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**The extent of possession Resource room Teachers
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for teaching arithmetic skills to students with
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(a survey study in the city of Amman)**

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Abstract

This study aimed to measure the extent to which resource room teachers in Amman possess the cognitive competencies associated with strategies for teaching arithmetic skills to students with dyscalculia in light of the variables of post-service training for teachers and the level of their academic qualifications. To achieve the objectives of the study, a questionnaire was prepared referring to these strategies. The study sample consisted of (150) male and female teachers. The results indicated that the degree of the resource room teachers in the capital, Amman, possessed the cognitive competencies related to strategies for teaching numeracy skills was high. The strategy for solving mathematical problems ranked first, and the strategies that employ technological methods ranked last. The results of the study also indicated that the degree varies according to their academic qualifications and their subjection to any form of post-service training. The most prominent recommendations of this study are to conduct further studies on larger numbers of schools that include the private and government sectors, and to use other methods to collect data, such as observation lists.

Keywords: Dyscalculia disorder, Teacher Training and preparation programs, Learning difficulties.

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مدى امتلاك معلمي غرف المصادر للكفايات المعرفية المرتبطة باستراتيجيات تدريس المهارات الحسابية لدى الطلبة من ذوي اضطراب عسر الحساب في ضوء عدد من المتغيرات (دراسة مسحية بمدينة عمّان)

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مستخلص الدراسة

هدفت هذه الدراسة لقياس مدى امتلاك معلمي غرف المصادر بمدينة عمّان للكفايات المعرفية المرتبطة باستراتيجيات تدريس المهارات الحسابية لدى الطلبة من ذوي اضطراب عسر الحساب في ضوء المتغيرات التدريب بعد الخدمة للمعلمين، ومستوى مؤهلهم العلمي. ولتحقيق أهداف الدراسة تم إعداد استبيان بتلك الاستراتيجيات. وتكونت عينة الدراسة من (١٥٠) معلم ومعلمة. وأشارت نتائج الدراسة إلى أن درجة امتلاك معلمي غرف المصادر في العاصمة عمّان للكفايات المعرفية المرتبطة باستراتيجيات تدريس المهارات الحسابية كانت مرتفعة؛ فاحتلت استراتيجية حل المشكلات الحسابية في المرتبة الأولى، والاستراتيجيات التي توظف الأساليب التكنولوجية في المرتبة الأخيرة. وكما أشارت نتائج الدراسة إلى أن الدرجة تختلف باختلاف مؤهلاتهم العلمية، وخضوعهم لأي شكل من أشكال التدريب بعد الخدمة. ومن أبرز توصيات هذه الدراسة إجراء مزيد من الدراسات على أعداد أكبر من المدارس التي تشمل القطاعين الخاص والحكومي، واستخدام أساليب أخرى لجمع البيانات كقوائم الملاحظة.

كلمات مفتاحية: اضطراب عسر الحساب، الكفايات المعرفية، استراتيجيات تدريس الرياضيات، صعوبات التعلم.

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Introduction:

Special education teachers practicing this profession require additional time and effort at all stages of the educational process other than the time spent by a regular classroom teacher with his students. In this respect, determining the eligibility of students with disabilities for special education services is associated with preparing appropriate and different teaching and training curricula for students, choosing the methods and strategies most appropriate to their characteristics and learning styles, and allocating additional time in teaching imposed by these different individual differences (Thapa, & Jala, 2023).

Dyscalculia, or so-called math disability, is a severe type of difficulty in mathematics. It is a special type of specific learning disability, and it results from a simple brain disorder. These difficulties are not limited to understanding numbers or what is known as comprehending the meaning of numbers and arithmetic facts, as students who have difficulties in mathematics may also face problems and difficulties in learning the concepts of time, measurement, and spatial relationships (Butterworth, 2010).

The US National Center for Learning Disabilities (2006) defines dyscalculia as a term that refers to a wide range of disorders in the field of mathematics. In this respect, dyscalculia is not one form, but rather several forms, as difficulties differ from one person to another, and their impact also varies from one person to another (Khadijah, & Neelkamal, 2022). Logically, after completing the diagnosis and analysis of the students' performance, the teacher begins setting educational goals and methods that lead to achieving them. Significantly, there is no single way to teach mathematics. A competent teacher can benefit from several methods and select from them what suits the students' individual learning model (Al-Waqfi, 2009).

Recently, there has been increasing research interest in the topic of effective mathematics teaching for students with special needs in general, and

students with specific learning disorders in particular (Steedly, et al., 2008). In this respect, the theoretical literature and related studies show a great number of strategies and teaching methods that have been proven effective in improving student achievement. We must realize that the reason for this difference in strategies is due to the diversity of theoretical models in the field of psychology, as each theory came with specific thought, philosophy, and specific information about the educational process and its educational objectives and teaching strategies (Jackson, 2010).

In this respect, the shortage of qualified and trained workforce in the field of special education is one of the most prominent contemporary issues and problems resulting from the pressures imposed on the teaching profession. Therefore, scientific research did not stop at describing the problem, but rather went beyond providing solutions and suggestions for educational reform in the past few years. An example of these efforts was providing training opportunities for teachers on topics of a practical nature that keep pace with modern developments and overcome the various difficulties and pressures they face in the field (Cancio, et al., 2018).

Effective teacher preparation procedures are among the most important procedures for raising the efficiency of the educational process at all levels and stages of teaching, as the teacher is the primary factor in bringing about appropriate development in all aspects of the educational process. Any educational effort aimed at reform and development cannot underestimate the importance of the teacher's role in directing and developing the educational process (Rusznyak, Walton, 2017).

