

Improving Special Education and Inclusion Course in Primary Mathematics Teacher Education Program

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To cite this article:

Sola-Ozguc, C. (2021). Improving special education and inclusion course in primary mathematics teacher education program. *Journal of Qualitative Research in Education*, 28, 156-182. doi: 10.14689/enad.28.7

Abstract: This study aimed to improve special education and inclusion courses given to pre-service teachers in a primary mathematics education program at a university in Turkey. The aim was to enhance their knowledge and skills and present solutions to problems occurring in courses given during the term and changes in the sense of efficacy of pre-service teachers. For this purpose, the research used qualitative and quantitative data collection methods based on the action research method. Shorter course duration and intense content were among the most important problems faced by the instructor. The course curriculum was adapted in line with the needs of primary school mathematics teachers. It was aimed to increase the effectiveness of teaching by providing a variety of materials. Pre-service teachers had the opportunity to gain experience working with special needs students by teaching them origami shapes in the special education and inclusion course. The data obtained from the scales at the end of the process revealed that teachers' sense of efficacy showed improvement regarding inclusion. Pre-service teachers were pleased to have such a course and offered suggestions to the course instructor. Based on the findings, the elements for improving this education are discussed, and suggestions are presented.

Keywords: Teacher training, inclusive education, special education, inclusion, students with special needs.

Article Info

Received: 21 Jan. 2021
Revised: 13 Sept. 2021
Accepted: 18 Sept. 2021

Article Type

Research

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Introduction

The most recent consensus as far as education is concerned is the idea that equality in education is a fundamental human right, and the effective implementation of this right lays the foundations for a fairer society. To that end, the concept of diversity comes to the fore instead of differences. The entry into force of diversity-oriented legal regulations has increased emphasis on the necessity of students with special needs to be educated alongside their peers displaying normal developmental stages based on their individual requirements (Florian & Camedda, 2020; UNESCO, [2017, 2020]). This should begin with inclusive education systems.

Services provided for children with special needs by teachers in the field implement an inclusive education system possible. Although developments in the law and the increase in the number of students benefiting from inclusive education demonstrate that inclusion practices have become widespread, one of the significant factors determining the success of the inclusion practices is the quality of teachers (UNESCO, 2017). Skills and attitudes of teachers toward students with special needs in inclusive education environments are also among the factors that determine the success and effectiveness of inclusion practices (Ahsan et al., 2013; Ballone & Czerniak, 2001; DeSimone & Parmar, 2006b; Mahat, 2008; Patkin & Timor, 2010; Subban & Sharma, 2005). Separating or rejecting students with special needs arises from teachers' lack of knowledge and skills about these students (Patkin, & Timor, 2010). Pajares (1992) suggested a relationship between teachers' knowledge and beliefs and that teaching ability is affected by these beliefs. Beliefs develop in the early stages of an individual's career, and it is not easy to change them later. For this reason, pre-service teachers should acquire the attitude and knowledge level to teach inclusion students during their training (Ahsan et al., 2013). A study conducted by Avramidis and Norwich (2002) between 1986–2000 regarding teachers' attitudes toward inclusion revealed factors affecting teachers' attitudes. One of these factors is training for individuals with disabilities.

Although the literature (e.g., Ozokcu, 2019; Akman et al., 2018) revealed that teachers had shown a more positive attitude toward the concept of inclusion since 2000, it is also seen that teachers have problems with inclusion practices; therefore, they stated that inclusion practices are not efficient (DeSimone & Parmar, 2006b; Leung & Mak, 2010; Patkin & Timor, 2010). Problems faced by teachers in the inclusion practices were defined as adapting the program content to the student level, choosing appropriate teaching methods and techniques for students with special needs and typically developing students, coping with behavioural problems, spending more time to deal with students with special needs, lack of comprehensive knowledge about the education of individuals with special needs, and lack of management support (Leung & Mak, 2010). Sharma and Nuttal (2016) suggested that, although the research reveals that teachers show positive attitudes toward inclusion, success is low

within the scope of inclusion practices. When the factors that affect teacher attitudes toward inclusion were examined, contact with individuals with special needs and type and amount of training they received was found to be predictive (Forlin et al., 2014; Jordan et al., 2009; Sharma et al., 2008; Sharma & Nuttal, 2016).

Research on training teachers to carry out inclusion practices revealed a general framework and presented data to teacher training institutions. Although it has been shown that courses given to pre-service teachers regarding inclusion or education of children with special needs have shown improvement toward their attitudes, they stated, after graduation, that this course was not effective (DeSimone & Parmar, 2006b); therefore, more qualified courses about inclusion were suggested (Sharma & Nuttal, 2016).

With a particular focus on training teachers who can effectively educate children with various needs within the scope of inclusive education, teacher competencies in inclusive education and how to train teachers equipped with such competencies have been significant research topics in recent times (Florian & Camedda, 2020). The study, titled "Teacher Professional Learning for Inclusion Literature Review", conducted by the European Agency for Special Needs and Inclusive Education (2019), deals particularly with the steps of initial teacher education. It clarifies the essential skills, knowledge, understanding, attitudes, and values teachers need, from pre-primary to secondary school teachers for inclusion. It emphasises what teacher competence should be and which qualifications teacher educators should have. UNESCO (2020) in the Global Education Monitoring Report points out the importance of preparing all teachers to teach students. This report offered recommendations to prepare pre-service teachers for inclusion. In the general sense, assessment of these recommendations usually includes consideration of a practical aspect in lessons and their theoretical dimension, the education of teachers through feedback within the scope of practice sessions, and the revision of existing teacher training curricula, considering inclusion.

Guðjónsdóttir and Óskarsdóttir (2020) underlined the need for universities and schools to collaborate, highlighted the consideration that teachers should not be responsible for inclusive practices on their own, and, to that end, emphasised that managers, teacher educators, and researchers must establish common dialogue and collaborate. Based on these suggestions, the aim is to improve the content of a course offered in a faculty of education department in Turkey to prepare prospective teachers for inclusive education and train these teachers in this regard.

In Turkey, teacher education is undertaken at faculties of education in the form of four-year bachelor degree programs. There are nine different departments under faculties of education for training teachers at the pre-school, primary school, and high school levels. The four-year curricula of faculties of education are drafted by the Council of Higher Education (CHE). In 2017, at the end of the studies conducted with the Ministry of National Education (MNE) and the Council of Higher Education (CHE), the departmental curricula of faculties of education were revised. The total number of credits in undergraduate programs range between 140 and 150. Courses taken were

classified under the titles of subject-specific knowledge, professional knowledge, and general culture courses. All departments have the two-credit mandatory course titled "Special Education and Inclusion" under professional knowledge. CHE sends universities the chapters concerning the content of this course.

