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COMMENTARY

Inclusive Education for a More Egalitarian Society

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"Every student can learn, just not on the same day or in the same way."
–George Evans

SPECIAL education for persons with disabilities is an integral part of a nation's education system. However, it is not until after World War II, particularly after the 1970s, that the right to education of children with disabilities garnered widespread attention in the global community. The UN' agencies released a succession of official papers related to or specialized in this issue, such as the *Universal Declaration of Human Rights, Declaration on the Rights of Mentally Retarded Persons, Declaration on the Rights of Disabled Persons, Declaration of the Rights of the Child, Standard Rules on the Equalization of Opportunities for Persons with Disabilities*, *Framework for Action on Special Needs Education, and Convention on the Rights of Persons with Disabilities*. Despite the variations in the context and content between these papers, they share the common conception that every society and its government have the responsibility and obligation to provide high-quality education services for children with disabilities to ensure their right to education and protect them from educational discrimination and exclusion (Li, 2023).

The earliest human practice of special education can be traced back to the late sixteenth century, where Pedro Ponce de Leon, a Spanish Benedictine monk, undertook the instruction of certain deaf boys from some of the Spain's wealthiest families, employing methods of his own devising. In the initial stage of special education, children with disabilities invariably received education in isolation provided by medical or religious institutions. Also, this kind of special education was restricted to children with severe disabilities and focused on the "physiology-based methods" (Liu, 1999). Later, independent special education institutions emerged under the notion that children with disabilities were not suitable to be educated in regular schools. As a result of its rapid development in modern Western countries, special education became a separate education system and research area in parallel with general education (Winzer, 1993).

With a growing awareness of universal human rights, people began to realize that educating children with special educational needs in isolation was somewhat a discriminatory practice. The ideas of equality and inclusion were infused into special education, and the rights of children with disabilities to the opportunities of participating social and cultural activities and sharing the development outcomes of human society gained legal recognition. In 1975, the U.S. Congress enacted the *Education of All Handicapped Children Act*, setting forth six mandates to secure the rights of children with disabilities and their parents: zero reject, nondiscriminatory identification and evaluation, individualized educational program, the least restrictive environment, legal procedures, and parental involvement (Yu & Hou, 2008). In the UK, the *1978 Warnock Report* recommends that segregated "special" schools should be for those with the most complex, chronic, and multiple disabilities and that mainstream schools should develop to meet the needs of all other children. The 1981 and 1993 Education Acts provide that where possible, children with "special educational needs" should be educated in ordinary classrooms. Subsequently, acts like the *Disability Discrimination Act, Special Education Needs and Disability Act, Education for Persons with Special Education Needs Act, and Equality Act 2010* were introduced to reaffirm the right of children with disabilities to education in an egalitarian and inclusive setting (Huang, 2013).

The term "inclusive education" was first officially advanced by the 1994 World Conference on Special Needs Education in the *Salamanca Statement*. The Conference called for all nations to develop inclusive education on the principle of equality and respect and ensure quality education for children with disabilities by drawing on the joint efforts of parents, schools, and the community (UNESCO, 1994). Under the theme of "inclusive education: the way of the future," the 48th Session of the International Conference on Education in 2008 established inclusive education as the strategy for achieving the universalization of education, marking it becoming the focus of the entire educational field beyond the realm of special education (UNESCO, 2008). Currently, special education has become one of the key areas in educational reform in many countries. The development status of special education is widely regarded as an indicator of the comprehensive level of social, economic, and cultural development of a nation or territory. Inclusive education offers an alternative to the prior educational arrangement for children with disabilities mainly provided by isolated special education schools (Wang & Xiao, 2012). The transition from isolation to inclusion signals a remarkable step forward in special education.

In the issue, *A Review of Inclusive Education Development in China* gives an overview of the history of inclusive education development in China (Du, 2024); *Inclusive Education in China: Complications and Causes* focuses on the challenges encountered in the implementation of inclusive education in China and their causes (Zhou, 2024). It is hoped these articles can inspire more explorations of inclusive education in academia.

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COMMENTARY

Argumentation Training Boosts the Outcome of Negotiation in Collaborative Learning

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"For good ideas and true innovation, you need human interaction, conflict, argument, debate."
–Margaret Heffernan

NEGOTIATION is an essential technique in collaborative learning. In the negotiation process, students learn to listen to others' opinions, express their own ideas, discuss divisions, and reach agreement. It also plays an important role in the construction of knowledge on the part of students. According to the constructivist theory, learning is a process of active construction, in which learners construct their knowledge and understanding through interaction with the environment (Yu-Jun, 2013). Negotiation is a crucial component of the interaction, contributing to enhancing learning engagement and developing in-depth understanding of information. Moreover, it is particularly effective in fostering students' critical thinking ability in that it concerns discrimination and judgement of differential information and perspectives (Olson, 1997).

To increase the outcome of negotiation in group work, it is necessary to help students master basic argumentation skills. Argumentation training focuses on developing argumentative powers of individuals or teams, aiming to improve their skills in negotiation, debate, persuasion, etc. Its components typically include critical analysis, logical structure, evidence use, counter argumentation, clear representation, and debate and analysis exercises (Wu, 2023). For students, the benefits of argumentation training are many. First off, it can significantly bolster students' communication skills. In collaborative learning, it is of vital importance for the individual to deliver their opinions accurately and effectively to group members, focusing on the core questions and circumventing

irrelevant discourse (Chen, 2018). Also, argumentation training helps foster students' logical thinking capacities. Negotiation in groupwork is not just a simple exchange of views between individuals, but more about debate based on logic and evidence. Students who have received argumentation training are better at spotting the flaws in teammates' representation and making forceful rebuttals. They also do better in structuring their own presentation and evidence, building defensible logical chains (Zhang, 2016). In addition, argumentation training helps enhance students' adaptability. In groupwork, it is important for the students to be able to adapt to emerging situations, adjusting their strategies in a timely manner and making effective reactions to changes (Li, 2019).

Administering argumentation training to students is a pervasive practice in many countries and territories. *Next Generation Science Standards*, released by the US National Research Council in 2013, lay down "evidence-based argumentation" as a basic practice across preschool and K-12 science education (National Research Council, 2013). Science education in the UK also places great emphasis on the cultivation of argumentation skills in students. Students are required to write detailed reports after completing scientific experiments to expound on their findings logically and support their conclusions with evidence. Activities like "debate clubs" are conducted on the campus to forge students' representation and argumentation abilities through debates (Song, 2023). Argumentation power development is equally important in Chinese science education. For example, in inquiry-based learning and project-based learning, students are encouraged to practice argumentation in groups by going through processes such as identifying issues, posing questions, proposing hypotheses, and critically analyzing information (Zeng, 2021).

Grade-7 Students Negotiation during the Engineering Design Processes Regarding the Status of Their Argumentation Training in this issue seeks to investigate the effect of argumentation training on students' argumentation-based negotiation in the engineering design process. Thirty-three participants were recruited from an urban public middle school in Turkey, who were divided into two groups with one being administered argumentation training in advance. The research corroborates the positive impact of argumentation training on students' negotiation outcomes by comparing the performance of the group with the argumentation training experience and that of the group without this experience in EDP negotiation (Tug & Namdar, 2024). The article provides valuable insights into the significance of argumentation training for science education.