One of the tasks of an effective teacher is to possess the cognitive and practical skills in choosing the appropriate curriculum that suits the needs of

the students. When addressing the issue of choosing mathematics curricula and methods of teaching it, we find general agreement among educational circles that it is one of the most troubling issues for many teachers. Choosing a curriculum that is characterized by coherence and the interconnection of its ideas with each other in a sequential manner increases the level of difficulty. The teacher who is keen to ensure that his teaching is effective takes this step slowly and does not rush. The step of carefully selecting mathematics curricula is important and it brings future benefits to the quality of life of individuals and different groups (Maguvhe, 2023).

Study Problem:

The issue of training teachers before and after service is one of the important and decisive issues in various fields. Through it, the field of education is provided with various trends and contemporary issues in the field of specialization. This in turn is reflected in the future through raising the quality of life of individuals with disabilities. Significantly, teacher preparation and continuous training on modern developments and his specialization occupy a prominent and priority place in developing human thought in all scientific and practical fields (Natasha, 2019).

Among the skills of an effective teacher, which various pre-service and in-service training programs focus on, is the issue of providing him with cognitive and practical skills related to choosing the appropriate curriculum that suits the needs of the students. When addressing the issue of choosing mathematics curricula and methods of teaching them, we find general agreement among educational circles that it is one of the most difficult issues for many teachers. In this respect, choosing a curriculum that is characterized by coherence and the interconnection of ideas with each other in a sequential

manner makes the matter more difficult for teachers. The teacher who is keen to make his teaching effective takes his time and does not rush at this stage. Thus, the step of carefully selecting mathematics curricula is important and brings future benefits to the quality of life of individuals, groups, and countries (Cancio, 2018).

In this respect, mathematics is no longer just a science taught within the walls of schools and universities. Rather, it has a direct and major impact on many sectors. Mastering calculation skills at all levels gives people a greater ability to make many personal and professional decisions based on a solid scientific basis and in a logical manner. After completing the diagnosis and analysis of the students' performance, the teacher begins setting educational goals and methods that lead to achieving them.

It is known that there is no single strategy or method for teaching calculation skills. Recently, there has been increasing research interest in the topic of teaching mathematics and effective calculation skills to students with disabilities in general, and students with specific learning disorders in particular (Stedly, 2008).

With these contemporary trends in teaching students with specific learning disorders, and this huge amount of strategies supported by the results of scientific research, the problem of the current research is represented in determining the degree to which resource room teachers in public schools in Amman possess the necessary cognitive competencies related to strategies for teaching calculation skills based on the results of scientific research in light of a number of changes. Therefore, this study seeks to answer the following questions:

- 1- What is the degree to which resource room teachers in public schools in Amman have the cognitive competencies related to strategies for teaching calculation skills based on the results of scientific research?

- 2- Are there statistically significant differences in resource room teachers' use of calculation teaching strategies due to the variables of (after-service training and the level of teachers' academic qualifications)?

Study objectives:

Therefore, it is an endeavor to achieve the following:

- 1- Identifying the teaching strategies used by resource room teachers to teach students with specific learning difficulties in calculation skills.
- 2- Determining the degree of teachers' familiarity with the teaching strategies used to teach students with learning difficulties the calculation skills developed by scientific research, regardless of academic qualifications and post-service training.
- 3- Providing teachers in the field of special education with the most prominent modern strategies recently suggested by scientific research.

Significance:

The practical and scientific importance of this study was as follows:

Scientific novelty:

- 1- This study addresses an important topic in contemporary special education which is viewed by literature as one of the important axes that ensure the provision of good quality services to students with disabilities. The topic is represented in teaching students with disabilities in a manner consistent with modern trends.
- 2- This study benefits teachers of students with learning difficulties by identifying the most prominent modern teaching methods used to teach their students arithmetic skills based on the results of scientific research.
- 3- This study provides decision-makers and researchers with information that allows them to conduct studies that evaluate the feasibility of the methods currently used.

Practical importance

- 1- Providing decision-makers in the Ministry of Education with the necessary information about the process of re-planning and restructuring appropriate training programs for teachers, based on the results of modern scientific research to reduce the existing gap between the results of scientific research and the practices in the field.
- 2- Urging students who are studying at universities and community colleges, and who are future teachers, to be trained in the mechanisms and methods of research and interpretation of the results of studies in order to acquire the most prominent modern knowledge and practice in their field of work.

Terminological and procedural definitions

- 1- **Training and preparation programs for special education teachers:** This term refers to every organized and planned program that enables teachers to develop in the educational profession by obtaining more cultural and behavioral experiences, and everything that would raise the level of the teaching and learning process and increase the productive energies of teachers. Therefore, training must have a prior plan and take place within a cooperative group framework and in accordance with a clear philosophy, an informed strategy, and specific goals (Al-Qamsh, & Al-Saaida, 2019). In this study, the training and preparation programs for special education teachers mean those programs that the teacher joins before and after service, and which are organized inside or outside universities, and whose goal is to raise the level of knowledge of teachers of learning difficulties with teaching strategies based on scientific evidence in teaching calculation skills to their students.

- 2- **Dyscalculia disorder:** It is a special type of specific learning difficulty resulting from a simple brain disorder. These difficulties are not limited to understanding numbers or what is known as comprehending the meaning of numbers and arithmetic facts. Students who have difficulties in mathematics may also face problems and difficulties in learning the concepts of time, measurement, and relationships (Butterworth, 2010). In this study, dyscalculia disorder denotes those difficulties in learning various calculation skills at all levels, which limit the student's ability to learn the syllabus using traditional methods and strategies in education, and require teachers to use strategies and methods scientifically and practically proven for their effectiveness in teaching various calculation skills.
- 3- **Teaching strategies:** The activities that are designed and implemented to bring change in student behavior” (Puri, 2006, 13). Sadaqa (2000) defined it as “a set of organizational arrangements and procedures, which the teacher chooses in light of principles and hypotheses in a way that is compatible with the structure of the educational material and the needs of the students, to achieve the intended educational goals in the educational situation and within a specific time.” In this study, what is meant is all the organized procedures that proceed according to specific steps and all the educational and teaching methods that the teacher uses in teaching students with learning difficulties the reading, writing, and arithmetic skills, which were collected from special education research, and included in the score achieved for answering the measurement tool.

