumstances affecting educational systems worldwide. Various definitions of learning loss have subsequently emerged. Angrist et al. (2021) defined learning loss as the gap between what students know and what they would have learned had schools not been closed. They also identified the following two components of learning loss: learning that has been forgotten (forgotten learning), and learning that has not been acquired (foregone learning). Forgotten learning refers to the decline in knowledge and skills that students acquired before the Pandemic. Foregone learning refers to the knowledge and skills students could have acquired but could not do so due to school closures. However, addressing these two types of learning loss may require different approaches, as the effects of forgotten learning can be addressed more quickly than those of foregone learning (Christodoulou, 2021).

Shortly after school closures, educational research efforts began to estimate the potential learning loss. Kaffenberger (2021) estimated that a three-month school closure could lead to a learning loss equivalent to an entire year. The observed learning loss following the COVID-19 pandemic can be explained by two main reasons. The first relates to the reduction in the number of formal teaching hours and days. There is a close correlation between reduced instructional time and increased learning loss (Cattaneo et al., 2016). This conclusion is supported by evidence from studies and reports published by the Organization for Economic Co-operation and Development (OECD), which confirm a relationship between instructional time and students' academic performance. In other words, students who spend more time in regular classroom sessions at school demonstrate academic superiority in language, mathematics, and science compared to those who spend less time in school (OECD, 2011). The second reason is the lower quality of distance learning compared to face-to-face learning, both in terms of quantity and quality. Chetty et al. (2020) reported a decline in student achievement levels based on data from a mathematics learning platform used before and during the pandemic. This decline was more pronounced among disadvantaged students.

2.2. Remedial Education

Remediation focuses on correcting existing knowledge and skill deficits, while intervention is a proactive strategy to identify and address potential learning difficulties early (Stecker et al., 2020). Intervention helps prevent problems from escalating, while remediation helps students regain their desired level. When schools reopened after the COVID-19 pandemic, many students showed a clear decline in their academic performance, falling behind what would have been possible in the absence of the pandemic. As a result, their studying of the official curriculum of their current year became challenging, especially in mathematics, because of its cumulative nature. Educational systems around the world have sought to address this challenge in a variety of remediation approaches.

Some countries have implemented remedial programs aimed at addressing learning losses. The designs of these programs have been influenced by factors such as the duration of school closures and the teaching methods adopted during school closures. Among the approaches used in these remedial programs have been the following: (1) allocating additional instructional time for remediation (UNICEF, 2023), (2) using differentiated instruction (Peteros et al., 2020), and (3) utilising structured pedagogy (Angrist et al., 2021). Below, the characteristics of these three approaches and

their relevance to remedial intervention are further examined. Notably, these approaches were highlighted because they are the most prominent characteristics of the remedial program of Jordan, which will be discussed in detail in the subsequent section. Extending school hours or days will provide the extra time needed to address learning loss without affecting the time plan for teaching the official curriculum. However, a systematic review of studies published between 1985 and 2009 on increasing instructional time conducted by Patall et al. (2010) showed that these studies were unable to demonstrate a clear relationship between increased instructional time and improved students' performance. Instead, the study stressed the importance of prioritizing teaching quality. It noted, in particular, that increased instructional time can be beneficial for low-achieving students, provided the additional time is used effectively through carefully designed and implemented teaching materials. Therefore, increasing the number of hours or days dedicated to studying can effectively address students' learning loss, provided that this additional time is utilized effectively to teach a curriculum specifically designed to meet students' diverse needs and abilities, employing effective teaching strategies such as differentiated instruction.

Differentiated instruction is defined as a teaching strategy that aims to meet the needs of all students, regardless of their differences in abilities, interests, or learning styles (Parsons et al., 2018; Valiandes et al., 2018). Differentiated instruction is based primarily on identifying individual student differences and weaknesses, then providing appropriate learning opportunities that cater to each student's needs (Civitillo et al., 2016). This requires adapting curricula and teaching plans to meet the unique needs of each student, rather than forcing students with different abilities and needs to adapt to a uniform curriculum (Roy et al., 2013; Tomlinson, 2014; Tomlinson, 2015). Differentiated instruction is important when teaching mathematics to enhance student engagement and encourage peer interaction (Mbugua & Muthomi, 2014). However, successfully implementing differentiated instruction is crucial for achieving the desired outcomes (Deunk et al., 2018). Since differentiated lessons start with basic skills and concepts and gradually progress toward more complex ones, it is essential to ensure that students have a solid understanding of these fundamentals before advancing to higher levels. Neglecting this aspect can lead to learning gaps that hinder students' ability to develop new skills and acquire additional concepts in later stages of learning (Torres, 2021). Therefore, identifying and addressing these gaps is essential for the success of mathematics teaching, particularly considering learning loss. In this context, differentiated instruction emerges as one of the most effective strategies for addressing learning loss. However, implementing differentiated instruction to address learning loss demands significant effort, especially given the high percentage of students experiencing learning loss in the classroom, notably after the COVID-19 pandemic. Thus, implementing differentiated instruction requires supporting teachers and equipping them with enhanced content and carefully designed lesson plans that address the learning loss experienced by students.

Structured pedagogy is an instructional approach characterized by systematic organization and careful planning of the entire teaching process. This approach involves the use of consistent teaching strategies, including differentiated instruction, to achieve precisely defined learning outcomes reflected in specially designed curriculum content (Piper et al., 2021). Structured pedagogy has recently emerged as an effective method for addressing learning loss resulting from the COVID-19 pandemic. Angrist et al. (2021) studied data from several programs across different countries in which the structured pedagogy approach was successfully employed to improve students' performance in literacy and numeracy, as well as some previous reports and studies on this approach, and proposed its use as a potential means of effectively addressing learning loss. In addition, the "Learning at Scale" (Stern et al., 2021) and "Numeracy at Scale" (Stern et al., 2023) studies pointed to some intervention programs designed based on a structured pedagogical approach that have proven effective in addressing students' learning gaps and improving their performance in literacy

and numeracy. According to Piper and Dubeck (2024), the most prominent features of programs that adopt a structured pedagogy approach are: (1) distributing a copy of the textbook or any study material to each student to ensure easy access to the content, (2) developing teacher guides with detailed daily teaching plans that address the diverse needs of students, (3) delivering professional training for teachers that aims at enabling them to implement the lesson plans effectively, and (4) integrating teachers into communities of practice to provide ongoing support and exchange experiences. Structured pedagogy programs vary in the level of obligation they impose on teachers and the degree of autonomy they grant them in designing the instructional process. While some programs require teachers to strictly follow teacher guides, others allow for some modifications to meet the varied needs of students. However, allowing such modifications requires additional teacher training to ensure effective implementation. According to evidence from a multi-country study on the use of structured pedagogy, most modifications made by teachers actually reduced the quality of lessons (Piper et al., 2018).

