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METHODOLOGICAL FEATURES OF WORKING WITH STUDENTS WITH SPECIAL EDUCATIONAL NEEDS IN TEACHING MATHEMATICS IN GENERAL SECONDARY SCHOOLS

Abstract: Inclusive education requires a dynamic and flexible approach to meet the diverse needs of students with special educational needs (SEN). In Kazakhstan, inclusive education is supported by several legal frameworks, such as the Law on Education, the State Program for the Development of Education (2020–2025), and the National Plan to Ensure the Rights of Persons with Disabilities until 2025. This study explores the methodological features of teaching mathematics to students with SEN in general secondary schools. The research focuses on the development and implementation of teaching strategies tailored to students' specific diagnoses. An experimental program was piloted in three schools in the Karaganda region, involving 87 students (including 19 with SEN) and 14 mathematics teachers. The study applied differentiated instruction, ICT-based teaching methods, and game-based learning approaches. The results demonstrated a 25% increase in academic performance among SEN students and a significant improvement in classroom engagement and motivation. The study highlights effective methodological strategies and provides recommendations for integrating SEN students into mainstream mathematics education.

Keywords: inclusive education, special educational needs, mathematics teaching, ICT tools, individualized education plans, pedagogical methods.

Introduction

Achieving the required outcomes of the state educational standards with students who have special educational needs is a complex process. Therefore, students with special educational needs require the development of individually oriented universal learning activities, which include regulatory, cognitive, and communicative components. These components involve: fostering a positive attitude, sustained motivation towards learning activities, and familiarization with general norms and behavioral rules; understanding and retaining learning goals and objectives, the ability to plan one's actions, implementing self-monitoring and self-assessment, making necessary adjustments, working according to rules and models, and accurately following verbal instructions; the ability to use symbolic and sign tools, and to complete intellectual and personal tasks; organizing and maintaining cooperation with adults and peers.

Using speech tools to resolve various communicative challenges, completing sufficient tasks, constructing statements, and mastering the dialogic form of speech (Abdiganieva, 2020).Example: Consideration of Students with Visual Impairments. When organizing socialization and correction-development processes for students with visual impairments, it is essential to take into account the environment designed specifically for them, including the main problematic structure arising from students' orientation and their interaction with the surrounding environment and creating conditions that ensure a comprehensive approach to correction tools through medical and psycho-pedagogical collaboration, so that the tasks of socialization, compensatory correction, and restorative treatment are interconnected.

The primary objectives for socialization and correction during the pedagogical work phase with students who have visual impairments include activating visual functions and

improving visual acuity by using various mosaics (floor, table, etc.), dominoes, lotto, beads especially for younger children (without overloading those with near vision impairments or with caution); training the retina through exercises with large, brightly colored objects; developing differentiation of primary colors and shades; strengthening the eye muscles, developing oculomotor and tracking functions, and expanding the visual field using tools such as laser pointers; developing stable visual fixation (localization); restoring spatial localization; developing binocular vision; developing stereoscopic vision.

Teaching students with visual impairments requires creating a conducive environment for socialization and visual development. This involves work on decorating reception walls in various ways, selecting visual trainers and didactic materials, and fostering sensory perception (Beyimbetov, 2017).

Visual Training Tools in Wall Decoration for Students with Visual Impairments

When decorating walls, the placement of visual training tools such as diagrams, various thematic paths, and labyrinths can be used as an effective method. This approach helps to exercise the eye muscles, stimulate visual functions, and promote the development of localization, fixation, spatial arrangement, and binocular vision.

An engaging visual method involves the use of glowing wire trainers (used during physical breaks or visual gymnastics). These elements harmonize uniformly with the interior when designed according to thematic or seasonal principles. Objects can be crafted using two-sided colored cardboard appliqué techniques and suspended from the ceiling with threads.

Unfortunately, educational resources specifically designed for students with visual impairments are limited in practice. As a result, teachers often have to rely on teaching aids intended for students with normal vision. Therefore, it is crucial for educators to pay attention to the following parameters when selecting materials:use of colorful images; clear and distinct contours of images; absence of additional unnecessary elements; models used should resemble real objects in shape and color pattern.

Among the researchers dedicated to working with students who require special education are Edi Supriyadi and M.E. Abdiganieva (Birzhanova, 2023; Dzheksenbeva, 2020).

Research Methods

The methodological framework of this study was designed to ensure a systematic and evidence-based approach to improving mathematics instruction for students with SEN.

The educational environment is a set of factors formed by the way of life within the school: the school's material resources, the organization of the learning process, nutrition, medical care, and the psychological climate.