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ORIGINAL ARTICLE

The Opinions of Prospective Teachers about Biology and Nature-Related Activities for Mentally Disabled Students

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***Abstract**: The aim of this study is to examine the opinions of prospective teachers about biology and nature-related activities for mentally disabled students. The survey method was used in this quantitative study. Attitude scale towards biology and nature-related activities for mentally disabled students was used as a data collection tool. The scale was applied to a total of 258 (183 females, 75 males) prospective teachers studying at the education faculty of a state university and taking special education courses. According to the findings, prospective teachers expressed their positive opinions about all the activities specified in the scale. However, a few prospective teachers stated that some of the activities, especially interaction with animals, were not applicable for their mentally disabled students. However, when the findings are evaluated in general, it is concluded that biology and nature-related activities are very valuable for mentally disabled students.*

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***Keywords:** Attitude, Mentally Disabled Students, Nature-Related Activities, Prospective Teachers*

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***AI Declaration**: The authors affirm that artificial intelligence did not contribute to the process of preparing the work.*

Introduction

THERE are various individual differences among the people who make up the society in terms of their physical, mental, spiritual and social characteristics. These differences can affect individuals' lives positively or negatively, and they are also decisive in terms of their competence and inadequacy (İlhan & Esentürk, 2015). The lives of individuals are negatively affected by their inability to perform certain movements, senses or functions expected from them depending on age, gender, social and cultural factors due to a physical or mental disorder. This situation is defined as disability (Sevimay, 2013). Due to these individual differences, individuals cannot receive the stimuli coming from their environment in the way that the majority perceive and cannot express themselves. This makes it difficult for individuals to adapt to society (Sözbilir et al., 2015). Different educational or medical classifications are defined for disabled individuals, depending on their disabilities. One of these classifications is mental disability.

Mental retardation is generally defined as an individual scoring 74 or lower on an IQ test. Mental retardation has also been defined as a persistent lack of at least two or more areas of behavioural adaptation (communication, self-care, life, social skills, sociability, self-management, health, safety, educational activities, free time, etc.) (Eripek, 2005). Within this group, individuals with an intelligence level of 45-75 points fall into the educable mentally disabled category. People in this group constitute 75-80% of mentally disabled people. These individuals need to break down an activity or job into simple parts in order to learn the whole thing. They may be slow and behind compared to their peers. Learning processes range from small parts to the whole. Their learning speed is slow. They think slowly and comprehend slowly. Verbal explanations don't mean much. To ensure learning, the work must be demonstrated practically (Şahin & Kardaş, 2023).

Education is a fundamental human right that is a significant prerequisite for people to participate equally in society and develop their potential. When considered from the perspective of mentally disabled people, it becomes clear that they have the right to special education. In this sense, individuals with special needs should be subjected to a special education program (Orhan & Genç, 2015). There are many definitions of the concept of special education, whose importance in society increases day by day and is constantly evolving. Special education according to the Special Education Services Regulation (Ministry of National Education [MoNE], 2021) is defined as education programs developed to meet the educational and social needs of people who differ significantly from their peers in terms of their personal and development characteristics and educational qualifications, and also education carried out in suitable places with specially trained personnel. The individual needs limited support educational services and special ar-

rangements during the education period (MoNE, 2019). According to this regulation, it is important to provide a suitable learning environment for students in need of special education through individual education programming. In this context, education for disabled people in our country is carried out with specially trained personnel, programs and materials, depending on their degree of disability. Education is provided in special education schools, especially with the necessary tools and equipment (Pakalın et al., 2023).

Science, and especially biological science, is an important discipline for all students, whether they have special needs or not. Because biology is the most important basic science that directly concerns humans and has both scientific and social aspects (Yetkin, 1998). Biology is the systematic study of the structure and behaviour of the physical, social and natural world through observation and experimentation. Therefore, it supports students' ability to understand and retain information as it provides tactile or visible evidence of many facts they see on television and in books (Rakap et al., 2023). Additionally, biology and nature-related activities contribute to the cognitive and sensory development of the individual to the extent of their abilities. Such activities psychologically support the development of individuals by giving them a sense of confidence and achievement (Karakaş, 2018; Uslu, 2012). Students with special needs are more likely to encounter some problems in the context of science education because of their differences compared to their typically developing peers. This situation requires teachers who teach students with special needs, either within the scope of inclusive education or in special education classes, to use some special activities for biology and nature education. However, some studies report that science teachers and prospective teachers do not have the necessary competencies to teach students with special needs (Cawley, 1994; Mastropieri & Scruggs, 1994; Patton, 1995; McGinnis & Stefanich, 2007). On the other hand, special education teachers receive limited training in the context of teaching science to students with special needs and have difficulty obtaining the necessary materials. For this reason, it is seen that science is generally not taught at all in special education classes, or when it is taught, much less time is devoted to this area than in general education classes (Maguvhe, 2015). According to the American National Center for Education Statistics, students with special needs perform significantly lower in science courses (National Center for Education Statistics, 2019).

The studies on education for mentally disabled students in our country have gained momentum in recent years, and in parallel with these studies, some studies have been started in the field of mentally disabled education (Baki, 2014; Karakaş, 2018; Şahin & Kardaş, 2023; Uçar, S., & Balbağ, 2021). Yet, studies on science education for mentally disabled students are quite limited (Çapraz, 2016; Demir, 2008; Gul et al., 2023; Mete, 2016; Mete et al., 2017; Terzioğlu et al., 2023; Uslu, 2012). One of these studies

was conducted by Mete (2016). In the study, some hard and soft substances were taught to students with intellectual disabilities in the context of the visible and sensible properties of the substance by direct teaching method. As a result of the study, it was seen that learning took place in two of the three students who constituted the sample of the study and they were successful at the level of remembering, but one student did not learn to the expected extent. In his study, Çapraz (2016) investigated the effectiveness of teaching the "solid-liquid-gas" states of some substances to students with intellectual disabilities by direct teaching method and the usefulness of this method. For this purpose, teaching and evaluation were made with solid, liquid and gaseous substances first themselves and then with their pictures. The research results revealed that the direct teaching method is an effective and useful method in teaching the "solid-liquid-gas" states of some substances to students with intellectual disabilities. In addition, it has been observed that this method provides students with permanence and increases academic success. Akman Yozgat et al. (2018) aimed to teach the names of the elements to students with mild mental disabilities. The findings of the study showed that the direct teaching method is effective for students with mild intellectual disabilities. In the research conducted by Kaya (2016), it was seen that the fixed waiting time teaching method was effective in teaching the concept of "living-inanimate" in the science course. In Sazak Pınar and Merdan's (2016) study, it was observed that students with autism gained conceptual knowledge of the digestive system subject at an accuracy level of 90% or above, and that they maintained these gains at an average level of 90% after a period of instruction.

Some activities related to biology and nature are needed for students with special needs to be successful in biology courses and to develop a positive attitude towards the course and to motivate them. Based on this, the study aimed to examine the opinions of prospective teachers in the field of special education about biology and nature-related activities for mentally disabled students. For this aim, the following questions were sought in this study:

- *What are the opinions of prospective teachers about biology and nature-related activities for mentally disabled students?*
- *What are the opinions of prospective teachers about the applicability of biology and nature-related activities for mentally disabled students?*

Method

Survey method was used in the study. The survey method aims to describe an existing situation as it is. The individual, event or object that is the subject of the research is tried to be defined in its own conditions and as it is. The individual, event or object is not affected or attempted to be changed in any

way. What is important is that what is wanted to be known can be observed and determined (Karasar, 2003).