2.3. National Program for Remedial Interventions

The Jordanian Ministry of Education launched the National Program for Remedial Interventions to address learning losses resulting from the COVID-19 pandemic, focusing on Arabic literacy and mathematics for grades 4 through 9. Grades 1-3 were excluded from this program due to the existence of another remedial program for these grades. High school grades were not included in the remedial program because students in these grades are divided into two distinct tracks: academic and vocational. The remedial program entailed developing remedial content parallel to the official curriculum implemented across all public schools. It also extended the number of school days by an additional 10 days at the beginning of each semester, allocating this time to teaching remedial content, thus reducing summer and mid-year vacations. In mathematics, the design of the remedial content was based on the principle of reviewing (re-teaching) all mathematical concepts and skills that are the basis for the targeted learning outcomes, day by day, rather than reviewing the mathematical concepts and skills that are the basis for the entire lesson or the entire study unit. The remedial mathematics program was designed with the primary goal of enabling students to learn their entire school curriculum, without reducing any of its lessons, as reducing the curriculum may cause learning gaps that hinder students from learning the next year's curriculum. A structured pedagogy approach was primarily adopted in the remedial program. Students in all schools received the same remedial content printed in booklets, and teachers received standardized training on how to implement the remedial program to ensure consistent implementation and facilitate monitoring and governance. They also received written instructions supported by an explanatory video. However, teachers were given some flexibility to estimate the time required for remedial content based on their students' varying needs. The remedial program ensured that the principles of structured pedagogy and differentiated instruction were combined by categorizing students into only three levels: below average, average, and above average. Specific remedial content was designed for each level in each lesson. The remedial content consisted of three components: (1) review content already integrated into the mathematics curriculum, (2) a remedial booklet specifically designed to align with the remedial program, and (3) targeted guidelines for addressing learning loss, which were included in teacher guides. A detailed explanation of each of these components is provided in subsequent sections.

2.3.1. Review Content Integrated into the Workbook

The official mathematics curriculum in Jordan includes a review of some mathematical concepts and skills that students have previously studied but are considered vital for current learning. This review appears under the heading "Get Ready to Study the Unit" in the workbook. It is organized into sections, each addressing a specific mathematical skill or concept and linked to a specific lesson in

the Student's Book. Each section is enclosed in a frame that separates its content from the others. To make it easier for teachers to use, each section is titled according to the mathematical concept or skill it addresses, along with the corresponding lesson number in the student's book. Each section begins with exercises and mathematical problems that students are expected to have acquired the necessary mathematical knowledge and skills to solve through their previous study. Each set of exercises and problems is followed by an example of a similar exercise or problem solved in a simplified and detailed manner. This review content, however, was developed as an integral part of the official curriculum before the COVID-19 pandemic, so it does not address the fundamental mathematical concepts and skills students acquired in earlier grades far removed from their current grade level. It rather covers concepts students most likely learned only a grade or two earlier. The depth of this review content was adequate before the pandemic, but this changed dramatically after the pandemic due to students' long absence from in-person learning in Jordan, which led to the loss of basic mathematical concepts and skills that students had studied in classes far below their current grade level.

2.3.2. Remedial Booklet

The National Center for Curriculum Development (NCCD), a governmental institution independent of the Ministry of Education of Jordan responsible for uniformly producing school textbooks, has developed remedial mathematics booklets for grades 4 through 9. Copies of these booklets have been printed in quantities matching the number of students in grades 4 through 9 in Jordanian public schools. These booklets present mathematical concepts and skills in a simplified manner, supported by diagrams and illustrations. These concepts and skills are considered very basic, as students have studied them in previous grades, far removed from their current grade, yet they serve as a foundation for their current learning. The design of the remedial booklet is aligned with the design of the review content originally integrated into the workbook, making it easy for students and teachers to use. Although the design is similar, there is no overlap in content between the remedial booklet and the curriculum review. Figure 1 shows part of the ninth-grade remedial booklet (translated from Arabic to English) that addresses the skill of graphing ordered pairs in the coordinate plane and identifying the quadrant in which they fall. Students had previously studied this skill in sixth grade, and it is one of the basic skills required for learning Lesson 4 in the ninth-grade student book, titled "Graphing Linear Inequalities in Two Variables." The figure shows a set of exercises on this skill, followed by a solved example (with a gray background) with detailed explanations that students can refer to if they cannot solve the preceding exercises.

2.3.3. Teacher Guide

When the remedial program's design began, the mathematics teacher guides were not available in hard copy but were available to teachers electronically. This allowed for modifications to align the lesson plans included in these teacher guides with the procedures of the remedial program and to add detailed guidance for teachers in each lesson. These modifications considered the official curriculum's continued teaching as the primary source of learning, emphasizing enabling students at all levels to catch up on current learning as quickly as possible. Additionally, a QR code to a video that illustrates how to implement the remedial procedures in general, along with a detailed practical example, has been included in the introductions of the teacher guides.

Plotting Points on the Coordinate Plane (Lesson 4)

Plot each of the following points on the coordinate plane, then determine the quadrant or axis it is on:

45 $A(-2, 3)$

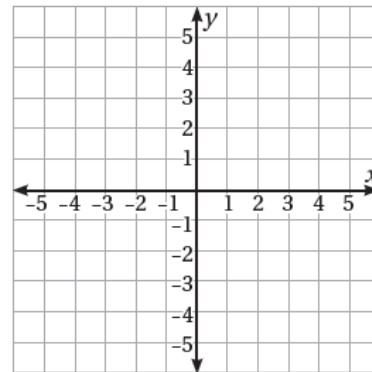
46 $B(3, 3)$

47 $C(3, -3)$

48 $D(-4, 0)$

49 $E(-2, 1)$

50 $F(0, 3)$



Example: Plot each of the following points on the coordinate plane, then determine the quadrant or axis it is on:

a) $(4, -3)$

Move 4 units to the right from the origin, then 3 units down, and plot the point. The point is in the fourth quadrant.

b) $(-5, 0)$

Move 5 units to the left from the origin, then 0 units up or down, and plot the point. The point is on the axis.

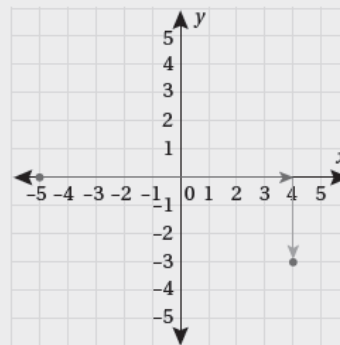


Figure 1. A Translated Section in the 9th Grade Remedial Booklet (Volume 1) (p. 12).