To change the mode of work, it is recommended to use dynamic breaks during lessons, the duration of which can vary from 2 to 5 minutes depending on the students' fatigue levels. Exercises for physical breaks should include various elements of breathing and finger gymnastics, as well as eye exercises. When performing exercises during class, it is advisable to use methods that do not distract from the lesson's objectives. For example, in mathematics lessons, simultaneous oral counting combined with eye relaxation or the use of motor-auditory analyzers can be implemented. On average, a student can focus on one activity for about 10 minutes, after which attention and interest decline. For students with delayed mental development, this indicator is even lower. This factor should be taken into account by incorporating at least four different activities within one lesson. In a mathematics class, these activities may include: control work, solving examples and equations, tasks on the notebook and blackboard, mental counting, drawing, reading, listening, frontal questioning, oral recitation of rules and theorems, sequential questioning, and others. At the same time, too

frequent changes in activities are ineffective; it is recommended not to use more than six types of activities per lesson (Edi Supriyadi, 2022).

For students requiring special education, the use of ICT (information and communication technology) tools is also possible. For instance, e-learning and ICT-based teaching technologies are critically important tools for implementing inclusive education. To ensure accessibility and quality of education, the use of ICT is vital as it enables high-quality remote interaction among participants within the educational process.

Some analysis of the mathematics teaching process is presented in Table 1.

Table 1.
Analysis Table

No.	Situation	Description
1	In case of visual impairments	The learning process allows information to be received through hearing or tactile channels by applying special modes. To adapt the presented information, system software that enables increasing font size and graphic image dimensions (screen magnifiers) is used, as well as specialized programs that allow adjusting the necessary brightness and contrast of images.
2	Hearing impairment	On one hand, it complicates or completely obstructs a person's ability to perceive auditory information, and on the other, it limits their ability to control their own speech. One approach to developing and improving communication skills through assistive technologies is feedback based on visual sensation. Another approach involves using alternatives to oral communication, such as subtitles. Modern ICT allows teachers to create audiovisual materials with subtitles.

Using ICT as a Didactic Tool in Inclusive Education

The use of ICT as a didactic tool contributes to a shift in attitudes toward the learning process and stimulates the development of new strategies for education and assessment, thereby maximizing students' intellectual and creative potential. Additionally, ICT serves as a means of distance learning to meet the educational needs of students who are unable to attend regular classes in educational institutions.

Alongside the use of available hardware and software, learners achieve positive educational outcomes when utilizing electronic tools directly developed by teachers and those accessible through Internet resources and websites, taking into account the specific educational needs of students (IKPRAO. , 2025).

When developing methodological materials for inclusive education, the following support can assist teachers (see Table 2):

Table 2
Methodological tool

№.	Name	Description
1	Special Child	Electronic library resources (http://www.webcenter.ru/~scdl)
2	Special Childhood	Materials from the book section
3	Website for Parents of Special Needs Children	Information and methodological portal materials (http://edu-open.ru)
4	Adapted Multimedia Modules of the Information and Educational Resources Center	http://fcior.edu.ru
5	Adapted Multimedia Modules of the “Interaction” Center	http://inclusion.vzaimodeystvie.ru/library

Selection of Teaching Approaches and Methods in Inclusive Education

When discussing the selection of teaching approaches and methods in inclusive education, it becomes evident that this is one of the most complex issues within teaching methodology.

A collaborative approach to teaching mathematics is a form of organizing lessons where each student alternates between the roles of learner and instructor. Every participant works for everyone, and everyone works for each participant. One of the methodologies for collaborative learning is A.G. Rivin’s method. This approach involves students independently exploring new material without direct explanation from the teacher. The teacher selects several topics, taking into account that learners should be able to study these topics in any order. Depending on the students' abilities, the number of topics should be limited; the teacher can simplify or complicate the text and divide it into paragraphs. In this case, the text should be optimal for inclusive education and accessible in content.

Each paragraph should contain a complete idea, and the prepared material can be studied either in one lesson or over several consecutive lessons on different days. Each student studies one topic and works according to a specific algorithm. At the initial stage, the learner receives the full text on a specific topic and reads it thoroughly to form a general understanding of the subject matter. Afterwards, the student prepares notes. For visually impaired children, printed templates can be provided (see Table 3).

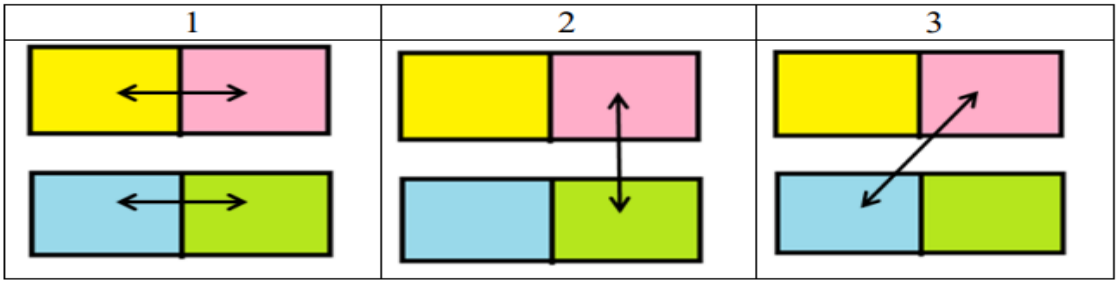
Table 3
Example of Special Worksheets

Date ___			
Topic Title___			
№	"Main idea of the paragraph"	"Key concepts of the paragraph"	Who did you work with?