Participants

In determining the sample, the rule of Bryman and Cramer (2001) that "the sample should be at least five times the number of items in the scale" was considered. In this way, the sample group included a total of 258 (183 females, 75 males) prospective teachers studying at the education faculty of a state university and taking special education courses. All the participants were selected from prospective teachers who had taken special education courses during their education and participated in the study voluntarily in the fall semester of academic year 2023. The ethic board of the institute approved the study.

Data Collection Tool

'Attitude Scale on Activities Related to Biology and Nature for Mentally Disabled Students' developed by Gul et al. (2023) was used as a data collection tool. The scale consisted of a total of 21 items grouped under 5 factors. The scale was prepared in a 5-point Likert type, and the expressions in the scale were scored as 1: strongly disagree, 2: disagree, 3: neutral, 4: agree, 5: strongly agree. As a result of factor analyses, considering the theoretical structure and content of the items in each of the five factors, the factors were determined as 'in-school activities', 'interaction with animals', 'activities related to the sense organs', 'interaction with plants' and 'free time activities'. The internal consistency coefficient of the scale (Cronbach Alpha= α) was 0.89.

Data Analysis

All statistical analyses were performed in Microsoft Excel and IBM SPSS 20. The data analysis was conducted in a descriptive manner. The arithmetic means were interpreted as follows: strongly disagree in the point range of 1.00-1.80, disagree 1.81-2.60, neutral 2.61-3.40, agree 3.41-4.20, and strongly agree 4.21-5.00 (Gul & Gul, 2022).

Results

The Results for the First Research Question

The first research question was aimed at examining the opinions of prospective teachers about biology and nature-related activities for mentally disabled

students. Findings for the overall scale and each of the five factors are shown in **Table 1**.

When the arithmetic means in **Table 1** are examined, the highest value belongs to F4, and the lowest value belongs to F2. However, it is seen that the prospective teachers completely agreed with the statements in F4, but also positively agreed with the statements in other factors. Similarly, the arithmetic means of the prospective teacher' opinions regarding the overall scale is within the 'agree' limits.

The Results for the Second Research Question

The second research question was aimed at examining the opinions of prospective teachers about the applicability of biology and nature-related activities for mentally disabled students. Findings for the second research question are shown in **Table 2**.

According to the findings in **Table 2**, the majority of prospective teachers thought that the activities in the scale were suitable for mentally disabled students. However, for a few activities (I6, I8, I9, I10), more than 30% of the prospective teachers stated that the activities were not applicable for mentally disabled students.

Discussion and Conclusion

The main purpose of the education of mentally disabled individuals is to provide them with the necessary skills to live their lives without being dependent on anyone else. For this, an educational environment that will meet their needs is needed (Obaseki & Osagie-Obazee, 2009). Many educational methods and techniques are used in the teaching process of mentally disabled individuals. One or more of these techniques and methods can be used at the same time, depending on the level of the disabled child and the skill given (Bedir et al., 2013). The scale used in this study is aimed at students who are included in the 'educable mentally disabled' category. Based on this, this study was examined the opinions of prospective teachers about biology and nature-related activities for mentally disabled students.

The findings indicated that that the prospective teachers completely agreed with the statements in F4 (Interaction with plants), but also positively agreed with the statements in other factors. One of the reasons why students have trouble trying to learn science concepts is that they cannot relate science concepts to daily life (Er Nas et al., 2018; Stolk et al., 2012). Biology, an important field of science, is also a branch of science intertwined with daily life. Therefore, it is important to offer activities related to daily life in teaching biology subjects to mentally disabled students. At this point, when the activities in the scale are examined, it is very valuable that prospective

Table 1. Descriptive Analysis of Prospective Teachers' Opinions Regarding the Expressions in the Scale.

Factors	Minimum	Maximum	Mean	SD
In-school activities (F1)	1.17	13.00	3.89	0.96
Interaction with animals (F2)	1.00	5.00	3.75	0.79
Activities related to the sense organs (F3)	1.00	12.00	3.88	0.94
Interaction with plants (F4)	2.00	5.00	4.23	0.60
Free time activities (F5)	1.00	5.00	4.01	0.79
Overall	1.24	6.67	3.94	0.62

teachers think that these activities are suitable for mentally disabled students. Because these activities are themed on nature and biology, which are life sciences, and are intertwined with daily life. As a matter of fact, Dilber (2017) stated that mentally disabled students can more easily relate biology subjects and concepts to daily life. In another study conducted by Er Nas et al. (2018), how special education teachers carry out the teaching process of science and nature activities with mentally disabled students was examined. As a result of the study, it was determined that special education teachers preferred the student's performance level, developmental characteristics, and concrete and understandable activities when designing science and nature activities. It was determined that special education teachers preferred experiments and activities related to the subject of "Living Creatures and Life".

When the findings for the second research question of the study are examined, it was determined that the majority of prospective teachers thought that the activities in the scale were suitable for mentally disabled students. Biology and nature-related activities in this scale require students' active participation in the teaching process. The activities also help students develop their observation skills. This may make it easier for students with mental disabilities to learn. In a study conducted by Bedir et al. (2013), teachers' opinions about active learning practices in schools where mentally disabled students were educated were taken. Teachers stated that their students were special education students and that the lessons were mostly based on individual education, therefore they ensured the active participation of the students in the lessons. It has been determined that students' active participation in the lesson makes them happy and is beneficial for the students. Similarly, in some studies, science teachers stated that most mentally disabled students were able to use more observation skills (Dilber, 2017; Er Nas et al., 2018).

To provide science skills to students who need special education, including the mentally disabled, and to develop science literacy, learning environments should be created by taking into account their individual

Table 2. Prospective Teachers' Acceptance Level Towards the Applicability of Biology and Nature-Related Activities for Mentally Disabled Students.

Factor	Items	Acceptance Level	
		Yes	No
In-school Activities (F1)	**I1.** Performing biology-related laboratory activities increases the attitude of mentally retarded individuals towards biology and nature.	217 (84.1%)	41 (15.9%)
	I2. Inviting expert guests in biology and nature (doctor, veterinarian, biologist, etc.) to the class increases the attitude of mentally retarded individuals towards biology and nature.	223 (86.4%)	35 (13.6%)
	I3. Observing animate and inanimate nature elements with a microscope and lens increase the attitude of mentally retarded individuals towards biology and nature.	211 (81.8%)	47 (18.2%)
	I4. Watching documentaries, photographs, slides or movies about biology and nature increases the attitude of mentally retarded individuals towards biology and nature.	228 (88.4%)	30 (11.6%)
	I5. Doing activities aimed at observable change, such as fermenting yoghurt and making pickles, increase the attitude of mentally retarded individuals towards biology and nature.	208 (80.6%)	50 (19.4%)
	I6. Collecting living and non-living things in nature increases the attitude of mentally retarded individuals towards biology and nature.	180 (69.8%)	78 (30.2%)
Interaction With Animals (F2)	**I7.** Going to the zoo increases the attitude of mentally retarded individuals towards biology and nature.	218 (84.5%)	40 (15.5%)
	I8. Fishing increases the attitude of mentally retarded individuals towards biology and nature.	172 (66.7%)	86 (33.3%)
	I9. Doing activities that communicate with animals, such as riding horses and swimming with dolphins, increase the attitude of mentally retarded individuals towards biology and nature.	179 (69.4%)	79 (30.6%)
	I10. Participating in swimming and diving activities to watch underwater creatures increases the attitude of mentally retarded individuals towards biology and nature.	167 (64.7%)	91 (35.3%)
Activities Related to the sense organs (F3)	**I11.** Smelling activities such as flowers and spices that will appeal to the sense of smell increase the attitude of mentally retarded individuals towards biology and nature.	223 (86.4%)	35 (13.6%)
	I12. Conducting various fruit and vegetable tasting activities that will appeal to the sense of taste increases the attitudes of mentally retarded individuals towards biology and nature.	223 (86.4%)	35 (13.6%)
	I13. Doing activities by touching various living things and inanimate objects that will appeal to the sense of touch increases the attitude of mentally retarded individuals towards biology and nature.	223 (86.4%)	35 (13.6%)
	I14. Listening to music containing various animal, water and nature sounds that will appeal to the hearing sense increases the attitude of mentally retarded individuals towards biology and nature.	231 (89.5%)	27 (10.5%)
Interaction With Plants (F4)	**I15.** Doing activities such as planting seeds and collecting fruits and vegetables increases the attitude of mentally retarded individuals towards biology and nature.	242 (93.8%)	16 (6.2%)
	I16. Going to the botanical garden increases the attitude of mentally retarded individuals towards biology and nature.	225 (87.2%)	33 (12.8%)
	I17. Participating in tree and sapling planting activities increases the attitude of mentally retarded individuals towards biology and nature.	243 (94.2%)	15 (5.8%)
	I18. Participation in the camp-picnic event increases the attitude of mentally retarded people towards biology and nature.	213 (82.6%)	45 (17.4%)
Free Time Activities (F5)	**I19.** Growing ornamental plants increases the attitude of mentally retarded individuals towards biology and nature.	226 (87.6%)	32 (12.4%)
	I20. Spending time with inanimate elements such as stone, soil, sand increases the attitude of men-tally retarded individuals towards biology and nature.	221 (85.7%)	37 (14.3%)
	I21. Observing celestial elements such as stars, clouds and rainbows increases the attitude of men-tally retarded individuals towards biology and nature.	223 (86.4%)	35 (13.6%)