2.4. Procedures for Addressing Learning Loss

According to the instructional manual for addressing learning loss in mathematics issued by the Ministry of Education (Ministry of Education, 2023), the daily process of addressing learning loss begins with the teacher identifying the parts of the remedial booklet that relate to the learning outcomes that will be taught to students in the next period and assigning them as homework for all students. The students' answers are then used as a diagnostic test to determine their needs. At the beginning of the next period, the teacher identifies students who still need support with the mathematical concepts or skills included in the homework. The teacher then discusses with them the examples related to those concepts or skills in the remedial booklet, and then asks them to redo the exercises with the help of other students who have successfully completed the homework. All students are then asked to complete the exercises and problems related to the day's learning in the review content integrated into the workbook in mixed-ability groups. The teacher walks between the groups as they work on the review content, offering any necessary support. The teacher begins the regular teaching procedures, following the teaching plan outlined in the teacher's guide, after ensuring that all students have the prior knowledge necessary to learn the topics to be presented in

today's meeting. The approximate time required to implement remedial procedures at the beginning of each period is approximately 10 minutes. However, adhering to this time is not mandatory, as the teacher can increase or decrease it according to the needs of their students. The use of the remedial booklet is also not mandatory in all cases. Sometimes, students may not need the remedial booklet as the review integrated into the workbook is sufficient to prepare them for the current learning, while at other times, they need both resources to address the learning loss.

3. Methodology

3.1. Participants

A participation link for an online questionnaire was shared via WhatsApp with 12 mathematics supervisors who collaborated with the study team. These supervisors forwarded the link to their colleagues, other mathematics supervisors, who then directly distributed it to mathematics teachers they oversee through WhatsApp groups used for communication. A text message accompanied the questionnaire link, explaining the study's goals, importance, and the benefits of participating. It emphasized that their privacy would be protected, that they did not need to include their names in their responses, and that they would be given letters of appreciation from the NCCD. The study was limited to teachers of grades four through nine, which are the grades included in the remedial program. In total, only 342 male and female mathematics teachers for grades 4-9 responded to the questionnaire, representing 244 schools across 12 of Jordan's 43 educational directorates. Considering the depth of the data analyzed, the sample size of 342 participants was deemed suitable to reflect a diverse range of experiences and perspectives (Button et al., 2013). Participants were given letters of appreciation by the NCCD to encourage their active contribution to the study. These letters, issued by official institutions, support the professional portfolios of participants and contribute to their career advancement. The sample included teachers teaching grades 4 through 9 with a balanced distribution as follows: 56 fourth-grade teachers, 59 fifth-grade teachers, 54 each sixth and eighth-grade teachers, 62 seventh-grade teachers, and 57 ninth-grade teachers.

3.2. Data Collection

Data for this study were collected approximately two years after the launch of the remedial program, near the end of the second semester of the 2023-2024 academic year. An electronic questionnaire was developed for this purpose by the study team. The items included in the questionnaire were reviewed by 12 educational supervisors within the Ministry of Education, as well as a university professor specializing in measurement and evaluation, and then refined based on their feedback. The questionnaire was also piloted on 18 teachers outside the study sample, then revised based on their feedback. To enhance the credibility and depth of findings, this study employed triangulation by integrating quantitative and qualitative data. This allowed for a more comprehensive understanding of the participating teachers' insights into the remedial program. The questionnaire consisted of three main sections, each of which contained items related to a specific aspect of the remedial program. The items varied between open-ended and objective (Likert scale and yes or no), with a place for teachers to write their comments next to the objective items. The notes left by the participating teachers next to the objective items served as qualitative data for this study, along with the open-ended items included in the questionnaire. Therefore, each teacher involved in the study contributed to generating both quantitative and qualitative data. The aspects of the remedial program covered by the three sections of the questionnaire are: (1) the effectiveness of the remedial approach design that integrates the remedial content with the official curriculum; (2) the accuracy of the remedial content and its comprehensiveness of all mathematical concepts and skills necessary to prepare the student for the official curriculum lessons; and (3) the impact of the remedial program on students' performance and ability to learn the official curriculum lessons.

4. Data Analysis

Since this study is based on both qualitative and quantitative data, the content analysis approach (Krippendorff, 2004) was employed in the data analysis process, as it provides techniques that allow for extracting results from various types of data and linking them in a way that enhances the validity. In this study, the content analysis approach facilitated the application of statistical techniques to analyze quantitative data, alongside quantifying themes identified in qualitative data and interpreting certain findings derived from quantitative data that relate to qualitative data. As a first step in the data analysis process, the quantitative data resulting from the questionnaire were exported to an Excel file, and a statistical analysis specialist was consulted to conduct the statistical analysis of this data. The data were processed using the Statistical Package for the Social Sciences (SPSS) software. Descriptive statistics tools were used to summarize teachers' responses to each Likert scale item by calculating the mean and standard deviation for each item separately. Reliability analysis was also conducted to ensure the internal consistency of the questionnaire by calculating Cronbach's alpha coefficient. Regarding the qualitative data, the study team transferred it to a Word file and then employed a thematic and structured approach to analyze it. This involved identifying sentences and phrases that convey similar ideas (codes) and distinguishing them with different colors wherever they appeared in the participating teachers' responses. Then, they used a table to group codes under broad themes, which they collectively used to extract findings of the study elaborated in the subsequent sections.

4.1. Effectiveness of the Remedial Approach Design

The questionnaire included the following "yes-no" question, which was designed to ascertain the perspective of participating mathematics teachers on the effectiveness of the remedial program design that integrates remedial content with daily teaching plans:

Do you think that allocating 10 minutes at the beginning of each math period for remediation, with the flexibility to adjust the duration based on students' needs, is a suitable approach for addressing your students' learning loss?

Of the 342 participants in this study, 287 teachers responded "yes" to this question, while only 55 responded "no." Additionally, 88 teachers only justified their answers in the notes box next to the question. When analyzing these justifications, it was noted that the majority of those who answered "yes" believed that the time available to deliver the remedial content was appropriate, taking into account the flexibility afforded by the design of the remedial program. Also, they emphasized the design's effectiveness in linking the remedial content with the official curriculum. They reported that they were able to address their students' learning loss and prepare them to learn the lesson of the official curriculum on most days within the first 10 minutes of the period or a little longer. In contrast, some of the "no" respondent teachers reported that allocating 10 minutes for remediation was insufficient. They stated that on numerous occasions, they had to stop teaching the remedial content after 10 minutes without completing all the procedures and move on to teaching the official curriculum, fearing that there would not be enough time left for the official curriculum. However, none of them indicated that the remedial program had increased the number of math periods by 10 periods per semester to compensate for the time spent teaching the remedial content at the beginning of each period. Some of the "no" respondent teachers (34 teachers) also noted that implementing remedial procedures as part of the period led to students being distracted by switching between the official curriculum and the remediation booklet. Therefore, these teachers suggested modifying the remedial program design so that one of the five math periods per week would be dedicated to addressing learning loss at once.