In Turkey, relevant action has been taken, and new laws and regulations have adopted this approach. However, it has been observed that teacher practices do not necessarily adopt the inclusive education logic and that there have been some practical problems (Akdag & Haser, 2016; Sakiz et al., 2015). Considering that teacher attitude and competence are important factors in inclusion practices, the most important question, in this case, is "How can we qualitatively train general education teachers about inclusive education in a lesson and in a short time?" Thus, the main questions of this study were determined as "How can the content of the special education and inclusion course, for primary school mathematics education students in Turkey, be improved?" and "How can pre-service teachers gain skills in inclusion practices better?" This study aimed to include the information and practice in the special education and inclusion course, present the problems encountered, and provide solutions. These solutions were aimed to improve the quality of special education and inclusion courses. For this purpose, the following questions were asked:

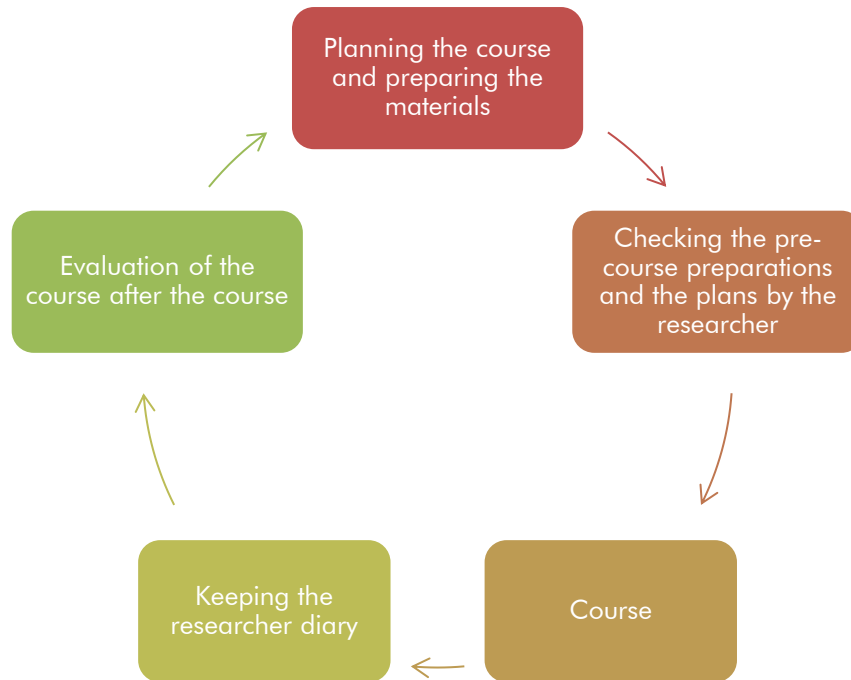
- How can the special education and inclusion course content for primary school mathematics education students be improved?
- What kind of problems are encountered in special education lessons in elementary mathematics teaching?
- How can these problems be resolved?
- What are the opinions and suggestions from pre-service teachers about improving the special education and inclusion courses?
- What is the difference between pre-service teachers' perceptions of inclusion before and after this lesson?

Method

This study was designed as action research to improve the content of the special education and inclusion course given in primary mathematics teacher education and to identify and solve problems encountered in the course. Action research, also referred to as teacher research, is defined as a research method involving the researcher's awareness of a problem in practice, developing suggestions for solving the problem, examining the efficiency of the solution, and the process of improving the situation (Mertler, 2012; Mills, 2005). It was aimed to improve the course content by using quantitative and qualitative data and to help pre-service teachers studying in the department of mathematics teaching gain the necessary knowledge and skills for educating individuals with special needs.

Figure 1.

Weekly Cycle



Considering this cycle, the researcher conducted lectures for 12 weeks. Upon encountering problems regarding the plan they created at the beginning of the semester, they developed action plans to solve these problems.

Research Setting

The research was carried out in a classroom of the education faculty building of a public university. The classroom is located on the first floor of the two-storey building with student classrooms and has a capacity of 72 people.

In addition, the applications of pre-service teachers who took part in the research activities were carried out in the special education unit of the special education department. The special education unit was an 80 m² class on the ground floor of a two-floor building. A computer and a computer desk was leaning on the left wall. There was a large bookcase/material cabinet on the right wall of the room, there were two round tables in the corners of the room, and there were two bean tables and five chairs in the middle of the room. Applications were carried out on one of two bean tables.

Participants

Researcher

The author, working as a lecturer in the special education department of a public university for 10 years, participated in this study as a researcher. For the past five years, she has been teaching various courses in the Department of Education of the Mentally Disabled. In addition, she carried out the special education course in the Department of Guidance and Psychological Counselling for three semesters and the Special Education course in the Department of English Language Teaching for one semester. The researcher has designed studies using qualitative research methods. She also has experience in conducting action research. The researcher gave lectures in the role of participant-observer and transferred her observations and thoughts to the researcher's diary. In addition, she monitored pre-service teachers' teaching and gave feedback, developed semi-structured interview questions, conducted interviews, and organised and analysed data.

Pre-service teachers

Other participants in the research are pre-service teachers. Forty-five pre-service teachers attending the special education course in their seventh semester during the 2018–2019 academic year fall semester at the Primary School Mathematics Education Department participated in the study. Thirty-eight of the pre-service teachers are women; seven are men. Their ages range from 21 to 23.

Students with special needs

Origami applications, in which pre-service teachers teach origami shapes, were carried out with three students with special needs. The first student is an eight-year-old boy with a learning disability. He attends the second grade of public primary school, and he receives support training from the department of special education at the university. The second student is a 15-year-old boy with Down's syndrome. He attends the second grade of special education middle school. He also receives support training from the rehabilitation centre and department of special education at the university. The third student (a seventh-grade inclusion student with special needs) is a 12-year-old girl with mild intellectual disability. Informed consent was taken from their families.