differences (Uçar & Balbağ, 2021; Uzoğlu & Denizli 2017). At this point, teachers have a great responsibility. Teachers need to have information about students who need special education, the learning difficulties they may encounter in the classroom, the precautions that can be taken, and how they can be useful to these students (Toptaş, 1998). Reading difficulties, behavioral problems and some sensory deficiencies of students who need special education can make science teaching difficult (Sönmez Kartal, 2017). Therefore, these students should be provided with environments that will improve themselves in terms of their physical, social and personality characteristics, by getting rid of the education and training approach aimed only at their cognitive development (Tatlılıoğlu & Avcı, 2012). At this point, the importance of applied approaches in the learning environment becomes evident. According to some researchers, the practical nature of science courses has a positive effect on students with mental disabilities (Dalton et al, 1997; McCarthy, 2005). Applied approaches and experiments reveal that they enable students to focus on concrete materials such as microscopes, plants and animals, rocks and minerals rather than the textbook, and are very useful for mentally disabled students (Scruggs & Mastropieri, 1994). Accordingly, although biology and nature-related activities were accepted as applicable by the majority of prospective teachers in the study, some activities were not found suitable for mentally disabled students by a limited number of teacher candidates. Considering these findings, more than 30% of the prospective teachers stated that a few activities (I6, I8, I9, I10) were not applicable for mentally disabled students. Among these activities, activity I6, which is included in the in-school activities (F1) factor, is about collecting living and non-living things in nature. Prospective teachers may not have approved this activity, thinking that collecting living creatures in nature or interacting directly with these creatures could be dangerous for mentally disabled students. As a matter of fact, some activities (I8, I9, I10) that prospective teachers think are not most applicable for mentally disabled students are related to interaction with animals (F2). Animals are creatures that add enriching experiences to children's world. It is also known that animal-assisted therapies are frequently used in disabled rehabilitation. At this point, it is interesting that some prospective teachers have low acceptance of the applicability of the activities specified in the scale. Perhaps prospective teachers may not have approved of these activities because they were not in-school activities. However, considering out-of-school learning activities, these are also applicable today. It should also be noted that such activities can be carried out with the participation of all students within the framework of an activity planned by the teacher, outside of the free time activity (Yağlıkara, 2006). The results of a study conducted by Scruggs and Mastropieri (1994) showed that students with mild mental disabilities in applied science courses greatly

enjoyed science activities and significantly benefited from the opportunity to directly interact with scientific materials.

In the study, the highest mean value among activities related to biology and nature was found in interaction with plants (F4). The fact that plants do not actively move from one place to another like animals or that they can be more harmless when in direct contact may have caused teachers to prefer F4 as the most applicable activities. On the other hand, activities involving plant cultivation, planting, growing, and observing plants are among the activities that students participate in with interest (Yağlıkara, 2006). Students learn to recognize the properties of the soil while growing plants, to recognize and use the tools and equipment used in growing plants, to cooperate with their friends, and to be sensitive to the needs of plants, which are living things. Since students have the opportunity to observe and learn by doing such activities, it can be said that these activities are effective in creating environmental awareness and awareness (Dere & Ömeroğlu, 2001). In the study conducted by Er Nas et al. (2018), when the science and nature activities carried out with mentally disabled students were examined, it was determined that almost all of the special education teachers frequently included plant growing and germination experiments. Students can better comprehend situations that they can relate to their daily lives (Ültay & Çalık, 2012). In this regard, it can be stated that the reason why special education teachers give more space to plant growing and germination experiments is due to the fact that students with learning disabilities frequently encounter these activities in their daily lives.

When the findings of the study were evaluated in general, the majority of prospective teachers accepted that biology and nature-related activities were useful for mentally disabled students and applicable in learning environments. This can be attributed to the fact that the activities in question are practical. According to Gerston et al. (2000), in an applied approach, full learning can occur when knowledge is concretized for the student and the entire activity process is experienced and observed by the student. At this point, implementing these activities in classes with mentally disabled students can provide effective teaching. Despite these positive results, the study has some limitations. Therefore, the following recommendations are offered for future research:

- According to the prospective teachers in the study, biology and nature-related activities can develop positive attitudes in mentally disabled students. For this reason, both science and biology teachers teaching in inclusive classrooms and special education teachers should frequently include such activities in their learning environments.
- The contribution of students' cognitive, affective, and social development can be investigated by carrying out biology and nature-related ac-

tivities in learning environments where mentally disabled students are present.

- This study was limited to a total of 258 prospective teachers. For further studies, similar studies can be conducted with science or biology teachers and special education teachers.

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ORIGINAL ARTICLE

Grade-7 Students' Negotiation during the Engineering Design Processes Regarding the Status of Their Argumentation Training

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***Abstract**: This study aimed to investigate grade-7 students' negotiation during the engineering design process regarding the students' status of argumentation training. The participants were 33 students studying at a public urban middle school in Turkey. They worked in small groups on four engineering design tasks about electricity and light. Data were collected through small group audio recordings, student worksheets, and the observation. The data were analyzed by using content analysis. The results indicated that negotiation patterns were similar across all groups. However, differences were found between the group that received argumentation training and the one that did not receive in terms of proposing ideas for material design, using justifications when in agreement with others, counter proposing and acquiring information for better planning and altering the design, and critiquing for design advantages and disadvantages.*

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Introduction

RECENT curriculum reforms highlight the need for engaging students in science and engineering practices (Ministry of National Education, 2018; National Research Council [NRC], 2012). Both scientists and engineers utilize argumentation in their daily work. While scientists use argumentation to evaluate and explain natural phenomena, engineers use it to find the best design solution (NRC, 2012). Argumentation provides an opportunity for reaching a consensus over design solutions by enabling negotiation in the engineering design process (EDP). Negotiation is broadly defined as the collaborative decision-making process of more than one party (Pruitt, 1981). Since they facilitate information exchange and exploration of different perspectives by using multidisciplinary perspectives, negotiation processes can lead to the creation of new designs (Jin & Geslin, 2009).