4.2. Quality of the Mathematical Remedial Content

Table 1 below presents six five-point Likert scale items included in the questionnaire to evaluate the quality of the remedial content from the perspective of the participating teachers. The highest value for this scale is 5, indicating “strongly agree,” while the lowest is 1, indicating “strongly disagree.” The table also displays the mean and standard deviation (SD) of the responses from the participating teachers for each of these items. To verify the validity of the six items, Pearson’s correlation coefficients were calculated to assess the consistency of these items with the construct, namely “the quality of remedial content.” The Pearson correlation coefficients for the six items ranged from 0.5 to 0.67, indicating medium to strong correlations. All six correlation values are significant at the 0.01 level, reflecting the validity of the construct and its alignment with the six items. The internal consistency of the items was also verified by calculating Cronbach’s alpha value, which was 0.605, indicating an acceptable level of internal consistency, as the optimal range for internal consistency without redundancy is between 0.70 and 0.95 (Tavakol & Dennick, 2011).

Table 1. Items Related to the Quality of the Remedial Content

Item	Mean	SD
1. The remedial content is mathematically accurate.	4.17	0.90
2. The remedial content encompasses all mathematical concepts and skills regarded as prior knowledge for the corresponding lessons in the curriculum.	4.07	0.77
3. The language of the remedial content is clear and free from errors.	4.34	0.61
4. The remedial content addresses the needs of students at various levels.	3.78	0.94
5. The number of exercises offered is sufficient.	3.96	0.86
6. The space provided for students’ responses is adequate.	3.62	1.09

Referring to the mean and standard deviation values shown in Table 1, it is noted that each of items 1 and 2 had a high mean and relatively low standard deviation, reflecting a high degree of agreement among the participating teachers that the remedial content is mathematically accurate and includes all the mathematical concepts and skills essential for learning official curriculum lessons. Teachers’ written comments on these two items provided additional details. Some teachers indicated that the remedial content for specific lessons lacked essential mathematical topics, demonstrating this with examples, as reflected in the following note written by one teacher:

The remedial content for Lesson 3 of Unit 6 did not include a review of the concept of percentages and the method for converting them into decimal fractions, even though this concept is regarded as essential prior knowledge for understanding Lesson 3.

Item 3 showed moderate to high agreement among participating teachers, with minor variation regarding the linguistic accuracy and clarity of the remedial content. Comments from 63 teachers indicated that many students had severe language impairments, which prevented them from understanding the remedial content texts. Some teachers suggested enhancing the remedial

program with digital content supported by text-to-audio features to avoid language barriers. Item 4 assessed teachers' views on the suitability of the remedial content for students of varying levels. Teachers' responses to this item had a medium mean and a high standard deviation, reflecting their overall agreement with some variability. Sixty-seven teachers explicitly noted in their comments on this item that the cognitive level of the remedial content was appropriate for average and below-average students. Eleven teachers noted that the content is boring for above-average students due to its simplicity. Others (26 teachers out of 342) highlighted the rigidity of the remedial content and the absence of hands-on activities and games, which could boost students' motivation and engagement. Therefore, they recommended enhancing the remedial program by equipping teachers with mathematics manipulatives that are not available in every public school classroom, specifically, base 10 blocks and fraction models. The mean and standard deviation values for items 5 and 6 indicate a medium to high degree of agreement, with some variation in the views of the participating teachers, that the number of exercises and problems included in the remedial content is sufficient to meet the needs of the students and that the space available for writing their solutions is appropriate. When analyzing the teachers' notes on these two items, it was observed that a few (9 teachers) indicated the need to increase the number of exercises related to basic mathematical skills to enhance the students' mastery of these skills. Others (23 teachers) mentioned that the space available for writing answers was insufficient on some pages, which led students to settle for writing a final answer instead of detailing the solution.

4.3. Impact of Remediation on Students' Performance

To survey the perceptions of mathematics teachers participating in this study about the impact of the remedial program on students' performance and their ability to learn the official curriculum, the questionnaire included the following open-ended question:

Have you observed an improvement in your students' performance and ability to learn from the official mathematics textbook after applying the remedial procedure? Please support your answer with examples.

Analysis of the qualitative data resulting from the participating teachers' written responses to this open-ended question revealed that they confirmed students' improvement in two main areas: mathematical performance and motivation. Regarding mathematical performance, 87% of participating teachers explicitly reported a clear improvement in their students' performance after implementing the remedial program, particularly among students with average and below-average levels, in basic concepts and skills, such as the four arithmetic operations, fractions, percentages, and geometric shapes. For example, one teacher provided an example of one of his below-average students who, through the remedial content, mastered the area laws of basic geometric shapes and successfully applied them to calculate the areas of two-dimensional complex shapes. Another teacher noted that one of his below-average students unexpectedly mastered proportion-related calculations, which are sometimes difficult even for above-average students.

Regarding motivation, even though the above question did not reference student motivation and instead focused on student performance and their ability to learn from the official curriculum, 39% of participating teachers explicitly reported a clear improvement in students' motivation and engagement after implementing the remedial program, particularly among students at or below average levels. One of these teachers noted that below-average students felt, for the first time, they could confidently solve mathematical problems and participate in math class. Several teachers provided examples of students whose participation in classroom activities and discussions had increased. Their involvement was not limited to the remedial content but also included the official curriculum. One example mentioned was from a teacher about her seventh-grade student, who had always expressed that she did not like math. However, following the remedial program, her

engagement in math class and her self-confidence improved, so her performance was often on par with that of average-level students. Another teacher noted the increased self-confidence of some of his below-average students, to the point that they dared, contrary to usual, to solve problems on the board in front of the rest of the class, knowing that some of these problems were not easy, and included in the official curriculum. Another teacher also shared the following success story of her fifth-grade student:

Before the COVID-19 pandemic, one of my fifth-grade students, Tamara, struggled with fundamental math skills. However, after implementing the remedial program, she achieved the highest score among her classmates on the final exam for the first semester, and her math score was the highest among all subjects.