When selecting teaching methods and approaches in inclusive education, one of the most complex issues arises. Each student is encouraged to find a partner, and learners may be given the freedom to choose their partners. At the initial stage, the teacher should develop an organizational-activity scheme to structure the work, which is then either displayed on the board or distributed in printed form at the workstations.

For example, when four different texts are reviewed in a lesson, an interaction model is employed where students can collaborate in pairs according to the given diagram (see Figure 1). This approach facilitates peer cooperation, promotes active engagement, and helps students navigate the learning material effectively within the inclusive classroom environment.

Figure 1.
Organizational-Activity Diagram



Thus, two students sit side by side, each having their own topic. First, they study the topic of the first student. The first student reads the first paragraph of their text while the second listens attentively. Then, this part of the text is discussed jointly: questions are asked, the meaning and main idea are highlighted, and key concepts are reviewed. Next, the second student writes the conclusions drawn from this paragraph into the first student's notebook and records their surname in the last column. Afterwards, the second student reads the first paragraph of their own topic, with the first student providingassistance. The partners then switch roles. In this way, both partners study the second part of the text and become familiar with two parts of their partner's material.

Alongside ICT tools, game-based technologies also hold significant potential for organizing the learning process in inclusive classrooms. However, the specific nature of the class demands a well-thought-out approach when selecting didactic games. Game technology can be used as a segment of a lesson (introduction, explanation, reinforcement, practice, assessment) to activate and motivate students in mastering concepts and topics. Some examples of didactic games suitable for these purposes are presented in Table 5:

Table 5
Types of Didactic Games

No.	Name	Description
1	Find the Mistake	Focuses on the student identifying the error made
2	Odd One Out	The student removes the extra item from five pictures and explains the logic behind the action
3	Lotto	Content may include concepts and definitions, formulas and their names, images and descriptions
4	What's Missing?	A whole is shown with missing parts on the card; the student identifies the missing part and justifies their answer

The variety of games allows for accommodating the individual characteristics of students with special educational needs (SEN). For example, for visually impaired students, the games mentioned above should include images with strong contrast against the background to

facilitate perception. Additionally, collective group games can be designed to be short in duration to maintain engagement and focus (see Table 6).

This tailored approach ensures that the learning process is inclusive, accessible, and effective for all learners, taking into account their unique sensory and cognitive requirements.

Table 6

Types of Games Applicable in Mathematics Lessons

№	Name	Description
1	Mosaic Game	Students must assemble a detailed picture. All parts of the picture are held by the teacher and distributed to groups based on correct task completion.
2	"Hands" Exercise Game	Primarily aimed at developing communication skills. Students are asked to draw as many palms of all group members as possible on a sheet of paper, writing terms, definitions, or formulas related to the studied topic on each drawing.

These games can be applied across all subjects in the natural science and mathematics fields, and students with special educational needs become full participants depending on the nature of the game situation.

Different types of pedagogical support are equally important in the process of knowledge acquisition (see Table 7):

Table 7

Types of pedagogical support

№	Description
1	Non-coercive teaching (based on interest, success, and confidence);
2	Lessons as a system of rehabilitation, whereby each student begins to feel themselves, act rationally, set goals, and achieve them;
3	Content adaptation by simplifying learning material and removing excessive complexity;
4	Simultaneous engagement of hearing, vision, motor skills, memory, and logical thinking in the process of material perception;
5	Use of anticipated action foundations (reference signals);
6	Additional exercises;
7	Optimal pacing for complete assimilation, etc.

Tasks for students with special educational needs should be communicated by the teacher both orally and in writing. The instructions must be short and clear, consisting of a single verb, and the teacher should be present near the student when giving the task. To ensure the child understands the task, it is important to ask them to repeat the instructions and explain their meaning.

Incorporating corrective and developmental exercises during lessons enhances students' mental processes and fosters the development of cognitive functions, thereby laying the foundation for successful learning activities. The use of these exercises also helps to alleviate emotional tension, create conditions for achievement, and support behavioral correction. Consequently, it enables children to feel more independent and confident in themselves (NAO Kazakhstan. , 2025).

Recommendations for Mathematics Teachers

Correctional and Developmental Tasks:

1. Given the numbers 12, 0, 15, 1, 8, 5, 2, 3, 44, divide them according to the following criteria:
2. – Single-digit numbers _____
3. – Two-digit numbers _____
4. – Natural numbers in ascending order _____
5. In each of the following four sets of words, underline the word that does not belong:
6. Segment, line, ray, triangle, figure, square.
7. Centimeter, millimeter, decimeter, length, meter, kilometer.
8. Ton, centner, mass, gram, pood.
9. In Table 8, identify the common properties of the concepts "segment," "ray," and "line," and list as many differences as possible. This task is aimed at developing comparison skills.