Limitations of the study

- 1- **Data collection tool:** One of the survey tools was prepared to answer the study questions, which is the questionnaire. This tool is designed to know the personal tendencies and views of the respondents.

- 2- **Population:** The study was applied to resource room teachers working in government schools in Amman that contain resource rooms. The results of the study were approved based on the representativeness of the sample members, and the objectivity and accuracy of their responses to the study tool.
- 3- **The place limitation:** The study was applied in the city of Amman, Jordan.

Literature Review:

The theoretical framework:

The teacher is the primary factor in bringing about appropriate development in all aspects of the educational process. Since any educational effort aimed at reform and development cannot underestimate the importance of the teacher's role in directing and developing the educational process. Therefore, effective teacher preparation procedures are among the most important measures to raise the efficiency of the educational process at all levels and stages of teaching. The process of teacher preparation and continuous training has occupied a prominent place and is considered one of the priorities for developing educational thought in most countries of the world. Therefore, it is necessary to pay attention to the necessity of planning training programs based on the actual needs of teachers and students and planning the necessary training programs. Criteria must also be set for selecting a special education teacher so that he has personal and professional characteristics that lead him to success in this profession (Rusznyak, Walton, 2017).

The programs for preparing teachers working in the field of special education are varied. The first type is concerned with pre-service training programs, which is intended to train and qualify teachers while they are studying in various scientific institutes and at all academic levels, starting from the

intermediate diploma level until graduate studies. The second type of teacher preparation programs is in-service training programs, which is any activity carried out by the teacher after he engages in teaching. This keeps teachers informed of educational innovations and developments. One of the most important goals of in-service teacher training is to develop his teaching skills and familiarize him with modern methods in his profession (Yahya, 2020).

One of the tasks of an effective teacher is to possess the cognitive and practical skills in choosing the appropriate curriculum that suits the needs of the students. When addressing the issue of choosing mathematics curricula and methods of teaching it, we find general agreement among educational circles that it is one of the most troubling issues for many teachers. Choosing a curriculum that is characterized by coherence and the interconnection of its ideas with each other in a sequential manner increases the level of difficulty. The teacher who is keen to ensure that his teaching is effective takes this step slowly and does not rush. The step of carefully selecting mathematics curricula is important and it brings future benefits to the quality of life of individuals and different groups (Maguvhe, 2023).

Mathematics is no longer just a science taught at schools and universities. Rather, it directly and fundamentally affects many sectors, such as business, finance, health, and law. In this respect, mastering mathematical skills opens up opportunities for students to join a number of different professions. Mastering mathematical skills at all levels gives individuals a greater opportunity to make many personal and professional decisions based on a solid scientific basis. To achieve the goals and objectives of teaching mathematics, many countries of the world adopt five main areas of mathematical knowledge, starting with the field of numbers and numerical sense of numbers and ending with the field of data management and probability (Al-Nawashi, 2010).

In this respect, the term (Specific Learning Disorder, SLD) is introduced as one of the modern scientific terms recommended by contemporary disability science literature. This term is considered an extension of a previous term that appeared in the sixties of the last century among specialists in the field of psychology and special education, which is the term (learning disability). Aside from the classifications of Specific Learning Disorder (SLD), the criterion for inability to use or acquire mathematical skills - dyscalculia disorder - is that this inability lasts for a minimum of six months with the provision of all forms of support, training and therapeutic interventions aimed at raising the level of performance. The student faces (Specific Learning Disorder, SLD) according to the Diagnostic and Statistical Manual of Mental Disorders, DSM (Mammarella,, et al., 2021).

Dyscalculia, or so-called math disability, is a severe type of difficulty in mathematics. It is a special type of specific learning disability, and it results from a simple brain disorder. These difficulties are not limited to understanding numbers or what is known as comprehending the meaning of numbers and arithmetic facts, as students who have difficulties in mathematics may also face problems and difficulties in learning the concepts of time, measurement, and spatial relationships (Butterworth, 2010).

The US National Center for Learning Disabilities (2006) defines dyscalculia as a term that refers to a wide range of disorders in the field of mathematics. In this respect, dyscalculia is not one form, but rather several forms, as difficulties differ from one person to another, and their impact also varies from one person to another. When dealing with the issue of the causes of mathematics difficulties, we find that they are not entirely clear, although a

number of studies have indicated some proposed causes of dyscalculia, such as neurological causes, weakness in working memory, and congenital disorders, as well as difficulties in learning effective calculation strategies resulting from poor attention span for a sufficient period and lack of perseverance in solving verbal calculation problems (Khadijah, & Neelkamal, 2022).

Logically, after completing the diagnosis and analysis of the students' performance, the teacher begins setting educational goals and methods that lead to achieving them. Significantly, there is no single way to teach mathematics. A competent teacher can benefit from several methods and select from them what suits the students' individual learning model. Regardless of the method, the individual mathematics plan must be directed towards developing calculation skills, mathematical understanding, logical thinking, and solving calculation problems. Thus, it includes various areas of mathematics (Al-Waqfi, 2009).

Recently, there has been significant research interest in the topic of effective mathematics teaching to students with special needs in general, and students with specific learning difficulties in particular (Steadly, et al., 2008). In general, there are many principles and methods through which the teacher can teach students basic calculation concepts and skills, which are described as follows: (1) Developing readiness to learn mathematical skills and operations, (2) moving from the tangible to the physical, (3) teaching calculation, (4) teaching rules, (5) training students to generalize the learned skills, (6) providing sufficient opportunities for students to practice and review, (7) developing problem-solving skills, (8) monitoring progress and providing feedback, (9) developing a positive attitude towards calculation (Al-Khatib, 2013).