Despite the previously mentioned teachers' statements indicating an improvement in their students' performance and ability to learn the official curriculum after implementing the remedial program, 44 other teachers, representing 13% of the participating teachers, believed that the impact of the remedial program on students' performance was limited. Some of these teachers attributed this to overcrowded classrooms, which constituted an obstacle when implementing remedial procedures for more than 40 students of varying abilities simultaneously, as is understood from the teacher's response below:

I noticed no significant improvement in the students' performance because implementing the remedial program was challenging for me. One of the seventh-grade classes I teach has 41 students, and the classroom is barely large enough to accommodate them. Therefore, it is challenging to implement the remedial content properly, especially since many of the students in this class are struggling.

Twenty-four teachers also attributed the lack of significant impact of the remedial program on their students' performance to the fact that it did not provide teaching plans for severely weak students. In this regard, the following is an example of a response from one of the ninth-grade teachers participating in the study:

The remedial program did not provide solutions for accommodating severely weak students separately from the rest of the class, such as pulling them out of the classroom. Therefore, I believe the remedial program offered little or no benefit to these students.

5. Discussion

This study sheds light on Jordan's efforts to address learning loss in mathematics caused by the interruption of face-to-face teaching during the COVID-19 pandemic and thoroughly documents this experience. Primarily, it assesses the NPRI through the perspectives of a sample of mathematics teachers involved in its implementation. The research questions that guided the study are centered around three main dimensions of the remedial program, with the aim of providing insights into these dimensions. In addressing the first research question, the data analysis of this study provided insights into the suitability of the remedial program design, highlighting both its strengths and areas for improvement. The responses of participating teachers indicated a consensus regarding the effectiveness of the remedial program design, particularly in allocating approximately the first 10 minutes of each mathematics period to address students' learning loss, while allowing flexibility to adjust this time based on students' needs. Some of them confirmed in written comments that the flexibility they were given enabled them to address their students' learning loss in most cases effectively. This result aligns with recommendations by Allensworth and Schwartz (2020), which stress that increasing teaching time and using remedial content connected to the school curriculum might effectively address learning loss. Despite this, a few teachers indicated that allocating 10 minutes was insufficient to fully address their students' learning loss. They explained that they

sometimes had to stop remediation after 10 minutes before adequately preparing students for the current learning and had to switch to the official curriculum to save time. This observation suggests that this small group of teachers may have misunderstood the 10-minute remedial time at the beginning of each period as restrictive. Also, some teachers indicated that allocating this time to address learning loss affected, in one way or another, the time allocated to teaching the official curriculum book. However, these teachers did not explicitly indicate that the remedial program added 10 school days each semester to compensate for the time allocated for remediation. This emphasizes the importance of ensuring the effectiveness of the training program these teachers have received and addressing any gaps that affect some teachers' competence. This aligns with Munusamy et al.'s (2025) study, which highlighted that addressing learning loss in mathematics depends on teachers' understanding of the philosophy of the remedial approach and the changes it brings to their traditional teaching practices.

Analysis of the data related to the design of the remedial program also revealed a suggestion by some teachers: to allocate an entire period for remediation out of the five weekly periods allocated to mathematics in grades four through nine. These teachers justified their suggestion by minimizing distractions caused by switching between remedial content and the official curriculum during the same period. Although this suggestion seems reasonable, it has two drawbacks. First, the suggestion lacks flexibility in terms of time, as a single period may not be sufficient to address the learning loss in the topics that form the basis of the week's lessons, or at other times, it may be more than necessary. Second, it undermines students' ability to connect remedial content to the official curriculum, as several mathematical topics are re-taught simultaneously during this period without linking each to the corresponding lesson in the official curriculum. Additionally, the time gap between the period of the remedial content and when the related mathematical content in the official curriculum is taught may lead students to forget some concepts covered during the remedial period. Therefore, the suggestion appears inconsistent with the philosophy of the remedial program, which aims to prepare students for ongoing learning each day. This aligns with Louge et al. (2022), who indicated that integrating remedial content into daily teaching and aligning it with the core curriculum is more effective than delivering it in spaced-out sessions, as this approach ensures that students' learning difficulties are addressed while they continue to learn the formal curriculum simultaneously. In addressing the second research question, a quantitative analysis of teachers' responses to six Likert-scale items provided insights into the strengths and potential areas for improvement regarding the mathematical accuracy of the remedial content and its suitability for students of varying levels. Participating teachers agreed, with a high mean and minimal variability, that the remedial content was accurate, clear in language, and comprehensive of all mathematical topics that are the basis of formal curriculum lessons; therefore, if mastered, it would be sufficient to prepare students for formal curriculum study.

Some teachers provided explanations for their quantitative responses. For example, some justified their belief in the inadequacy of the remedial content by citing the lack of some mathematical topics in the remedial booklet related to specific lessons in the curriculum. However, a review of the remedial content revealed that many of the topics referred to in the teachers' comments were already included in the review content integrated into the workbook, which forms an integral part of the remedial content as a whole, or they were topics that students had just studied in previous lessons in the same unit, or had been covered in the remedial content for previous lessons close to the lesson referred to in the teacher's comment. Therefore, repeating them in the remedial content for that lesson would be unnecessary. The quantitative data analysis also showed that teachers agreed, to a medium to high degree, that the number of exercises and problems included in the remedial content was suitable, and that the space allocated for writing students' answers in the remedial booklet was sufficient. However, their opinions varied on these two aspects, as

evidenced by the high values of the standard deviations. These two findings highlight an opportunity to improve the remedial content by adding more exercises and problems, and increasing the space allocated for writing students' answers. The first finding is consistent with the recommendations of other studies that have confirmed the pivotal role of practice in improving students' procedural fluency and enhancing their conceptual understanding in mathematics (Levine, 2018). It is worth noting that some participating teachers reported in their written comments that, because of the limited space allocated for students to write their answers in certain areas, students often wrote only a final answer rather than a detailed response. This made it difficult to identify and address deficiencies in students' answers, along with the negative effects on their performance and engagement, as highlighted by other studies on worksheet and workbook design. These studies have shown that providing ample space for writing enhances student engagement and promotes deeper thinking (Burkholder et al., 2021).