Participation of individuals with special needs has emerged in line with the weekly action plans of the research. These three students were selected because the accessibility of the students studying at the special education unit of the special education department has been more convenient. At that time, it was limited to three students with special needs who received training from the special education unit of the special education department at the university. The students' participation hours were determined according to their school hours and the availability of the pre-service

teachers. Therefore, five groups worked with the first student, four with the second student, and four with the third student.

Data Collection

Qualitative and quantitative data were used in the research.

Qualitative data

Qualitative data were obtained from process products, researcher diaries, and semi-structured interviews. Process products are various products developed by participants or researchers during the research. The performances of pre-service teachers were measured with various assessment tools in this course. The knowledge and skills related to the course were evaluated five times as midterm, two quizzes, one homework, and final within the scope of the university's evaluation standards.

Products of the activities were carried out in two quizzes formed the process products of the research. In the first quiz, pre-service teachers formed 13 groups ranging from three to five participants. The teachers taught students with special needs mentioned in the participants' section to create a pattern within the content of the origami activity. Pre-service teachers taught an origami shape to a participant student. The group carried out the applications, and the application from each group was video-recorded.

Each student was asked to express their feelings and thoughts regarding the origami activity in the second quiz. Students wrote down their feelings and thoughts about the activity in one or two pages during one lesson and gave them to the researcher. The pre-service teacher did not know that this activity would be graded as a second quiz while writing the report.

Developed IEP forms as homework, documents of midterm and final were not used as research data. The researcher's diary is another data source used in the research. This diary provides information about the research steps, but it also functions as a work plan. It is defined as the records through which researchers comment on their practices (e.g., observation, interview, etc.) (Mills, 2003). The researcher used the diary to report on the topics taught in the course, students' participation in the course, questions, and observations related to the activities.

The semi-structured interview form was developed to obtain opinions and suggestions from pre-service teachers about the special education and inclusion course they attended for a semester. The form had five questions: (1) What would you say about the special education lesson taught last semester? (1a) What were the situations that interested you in the lesson? (1b) What were your difficulties in the lesson? (2) What would you say about interacting with a student who progressed differently within the lesson? (3) What are your opinions and suggestions about the course process? (4) If you have an inclusive student in your class when you are a teacher, how could you use

the information you get from this lesson? (5) When comparing the lesson before and after, have there been changes in your thoughts about students with special needs? If so, what kind of changes have happened?.

Semi-structured interviews were carried out during the spring semester (after the grades of the course were given) via a typical case sampling method with a total of eight pre-service teachers (three of the students with the highest score, two of students with an average grade, and three of students with a low score). The shortest interview lasted seven minutes; the longest interview lasted 17 minutes. The average duration of the interviews was 13 minutes. The interviews were audio-recorded.

Quantitative data

The teachers' sense of efficacy scale (TSES) and teaching mathematics in an inclusive setting survey (TMIS) were used to determine the change in the inclusion practices and mathematics teaching competencies of pre-service teachers during the improvement studies carried out with the action research method for one semester.

Hollender (2011) developed the TSES to determine teacher efficacy in inclusion applications. Meral and Bilgiç (2012) performed Turkish adaptation, validity, and reliability studies of TSES, which included 24 items under one factor. The highest and lowest scores to be obtained from the 5-point grading scale (1 = I can never do it; 5 = I can certainly do it) include 24 items. The highest possible score is 24; the lowest possible score is 120. Cronbach's alpha (α) internal consistency coefficient for the scale was calculated as .94. The criterion-related validity correlation coefficient of TSES was calculated as $r=.83$ ($p<0.01$).

The TMIS, developed by Aerni (2008), is a 12-item scale that measures teacher efficacy in mathematics teaching to children with special needs in inclusion settings. Meral and Takunyacı (2016) performed Turkish adaptation, validity, and reliability studies of the TMIS. Respondents were asked to score on a 9-point Likert scale (1 = never; 9 = quite much).

Data Analysis

Analysis of qualitative data

All data consisting of video and transcriptions of audio recordings obtained and process products were transferred to the NVivo 10 program. Table 1 below shows research questions and data collection methods used to answer them.

Table 1.

Research Questions and Data Collection Methods

Research questions	Data collection methods
How can the special education and inclusion course content for primary school mathematics education students be improved?	Researcher diary Literature review Researcher diary
What kind of problems are encountered in special education lessons in elementary mathematics teaching?	Video records Semi-structured interview
How can these problems be resolved?	Written documents expressed by the students about the origami activity
What are the opinions and suggestions from pre-service teachers about improving the special education and inclusion courses?	Semi-structured interview
What is the difference between pre-service teachers' perceptions of inclusion before and after this lesson	Teachers' sense of efficacy scale Teaching mathematics in inclusion setting survey

The semi-structured interview data were analysed via the content analysis method for research purposes. As a result of the semi-structured interviews with pre-service teachers, the data indicated answers to the research questions. The codes, which were not initially aimed at the researcher but were later considered important findings, were obtained. In the first analysis, 25 codes were obtained. In the second analysis, these codes were reduced to 12 codes, some of which were thought to serve the same purpose. Later, themes and subthemes were created from these codes.

The researcher diary was used as field notes. The researcher diary and process products were analysed as a second file in NVivo 10. These data were analysed via content analysis. In line with the data analysis, themes were created as follows: (a) editing course content, (b) combining the content expected in the course with the field of mathematics, (c) materials used to give the course content effectively, (d) problems encountered in the course.

Analysis of quantitative data

Pretest results obtained from 45 students were stored by giving numbers to each student. Post-test data were obtained by considering the codes determined after the application. The two scales were determined to be invalid, and the analysis was based on the data of 43 pre-service teachers. The data were entered into the SPSS 21 program, and a paired sample t-test was performed to discern the differences between the pretest and post-test scores obtained from TSES and TMIS.

Validity, Reliability and Ethics

Guba's criteria for the validity of qualitative research are credibility, transferability, dependability, and confirmability (Gay, Mills, & Airasian, 2006, p. 405; Mills, 2003, p.78). The researcher has done prolonged participation for 12 weeks for the credibility of this study. In addition to this, triangulation was used. Data from various data sources, e.g., observation, researcher diary, semi-structured interviews, process products, were obtained and analysed in the research process. The researcher tried to give detailed descriptions such as course content list, settings, and the process for transferability. For dependability, methods (use of scale, semi-structured interview, etc.) were overlapped. For semi-structured interview questions, expert opinions were received from three experts who studied special education and qualitative research. For the content list, views of two experts in the department of special education were received. Various data were gathered together and supported each other; thus, confirmability was provided.