In this respect, the theoretical literature and related studies show a great number of strategies and teaching methods that have been proven effective in improving student achievement. We must realize that the reason for this difference in strategies is due to the diversity of theoretical models in the field of psychology, as each theory came with specific thought, philosophy, and specific information about the educational process and its educational objectives and teaching strategies.

Despite the growing interest in the field of calculation problem solving by researchers, practitioners, and students themselves, students with learning difficulties have had to continue the struggle to overcome difficulties in remembering, developing processing speed, and identifying the correct calculation procedures (Krawec, et al., 2001). In this respect, the use of technology in teaching mathematics has contributed many benefits in the field of teaching mathematics. Although most computer programs and applications were not designed specifically for students with learning difficulties, their effectiveness has recently been proven. In this regard, computer applications are an effective means of motivating students, as well as providing students with sufficient time to repeat and practice different tasks according to the students' abilities, while providing corrective feedback about their performance.

One of the contemporary strategies is mental calculation strategies that have proven effective in teaching students calculation skills. It is one of the cognitive and metacognitive strategies that is based on using the student's mental imaginative abilities to solve many calculation problems according to mental imaginative training that the student mentally imagines in his imagination. Based on the calculation problem given to him, he increases the numbers according to a specific reason until he reaches the final result of the problem (Yunus, 2023).

Previous studies:

Through research, The researcher found a studies related to the topic of the current study:

Feng and Sass (2013) conducted a study which aimed to reveal the impact of preparing and formal and informal training pre-service and in-service special education teachers on enhancing the academic achievement of students with special needs. To achieve the study objectives, 5 year-longitudinal data for each student, “value-added” models and records were used to estimate their achievement. Moreover, the study results showed that there is less support to implement in-service professional development courses that focus on special education. The results also indicated that there were statistically significant positive effects of preparing special education teachers before and during service as well as formal and informal training on enhancing the achievement of students with special needs, especially in reading skill.

Another study of Feng and Sass (2013) was conducted that aimed to reveal the impact of the academic qualifications of special education teachers on their performance and enhancing the academic achievement of students with special needs. To achieve the objectives of the study, a database of teachers and students was used at the state level of Florida. The results of the study showed that teachers with higher academic degrees are more effective in enhancing the achievement of students with disabilities in mathematics than those who hold a bachelor’s degree. The results of the study also indicated that there is a positive relationship between the performance of special education teachers, academic qualifications, and university specialization in special education.

Tzivinikou (2015) also conducted a study aimed to determine the impact of a 6-month in-service training program in the context of continuing professional development for special education teachers on educational practice. To achieve the objectives of the study, a training program was designed that aims to improve teachers' teaching skills and enrich their practices with the most effective strategies and the latest results extracted from research evidence in order to increase the quality of their educational interventions for teachers. Students with special educational needs. The sample consisted of (30) special education teachers, divided into 15 pairs, each pair working in the same school and sharing the responsibility for educational support for a student who suffers from learning difficulties. The results showed that the training program has a positive impact on teachers' self-efficacy and their effectiveness toward cooperative educational interventions for students with special needs.

Furthermore, Louw and Mofolo-Mbokane (2019) conducted a study that aimed to identify the role of teaching strategies used by mathematics teachers and their perspectives in facilitating learning mathematics for students with learning difficulties. To achieve the objectives of the study, this study relied on the observational approach and open-ended post-questionnaires. The study sample consisted of four primary school teachers. The results of the study showed that among all five teaching strategies (authentic context, building meaningful connections, abstract concrete sequencing, problem solving, and scaffolding), all teachers tend to use scaffolding, and prefer to use explicit instructions. Teachers who used a problem-solving strategy consistently guided their students. The results of the study also found that teachers used real and tangible objects when delivering lessons. The results of the study also showed that the most experienced teachers used most teaching strategies successfully.

Goktas and Yazici (2020) conducted A study was aimed to reveal the effect of teaching problem-solving strategies applied during mathematics class to students with mild intellectual disabilities on their success. To achieve the objectives of the study, this study relied on a qualitative research approach through the use of educational experience. The sample consisted of three high school students from special education schools, who were selected using the control sample method. The results showed that teaching problem-solving strategies to students with mild mental disabilities improves their mathematical problem-solving skills.

Gul, et al. (2021) conducted a study that aimed to identify the impact of professional development on teachers' educational practices due to the variables of gender and academic qualification. A self-survey was used to collect data. The study sample consisted of (205) special education teachers. The results showed that there was no effect of the variables of gender and educational qualification on the educational practices of special education teachers. The results also indicated that there is a direct relationship between teachers' professional development and pedagogical practices in special education.

Polo-Blanco and Gonzalez (2021) conducted a study that aimed to examine the effect of direct education on addition strategies, and to analyze the difficulties that appear during this process. To achieve the study objectives, an adapted multiple-probe design across students using a microgenetic approach was used to evaluate the effectiveness of the direct instruction and acquisition of minimal addition strategy. The sample consisted of (3) children in the primary stage (two boys and a girl) who Diagnosers with learning difficulties. One of them was diagnosed with Autism Spectrum Disorder. The results showed that all three participants

were able to obtain the minimum addition strategy and move to the two-step problems. This indicates the effectiveness of direct instruction in children's acquisition of the minimal addition strategy. They all showed difficulties during the educational process, and difficulties with quantitative comparison were the most common.