Table 8

Task Appendix

General properties	Differences		
	Segment	Ray	Line

Drawing Task Card (with Game Elements). Using the letter values indicated in the table below, find the value of the expression A − B − C. Write the obtained values in the "Result" row, and color each part of the picture according to the corresponding result in the table. For example, in the first column of the table, the student should get the result 13 (seeTable 10).

Table10

Creative Assignment in Mathematics

Letter Values					
a b c	7,7 2,2 3,94	4,7 1,9 6,03	14,3 3,2 40,76	1,3 8,7 3,7	9,1 2,9 7,15
Result	1				
Color in the picture					

In the picture, the areas marked with these numbers should be colored red. Thus, if there is a student requiring special education needs in the class, individual assignments can be organized using the methods described in this section.

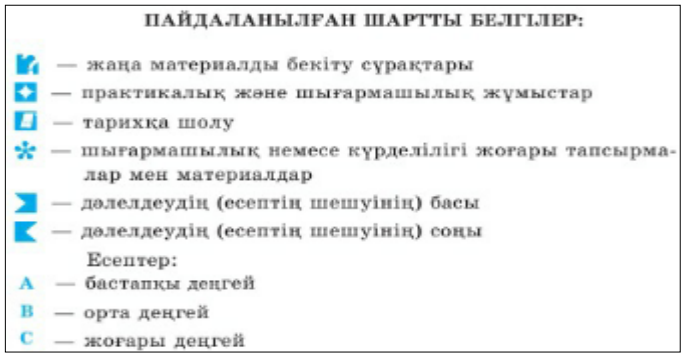
There are websites dedicated to analyzing regulatory documents, reviewing textbooks, and compiling specialized materials for working with students with special educational needs (Nurmukasheva, 2018; SATR. , 2025; Sorokoumova, 2023; Special Education Portal. , 2025). Additionally, information dissemination platforms are also operational.

The network of special education institutions in the Karaganda region comprises 29 organizations, categorized by various directions and functions, which are fully detailed on the official website.

Several textbooks are used when teaching mathematics to students with special educational needs. The primary one is the general school textbook.

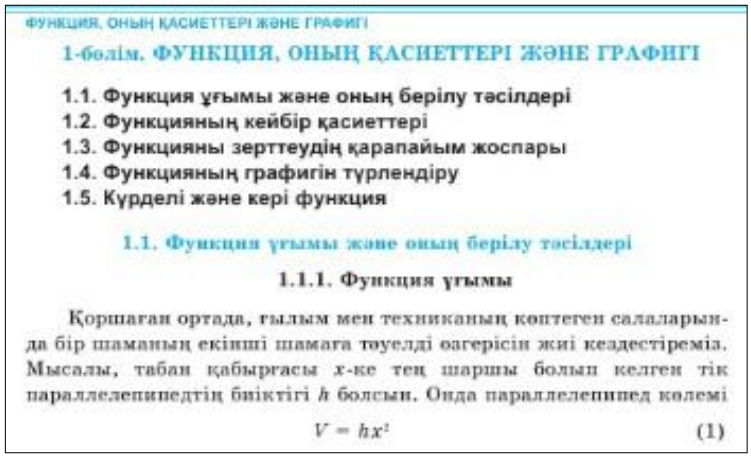
As an example, an analysis is conducted on the 10th-grade textbook "Algebra and the Basics of Analysis." According to the textbook's coding system, tasks are divided into different levels (see Figure 15).

Figure 15.
Legend of Symbols



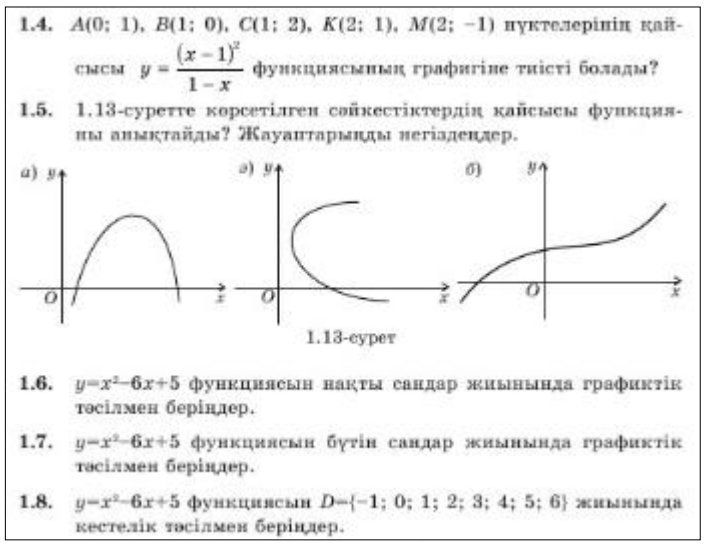
The first topic in the textbook is "Function, its Properties, and Graph" (see Figure 16):

Figure 16.
Textbook Topic



Problems for this topic are divided into levels: Level A includes problems 1.1–1.10, Level B includes problems 1.11–1.21, and Level C includes problems 1.22–1.26. Judging by the number of tasks, the textbook content is designed for students with average to above-average academic performance. Level A tasks are aimed at developing fundamental understanding of the topic and helping students acquire the simplest essential skills. For students requiring special education, alternative learning objectives are set, and these students primarily work with Level A tasks. Based on the topic discussed above, a selection of Level A tasks can be made specifically for students with special educational needs (see Figure 17).