Engineering design tasks usually occur in teams (Sheppard et al., 2006). These tasks require team members to engage in discourse and construct, share, negotiate, and critique ideas for the best design solution (Brereton et al., 1996; Crismond & Adams, 2012; Mentzer et al., 2015). However, group products might negatively reflect students' argumentation qualities and discourse problems (Chi & Menekse, 2015; Dillenbourg & Hong, 2008). Furthermore, verbal interactions such as questions, conflict, and reasoning in group work affect individual and group success (Menekse et al., 2019). Collaboration during EDP does not always guarantee a good design, so different supports should be in place to structure students' design process (Hertel et al., 2017). Argumentation-based negotiation in engineering has been proposed to address issues related to cooperation and co-construction (Jin & Geslin, 2009). Therefore, engineering design is affected by the speech acts enacted during negotiation processes. Speech acts give designers a space to exchange ideas and information, get exposed to distinct perspectives, and identify opportunities for improving the design. Therefore, argumentation-based negotiation as a verbal process is essential to successful decision-making (Jin & Geslin, 2009).

Studies show that students' prior knowledge and argumentation skills influence their decision-making. In engineering design, recent research indicates that argumentation scaffolds can increase, for example, preservice teachers' use of scientific concepts (Urueña et al., 2017) and their evidence-based reasoning, and thus, decision making on engineering design tasks (Rebello et al., 2019). However, fewer empirical studies exist on the negotiation process in engineering design discourse (Guzey & Aranda, 2017). Our research addresses this gap in the literature by investigating the effect of students' argumentation training on students' argumentation-based negotiation during EDP. Analyzing the influence of argumentation training on negotiation processes within EDP and evaluating students' strengths and weaknesses

in these processes will provide valuable insights for optimizing the structure of EDP. This, in turn, will guide the implementation of necessary measures to enhance students' engineering design skills. (Jin & Geslin, 2009). In this context, we examined the argumentation-based negotiation of seventh graders. The research question guiding the study was: "*How do grade-7 students use argumentation-based negotiation in engineering design processes regarding their status of argumentation training?*"

Engineering Design Process (EDP)

During a design process, students are expected to decide on design components, select, plan, draw a prototype, and create arguments based on evidence in steps such as product promotion. Engineering design involves processes in which decisions are jointly made. Therefore, EDP requires designers to engage in argumentation to negotiate possible solutions to the given problems (NRC, 2012). "However, understanding how students engage in argument from evidence within K-12 engineering settings has not been studied extensively" (Siverling et al., 2019, p459).

Students engage in discourse and argumentation in design processes. They negotiate and justify the design for a productive and effective solution. Azevedo et al. (2015) found that students' discourse in engineering design involved description and explanation practices, while argumentation episodes occurred less frequently. Guzey and Aranda (2017) found that design discourse unfolds uniquely in small groups, influencing students' decision-making in engineering design. In small group discussions, students tend to focus more on the financial aspects of their designs rather than the scientific aspects. Additionally, the instructors play a role in shaping the argumentation processes during these discussions. In another study, Wendell et al. (2017) found that articulating multiple solutions, evaluating pros and cons, intentionally selecting a solution, retelling the performance of a solution, analyzing a solution according to evidence, and purposefully choosing improvements as reflective decision-making elements of elementary students in EDP. More specifically, argument-driven engineering is proposed for developing students' engineering experience in an argumentation context. A model that allows these design tasks to be completed in a few weeks is suggested. The EDP comprises eight stages: introducing the problem, concept generation, concept selection, design argumentation, design testing, evaluation argumentation, report development, and reflection and discussion (Chu et al., 2019).

Argumentation-Based Negotiation in the Context of Engineering Design Process

Depending on the design task's complexity, designers can engage in different collaborations (Engeström, 2014; Leont'ev, 1978). Subtasks are examined to perform the interactions between designers in mutual collaboration. In this context, a designer's design decisions may influence the group's decisions. Argumentation-based negotiation has been proposed for collaborative design in engineering to understand joint decision-making processes (Jin & Geslin, 2009). The original framework interlinks both the designers and engineering systems. Jin and Geslin argue, "For multidisciplinary collaborative design problems, negotiation is a way for multiple designers to exchange information, acquire knowledge of other designers' perspectives and intents, and identify new opportunities. Therefore, design negotiation has the potential to create new opportunities and new designs (Jin & Geslin, 2009, p127)." They suggest that negotiation helps designers resolve conflicts cooperatively, co-construct an understanding of the task, and discuss alternative design solutions. Based on the argumentation-based approach, argumentation-based engineering negotiation focuses on moving beyond simply accepting and rejecting the proposal; instead deals with how individuals argue about their positions, understandings, and goals about the design task. Their model suggested speech acts, negotiation stages, and strategic actions.

Drawing on the Toulmin (2003) argument model, Jin and Geslin (2009) mentioned nine negotiation states in their developed model, all leading to claims, data and warrants. Besides, the model includes speech acts and strategic actions. In strategic actions, the action of 'quit' differs from negotiation patterns. This act was not used in the current study as students' regular participation was ensured. We adopted these negotiation states to identify how students' design involved negotiation based on their argumentation training. In the current study, this three-stage framework in the argumentation processes has been merged into a single structure called negotiation patterns to make it easily applicable in the middle school context. **Table 1** shows the negotiation patterns and their explanation.

Method

In this exploratory case study (Stake, 1995), the participants were 33 students from two grade-7 classes studying in a public-school in Northeast Turkey. The case study approach allowed us to explore groups' EDP more in-depth. In addition, the convenience sampling method was used in student selection. A total of 17 students were in the group that did not receive argumentation training, and 16 were in the group that received argumentation training. The reason for selecting grade-7 students was that physics subjects such as the "Light-matter Interaction and Electric Circuits" unit in the curriculum are suitable for STEM activities enriched with argumentation (Bağ & Çalık, 2017).

Table 1. Negotiation Patterns and Their Explanation.

Proposing	The student proposes an idea for their design solution, design process, and design product
In Disagree-ment	The student disagrees with a proposed idea
In Agreement	The student agrees with a proposed idea
Acquiring Info	The student asks questions to comprehend any information regarding the engineering de-sign.
Defending	The student defends an idea by providing—further justification.
Critiquing	The student proposes counterclaims and evaluates the provided arguments.
Counter proposing	The student proposes counterclaims when encountered with a claim.
Evaluating	The student weighs the appropriateness and validity of the claims, planning, design solu-tions, and processes.
Compromise	The student compromises their claims when they accept the proposed claims for the design.
Explaining	The students elaborate on their ideas and claims put forward during the design.

Procedures

The study was conducted in the spring semester of the 2018-2019 academic year. First, a three-hour argumentation training was given to one of the groups based on Toulmin's argumentation model. Subsequently, both groups participated in four STEM activities, each lasting 16 hours (40 minutes per session).