For the reliability of the research, the researcher worked in line with the measures and recommendations outlined in the literature (Gay et al., 2006). In the process of analysing the semi-structured interviews, (a) three of the audio recordings were randomly selected and listened to by a master student; ensuring control; (b) a reliability study was conducted with a research assistant, who is doing a doctorate in special education and has studies on qualitative research. Three randomly selected interview texts with the theme and subthemes created with the NVivo output were shared with the expert. The expert was asked to find the themes and subthemes specified in the text by reading these texts. In addition, experts were asked to examine the theme and content compatibility of the interview sections under the theme and subthemes. After these examinations, the researcher and expert came together and made comparisons. There was no disagreement between them. For the reliability of other data, a research assistant was asked to find the themes and subthemes by taking into account the researcher's diary data. There were few disagreements between them. They gave the final form of the themes after discussion.

Before conducting the semi-structured interviews, pre-service teachers were informed about the research process for informed consent. Approval was obtained from the parents of students with special needs. Pre-service teachers and students' personal information was not included in the study. The research was carried out with the approval of Sakarya University Ethics Committee No. E-61923333-050.99-60519.

Results

Editing Course Content

Improvement efforts for the special education and inclusion course in the Department of Elementary Mathematics Education, the main purpose of the research, continued before the semester and during the course. The course content was carried out in line

with CHE's Elementary Mathematics Education Program, which was put into practice in 2017. The course content consisted of children with special needs and special education, developmental disabilities, intellectual disability and autism spectrum disorders, learning difficulties, hearing disabilities, language and speech disorders, emotional and behavioural disorders, visual disabilities, physical disabilities, gifted students, inclusion, early education, and family education. For the special education and inclusion course, lasting two hours a week for 12 weeks, the content proved intense; further, the author planned to give wide coverage to subjects that are considered to be a priority for primary mathematics teachers and to cover the subjects they may encounter less (multiple deficiencies, moderate and severe intellectual disabilities, etc.) superficially without elaborating. The topics presented to pre-service teachers, the tools used, and the timetable are presented in Table 2 below.

Course subjects were covered in the order listed in Table 1. While listing these topics, the author has benefited from some textbooks (Baykoc, 2015; Cavkaytar, 2013; Diken, 2008). She has also taken into account her experiences in special education courses she has given in previous years. In this study, three textbooks written in Turkish under the title of "Special Education" and a Turkish textbook (Ari & Sonmez Kartal, 2018) named "Introduction to Special Education for All Teaching Programs" were used. When the content of the books was examined, it was seen that the first subject was the explanation of the concept of special education. The author included the concepts related to special education and content related to the history of special education as the first subject in terms of introduction. The contents of the books have been different since the first issue. In a resource, after mentioning the personnel-family cooperation issues in special education in a source (Cavkaytar, 2013), the titles related to the types of disability were listed. In another resource (Diken, 2008), educational evaluation, IEP, inclusion, and family education issues were discussed after the concept of special education, and the types of disability were included later on. A similar order was also observed in other sources. After the author examined these content outlines and considering her experience in teaching special education courses in different departments in previous years, she has altered the order of subjects, time, and content intensity without changing the content determined by HEI. Another factor that affects these changes is the department where the course is given. It was suggested that subjects such as adaptation and IEP should be examined, emphasizing emphasizing that mathematics teachers are more likely to encounter within the context of inclusion. According to the suggested content, the author has not covered language and speech disorders as a weekly subject but in increasing communication skills within the autism issue. In addition, in the same week, she has processed some topics (for example, individuals with attention deficit and hyperactivity disorder and emotional and behavioural disorders) and added new topics. She explained the question "How to develop IEP by allocating a separate week for the subject of IEP given in the subject of inclusion?" via the sample IEP template. Pre-service teacher 2 (PT2) further stated that "the homework given in IEP was good, in fact, more or less; after all, when a child comes across, we will not know about it, however at least we have learned it, I mean we have learned how to look where."

Table 2.

Weekly Subjects of Special Education and Inclusion Course

Weeks	Subjects	Materials Used
1. Week	What is special education? History of special education	<ul style="list-style-type: none"> • PowerPoint presentation
2. Week	Individuals with intellectual disabilities	<ul style="list-style-type: none"> • PowerPoint presentation • Video about adult individuals who acquired a profession • Video recorded during the researcher's work with a student with intellectual disability
3. Week	Individuals with learning disabilities	<ul style="list-style-type: none"> • PowerPoint presentation • Lecture notes about the topic of dyscalculia from a learning disabilities book • Examples of activity work related to the Turkish and mathematics course of a child with dyslexia
4. Week	Individuals with autism	<ul style="list-style-type: none"> • Video of the student with dyslexia who the researcher worked with • PowerPoint presentation • Videos of a student with autism disorder when carrying out activities based on applied behaviour analyses (ABA)
5. Week	Gifted individuals	<ul style="list-style-type: none"> • Powerpoint presentation • Article titled "Problem-Based Learning in Teaching Mathematics at the Science-Art Centres" http://www.tuzyeksav.org.tr/wp-content/uploads/2015/09/boran-ali-ihsan-aslaner-recep-bilim-ve-sanat-merkezlerinde-matematik-ogretiminde-probleme-dayali-ogrenme.pdf
6. Week	Individuals with visual and hearing disabilities	<ul style="list-style-type: none"> • PowerPoint presentation • Materials written in Braille alphabet • Interview conducted with an individual with visual disability
7. Week	Individuals with attention deficit and hyperactivity disorder Individuals with emotional and behavioural disorders	<ul style="list-style-type: none"> • PowerPoint presentation • Video sections of students with emotional and behavioural disorders
8. Week	Behaviour change methods and techniques	<ul style="list-style-type: none"> • PowerPoint presentation • Video showing the change in the student before and after the ABA-based application • Reinforcement table • Reinforcement box which has several favourite foods for a student
9. Week	Inclusion	<ul style="list-style-type: none"> • A video prepared by Tohum Autism Foundation Special Education School https://www.youtube.com/watch?v=fcAUuP3z5Ew • A video recorded by the researcher on inclusion
10. Week	IEP (Individualised Education Plan)	<ul style="list-style-type: none"> • PowerPoint presentation • Individualised education plan sample/template
11. Week	Early education and parent education	<ul style="list-style-type: none"> • PowerPoint presentation • Video showing early education practices for a 2-year-old girl with Down's syndrome • Interview about the difficulties experienced by a mother of a child with autism spectrum disorder
12. Week	Watching videos of origami activities	<ul style="list-style-type: none"> • Video sections from the practices of 15 group

Whether students with special needs or typical development, classroom management skills are among the first situations that pre-service teachers have difficulty with in general. It was observed that the most frequently reported problem for teachers who have inclusion students is classroom management (Ahsan et al., 2013). In addition to the proposed course content, increasing positive behaviour and reducing disruptive behaviour techniques were given in the form of a summary of the applied behaviour analysis (ABA) course, which was given over a period in the field of special education. Videos were also shown on how students' behaviours can change when appropriate behavioural techniques are used. This content list was presented to two experts from the special education department, and their opinion was received.