Figure 17.
Content of Level A Tasks



1.4. $A(0;\ 1)$, $B(1;\ 0)$, $C(1;\ 2)$, $K(2;\ 1)$, $M(2;\ -1)$ нүктелерінің қайсысы $y=\dfrac{(x-1)^2}{1-x}$ функциясының графигіне тиісті болады?

1.5. 1.13-суретте көрсетілген сәйкестіктердің қайсысы функцияны анықтайды? Жауаптарыңды негіздеңдер.

а) б) в)

1.13-сурет

1.6. $y=x^2-6x+5$ функциясын нақты сандар жиынында графиктік тәсілмен беріңдер.

1.7. $y=x^2-6x+5$ функциясын бүтін сандар жиынында графиктік тәсілмен беріңдер.

1.8. $y=x^2-6x+5$ функциясын $D=\{-1;\ 0;\ 1;\ 2;\ 3;\ 4;\ 5;\ 6\}$ жиынында кестелік тәсілмен беріңдер.

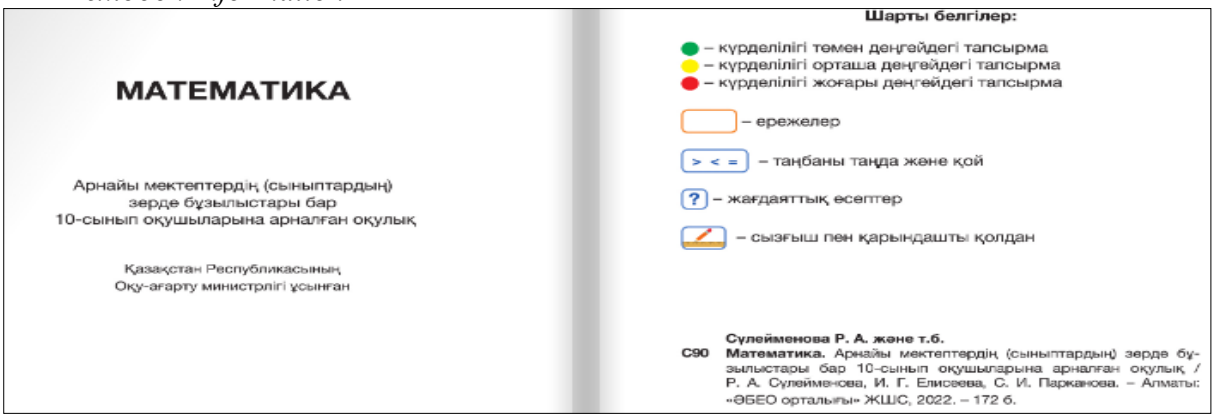
For this topic, students are required to master the simplest operations using definitions. Textbooks and instructional-methodological kits designed for special education are recommended based on students' specific diagnoses. Currently, mainstream schools offer educational materials tailored to students with special educational needs across several directions. An analysis is conducted of textbooks intended for students with intellectual disabilities (see Figure 18).

Figure 18.
Textbook Cover

Сүлейменова Р. А. және т.б.
Математика.Арнайы мектептердің (сыныптардың) зерде бұзылыстары бар 10-сынып оқушыларына арналған оқулық / Р. А. Сүлейменова, И. Г. Елисеева, С. И. Парканова. – Алматы: «ӘБЕО орталығы» ЖШС, 2022. – 172 б.

The inside cover of the textbook includes the legend of symbols, a description of the textbook, and information about the authors (see Figure 19).

Figure 19.
Textbook Information



The content of the textbook is compared with the standard textbook for general secondary education students, "Algebra and the Basics of Analysis." The first topic of the Grade 10 textbook designed for students with intellectual disabilities begins with the topic shown in the following figure (see Figure 20).