In the first session of the training, the claim, evidence, reasoning, and rebuttal model was used to introduce argumentation (McNeill & Krajcik, 2007). In addition, the features that would make a good argument were discussed with the students. In the second session, an activity including argumentation components was carried out for students to create verbal and written statements containing argument components. The third and last session completed the process by evaluating and discussing the students' arguments during the activity. Argumentation training lasted 3 hours (40 mins each). Although the students had prior experience in engineering design, none had previous experience regarding argumentation in either group. The students worked in groups of 4-5 to complete the tasks. A total of 4 engineering design tasks on the absorption of light, reflection of light, and electric current subjects were designed. Based on the 7th-grade objectives and subject matter, students worked on solar ovens, telescopes, camping lighting systems, and battery construction design tasks.

The researchers, in compliance with EDP, prepared worksheets. The students utilized these worksheets as the primary course material. Content in each worksheet channeled the students to the stages of EDP. All activities were led by the first author, a science teacher of the participants with bachelor's degrees in civil engineering and science education.

Data Collection

First, audio recordings of the groups for EDP processes were used as the primary data source in the study. Each group's negotiations were audio recorded in each class as verbal data. High-quality audio recorders were placed on each groups' tables during the activities. Second, the worksheets completed by the students during the activities were also collected. Third, the first author acted as a percipient observer (Creswell, 2013). The observation notes kept by the first author each day were used as a secondary data source for data triangulation.

Data Analysis

Each audio recording was transcribed verbatim by the first author. Conversations that were irrelevant to the task were excluded from the transcription. The content was analyzed descriptively based on argumentation-based negotiation patterns. The purpose of descriptive analysis is to present the findings to the reader in an organized and interpreted way (Yıldırım & Şimşek, 2006). First, we read the transcripts thoroughly. Then, we identified the turns. A turn constituted a timeframe when a student started presenting an idea and completed it. We coded each turn based on the negotiation patterns for each group. Then, the percentage of negotiation patterns among all turns were calculated. The contents of the observation notes were examined to better understand the students' negotiation patterns and used to support the data in the audio recordings when necessary. Similarly, the observation notes were analyzed descriptively according to the negotiation patterns.

Validity and Reliability

Expert opinions on the designed activities were sought from three science teachers, two of whom held master's degrees in science education. Additionally, two faculty members, possessing doctoral degrees in science education, provided their expertise in evaluating the activities. The content analysis of the audio recordings was done by both researchers independently for one group in each activity. The interrater reliability was calculated (Miles & Huberman, 1994) for four design activities. The reliability score for solar oven activity data was .92, for telescope activity data was .86, for camping light activity data was .94, and for battery construction activity data was .88; all indicating a high level of agreement. The researchers met twice to work on the disputes regarding the tapes, and all the conflicts were resolved through peer debriefing. The rest of the coding was completed by the first author.

Table 2. Negotiation Patterns in Groups that Received Argumentation Instruction.

	Group1		Group2		Group3		Group4	
	f	**%**	**f**	**%**	**f**	**%**	**f**	**%**
Proposing	109	30	70	32	80	31	97	29
Defense	15	4	2	1	0	0	0	0
Evaluating	50	14	4	2	22	8	22	7
In agreement	29	8	23	10	16	6	16	5
In disagreement	4	1	3	1	0	0	0	0
Critiquing	13	4	31	14	17	7	25	7
Counter proposing	11	3	8	4	9	3	10	3
Acquiring info	78	21	32	14	51	20	64	19
Opposing	7	2	2	1	0	0	1	0
Compromise	5	1	0	0	0	0	1	0
Explaining	48	13	47	21	65	25	99	30

Table 3. Negotiation Patterns in Groups that did not Receive Argumentation Instruction.

	Group5		Group6		Group7		Group8	
	f	%	f	%	f	%	f	%
Proposing	119	37	141	39	95	40	141	38
Defense	16	5	2	1	0	0	0	0
Evaluating	17	5	1	0	5	2	9	2
In agreement	31	10	16	4	5	2	15	4
In disagreement	11	3	0	0	0	0	0	0
Critiquing	17	5	21	6	15	6	26	7
Counter proposing	9	3	10	3	2	1	9	2
Acquiring info	33	10	98	27	38	16	84	23
Opposing	0	0	0	0	0	0	0	0
Compromise	0	0	1	0	0	0	3	1
Explaining	73	22	70	19	78	33	84	23

Findings

Negotiation Patterns in Groups

Negotiation patterns were identified in both groups to understand the discourse during EDP (**Table 2**). Eleven codes based on the literature were used to determine the negotiation patterns. The use of negotiation patterns was

similar across groups. For example, the most used negotiation pattern was proposing for all groups, followed by acquiring information. This pattern was expected as students' design processes mostly use proposing ideas and acquiring information regarding design choices.

However, close examination of the qualitative data, including audio recordings and the researcher's observation notes, revealed different purposes for using negotiation patterns during the EDP. Across all eight small groups, six negotiation patterns were used: proposing, in agreement, critiquing, counter proposing, acquiring information, and explaining. Except proposing, groups receiving argumentation training used the remaining negotiation patterns for different purposes. We chose Group 1 and Group 5 to illustrate the differences and similarities of the negotiation regarding EDP, as these groups used the highest number of negotiation patterns in total (**Table 3**).

Proposing Ideas for Negotiating Material Design

Upon close examination of audio recordings, it was observed that students in both groups predominantly generated ideas during the research phase for potential design solutions and in the planning stages. For instance, in Group 1, during the planning of the camping light equipment, students put forward ideas to enhance the design by taking into account scientific data related to lenses and the optimal reflection of light.

S2: We will fix the torch here. Then, we need something to reflect the light.

S3: Convex mirror?

S2: Does light not reflect when it hits a convex mirror? Uhm, we tie a mirror to a tree.

S3: Torch already reflects the light; it has a convex mirror. It does not only reflect light where you point to it. It reflects everywhere.

S4: So it reflects it, right?

S1: Yes, so we use convex.

Overall, both groups proposed ideas across five stages of the engineering design. The students were proposing ideas for ensuring a better design. It was also evident from the researchers' notes that the group that did not receive argumentation training used the proposing state more. "In general, it was seen that the students in the group who did not receive argumentation training took more time to decide on which material to use." (Observation notes). The students tended to propose ideas instead of justifying and negotiating the design ideas.

In Agreement Followed by a Justification for a Design Solution

When the students in Group 1 agreed on a proposed idea, they tended to follow their agreement with a justification across all engineering design stages. Out of 28 in-agreement states, 24 of them followed by justification and data. As an illustration, students in Group 1 engaged in negotiations regarding the decision to use concave lenses. During these discussions, scientific information was utilized by students to support and agree with their peers.

S1: I think this is good. We have aluminum foil and cardboard containers. We assemble them and put concave lenses to the sides.

S2: Yes, correct…, in terms of data, concave lenses collect light, so it heats things. Perfect.

The students in Group 5 mostly used this negotiation pattern to approve their friends' design choices or support the claim put forward during the planning and construction of the design. However, no justification for why they support the design choice or plan is provided. Out of 31 turns taken for this negotiation pattern, only four times they followed with a justification.

S2: I'm taking this lens out and putting this one in, OK?

S3: Yes, sure. It is better this way.

Overall, the students' negotiation in the agreement was expected in the group that received argumentation instruction because the first author spotlighted the importance of justifying claims during negotiation.

Counter proposing and Acquiring Information for Better Planning vs. Changing the Design

The students in Group 1 used counter proposing and acquiring information more frequently while planning their design. Out of 11 turns during counter proposing, eight turns occurred during the planning stage. Justifications also followed these turns. For example, in telescope design activity, Group 1 negotiated which lens they should use. This occurred before they interacted with physical materials. During these turns, students were also acquiring information about their planning regarding the design.