Combining the Content Expected in the Course with the Field of Mathematics

After arranging the course content for primary school mathematics pre-service teachers (i.e., the target audience), the importance of associating the content with the field was considered. In this regard, the researcher examined the curriculum according to the classes to give appropriate examples about the subject that she will present the day before and used examples from the curriculum subjects that the students have mastered. When the teacher received information about their own fields, it attracted the students' attention, and they better understood the subject. PT6 stated at the end of the lesson that "It was firstly focused on our target audience because we will be a math teacher," showing that this situation attracts the attention of pre-service teachers.

In the first quiz, the researcher asked pre-service teachers to teach origami to a student with special needs. In this stage, pre-service teachers had the theoretical knowledge, but they also had experience communicating with individuals with special needs in line with this information. One pre-service teacher (PT3) commented: "Professor, Sir, Miss, it was very good, for example, origami. You know, because we had so much fun." Another pre-service teacher (PT5) said, "I already warmed up after that origami. Because hearing is different, the feeling is different. When you feel it, it becomes more permanent. I mean, now I know not only theoretical information but also I know its characteristics better because I practised it," referring to the benefits of interaction with an individual with special needs.

For example, during the week of training gifted individuals (19.11.2015), the author asked pre-service teachers to read the article "Problem Based Learning in Teaching Mathematics in Science and Art Centers" at the end of the lesson. Although pre-service teachers were initially reluctant, they noted that the article was related to their fields and discussed it in the classroom. The author wrote her observations about this situation in the researcher diary as follows: "At the end of the article, there were examples of questions that could be directed to gifted students. We talked about that section. It attracted a lot of attention. They even asked me to ask us such questions in the exam. Many of them tried to solve the questions. That was nice. I feel that it should be made sure that students are not taught about anything detached from their own

fields while explaining special education. Indeed, they should be felt how effective they are in this field" (Researcher Diary, p. 5).

Materials Used to Give the Course Content Effectively

The researcher diversified the tools and resources used while teaching. Resources used for this purpose are books on the field of special education, PowerPoint presentations, the researcher's own practices or videos of the practical examples related to the subject, academic articles related to the subject, symbol reinforcement table, food reinforcement box, texts written in the Braille alphabet, and assistive technology applications used by individuals with visual disabilities. A list of resources and materials used for the subject covered each week is presented in Table 2 above.

Problems Encountered in Special Education and Inclusion Courses Conducted in Elementary Mathematics Education and Solutions

The study is focused on improving an existing situation via the nature of action research and resolving problems that arise during the improvement process. The author enriched the content, resources, and materials in terms of course quality in this process. However, problems were encountered in this process. These were; (a) limited time and intense content for special education and inclusion course, (b) attitudes of pre-service teachers towards inclusion, (c) Obvious mistakes made by pre-service teachers in origami activities (d) difficulties experienced by the instructor.

The first of which are the limited duration and intense content of the course. Because the subjects were more intense in some courses, these were postponed to the next week. The researcher stated this in her diary as follows: "Although I explained quickly in the last lesson, I was able to explain only the intellectual disability. It is really challenging to have two lessons and then to have another lesson immediately. The students get bored when the lesson is blocked as two hours, and when they take a break, it becomes 40+40. I am worried that all subjects will not be covered. The question of how I can teach a lesson with a lot of content in a way to be useful for them always appears in my mind" (Researcher Diary, p. 1). The researcher resolved this problem by presenting the lecture notes (article, electronic article, book section, etc.) about the subject before the lesson, preparing for the lesson, adapting it to the subject of a mathematics lesson, and watching the video in the following weeks. The students expressed this limitation in a semi-structured interview. For example, PT2 stated this limitation as "we could actually talk about what can be done with mathematics gainings. We could come up with more different ideas like that in the lessons, but the lesson time was too short, and it was only enough for us to understand the subjects. "

Another problem faced during the course process was that pre-service teachers stated that inclusion students might prevent the development of other students in education environments. However, they have positive thoughts about the need to integrate them

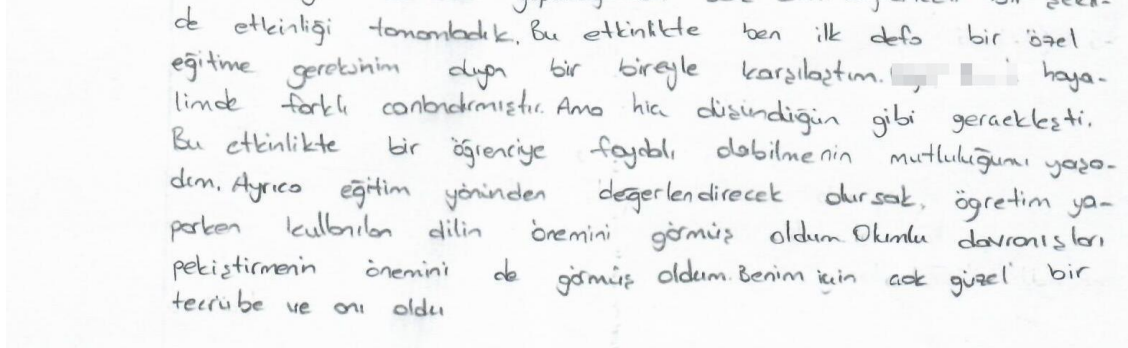
into society. In the process in which the researcher participated in an interactive lesson, pre-service teachers stated that they would be unable to improve their inclusion students. However, time will be stolen from students who demonstrate good performance. The researcher frequently wrote in her diary, which shows this situation in different weeks. For example, on November 5, 2018, the researcher wrote, "That made me surprised and angry when the student named Ahmet said that 'It is wrong for this student to be in such a class. Other students are also getting negatively affected.'" The researcher noted another student response: "A student, but even if she takes five minutes, she will still have taken it from other students' time." Although students' attitudes seemed positive, it is seen that this situation is perceived as impossible for them when it comes to application. The researcher thought it would be positive to combine the origami study with mathematics, considering that the experience of pre-service teachers with individuals with special needs can eliminate negative thoughts.