Filiz and Gunes (2023) carried out a study that aimed to support the learning of mathematics for primary school students with learning difficulties in out-of-school learning environments through artistic or sports activities. To achieve the study objectives, the researchers adopted the case study approach through forming activities in four educational areas (numbers, geometry, measurement, and data processing), which prepared for students with learning difficulties, for four days during the school holidays. The study sample consisted of (24) students with learning difficulties (males and females) in the third and fourth grades of primary school. The study results showed that teaching mathematics using artistic or mathematical activities has a positive impact on the learning of students with learning difficulties.

Comments on previous studies:

It has become obvious that the majority of the previous studies emphasized the importance of using various teaching strategies in the field of teaching different calculation skills to students with learning difficulties, and that among the most important different teaching strategies are problem solving, direct teaching, and using real objects in the class. This was indicated by Louw & Mofolo-Mbokane (Chepkorir, 2020), which emphasized the tendency of teachers to use sensory means, direct teaching, and the use of real, concrete objects when presenting lessons. This aspect was also confirmed by the study carried out by Polo-Blanco and Gonzalez (Jackson, 2010), which indicated the effectiveness of the direct teaching strategy in acquiring the minimum addition strategy for children with learning difficulties.

Some studies also addressed the impact of problem-solving strategies, reviewing previous lessons, making use of homework, and peer teaching on increasing the performance of learners with dyscalculia, as stated in Goktas & Yazici (Suhail, 2020), which indicated that teaching using problem-solving strategies for students with mild intellectual disabilities improve their mathematical problem-solving skills. This agrees with the results of (Polo-Blanco, Gonzalez Lopez, 2021) which showed that there is a shortage of experienced teachers with special needs, and weak cooperation between parents and other staff.

The study of Filiz and Gunes (Kotsopoulos, 2008) investigated the impact of using artistic or sports activities on the learning of students with learning difficulties, which its results indicated that teaching mathematics using artistic or mathematical activities has a positive impact on the learning of students with learning difficulties. Some studies like the study of Feng and Sass (Feng, & Sass, 2013) focused on revealing the impact of special education teachers' academic qualifications on their performance. In this respect, Phytanza & Burhaein (Gul, Jahangir, & Saleem, 2021) also focused on revealing the impact of job tenure, academic qualifications, and work motivation on the performance of special education teachers. The results of these studies confirmed that there is a significant positive impact of the difference in academic qualifications of special needs teachers on their performance.

Other studies addressed the impact of professional development on teachers' educational practices according to the variables of gender and academic qualification, such as Gul, et al. (Al-Diyat, 2014), while others addressed the impact of an in-service training program for special education

teachers on educational practice, such as Tzivinikou (Louw, & Mofolo-Mbokane, 2019) and Suhail (Filiz, & Gunes, 2023). Contrastingly, Al-Taj and Al-Oweidi (Goktas, & Yazici, 2020) discussed the impact of a training program on improving the skills of first-grade teachers in dealing with students with special needs in regular classes.

Significantly, the researcher noted that these studies addressed some issues related to the current study. However, they did not address measuring the extent to which resource room teacher's public schools possess the cognitive competencies of the most prominent developments reached by scientific research in the field of teaching various calculation skills to students with a specific learning disorder in light of a number of variables such as the after-service training for teachers, and the level of academic qualification.

Although there is no direct similarity or correspondence between the axes addressed in previous studies and the subject of the current study, there is a convergence, albeit partial, in some axes, which benefited the researcher in designing the study tool. In commenting on the results revealed by the current study and comparing it to previous studies, the current study differs from these studies in that it dealt with measuring the extent to which resource room teachers in Amman public schools possess cognitive competencies in the field of teaching various calculation skills to students with a specific learning disorder in light of a number of variables, such as the after-service training for teachers and the academic qualification level. This has not been addressed by previous studies, whether in a foreign or Arab environment. In addition, the current study sheds light on the issue of preparing and training teachers before and after service, which is considered one of the contemporary issues in the field of special education. Through it, special education is provided with various practices with scientific and practical credibility that raise the efficiency of teachers on the one hand and the level of performance of their students with disabilities on the other hand.

Methodology:

The descriptive survey method was used. In this respect, a questionnaire was designed to measure the degree to which resource room teachers in government schools in Amman possess the cognitive competencies related to strategies for teaching various calculation skills according to a number of variables such as the after-service training and the variable of different academic levels of teachers.

Population:

The population included (153) teachers (males and females) in resource room in Amman, according to statistics from the Special Education Unit of the Jordanian Ministry of Education for the year (2015/2017).

The study sample:

The researcher adopted the non-probability sampling, to the small number of due members of the study population, and Table No. 1 represents the distribution of the study sample members among Amman education directorates. as in table (1) below.

Table (1)
Distribution of the study sample members

No.	Region	Number
1	Kasbah Amman	37
2	University Brigade	22
3	Qweismeh Brigade	32
4	Sahab Brigade	9
5	Marka Brigade	32
6	Wadi Al-Seer Brigade	8
7	Naour Brigade	10
The total number of sample members		150

Table (2) shows the distribution of the study sample members according to the variables of educational qualification and training.

Table (2)
Distribution of the sample members according to their qualification and training

Variables	Category	No.	Percentage	Total
Qualification	Bachelor's degree	100	%66.6	100%
	Higher than	50	%33,3	
Training	Yes (Trained)	97	%64,6	100%
	No (Not trained)	53	%33.3	
Total		150		

Study tools:

A questionnaire was designed with the aim to identify the degree to which resource room teachers in public schools in Amman possess sufficient cognitive competencies related to strategies for teaching calculation skills. It was developed based on several previous studies such as Louw & Mofolo-Mbokane (Chepkorir, 2020), Goktas & Yazici (Suhail, 2020) and Filiz & Gunes (Kotsopoulos, 2008). The first scale, in its initial form, consisted of (22) items, and a three-way Likert scale (high degree of application, moderate degree of application, low degree of application) was used to measure the scores.