Figure 20.
Textbook Material

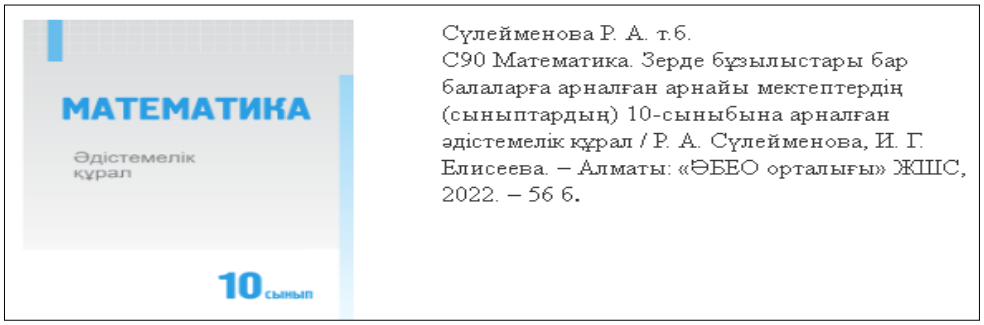
The next topic in the textbook is "Lines, Curves, Broken Lines, and Segments" (see Figure 21).

Figure 21.
Textbook Material

By examining these two topics, it becomes evident that for students with the aforementioned diagnoses, the subjects "Algebra and the Basics of Analysis" and "Geometry" are taught as a single integrated subject. Additionally, there is a significant difference in the scope of topics and materials covered.

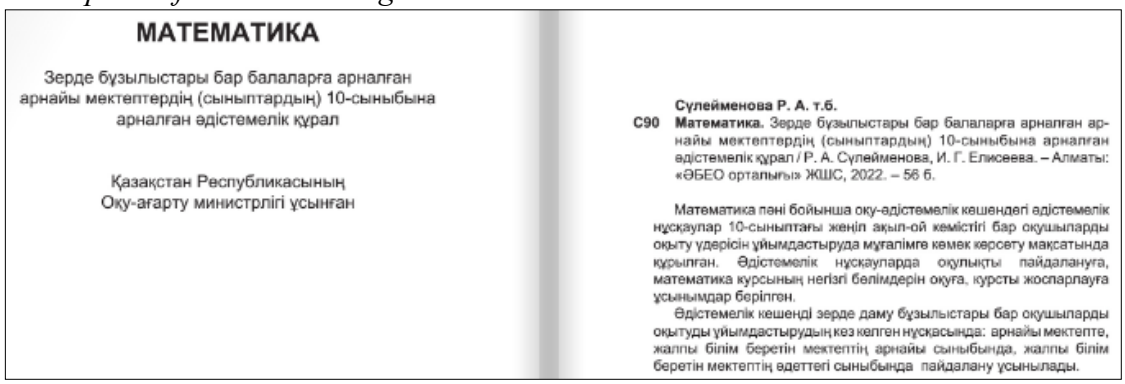
For such students, a methodological guide is provided alongside the textbook (see Figure 22).

Figure 22.
Methodological Guide



The methodological guide was also analyzed for this diagnosis and for the same 10th-grade students (see Figure 23).

Figure 23.
Description of the Methodological Guide


МАТЕМАТИКА

Зерде бұзылыстары бар балаларға арналған арнайы мектептердің (сыныптардың) 10-сыныбына арналған әдістемелік құрал

Қазақстан Республикасының Оқу-ағарту министрлігі ұсынған

Сүлейменова Р. А. т.б.
С90 **Математика.** Зерде бұзылыстары бар балаларға арналған арнайы мектептердің (сыныптардың) 10-сыныбына арналған әдістемелік құрал / Р. А. Сүлейменова, И. Г. Елисеева. – Алматы: «ӘБЕО орталығы» ЖШС, 2022. – 56 б.

Математика пәні бойынша оқу-әдістемелік кешендегі әдістемелік нұсқаулар 10-сыныптағы жеңіл ақыл-ой кемістігі бар оқушыларды оқыту үдерісін ұйымдастыруда мұғалімге көмек көрсету мақсатында құрылған. Әдістемелік нұсқауларда оқулықты пайдалануға, математика курсының негізгі бөлімдерін оқуға, курсты жоспарлауға ұсынымдар берілген.

Әдістемелік кешенді зерде даму бұзылыстары бар оқушыларды оқытуды ұйымдастырудың кез келген нұсқасында: арнайы мектепте, жалпы білім беретін мектептің арнайы сыныбында, жалпы білім беретін мектептің әдеттегі сыныбында пайдалану ұсынылады.

The content of the methodological guide includes the topic, learning objectives, and number of hours. The full version of the special textbook and methodological guide is available on the dedicated website. Under the class objectives for the lesson topic, it is required to specify individual goals for students with special educational needs (SEN). It is also important to note that individualized education plans (IEPs) and differentiated tasks designed for such students should not exceed Level A in difficulty. While working with general education students, attention must also be given to students with SEN. Assessment criteria are similarly documented when developing individual learning plans. During classroom activities, various types of work are naturally carried out (see Table 17).