For this purpose, it was aimed that pre-service teachers form a group and practice with students with special needs who receive service from the special education unit. It was thought that their experience could cause a positive change in the perspectives of pre-service teachers about inclusion. Students and working hours were determined for pre-service teachers. The pre-service teachers stated that they took origami as an elective course at that time. With the suggestions of the lecturer, they took the origami course, and each group determined the shape to be made with origami, such as tulips, dogs, hearts, etc., according to the level of the student with special needs. The course lecturer evaluated the origami shapes suitability considering the special needs students level. Education in the special education unit was carried out in line with the determined hour and under the observation of the lecturer. It was observed that the pre-service teachers' attitudes positively changed according to the documents in which they conveyed their feelings and thoughts and were graded as the second quiz study. They stated that the students they work with are not much different from the normally developing children and do the origami stages very well. For instance, a pre-service teacher wrote down her experience as follows:

Arkadaşımız uygulamayı yaptırdı. Tekrarlamasını istediğimizde hiç bir basamağı atlamadan yapabildi. Buna çok şaşırırım. Bu şekilde en yavaşlarımı yitirmişim söyleyebilirim. Bu durumdaki öğrencilere nasıl iletişime geçeceğim konusunda tecrübe kazandım. Öğrencilerinizle ilgilenmek ve öğrettikleriniz şey hakkında geri dönüt alabilmek mükemmel bir duygu.

Our friend conducted the activity. When we asked the student to do it again, she did it without skipping any steps. We were so surprised. I can say that I have broken down my prejudices this way. I experienced how to communicate with students with special needs. It is great to show interest to your students and get feedback about what you are teaching.

Another pre-service teacher has noted her observations as follows:



It was the first time that I met a student with special needs in this activity. I had imagined the student differently. However, it didn't happen as I thought before. I had the pleasure of being useful to a student in this activity. I also saw the importance of the language used in terms of education. I've also seen the importance of reinforcing positive behaviour. This was a very good experience for me.

The researcher expressed her observation regarding this situation as follows:

"A pre-service teacher said that students they studied together had learned very quickly; she had no problems. I also stated that there is prejudice against students when intellectual disability is mentioned. They can teach that they are at this level when they have students with intellectual disabilities in the future. They were very surprised. I think it is a very good attitude study. Let's see what awaits us at the end of the term" (Researcher Diary, p. 7).

During these practices, although pre-service teachers were not expected to have the methods and techniques in special education, it has been observed that they also experience limitations in the basic skills that need to be considered in the teaching profession in general. These limitations can be listed as student-teacher placement while teaching, tips provided at teaching stages, and feedback given by the pre-service teacher regarding the wrong and correct responses of the students with special needs. When the applications of the pre-service teachers were observed, it was determined that the pre-service teachers did not sit in the same direction with the student during teaching, so they could not be effective for the student (Confusion due to sitting in the opposite direction). An example of this situation is presented in Figure 2 below. The lecturer gave feedback referring to the practices of the students who were doing the activity in the classroom during class time. It was stated that students who have not practised the activity yet should pay attention to this situation and consider this situation in their teaching experiences. In the next application, the teacher candidates made sitting arrangements as in Figure 3 below.

Figure 2.

Example of Wrong Placement of Teacher and Student in an Origami Activity



Figure 3.

Example of Correct Positioning of Teacher and Student

.....



Pre-service teachers have had reactions such as “No, it is not!” “No, no, not!”. The instructor stated that, with negative reactions, pre-service teachers should repeat the step or ignore it and continue with the next step. Also, it was determined that the pre-service teachers did not reinforce it when the students with special needs performed the skill steps. Verbal reinforcement such as “Well done, good!” was suggested. Regarding this situation, the researcher noted the following in his diary: “I told the students how they should reinforce students' positive rather than negative behaviours, they said “no, it is not” when the student could not do origami practice, but they did not reinforce it when the student achieved the step correctly. Pre-service students said they didn't notice this situation” (Researcher diary, p.9).

Another problem encountered in this process was reaching students with special needs for the origami activity and planning the work of pre-service teachers and students with special needs. Since there is a special education unit at the university, we have worked with students with special needs who receive education here. Determining the suitability of the students coming to the unit, the suitability of the pre-service teacher and determining the mutual time and following the scheduled activities required the instructor to work overtime. The researcher stated that “First of all, we determined the groups, then determined the student they will work with, and the appropriate time conditions. It was very tiring for me to determine the suitability of the two parties and place them on a convenient time slot” (Research diary, p.5). In another statement, the researcher noted that “the instructor of another lesson could not do the fifth group activity today because he gave a make-up lesson.” (Research diary, p.6). She noted in her diary that determining the dates of activities, postponing and re-dating in a situation caused by students with special needs or pre-service teachers have been a source of extra effort in the course.

What are the Opinions and Suggestions of Pre-service Teachers for Improving the Special Education and Inclusion Course?

Opinions and suggestions of pre-service teachers regarding the special education and inclusion course, which were carried out for one semester, were received. The pre-service teachers stated they were satisfied with the content and how lessons were covered because the special education and inclusion course was a different subject than mathematics. Themes and sub-themes were created by analysing the data obtained from semi-structured interviews.

Table 3.

Theme and Sub-themes Obtained from Semi-structured Interview

Themes	Sub-themes
Course presentation	<ul style="list-style-type: none"> • Methods and techniques used
Contribution of Special Education and Inclusion Course	<ul style="list-style-type: none"> • Topics and situations that are interesting/liked in the lesson • Features of the lecturer • Changes in the perspective on students with special needs • Contribution of Special Education to the Teaching Profession in General
Suggestions for Improving the Course	
Course presentation	

Pre-service teachers were asked their opinions on the course. In terms of the methods and techniques used in the course, PT1 stated that “The presentations were good”; PT3 stated, “We were not sticking to the book”; PT4 stated, “We were constantly discussing”; PT7 stated, “It was a different style than the courses taught in the Mathematics Education Department”; and PT8 stated, “The course was not based on memorising,” indicating that they liked the way the course was presented and that it was different from the style they encountered in general.