Validity of the tool:

After structuring the questionnaire in its initial form, it was presented to (10) experienced and specialized arbitrators, with the aim of ensuring the clarity and soundness of the wording of the paragraphs and the extent of their suitability to measure what they were designed for, and to make any modification; deleting, adding or moving from one field to another. Modifications were made according to the comments unanimously agreed

upon by 80% of the arbitrators. Thus, the study tool in its final form consisted of (22) items, as a number of grammatical and linguistic modifications were made to these items (6, 4, 3, 17, 22).

Construct validity:

The researcher applied the study tool (the questionnaire) to an exploratory sample of (30) teachers (males and females), from outside the study sample, with the aim of verifying the correlation of the questionnaire items with the overall grade. The Pearson correlation coefficient was calculated for the survey sample members' estimates of the tool's items and their total scores. Two criteria were adopted to maintain the item; the presence of statistical significance for the item's correlation with the tool's total score, and the value of the item's correlation coefficient with the total score for the field to which it belongs, or with a total score of (20%) for the tool. The values of the correlation coefficient of the item's score with the field to which it belongs were as shown in Table (3) as follows:

Table (3)

Pearson correlation coefficient between the score on the item and the field to which it belongs

Item No.	Correlation coefficient	Item No.	Correlation coefficient	Item No.	Correlation coefficient
1	0.848**	10	0.732**	19	0.777**
2	0.877**	11	0.847**	20	0.867**
3	0.851**	12	0.737**	21	0.798**
4	0.851**	13	0.417**	22	0.470**
5	0.859**	14	0.666**		
6	0.832**	15	0.796**		
7	0.735**	16	0.859**		
8	0.827**	17	0.650**		
9	0.799**	18	0.368*		

**Statistically significant at $\alpha \leq 0.01$

*Statistically significant at $\alpha \leq 0.01$

The values of the correlation coefficient between the score of the item and the field to which it belongs indicate that all items have a strong, significant correlation, as the correlation rates ranged between (0.368 - 0.877).

Table (4) below shows the values of the correlation coefficient between the item score and the total score of the study tool:

Table (4)

Pearson correlation coefficient between the score on the item and the total score of the study tool, distributed according to fields

Item No.	Correlation coefficient	Item No.	Correlation coefficient	Item No.	Correlation coefficient
1	0.782**	10	0.703**	19	0.709**
2	0.805**	11	0.795**	20	0.769**
3	0.744**	12	0.717**	21	0.747**
4	0.782**	13	0.343*	22	0.442**
5	0.773**	14	0.666**		
6	0.801**	15	0.796**		
7	0.669**	16	0.813**		
8	0.732**	17	0.577**		
9	0.725**	18	0.425**		

**Statistically significant at $\alpha \leq 0.01$

*Statistically significant at $\alpha \leq 0.01$

The values of the correlation coefficient between the item score and the total score of the study tool indicate a positive and strong correlation, as the Pearson correlation coefficient values ranged between (0.343* - 0.813).

The Pearson correlation coefficient values presented in Tables (3, 4) between the item score and the score of the field to which it belongs, on the one hand, and between the item score and the total score of the study tool, indicate that the study tool has constructive validity.

Tool stability:

The stability of the study tool was verified in three ways. First, the Stability Coefficient was calculated using the Test-Retest method. The study tool was applied to a survey sample of (30) teachers (male and female) from outside the study sample, and then it was re-applied to them again two weeks after the first application. The Pearson correlation coefficient was calculated between their average rating on the study tool between the first application and the second application. Second, the Internal Consistency Coefficient was calculated using the Cronbach Alpha equation, while the third method relates to estimating the reliability coefficient using the split-half/Spearman-Brown method. Table (5) shows the reliability coefficient values extracted using the three methods for the main areas that make up the study tool.

Table (5)

Reliability coefficient values extracted using the three methods for the main areas that make up the study tool

Field	Number of items	Pearson correlation coefficient	Cronbach's alpha internal consistency coefficient	Spearman-Brown reliability coefficient
Mathematics teaching strategies	22	0.877**	0.957	0.930

The reliability coefficient values for the three methods presented in Table (5) indicate that the study tool has high reliability, and that they are sufficient and acceptable values to achieve the objectives of the current study.

Tool correction method:

The degree of the scale that was designed to measure the extent to which resource room teachers in Amman possessed the cognitive competencies related to strategies for teaching calculation skills based on scientific evidence was categorized according to three ratings: (low, medium, and high), which are ratings of the Likert scale. The averages of the sample's answers for each item were extracted according to the following equation: Category length = upper limit of alternatives - lower limit of alternatives / number of levels. Accordingly, the category length for the first scale = $(3-1/3) = 0.67$. Therefore, the limits of the three levels are as follows: (1) The arithmetic mean, which falls between (1.67-1), indicates a low degree of application and direction. (2) The arithmetic mean, which falls between (2.35-1.68), indicates an average degree of application and direction. (3) The arithmetic mean, which falls between (2.36 -3), indicates a high degree of application and direction.

Study variables:**The study included the following variables:**

- a) The independent variables, including:
 - 1- Academic qualification, which has two levels: (Bachelor's degree or below, and higher than Bachelor's degree)
 - 2- Training: yes (trained) and no (not trained).
- b) Dependent variables, including: resource room teachers' possession of cognitive competencies related to strategies for teaching numeracy skills based on the results of scientific evidence.

Statistical Analysis:

The analysis of the data was based on the Statistical Package for the Social Sciences (SPSS) program, and was processed according to the following statistical methods: (1) Using simple descriptive statistical methods: frequencies, percentages, arithmetic means, and standard deviations. (2) Multiple analysis of variance (MANOVA) to examine whether there are differences between the average responses of the study sample due to its variables.

Results and discussion

Below is a presentation of the results and their discussion according to the sequence of the study questions:

- Results related to the first question, which states: “What is the degree to which resource room teachers in public schools in Amman have the cognitive competencies related to strategies for teaching calculation skills based on the results of scientific research?”