Table17

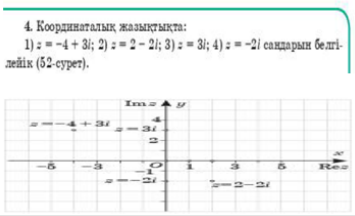
Sample Assignment

Тапсырма 1.Алматы облысындағы кездейсоқ алынған 25 ауылдағы халық санын зерттеу мынандай нәтиже береді: 2680 2805 2700 2050 2760 2930 2430 2990 2795 2170 2945 2430 2990 2795 2170 2095 2786 2545 2869 2890 2590 2712 2120 2986 2775 a) жиіліктің аралық кестесін жазыңыз (2150 адамнан бастап, аралық ұзындығын 150 адам етіп алыңыз); b) гистограммасын тұрғызыңыз.			

If such tasks prove too difficult for students with special educational needs (SEN), they are given simpler tasks involving reading the provided information and performing basic operations according to their level. Since one of the key goals in working with SEN students is their social integration, it is essential to involve them in group work as well. Therefore, as a subject teacher, group work was organized during the lesson (see Figure 30):

Figure 30.

Group Work Assignment

ТОПШЕН ЖҰМЫС	Мұғалім мысал көрсетеді, топтарға тапсырма береді * Ескерту - ЕББҚ бар оқушыны қоса алғанда (есту қабілетінде бұзылыстары бар) 	Үш топқа да бірдей тапсырма 16.8. Координаталық жазықтықта келетін нүктелерді 1) $z = -1 - 3i$; 3) $z = -\sqrt{5} + i\sqrt{3}$; 	Елші әдісі арқылы тапсырмаларды топ басшы қарап шығады. Бағалау «үш шапалақ» арқылы бағалайды 	Оқулық Оқу құралдары; Слайд; Интернет ресурстары 

The content of paired work organized with SEN students in the class covered by the Individual Education Plan (IEP) is shown in the following figure (Figure 31):

Figure 31.

Content of Paired Work

ЖҰПТЕН ЖҰМЫС	* **Ескерту - ЕББҚ бар оқушыны қоса алғанда** (жеңіл бұзылыстары бар) **3.** Комплекс санның модулін анықтаңдар: 1) $4-3i$; 2) $-3+2i$; 3) $0,2+0,1i$; 4) $\frac{1}{3}-\frac{4}{5}i$; **5.** Комплекс санның модулін табыңдар: 1) $(2-i)(i+1)$; 2) $\frac{2i-1}{1+i}$; 3) $(2-3i)^3$;	$Z = a + bj$ $r = a + bj = \sqrt{a^2 + b^2}$ $r = \sqrt{a^2 + b^2}$ – *комплекс санның модулі* Анықтама: комплекс санның модулі нақты және жорамал бөліктердің коэффициенттерінің квадраттарының қосындысының квадрат түбірінің арифметикалық мәні деп аталады және r белгіленеді	-Комплекс санның нақты бөлігін білдеді; - Мадақтау Жарайсың!, Керемет! Жақсы! Талпын! 	Оқулық Оқу құралдары; Слайд; Интернет ресурсары 

Thus, an example of working with students with special educational needs (SEN) in grades 10-11 has been analyzed. Additionally, a survey was conducted among teachers and parents of general education institutions to identify issues related to working with students who have special educational needs.

As part of the research focused on the practical application and methodological analysis of the topic, a roundtable discussion was conducted across five educational school-centers in Karaganda. The event brought together teachers working with students with special educational needs (SEN) and 3rd- and 4th-year university students. The roundtable was held under the theme "Methodological Features of Working with Students with Special Educational Needs in the Teaching of Mathematics." During the session, senior students shared the challenges encountered during their teaching practice and received professional guidance and recommendations from experienced educators.

In the 2024–2025 academic year in collaboration with the Faculty of Professional Development at E.A. Buketov University, a specialized training course"Using Interactive Educational Platforms in the Learning Process" was organized. This course was dedicated to examining and implementing interactive platforms designed to improve teaching effectiveness and enhance student learning outcomes.

During the research process, particular emphasis was placed on ensuring alignment with the learning objectives of secondary school mathematics and strict adherence to the principles of inclusivity. The methodology was evaluated in terms of its structural coherence, systematic implementation, accessibility and simplicity of instructional materials, and the integration of innovative elements. The effectiveness and efficiency of the approaches were continuously assessed at various stages of implementation.

The evaluation of the methodology was based on the following criteria: development of mathematical thinking skills among students with special educational needs (SEN); availability of practical outcomes supported by empirical evidence; analysis of the level and quality of differentiation; provision of tasks appropriate to students' individual readiness levels; use of supportive tools, such as concrete models, visual aids, and technological resources; application of methods enabling students to assess their own learning progress; well-defined and systematic feedback mechanisms; availability of specialized equipment or viable alternative resources; integration of modern pedagogical technologies, including ICT, gamification elements, and multimedia; utilization of objective methods for evaluating student performance; inclusion of self-assessment and peer-assessment practices; opportunities for reflection by both teachers and students.

The practical implementation of these methodologies confirmed their relevance, effectiveness, and necessity in inclusive mathematics education.