S2: To better see the sky, [we should use] the things that reflect light, I mean convex mirror and concave lens.

S1: No, we should use convex lenses, not concave….
S2: If we use concave, it collects the light in one area; if it reflects, we see bigger and more apparent.

However, in Group 5, all six turns occurred during the design stage. It was also evident from the researcher's notes that the students in this group spent less time planning. "The students in this group did not spend time discussing how they would construct their telescope. Instead, they immediately interacted with the materials available, and during their negotiation, they tend to manipulate the materials physically" (Researcher's notes, Group 5, Activity 2). The excerpt below shows how students in this group negotiated for the changes in their design.

S3: We need lenses. I get it.

S4: Let's use these magnifiers as well.

S1: This is a concave lens, and let's cut this [cupboard]

S2: Lenses here. I put them to the back, which goes here and the other.

S1: It asks, please explain why you chose the design and why you eliminated the other… We chose this design….

S2: We chose this one because we can see other items more clearly.

S3: Well, can we say that the lenses make it look closer so that we see clearly?

It was evident from the excerpt that the students' counter-proposing and acquiring information occurred after they already chose the better design and finished the construction of their design. The student's reasoning, on the other hand, was not complete. This situation was also evident from the researcher's notes "It was observed that the students in the group that received argumentation training spent more time on the planning stage while students in the other group skipped the planning stage quickly and spent more time on the design process." (Researcher's notes, Group 5, Activity 2)

Critiquing for Design Advantages and Disadvantages

Group 5 did not justify the reasons for the advantages and disadvantages of their design decision. For example, this group did not explicitly discuss the advantages and disadvantages of their solar oven design.

S1: What could be the disadvantage of this [design]

S2: I do not see anything

S3: What could it be?

S1: It won't cook everywhere.

However, Group 1 elaborated on their design by justifying the construction and planning of it. The justification of the disadvantages leads to the modification of their design. This could lead to better design solutions. The excerpt below illustrates how Group 1 changed its design based on negotiation process.

S1: We can put a solar panel here on top.

S2: Can we?

S1: We have two disadvantages here. One is the inappropriate use of the lenses, and the other is the lack of an actual solar panel.

S3: What can we do to cook in a shorter time?

S1: Do we increase the number of lenses?

S3: An egg cooks at 90-100 degrees. Ours is only 30.

S1: I think our system is not good enough.

S2: OK, let's increase the lenses to collect more light to increase the oven's temperature.

The researcher also noted a similar observation regarding the discussion on the advantages and disadvantages of the design. "Students in Group 1 did a better job discussing the advantages. They engaged in argumentation, and their design progressed due to critiquing the design advantages and disadvantages" (Observation Notes, Group 1). On the other hand, although Group 5 stated the disadvantages and advantages, they did not elaborate on how this could strengthen their design.

Discussion and Implications

Student conversations, essential for accessing students' decision-making processes during a given design challenge, have been scarcely studied in science classrooms. As students engage in evidence-based reasoning during engineering design (Aranda et al., 2020), this study explored the negotiation patterns of grade-7 students regarding their argumentation training. The findings illustrated that all groups similarly used negotiation patterns. However, differences were found between the group that received argumentation and the one that did not.

Our findings highlight that students' negotiation patterns showed similar patterns among groups regardless of their argumentation training. A similar result was obtained in a study by Guzey and Aranda (2017), where they compared small group discourse patterns during an engineering design task. They found that although the students' discourse patterns showed similarities in terms of discourse patterns, they differed in the number of turns

and the complexity of discourse patterns (Guzey & Aranda, 2017). In addition, they found that the groups could not causally elaborate on their design. Our results are consistent with the previous research regarding the similarities in the number of negotiation patterns. However, the result of the current study further showed that causal elaboration could be enhanced by giving direct argumentation instruction so that the students can elaborate on their proposed ideas by providing justifications.

A previous study also indicated that the high-performing group, in terms of argumentation, discussed proposed ideas more than the low-performing group before accepting or rejecting a proposed idea (Sampson & Clark, 2009). Our findings indicate that direct argumentation training has the potential to assist students in providing more extensive justifications for their claims, even when they are in agreement with their peers. This implies that regardless of students' initial argumentation performance, dedicated argumentation training can effectively support them in articulating and defending their design solutions and ideas.

The planning stage creates a space for students to explore ideas and co-create a shared understanding (McDermott, 1978). "Outcomes from initial brainstorming activities are thus important for understanding and improving design choices, decisions, and constraints" (Lutz et al., 2022, p2). However, rather than discussing the possible design solutions, novice learners tend to test the tangible properties of their design (Wendell & Lee, 2010). To overcome such design challenges, researchers, for example, suggest giving written support (McFadden & Roehrig, 2019). Our findings additionally suggest that argumentation training may contribute to students employing counter-proposing strategies and acquiring information to enhance the planning phase. This implies that, with the aid of argumentation training, students may develop skills to navigate challenges and gather relevant information for more effective planning in the design process.

Decision-making through negotiation and consensus has been identified as one of the core components of engineering design (Wendell et al., 2017). It requires students to critique design ideas and solutions. During this stage, students evaluate the advantages and disadvantages of the design components, processes, and solutions. This process requires students to engage in evidence-based reasoning. Argumentation engages students in reasoning processes in which students weigh advantages and disadvantages, pros and cons related to a given problem. Argumentation might be externalized by high-quality reasoning processes (Sadler & Zeidler, 2005). Therefore, argumentation as a core component of EDP should be incorporated into engineering design contexts to enrich the design process through students' reasoning.

In this study, the frequency of counterclaims was low across all groups. The results were similar to Seppanen (2022), who found that univer-

sity students that did not receive argumentation training also had low levels of counterclaims in their arguments. Hence it becomes critical to engage students in situations where they could discuss alternative design ideas through high-quality argumentation. Verbal scaffolds can be provided to enrich such a learning environment so that the students can negotiate the design alternatives. Future studies can focus on the argumentation scaffolds provided by the teachers and their influence on EDP.

Previous research indicates that instructors' discourse patterns influence students' scientific reasoning and justifications when working in small groups to solve a design challenge (Guzey & Aranda, 2017). However, our study only focused on students' negotiation without considering the teachers' influence on design negotiation and argumentation. Therefore, future research can focus on the effect of different teachers' discourse moves and argumentation on students' engineering design decisions. Furthermore, the current study did not elaborate on the students' consensus and design. Therefore, future studies might focus on the impact of such negotiation patterns on students' engineering design products.

Conclusion

This study investigated grade-7 students' negotiation during EDP regarding the students' status of argumentation training. It addresses the gap in the literature by providing evidence from negotiation processes during four different design tasks. While both groups exhibited similar negotiation patterns, those with argumentation training justified their design solutions, enhance their planning for a design solution, critique for design advantages and disadvantages. Incorporating argumentation instruction enhances the engineering design process.