Arithmetic means, standard deviations, and relative importance of the average response of the study sample to the scale items were calculated, and Table No. (6) shows this:

**Table (6).
Arithmetic means, standard deviations, and relative importance
of the study sample’s estimates on the scale items (n=170)**

No.	Item	Arithmetic mean	Standard deviation	Relative importance
7	I encourage students to follow the necessary steps to solve problems appropriately.	2.7470	0.53361	91.5%
20	I monitor students' performance and monitor their progress and mastery of various calculation skills.	2.7117	0.55935	90.3%
21	I use examples from students' real lives to teach them various calculating skills.	2.7117	0.54866	90.3%

No.	Item	Arithmetic mean	Standard deviation	Relative importance
3	I educate students on various calculation concepts (such as the concept of addition, subtraction, and other concepts)	2.7001	0.53126	90.1%
2	In teaching various calculation concepts, I rely on following a sequential approach in providing information from the tangible to the semi-observable, all the way to the abstract.	2.7001	0.53126	90.1%
1	I do not limit my training to simple mathematical concepts and skills, but rather I extend them to complex ones, such as comparisons and concepts related to space, time, heat, and cold.	2.6940	0.52224	89.7%
6	I provide many opportunities to review the educational material by providing different exercises and worksheets.	2.6881	0.54652	89.5%
10	During my teaching, I determine the current performance level of each student, then sequentially train him in various calculation skills, and in the process I relate this information to the student's various prior knowledge.	2.6528	0.59843	88.3%
8	I follow and monitor students' progress and provide them with continuous feedback on their current level of performance.	2.6470	0.58996	88.1%
9	I develop positive attitudes among students towards mathematics and various mathematical concepts.	2.6293	0.58406	87.5%
11	I set my teaching goals in a sequential manner, with continuous monitoring of my students' progress, while providing an atmosphere full of constructive interaction towards the teaching skill, with a sequential transition to the more difficult calculation skills.	2.6293	0.62327	87.5%
5	I diversify the methods of presenting the material so that the student can generalize different calculation skills to different life situations.	2.5940	0.60075	86.4%
16	To teach various mathematical skills and verbal calculation problems, I employ different forms of visual aids and media, such as pictures, charts, and other means.	2.5823	0.64057	86.0%

No.	Item	Arithmetic mean	Standard deviation	Relative importance
19	I take into account the differences among students regarding the time allocated to performing various calculation activities.	2.5705	0.66015	85.6%
14	I use simple, familiar language to guide students in following the steps necessary to solve various calculation problems.	2.5587	0.69618	85.2%
15	I follow the think-aloud strategy to train students to model the steps to solve calculation problems	2.5528	0.69666	85.0%
4	I provide students with calculation rules that make it easier for them to perform various calculation problems quickly and easily (such as knowing that 2×4 equals 4×2) (the reciprocal rule for solving various calculation problems)	2.5352	0.63566	84.4%
17	I train students to be thoughtful and deliberate when solving various calculation problems by following the same steps and skills that were applied with previous calculation problems.	2.4587	0.72246	82.1%
12	I encourage students to pay attention to the educational process, monitor their progress, and train them to ask themselves leading questions that direct them toward the correct answer on their own.	2.4234	0.71956	80.7%
13	I encourage forms of cooperation among students by allowing one student to train and teach another colleague on various mathematical skills, but under my continuous supervision and guidance.	2.3175	0.75700	77.2%
22	I provide students with steps that help them solve various calculation problems	2.3175	0.76477	77.2%
18	I use technology while teaching various calculation skills, such as educational videos, graphs, and various applications that enhance learning various calculation skills.	2.0352	0.84890	67.7%
Total score (Mathematics teaching strategies)		2,5662	0,47982	85,1 %

The results presented in Table No. (4) indicate that the average rating of the study sample, from their point of view, on the scale items is (2.5663), with a standard deviation estimated at (0.47982) and a relative importance of (85.1%). This high result of the study sample's estimates on the scale items as a whole can be explained as stemming from their awareness of the importance of teaching calculation skills to their students and their complete conviction that mathematics is not just a science taught at schools and universities, but has become a basic and major requirement in many sectors. In this regard, mastering calculation skills opens up more opportunities for students to integrate into various aspects of life, as it increases their chances of independence and prepares them for various future professions. Significantly, mastering mathematical skills at all levels gives strength to various personal and professional decisions made by individuals, as these decisions are characterized by being based on a solid scientific basis.

The benefits of teaching calculation skills are not limited to the level of individuals and small groups, but their benefits extend beyond the level of the country as a whole. At the state level, learning calculation skills gives countries a broader scope for economic competition and participation in shaping the state's national and regional future. In this context, we highlight the characteristics of an effective teacher in teaching various calculation skills. The effective teacher here is the teacher who has a broader view of the requirements of future life, based on which he prepares his various plans to be in line with the developments of the era and its requirements. This in turn enables him to provide students with those skills that improve the quality of their future lives. When the teacher of students with disabilities in particular and the teacher of ordinary students in general begins to build

their various plans, these plans must be characterized by keeping pace with the developments related to the teaching curriculum, strategies and modern methods that help them achieve their ultimate goal, which is to prepare students who are empowered in various functional calculation fields, starting with numerical sense of numbers, ending with data management skills and arithmetic probability.

This was indicated by Furaihi (Mammarella, et al., 2021) when he described the field of mathematics as the key to successful future opportunities for everyone. This field is no longer just a science taught in various schools, institutes and universities, but rather it has become one of the fields that contributes directly to many sectors. Therefore, mastering mathematical tasks opens up opportunities for students to join many different jobs and make many personal and life decisions based on knowledge. And with the developments in various social media applications and the availability of free courses and books on search engines, it has made it easier for teachers to easily enrol and learn various of these strategies and methods. Which makes it easier for them to teach mathematical and arithmetic concepts.