Regarding the suitability of the remedial content for students at all levels, quantitative data analysis revealed that participating teachers agreed, to a moderate degree, that the remedial content was appropriate for all student levels, with variability among their opinions, as confirmed by high standard deviations. Analysis of teachers' comments on items related to this aspect in the questionnaire elaborated on the viewpoint of some teachers who responded that the remedial content was inappropriate for all student levels. Sixty-seven teachers explicitly noted in their comments on this item that the cognitive level of the remedial content was appropriate for average and below-average students only. Eleven teachers noted that the content is boring for above-average students due to its simplicity. Given the small number of teachers who made this observation (only 11 teachers), it cannot be concluded that all above-average students feel bored when presented with remedial content, as other studies have shown that remedial content may be more exciting and beneficial to this group of students than to their below-average peers because of their greater ability to handle and understand remedial material and therefore make progress in it (Papadogiannis et al., 2023). Eighty-three teachers explicitly noted in their comments on this item that some students had severe reading difficulties, to the point that they could not read the exercise texts and problems included in the remedial content. Therefore, these students struggled to handle the remedial content independently and often relied on someone else to help them read the texts included in the remedial content's exercises, problems, and examples. These teachers suggested enhancing the remedial program by integrating digital resources with text-to-audio features to boost student engagement and address language barriers. Notably, classrooms in Jordan lack computers and other technological devices, making the use of digital content during lessons impossible. However, this suggestion is still valuable as students can use such content at home, as most households have access to computers. Some teachers also suggested enhancing the remedial program with game-based digital activities to increase student motivation, especially for those with below-average abilities. This suggestion aligns with the recommendations of other studies that indicated the effectiveness of game-based computer activities in improving students' motivation and achievement in mathematics (Fada, 2022). The participating teachers also suggested providing classrooms with mathematics manipulatives, specifically base 10 blocks and fraction models, to support students' learning. It is worth noting that the basic mathematical concepts, such as fractions and place value, are accompanied in the remedial content by illustrations and images of mathematical manipulatives, including base ten blocks (Dienes blocks). However, this does not diminish the necessity of having these manipulatives in the hands of students. Therefore, providing them uniformly in all classrooms will enhance the effectiveness of the remedial program. This suggestion also seems appropriate in light of the recommendations of some educational studies summarized in the meta-analysis study conducted by Carbonneau et al. (2013), which showed agreement among a large number of studies that the effective use of manipulatives leads to deepening students' understanding of mathematical concepts in addition to improving their interaction and motivation.

The third research question in this study was addressed by analyzing teachers' responses to an open-ended question about the extent to which the remedial program impacted their student performance. The results of the data analysis showed that 298 out of 342 teachers (87%) noticed an improvement in students' confidence and participation, particularly those with below-average levels, which led to an improvement in their basic mathematical skills. They reported that they had observed frequent improvements in basic mathematics skills and concepts. They also cited success stories of students who had suffered from severe weaknesses in these basic skills and who, after engaging with the remedial program, could achieve high grades in classroom assessments. Forty-four other teachers (13% of participants) believed, conversely, that the remedial program's impact on students' performance was limited. Some attributed this in their written comments to several factors, most notably the crowded classrooms, which hindered their ability to implement the remediation procedures effectively, and the lack of purposefully designed remediation plans for severely weak students.

Despite some variation in their views, the teachers participating in this study generally agreed that the remedial program positively impacted student performance. This reflects the effectiveness of the design of this remedial program, which integrates the official curriculum and remedial content systematically and is implemented uniformly across all schools. These results are consistent with the findings of Maruyama and Kurosaki's (2021) study, which aimed to assess a remedial mathematics intervention program in Niger targeting 350,000 students in grades one through four. The remedial program was similar in design to the remedial program, as the remedial content was included in the workbook and followed a structured pedagogical approach. The study clearly demonstrated the program's effectiveness in addressing learning gaps among low-achieving students.

6. Limitations

Collecting more qualitative data from teachers through face-to-face interviews or classroom observations may provide a deeper understanding of the challenges highlighted by the study's findings. Future studies could also examine the extent of teachers' readiness to implement the remedial program, as some results indicated that certain teachers were uncertain about the mechanisms for successfully implementing the remedial program. Teachers' lack of awareness of the philosophy of the remedial program could negatively impact its implementation and lead to inaccurate data about its effectiveness and limitations.

7. Conclusion

Data analysis in this study demonstrated the effectiveness of Jordan's NPRI in integrating remedial content with the formal mathematics curriculum on a daily basis, supporting students' progress in learning the formal curriculum. This finding is evidenced by the consensus among teachers regarding the effectiveness of allocating 10 minutes at the beginning of each lesson to provide remediation, with the option to increase or decrease this time according to students' varying needs. However, some teachers seemed unaware of the flexibility in the time allocated for remediation and believed that the time was fixed across all lessons at 10 minutes. This misunderstanding led those teachers to express concerns about their ability to cover remedial content effectively within the designated time in certain lessons. Furthermore, while teachers noted the comprehensiveness and accuracy of the remedial content, their suggestions for program improvement included adding more exercises and problems and expanding the space allocated for recording students' solutions within the remedial booklet. The analysis also revealed improvements in students' basic math skills, particularly among below-average students, as well as increases in their self-confidence and engagement. What this study revealed about the positive impact of the remedial program on students' performance, especially below-average students, aligns with findings from international studies conducted to assess similar remedial programs, including Maruyama and

Kurosaki's (2021), who evaluated a remedial program implemented in Niger. The remedial program relied on tools similar to those used in the Jordanian remedial program, primarily workbooks similar to the remedial booklet designed in Jordan for this purpose. This study documented this unique, large-scale program in detail, offering insights that can inform similar initiatives in other regions. It also provided evidence-based recommendations for enhancing the NPRI at the local level.

8. Suggestion

Although this study has a large sample size, it cannot precisely assess the impact of the remedial program on student performance because the data collected are only teachers' observations, not actual student assessment results. Therefore, this study recommends conducting a precise diagnostic assessment and comparing the results with the data previously available from the Ministry of Education regarding students' performance after the pandemic, upon their return to schools, and before implementing the remedial program. This will help verify the actual impact of the program on students. This study revealed that below-average students face challenges related to reading difficulties, highlighting the need for developing customized strategies to meet their unique needs more effectively. Some teachers proposed enhancing the remedial program with interactive digital content based on games and activities to motivate students. These teachers believe that interactive digital content contributes to the integration of students with reading difficulties by utilizing the text-to-speech feature, which can read the texts of the remedial content, resulting in greater accessibility and participation.

Declarations

Author Contributions. All authors contributed equally to the conception and design of the study. All authors have read and agreed to the published version of the manuscript.

Conflicts of Interest. To the best of our knowledge, no conflict of interest exists worth reporting.

Funding. This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Ethical Approval. The Ethical Committee of the Department of Educational Planning and Research at the Ministry of Education of Jordan has granted approval to conduct this research in letter No. 3/10/39875 dated 14/8/2025

Data Availability Statement. The data supporting the findings of this study are available from the corresponding author upon reasonable request.

Conflict of Interest. The authors declare that they have no conflict of interest.

Acknowledgements. We thank all participants and the Ministry of Education in Jordan for their support.