In general secondary schools, instruction for students with special educational needs is carried out primarily using standard textbooks, supplemented, when necessary, by specialized educational resources. However, to ensure full comprehension and mastery of the material, it is essential for mathematics teachers to carefully select and adapt teaching methods and strategies to meet the diverse needs and abilities of learners.

Conclusion

The assessment of student progress is closely connected to the jointly defined goals of teachers, parents and specialists. When aims are realistic and structured within targeted educational domains, assessment becomes an effective tool for adaptive teaching rather than a formality. Successful progress tracking for students with special educational needs requires clear task-setting, use of resources and specialist support, continuous monitoring, and transparent communication with families and school administration.

Effective assessment should be based on individualized education plans that translate broad curricular aims into measurable objectives. It needs to combine formative and summative measures, draw on multiple sources of evidence such as teacher observation, ICT-based data and self-assessment, and ensure documentation is accessible to parents and professionals.

The study confirmed the importance of activity-based methods, ICT tools and adapted curricula. Alternating structured tasks and collaborative formats increased engagement, while digital resources improved accessibility and broadened teaching options. Practical classroom work showed that combining these approaches enhances both academic results and participation of students with special educational needs.

Limitations include the modest sample and the focus on mathematics. Future research should expand to other subjects, evaluate long-term outcomes and integrate indicators of social inclusion and student well-being. Overall, the methodological strategies outlined here demonstrate strong potential to raise the quality of inclusive education, provided that evaluation, professional training and collaboration among stakeholders are consistently maintained.

Conflict of Interest Statement

The authors declare no potential conflicts of interest regarding the research, authorship, or publication of this article.

Author contributions

Seitimbetova Aigerim: Conceptualization, Methodology, Resources and Editing. Kossybayeva Umitzhan: Writing - Original draft preparation, Supervision, Writing-Reviewing, Investigation, Project administration. Kauymbek Indira: Formal analysis, Visualization, Inestigation.

References

Adilet Legal Information System. (n.d.). *Law of the Republic of Kazakhstan on Education*. Retrieved September 16, 2025, from http://www.adilet.kz

Adilet Legal Information System. (n.d.). *State Program for the Development of Education in the Republic of Kazakhstan for 2020-2025*. Retrieved September 16, 2025, from http://www.adilet.kz

UBA. (n.d.). *State Compulsory Education Standards of the Republic of Kazakhstan (Primary, Basic Secondary, General Secondary Education)*. Retrieved September 16, 2025, from http://www.uba.kz

Adilet Legal Information System. (n.d.). *Law of the Republic of Kazakhstan on Social and Medical-Pedagogical Support for Children with Disabilities*. Retrieved September 16, 2025, from http://www.adilet.kz

Adilet Legal Information System. (n.d.). *Law on the Rights of the Child in the Republic of Kazakhstan*. Retrieved September 16, 2025, from http://www.adilet.kz

Adilet Legal Information System. (n.d.). *National Plan for Ensuring the Rights of Persons with Disabilities until 2025 in the Republic of Kazakhstan*. Retrieved September 16, 2025, from http://www.adilet.kz

Abdiganieva, M. E. (2020). Implementation of inclusive education in Kazakhstan. In *Science, education, innovation: Approval of research results: Materials of the International Scientific-Practical Conference* (pp. 534–539). Scientific Publishing Center "World of Science".

Beyimbetov, Q. Zh., & Akhmetova, B. K. (2017). The role of didactic games in enhancing student engagement in mathematics lessons. *Education Bulletin*, (2), 3–8.

Birzhanova, A. A. (2023). Effective organization of mathematics lessons in inclusive education conditions. *Internauka*, 13(6[283]), 31–53.

Dzheksenbeva, K. O. (2020). Methodological organization of teaching students with special needs in general education institutions. *Scientific-Practical Research*, 5(5[28]), 14–17.

Edi Supriyadi, Sari, I. P., Fauzi, A. L., Mahmudin, & Dahlan, J. A. (2022). Bibliometric analysis: Inclusive mathematics education research. In *Proceedings of ICEHOS 2022*. Atlantis Press. https://doi.org/10.2991/978-2-38476-088-6_18

IKPRAO. (n.d.). *Official website*. Retrieved September 16, 2025, from http://www.ikprao.ru

NAO Kazakhstan. (n.d.). *Official website*. Retrieved September 16, 2025, from http://www.nao.kz

Nurmukasheva, S. K. (2018). Inclusive education and teaching methods for children with special educational needs. In *Integration of the scientific community to the global challenges of our time: Materials of the III International Scientific-Practical Conference* (Vol. III, pp. 320–327). Regional Academy of Management Public Fund.

SATR. (n.d.). *Official website*. Retrieved September 16, 2025, from http://www.satr.kz

Sorokoumova, S. N. (2023). Organization of inclusive education in the context of education modernization.

Special Education Portal. (n.d.). *Official website*. Retrieved September 16, 2025, from http://special-edu.kz

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