Videos, related materials, and homework titles under the subtheme of interesting topics and situations were used in the course. For example, PT5 stated about video use, “I was interested in the videos you showed, the videos you recorded during the applications.” PT7 expressed that the videos were interesting and effective: “Teacher, you showed us a school. They were teaching business to children. That school, for example, attracted my attention. He is one of the most memorable parts. You know, they are reintegrated into society like this. They have a job in the society that discarded them.”

In addition to the videos, pre-service teachers emphasised that the materials the instructor brought to the lesson contributed to the understanding and effectiveness of the subject. For example, PT4 said, concerning the materials, “You were giving ladybird stickers when the students achieved something and were giving a reinforcer

according to the number of the stickers." PT8 stated, "What I was interested in in the lesson was the assistive materials made for those with visual disabilities. For example, we had many materials for people with visual impairment in our country, and I did not have this information.

Pre-service teachers also stated that the given assignments contributed to their learning and were both fun and instructive. PT3 stated, "I think the homework you gave was good because mathematics was the intersection of origami and the lesson we took." Similarly, PT2 expressed, "The homework given in IEP was good, in fact, more or less, after all, when a child comes across, we will not know about it; however, at least we have learned it. I mean, we have learned how to look where or a counsellor will call to guide us one day so what will happen," with statements indicating that the homework is instructive and interesting.

It is seen, under the theme of the course presentation, that instructor qualities are also important. Pre-service teachers stated that the sincerity and high motivation of the lecturer affected them. PT2 stated their opinions on this subject: "For example, we take and attend a lot of lessons. But you, my teacher, really wanted to contribute something to us in the lesson"; PT5 similarly said, "You were teaching us from the heart. You know, it would be a shame if we didn't listen."

Contribution of Special Education and Inclusion Course

As a result of the analysis, the findings were given in two subthemes by determining that the special education and inclusion course contributes to the education of students with special needs and the perspective of the teaching profession. When it was analysed regarding the educational perspectives of students with special needs, PT1 stated, "If we did not take such a lesson, we would not know what to do. What is the IEP, what is the program, how will we behave, what are we supposed to do?" PT5 reported, "This lesson added meaning for us. How do we understand Down's syndrome? I think everyone's interest in the lesson has increased." PT7 similarly noted, "I said special education? Is it really the time for this? They had to give us this course in two or three years. Believe me, most of my friends thought so, you know, not because this course is unnecessary ... but after taking this course, our views about this course, what we have to do when we have such a student ... many schemas in our mind have been destroyed. It is a good thing we got the course!" emphasising the contribution of the course. Furthermore, the researcher also noted that "they consult me during the lesson about what to do in the classroom where they have a student with special needs in the scope of teaching practice course" (Researcher diary, p.10). Based on this data, pre-service teachers learned how to behave when they have a student with special needs in teaching practice.

Under the title "Contribution of Special Education to the Teaching Profession in General," it was stated that pre-service teachers had not taken a lesson using the methods and techniques in which the special education and inclusion course was

taught. Thus, their interpretative skills improved with this lesson. PT8 stated that “education lessons are based on a system with memorisation, same in mathematics. But special education has broadened our perspectives too much. In other words, we think about using it even for our own students, for example...”

Suggestions for Improving the Course

When pre-service teachers were asked, “What can be done to improve special education and inclusion course?” four pre-service teachers stated that they did not think the lesson needed improvement. Three pre-service teachers stated that the lesson durations were short, and more lesson hours were needed for this course with such rich content. Two pre-service teachers stated that the fourth grade was late for the course; thus, this course would be more meaningful when given in the earlier years, and they could not focus on the course properly due to their concerns about being assigned to work in the fourth grade. Two pre-service teachers stated that new topics could be added to the teaching practice in the department in line with the course objectives. A pre-service teacher emphasised that the school videos being watched were interesting; thus, the course could be more effective if school visits were organised. In addition, a pre-service teacher asked for more mathematics acquisitions examples during the course.

What is the Difference Between the Preservice Teachers’ Competence Regarding Inclusion Before and After This Course?

The main purpose of this study, designed via an action research model, was to learn how the course content can be improved. However, the results of the two scales were applied to determine how much these improvement applications affect teacher competencies and whether the application during the lesson was effective. A normality test was performed to determine whether the data showed normal distribution.

The normality tests of all measurements, Shapiro–Wilk results, ranged from 0.124–0.766 and were insignificant ($p > .05$). In the kurtosis and skewness coefficients, histograms and Shapiro–Wilk results, the data showed normal distribution in all test measurements.

Dependent Sample T-Test Results

Table 2.

Teachers’ Sense of Efficacy Scale (TSES)

Group	X	Ss	Sd	t	p
Pretest/Post-test	10,674	11,909	42	-5,877	.000

Table 2 above shows the t-test results for comparing the pretest and post-test mean scores for the TSES. As seen, the difference between the pretest mean scores and the post-test mean scores obtained from the TSES scale was found to be significant ($p < .001$). It is also shown that the special education and inclusion course significantly affected teachers' sense of efficacy.

Table 3.

Teaching Mathematics in Inclusion Setting Survey

Group	X̄	Ss	Sd	t	p
Pretest/Post-test	7,837	12,122	42	-4,239	.000

Table 3 shows t-test results regarding the comparison of pretest and post-test mean scores for teaching mathematics in the inclusion setting survey. As shown, the difference between the pretest scores and the group's post-test scores was significant ($p < .001$). It is also showed that the special education lesson was significantly effective on teachers' sense of efficacy.

Conclusion, Discussion, and Suggestions

This study aimed to improve the content of the special education and inclusion course taken by pre-service teachers of a primary school mathematics education program and present problems encountered and related solutions. At the end of this course, however, it was the examination of pre-service teachers' gains. The study conducted by DeSimone and Parma (2006b) on the issues and challenges faced by teachers in inclusion practices revealed that the courses given to teachers about inclusion are not qualified (i.e. only general issues are covered, and mostly the laws are emphasised). In parallel with these findings, Sharma and Nuttal (2016) emphasised that the courses about individuals with special needs should be more qualified in teacher education. In the current study based on this need, it can be said that time limitation affects the course quality. The suggestions of pre-service teachers emphasise the increase of lesson time. Instead of explaining the theoretical information in detail, the researcher made the course meaningful by assigning readings from resources before the lessons and with video and supplementary material support. In this regard, to achieve the goal of inclusive education, one might suggest that relevant content concerning the development of adaptations for students with differing developmental patterns should be used for the course in question and other courses offered within the program's framework.