When analyzing the scale's items, the item "I encourage students to follow the necessary steps to solve problems appropriately" ranked first with a mean of (2.7470) and relative importance of (91.5%). This result is explained by teachers' awareness of the importance of mathematical problem-solving skills at the present time. Every day, we are exposed to many situations that require us to use many problem-solving skills. This was also indicated by (Al-Diyat, 2014), which aimed to know the effect of the calculation problem-solving strategy to improve students' achievement in

verbal calculation problems, especially those who suffer from difficulty in mathematics, the results of which resulted in the students having shown noticeable progress in their ability to solve calculation problems.

On the other hand, the item “I use technology while teaching various calculation skills, such as educational videos, graphs, and various applications that enhance learning various calculation skills,” came in the last place with a mean of (2.0352) and a relative importance of (67.7%). This low result is explained in two ways. The first aspect relates to the type of schools that made up the study sample, as they are all public schools which are affiliated with the Jordanian Ministry of Education and its affiliated directorates suffer from a lack of resources available and allocated by the Ministry for such technological equipment necessary for teaching, not to mention that teachers do not possess the practical competencies necessary to use these various technologies in education. Although it is considered one of the most effective methods for acquiring various skills, because of its attractive nature, it provides many opportunities for students to learn at different times, with the possibility of self-learning and repeating the lesson again when needed.

This is indicated by many studies, such as Jackson (2010), which recommended the use of various types of technical means to develop the calculation skills of students with dyscalculia. The study also pointed to the effectiveness of the educational video that explains the steps for solving various calculation problems in conjunction with the software that provides self-learning opportunities for various calculation skills.

The answer to the second question: “Are there statistically significant differences in resource room teachers’ use of calculation teaching strategies

due to the variables (after-service training for teachers, and the level of academic qualifications for teachers)?” The researcher examined the effect of each variable separately by calculating the arithmetic means and standard deviations of the sample estimates. To reveal the statistically significant effects of the estimates of resource room teachers’ possession of the cognitive competencies related to the strategies for teaching arithmetic, statistical treatment related to multiple analysis of variance (MANOVA) was used to reveal that effect on the variables of the study, as shown in Tables No. (7 and 8), respectively :

Table (7)

Arithmetic means and standard deviations of the study sample estimates according to their variables

Variables	Variable levels	No.	Arithmetic means	Standard deviation
Training	Yes	97	2.6706	0.40820
	No.	93	2.4278	0.53305
Qualification	Bachelor’s degree or less	105	2.5675	0.50803
	Higher than Bachelor’s degree	65	2.7259	0.38300

Table (8)

Training variable and the level of academic qualification of teachers

Variables	Statistics used (Wilks Lambda)	F- alue	Statistical significance
After-service training	0.812	11.515	0.001
Qualification	0.913	12.632	0.000

Table No. (5) above includes the arithmetic means and standard deviations of the study sample's estimates for the areas of strategies for teaching calculation skills used according to the study variables. It was noted that the teachers who received post-service training obtained the highest arithmetic mean (2.6706) in the total score, while the teachers who did not receive any post-service training obtained the arithmetic mean (2.4278). Apart from this, teachers who hold a degree higher than a bachelor's degree obtained the highest arithmetic mean of (2.5675) in the total score, while teachers who hold a bachelor's degree or less obtained the arithmetic mean of (2.7259).

To detect statistically significant effects on estimates of resource room teachers' application of strategies for teaching calculation skills, multiple analysis of variance (MANOVA) was used to detect these effects according to the variables of the study, as shown in Table No. (6) above, which reveals that each of the variables has an effect at the significance level ($\alpha = 0.05$) on the strategies used by teachers in the resource room.

Significantly, teachers who received post-service training on various strategies for teaching calculation skills had more use of them than teachers who did not receive any form of post-service training. This result agreed with Tzivinikou (Louw, & Mofolo-Mbokan, 2019) who indicated that professional training for special education teachers after service has an effective and direct impact on improving their teaching practices, and has had a positive impact on teachers' self-efficacy. Teachers are provided with all the new strategies and teaching methods that enhance their teaching abilities and has a significant and positive impact on the performance of their students. This study also agreed with the results of Kotsopoulos,

(2008), which showed that the quality of teacher training institutions and the amount of training they undergo are among the most important characteristics that play a direct role in the achievement of students with learning difficulties.

Apart from this, teachers who hold a university degree higher than a bachelor's degree use such strategies more than teachers who hold a bachelor's degree or less. This confirms the current situation in university preparation for special education. Teachers are trained on the competencies of working with students with disabilities in general, as it is general, non-specific and inaccurate training for disabilities.

One of the ways through which a teacher can acquire knowledge is through progression in university preparation, such as obtaining a higher diploma with a specific disability or studying for a master's degree or doctorate in a branch of knowledge specialized with one of the disabilities. This is consistent with Edmonds (Otsopoulos, 2008), who confirmed that the qualification and university achievement of teachers are among the factors that can most predict the future achievement of their students with specific learning difficulties. Therefore, a teacher with comprehensive scientific qualifications can take all effective, thoughtful measures and steps based on scientific evidence when teaching his students. This gives students clear study instructions that enable them to succeed and achieve all their educational goals. The results of this study differed from Suhail (Filiz, & Gunes, 2023), which showed that there were no differences due to the influence of gender, academic qualification, or years of teaching experience due to any form of post-service training.

Recommendations:

- Conducting further studies on larger numbers of teachers in different schools, including the private and governmental sectors.
- Conducting studies that evaluate the feasibility of strategies and methods currently used in teaching.
- Conducting studies on resource room equipment, programs and technological devices appropriate for teaching students.

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