References

- Allensworth, E., & Schwartz, N. (2020). *School practices to address student learning loss*. EdResearch for Action. https://edresearchforaction.org/wp-content/uploads/EdResearch-School-Practices-Student-Learning-Loss_1.pdf
- Alshoubaki, W., & Harris, M. (2021). Jordan's public policy response to COVID-19 pandemic: Insight and policy analysis. *Public Organization Review*, 21(4), 687–706. <https://doi.org/10.1007/s11115-021-00564-y>
- Angrist, N., de Barros, A., Bhula, R., Chakera, S., Cumiskey, C., DeStefano, J., Floretta, J., & Kaffenberger, M. (2021). Building back better to avert a learning catastrophe: Estimating learning loss from COVID-19 school shutdowns in Africa and facilitating short-term and long-term learning recovery. *International Journal of Educational Development*, 84, Article 102397. <https://doi.org/10.1016/j.ijedudev.2021.102397>

- Azevedo, J. P., Hasan, A., Goldemberg, D., Iqbal, S. A., & Geven, K. (2020). Simulating the potential impacts of COVID-19 school closures on schooling and learning outcomes: A set of global estimates. *Policy Research Working Paper 9284*. World Bank. <https://doi.org/10.1596/1813-9450-9284>
- Azevedo, J. P., & Montoya, S. (2021). Will every child be able to read by 2030? Defining learning poverty and mapping the dimensions of the challenge. *Policy Research Working Paper 9588*. World Bank and UNESCO Institute for Statistics. <https://doi.org/10.1596/1813-9450-9588>
- Avanesian, G., Dikaya, L. A., Dikiy, I. S., Kirik, V. A., & Egorova, V. A. (2021). How personality traits are related to the attitudes toward forced remote learning during COVID-19: Predictive analysis using generalized additive modeling. *Frontiers in Education*, 6, Article 629213. <https://doi.org/10.3389/feduc.2021.629213>
- Burkholder, E., Mohamed-Hinds, N., & Wieman, C. (2021). Evidence-based principles for worksheet design. *The Physics Teacher*, 59(6), 402–403. <https://doi.org/10.1119/5.0020091>
- Button, K. S., Ioannidis, J. P. A., Mokrysz, C., Nosek, B. A., Flint, J., Robinson, E. S. J., & Munafò, M. R. (2013). Power failure: Why small sample size undermines the reliability of neuroscience. *Nature Reviews Neuroscience*, 14(5), 365–376. <https://doi.org/10.1038/nrn3475>
- Carbonneau, K. J., Marley, S. C., & Selig, J. P. (2013). A meta-analysis of the efficacy of teaching mathematics with concrete manipulatives. *Journal of Educational Psychology*, 105(2), 380–400. <https://doi.org/10.1037/a0031084>
- Cattaneo, M. A., Oggenfuss, C., & Wolter, S. C. (2016). The more, the better? The impact of instructional time on student performance. *Education Economics*, 24(6), 511–520. <https://doi.org/10.1080/09645292.2016.1201120>
- Chetty, R., Friedman, J. N., Stepner, M., & Team, T. O. I. (2020). The economic impacts of COVID-19: Evidence from a new public database built using private sector data. *National Bureau of Economic Research Working Paper Series*, 27431. <https://doi.org/10.3386/w27431>
- Christodoulou, D. (2021). Forgotten learning and foregone learning: Distinguishing the two and their policy implications. *Educational Leadership Quarterly*, 37(2), 142–150.
- Civitillo, S., Denessen, E., & Molenaar, I. (2016). How to see the classroom through the eyes of a teacher: Consistency between perceptions on diversity and differentiation practices. *Journal of Research in Special Educational Needs*, 16(1), 587–591. <https://doi.org/10.1111/1471-3802.12190>
- Deunk, M. I., Smale-Jacobse, A. E., de Boer, H., Doolaard, S., & Bosker, R. J. (2018). Effective differentiation practices: A systematic review and meta-analysis of studies on the cognitive effects of differentiation practices in primary education. *Educational Research Review*, 24, 31–54. <https://doi.org/10.1016/j.edurev.2018.02.002>
- Fadda, D., Pellegrini, M., Vivaret, G., & Zandonella Callegher, C. (2022). Effects of digital games on student motivation in mathematics: A meta-analysis in K-12. *British Journal of Educational Technology*, 53(5), 1150–1174. <https://doi.org/10.1111/bjet.13198>
- Fayez, M., Ahmad, J. F., & Oliemat, E. (2016). Jordanian kindergarten and 1st-grade teachers' beliefs about child-based dimensions of school readiness. *Journal of Research in Childhood Education*, 30(3), 293–305. <https://doi.org/10.1080/02568543.2016.1178383>
- GEM-UNESCO. (2020). Inclusion and education: All means all. *Global Education Monitoring Report*. Paris: UNESCO. <https://doi.org/10.54676/JJNK6989>

- Kaffenberger, M. (2021). Modelling the long-run learning impact of the COVID-19 learning shock: Actions to (more than) mitigate loss. *International Journal of Educational Development*, 81, Article 102326. <https://doi.org/10.1016/j.ijedudev.2020.102326>
- Krippendorff, K. (2004). *Content analysis: An introduction to its methodology* (2nd ed.). Thousand Oaks, CA: Sage Publications. <https://doi.org/10.4135/9781071878781>
- Kuhfeld, M. (2019). Surprising new evidence on summer learning loss. *Phi Delta Kappan*, 101(1), 25–29. <https://doi.org/10.1177/0031721719871560>
- Levin, M. (2018). Conceptual and procedural knowledge during strategy construction: A complex knowledge systems perspective. *Cognition and Instruction*, 36(3), 247–278. <https://doi.org/10.1080/07370008.2018.1464003>
- Louge, N., Miksic, E., & Lu, Y. (2022). *Remedial education: Models and approaches for successful impact on student achievement*. FHI 360 Global Education. <https://www.fhi360.org/wp-content/uploads/2023/12/resource-remedial-education-technical-brief.pdf>
- Maruyama, T., & Kurosaki, T. (2021). Do remedial activities using math workbooks improve student learning? Empirical evidence from scaled-up interventions in Niger. *International Journal of Educational Development*, 84, Article 102429. <https://doi.org/10.1016/j.ijedudev.2021.102429>
- Mbugua, Z. K., & Muthomi, M. W. (2014). Effectiveness of differentiated instruction on secondary school students' achievement in mathematics. *International Journal of Education and Research*, 2(6), 463–472. Retrieved from <https://karuspace.karu.ac.ke/handle/20.500.12092/1684>
- Ministry of Education. (2023). *Guidelines for addressing learning loss in mathematics*. Hashemite Kingdom of Jordan. https://moe.gov.jo/sites/default/files/546_rshdt_mlj_lfqd.pdf
- Munusamy, T., Mohamad Yatim, M. H., & Bin Suhaimi, S. (2025). *Challenges in teaching and learning mathematics among remedial students*. *International Journal of Academic Research in Business and Social Sciences*, 15(3). <https://doi.org/10.6007/IJARBSS/v15-i3/23976>
- Parsons, S. A., Vaughn, M., Scales, R. Q., Gallagher, M. A., Parsons, A. W., Davis, S. G., Pierczynski, M., & Allen, M. (2018). Teachers' instructional adaptations: A research synthesis. *Review of Educational Research*, 88(2), 205–242. <https://doi.org/10.3102/0034654317743198>
- Patall, E. A., Cooper, H., & Allen, A. B. (2010). Extending the school day or school year: A systematic review of research (1985–2009). *Review of Educational Research*, 80(3), 401–436. <https://doi.org/10.3102/0034654310377086>
- Peteros, E. D., Peconcillo Jr., L. B., Mamites, I. O., Sanchez, D. T., & Suson, R. L. (2020). Structuring determinants to level up students' performance. *International Journal of Education and Practice*, 8(4), 638–651. <https://doi.org/10.18488/journal.61.2020.84.638.651>
- Piper, B., Sitabkhan, Y., Mejia, J., & Betts, K. (2018). Scaling up successfully: Lessons from Kenya's Tusome national literacy program. *Journal of Educational Change*, 19(3), 293–321. <https://doi.org/10.1007/s10833-018-9322-4>
- Piper, B., Ralaingita, W., Mejia, J., Dubeck, M. M., DeStefano, J., Stern, J., Jordan, R., & Sitabkhan, Y. (2021). *Structured pedagogy how-to guides and literature review*. RTI International.
- Piper, B., Ralaingita, W., Mejia, J., Dubeck, M., DeStefano, J., Stern, J., Jordan, R., & Sitabkhan, Y. (2022). *How-to guide for structured pedagogy programs*. Retrieved from https://scienceofteaching.site/wp-content/uploads/2022/10/SP_2_Designing-an-Effective-Structured-Pedagogy-Program.pdf