Another important issue is the quality of special education and inclusion courses in different faculties of education. The researcher/author carried out special education and inclusion courses in the Guidance and Psychological Counselling and English Language Teaching departments, where she learned that improving content according

to the departments is an important factor. Examination of the content of the special education and inclusion courses in education faculties of different universities in Turkey revealed that the content did not differ in terms of the department. As stated in the literature, the information given about special education is important for the pre-service teachers' attitudes toward inclusion practices and to carry out successful inclusion practices. It is thought that this information, which pre-service teachers must obtain, should be transferred in connection with their own fields to be permanent and functional. For example, while the content of special education and inclusion courses given in the pre-school education department should be predominantly based on early education, a primary school mathematics education department should focus on learning difficulties, mild-level intellectual disability or autism, talented students, and adaptations.

Based on this need, "How can the content be improved?" was answered as the first question of the research. Pre-service teachers stated positive opinions about the connection of the subjects with the field of mathematics in the findings. They gained experience working with their own speciality and with individuals with special needs, especially with their origami activity. Further, Anderson and Gumus (2006) emphasised that pre-service teachers should be equipped with content to provide education to students with special needs in their fields. In addition to the adaptation of the course content (i.e. the methods and techniques used in the course), the connection between the course materials and the department was reported as an important factor, according to the pre-service teachers interviewed.

It can be said that providing information to pre-service teachers and providing experience should be a part of this course. Florian and Camedda (2020) supported this finding, i.e. "bridging coursework and practicum experiences is important for strengthen the qualifications of teachers." The study's quantitative findings revealed an improvement in the sense of efficacy of the pre-service teachers. In addition, findings supporting this improvement were obtained from the qualitative data. In this study, pre-service teachers stated that, after interacting with students with special needs, they vanquished their prejudices and got the chance to test their own qualities. Hopkin et al. (2018) expressed that pre-service teachers found studying with individuals with an intellectual disability easier than they thought. These two findings are consistent with each other.

The researcher, through her own means, provided prospective teachers with practice opportunities. Tasks such as identifying students with special needs and obtaining family consent, planning the setting and timing, and drawing up work plans for the prospective teachers entailed an additional workload for the researcher and the provision of the course content. In a practical sense, these roles might seem overwhelming for teacher educators. Therefore, the collaboration of universities and schools might indicate a significant step for teacher education within the framework of inclusive education to simultaneously integrate theory and practice. Guðjónsdóttir and Óskarsdóttir (2020) underlined the importance of university-school collaboration, marking its significance for teacher training.

The author also edited the course content as an introduction to special education and by explaining and experiencing the strategies they can use. Anderson and Gumuş (2006) adapted the topics in the course content; thus, pre-service teachers achieved positive gains for inclusion at the end of the course. Although it is known that the direct instruction method contributes to pre-service teachers in informing students through lecture notes, it was observed that the information could differ from student profiles in terms of being effective and permanent. Further, they were mostly approached by reducing their expectations. However, after the communication started, they were surprised by the students' levels. Nevertheless, due to their teaching practice, it was seen that the course made significant contributions toward observing whether students have special needs. Related research (Hopkins et al., 2018; Lambe & Bones, 2007; Mintz, 2007; Romero-Contreras et al., 2013) supports this finding.

DeSimone and Parmar (2006a) indicated that anxiety in completing a curriculum in secondary schools, major differences between individuals with special needs, and typical development lead to problems adapting gains from curriculums for students with special needs. During the course, pre-service teachers expressed these situations in the lessons. They stated that they conducted a lesson focused on solving more questions by the students with good performance in their teaching practice. With this research, theoretical and practical activities were adapted (IEP development), and pre-service teachers were informed about teaching strategies. Ignoring students with special needs and thoughts of seeing them as obstacles in teaching qualified lessons has been eliminated.

In general terms, it was observed that the course caused a significant change before and after regarding the inclusion skills of the pre-service teachers. Many studies have revealed that teaching attitudes about inclusion have an impact on pre-service teachers' self-efficacy. It also caused a positive change in the sense of efficacy in parallel with the literature (Anderson & Gumuş, 2006; Forlin et al., 2014; Stella et al., 2007; Sharma & Nuttal, 2016). In the present study, not only quantitative data but qualitative data also show that attitudes develop positively. However, it should not be forgotten that these knowledge and skills become meaningful when used in application environments. For this reason, in further research, the first years of mathematics teachers or other second-level branch teachers can be followed; further, the required subjects can be examined, and beginner teachers can be supported. Teacher education programs and special education and inclusion courses can be revised within the determined needs. It may be suggested to develop the contents of special education inclusion courses for programmes of different departments within the collaboration of different departments' educators and to examine the process using various research models.

In addition to these variables, pre-service teachers stated that the instructor carried out the lesson sincerely. It should not be forgotten that the instructors presenting the course also impact pre-service teachers, and they should not forget that the instructors working in the Special Education Department play important roles in teaching special

education in other branches. For this reason, it may be suggested that highly motivated academic staff be assigned to special education and inclusion courses outside the field.

Pre-service teachers also suggested shifting this course to second or third grade. However, the researcher observed that pre-service teachers could quickly transfer learned information to the teaching practice and have more experience with individuals with special needs. The teachers can also consult the instructor who conducts special education and inclusion course at any point when they are stuck in practice. The researcher's observations reveal that teaching this course in the fourth grade can be more beneficial.

Consequently, this study has shown the process of improving special education and inclusion courses and gains of pre-service teachers in a primary mathematics education program. This study indicated that teachers' sense of efficacy showed improvement regarding inclusion, and pre-service teachers gained experience working with students with special needs. The strength of the study is to be supported the findings with a wide variety of data sources. However, the research has some limitations. First, there are no field experts other than the researcher in the research process except expert opinion for the semi-structured interview and the course content list. The second limitation is that origami applications were carried out as a group activity of pre-service teachers and with a small number of students with special needs. For further research, it can be suggested that pre-service teachers study with students with special needs on a one-by-one basis. The performance of pre-service teachers could also be assessed individually.

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