- Piper, B., & Dubeck, M. M. (2024). Responding to the learning crisis: Structured pedagogy in sub-Saharan Africa. *International Journal of Educational Development*, 109, 103095. <https://doi.org/10.1016/j.ijedudev.2024.103095>
- Roy, A., Guay, F., & Valois, P. (2013). Teaching to address diverse learning needs: Development and validation of a differentiated instruction scale. *International Journal of Inclusive Education*, 17(11), 1186–1204. <https://doi.org/10.1080/13603116.2012.743604>
- Stecker, P. M., Hodge, J., & Griffith, C. A. (2020). Response to intervention framework: An application to school settings. In M. M. Martel (Ed.), *The clinical guide to assessment and treatment of childhood learning and attention problems* (pp. 77–97). Elsevier Academic Press <https://doi.org/10.1016/B978-0-12-815755-8.00004-6>
- Stern, J., Jordan, R., Sitabkhan, Y., Ralaingita, W., Carroll, B., Betts, K., Jukes, M., Norman, J., Dubeck, P., DeStefano, J., Mejia, J., Bahrawar, L., Cummiskey, C., Jalloh, N., Pamel, J., & Momanyi, R. (2021). *Learning at scale: Findings brief*. RTI International. Retrieved from <https://learningportal.iiep.unesco.org/es/biblioteca/learning-at-scale-interim-report>
- Stern, J., Jordan, R., Sitabkhan, Y., Ralaingita, W., Carroll, B., Betts, K., Jukes, M., Norman, J., Dubeck, P., DeStefano, J., Mejia, J., Bahrawar, L., Cummiskey, C., Jalloh, N., Pamel, J., & Momanyi, R. (2023). *Numeracy at scale: Final report*. RTI International. Retrieved from https://learningatscale.net/wp-content/uploads/2023/10/Numeracy-at-Scale_Final-Report.pdf
- Tavakol, M., & Dennick, R. (2011). Making sense of Cronbach's alpha. *International Journal of Medical Education*, 2(1), 53–55. <https://doi.org/10.5116/ijme.4dfb.8dfd>
- Tomlinson, C. A. (2014). *The differentiated classroom: Responding to the needs of all learners* (2nd ed.). ASCD.
- Tomlinson, C. A. (2015). *Leading for differentiation: Growing teachers who grow kids*. ASCD.
- Torres, R. C. (2021). Addressing the learning gaps in the distance learning modalities. *International Journal of Academic and Applied Research*, 5(6), 76–79. <https://www.researchgate.net/publication/352551820>
- UNICEF. (2023, March). *Education in a post-COVID world: Towards a rapid transformation*. Retrieved from <https://www.unicef.org/media/135736/file/EducationinaPost-COVIDWorld.pdf>
- United Nations Development Programme. (2020). *COVID-19 and human development: Assessing the crisis, envisioning the recovery*. UNDP. https://hdr.undp.org/system/files/documents//covid-19_and_human_development_undp_hdperspectives_2020.pdf
- United Nations, Department of Economic and Social Affairs, Population Division. (2022). *World population prospects 2022*. United Nations. <https://population.un.org/wpp/>
- Valiandes, S., Neophytou, L., & Hajisoteriou, C. (2018). Establishing a framework for blending intercultural education with differentiated instruction. *Intercultural Education*, 29(3), 379–398. <https://doi.org/10.1080/14675986.2018.1441706>

About the Contributor(s)

Omar Abu Ghalyoun, Ph.D., is an Assistant Professor in the Department of Curriculum and Instruction, School of Educational Sciences, University of Jordan, Amman, Jordan.

Email: o.abughalyoun@ju.edu.jo

ORCID: <https://orcid.org/0000-0003-4422-6637>

Ibrahim El-Shara, Ph.D., is a Professor of Mathematics and Education in the Department of Curriculum and Instruction, School of Educational Sciences, University of Jordan, Amman, Jordan.

Email: i.shara@ju.edu.jo

ORCID: <https://orcid.org/0000-0001-9507-1167>

Emad Ababneh, Ph.D., is an associate Professor of Measurement and Evaluation. He is currently working at the National Center for Human Resources Development (NCHRD) of Jordan as the National Project Manager(NPM) for the Program for International Students Assessment (PISA).

Email: imad_ababneh@yahoo.com

ORCID: <https://orcid.org/0000-0002-3170-1913>

Publisher's Note: *The opinions, statements, and data presented in all publications are solely those of the individual author(s) and contributors and do not reflect the views of Universitepark, EDUPIJ, and/or the editor(s). Universitepark, the Journal, and/or the editor(s) accept no responsibility for any harm or damage to persons or property arising from the use of ideas, methods, instructions, or products mentioned in the content.*