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REVIEW

Inclusive Education in China: Complications and Causes

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***Abstract**: Inclusive education is aimed at giving children with disabilities equality of opportunity in education. The Chinese government has released a host of regulations and action plans concerning inclusive education, defining its direction and setting forth the principle of respect for differences in its implementation. Nevertheless, there remain many challenges in inclusive education development. Among them is the low level of popularization of inclusive education in compulsory education. This article delineates the complications of the implementation of inclusive education in China and analyzes their causes with the intent of contributing to its high-quality development in this country.*

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Introduction

EDUCATIONAL equity is an essential component of social justice. In its modern sense, it means that education should benefit all children of all ages regardless of their physical, mental, social, emotional, or other conditions (Wang, 2015). It is also the central principle underpinning the right of children with disabilities to education. In the context of the modernization of education governance, actively advancing inclusive education is of vital significance for ensuring the equality of educational opportunities for the population of 85 million persons with disabilities (State Council of China, 2021). The notion of inclusive education was first officially put forward in the Salamanca Statement adopted by the 1994 World Conference on Special Needs Education. It is an educational approach aimed at eliminating segregation in education by creating supportive and inclusive learning environments for all students with differential backgrounds, abilities, and needs. It encourages respect for individual differences, resource sharing, and the creation of a cooperative learning atmosphere. For children with special educational needs, inclusive education has the potential to boost their learning outcomes and social integration (Bai, 2022).

In the past decade or so, the Chinese government has paid increased attention to special education. In the "2017 Regulations on Education for Persons with Disabilities," the State Council of China (2017) proposed to prioritize the use of the regular schooling method in special education provision, clarifying the direction for special education development in China. In 2022, the Ministry of Education and six other departments jointly formulated "The Action Plan for the Development and Improvement of Special Education in the 14th Five-Year Plan Period," which emphasizes the adherence to the principles of "inclusion, respect for individual differences, and common growth of children with disabilities and their normal peers." These principles are based on the student-centered education philosophy, conforming to the genuine educational needs of children with abilities and serving to set the orientation of inclusive education development (State Council of China, 2022). Nevertheless, there are still inadequacies in Chinese inclusive education. According to Deng and Zhao's (2019) study, about 70% of compulsory school-age children with disabilities in China were enrolled in schools, among whom only 52.2% received inclusive education. There are issues with inclusive education in terms of conceptions, teaching materials, and instructional methods. This article expounds on the complications of the implementation of inclusive education in China and pinpoints their causes in order to contribute to its high-quality development in this country.

Complications to the Implementation of Inclusive Education

Since the 1980s, the practice of "inclusive classes within regular schools" has been the chief form of inclusive education in China (Lan, 2022). According to the Ministry of Education (2022), there were a total of 919,800 special education students in China in 2021, of which 464,100 were enrolled in inclusive classes in regular schools, accounting for 50.45% of the total enrollment of this group. Despite the considerable size of inclusive education, there are issues with it, such as discrepancies between its theory and practice, conflicts between equity and efficiency, and difficulties balancing common and individual needs (Dong et al., 2017). Complications to the implementation of inclusive education are hindering its popularization as well as suppressing its quality enhancement.

Social Misperceptions of Inclusive Education

Pervasive positive attitudes towards inclusive education are conducive to its popularization, while negative views of inclusive education may hinder its implementation, leading to discrimination against and isolation of children with special educational needs (Yao, 2023). At present, there remain misperceptions of inclusive education among regular schools, parents of special education students, and the general public (Zhou, 2023), negatively affecting its popularization and implementation as well as the psychological well-being and social integration of this special group.

First, many regular schools tend to view inclusive education as merely a category of special education without reaching the realization of the principles of equality, inclusion, and individual rights underlying it. With a superficial understanding of inclusive education, the school cannot grasp its genuine spirit, thus being unable to develop a truly inclusive atmosphere on campus (Zhang, 2021). Furthermore, regular schools worry that the implementation of inclusive education may increase their teaching burdens and management complexities. As a result, some schools are reluctant to introduce inclusive education to their campuses. In those that do implement inclusive education, the provision of equipment and resources in this regard is limited, and teachers' interest and engagement in it remain low (Luo, 2023).

Second, there is a lack of thorough understanding of the purpose and value of inclusive education among most parents of children with disabilities. Many of them tend to see the "problems" with their kids as purely medical but fail to realize that social environments also relate to their physical or mental rehabilitation; the role of inclusive education in creating an equal, inclusive education setting has been disregarded (Ruan, 2023). As per

Zhang's (2021) questionnaire survey on the "perceptions of inclusive education among parents of preschool children with special educational needs," only 6.31% of parents polled realized that for children with disabilities, adaptation to collective environments is more important than intellectual development (Zhang, 2021). Moreover, some parents adhere to the belief that the special education school is the only right choice for their kids with disabilities, an outmoded notion that regards segregation in education as a proper arrangement for children with handicaps (Ruan, 2023). Some others are deeply distrustful of inclusive education, worrying that their kids cannot get adequate attention and support from teachers and are susceptible to discrimination and exclusion in an inclusive class, which may impose adverse effects on their psychological health and social adaptation (Wang, 2021). Parental worries and mistrusts like these lead to their unwillingness to enroll their children in inclusive classes.

Third, the stigmatization of children with disabilities is not rare in society (Tu, 2021). "Special needs" have become a unique label that distinguishes them from the rest of the class in inclusive education and are often seen as disruptions to normal classroom teaching. For example, their physical handicaps may appear to be distractions to their normal classmates; emotional and behavioral problems with some of them are likely to jeopardize classroom order; and their learning difficulties may slow down the teaching pace. The notion that special education students are "incomplete" elicits prejudice and discrimination against them among ordinary people (Ruan, 2023).

Many people hold the view that children with disabilities are only entitled to special education in isolation, and inclusive education is unfavorable to normal students as the participation of special education children is guaranteed to hinder teaching progress and be detrimental to the academic achievement of their classmates (Jing, 2013). Such a view is opposed to the nature of inclusive education, which is about creating an inclusive learning environment that allows all children equal access to high-quality education resources. Often, the strongest resistance to inclusive education comes from the parents of normal students in the inclusive class. In a news report on the compulsory education of rural autistic children published by The Paper in 2023, Lin from Hunan Province, the father of a child with autism, was struggling to find his son a proper school that provides inclusive education. His son was diagnosed with autism at the age of three and admitted to an ordinary township primary school following years of special training. However, most parents of other students exhibited strong opposition to the kid's joining the class due to their misconception of autism. They called and e-mailed the principal to demand that Lin's son leave. To Lin, it was a huge irony that the interference in his son's education was from the parents of his classmates (Wen & Dai, 2023).

Conflicts between the Special Needs of Children with Disabilities and the Overall Outcomes of Inclusive Education

In the implementation process of inclusive education, how to balance its overall outcomes with the special needs of children with disabilities is a pronounced challenge. Because of their special physical or mental conditions, children with disabilities need more attention and support in an inclusive class. Their special needs include specialized teaching materials and methods as well as additional tutoring time, among other matters. How to satisfy these special needs without sacrificing the academic attainments of normal students in an inclusive class is an issue pending further exploration (Zhu, 2023). At the same time, normal students also face the challenge of adapting to inclusive education. They need to spend a considerable amount of time adjusting to the classroom environment, where they must get along with disabled children and develop understanding and acceptance of their special needs. These challenges may bring them severe academic and psychological burdens (Pan, 2023).

In Yao's (2023) investigation of school support for primary education students who participated in the "inclusive classes within regular schools" program, teacher X stated that special education students needed a variety of additional teacher support, which was not always well met given the limited time and energy of the teacher, and that they may lag behind their classmates if they could not get extra backing timely. Teach Y said that he must conduct classroom instruction based on the prepared teaching plan to fulfill the delivery of course content and that it was impossible to slow down the teaching progress for the sake of the special circumstances of a certain student. According to him, the situation at the primary level was manageable, whereas at the secondary level, the whole class was working hard preparing for the high-stakes examinations, and thus, even less attention could be spared to students with special needs.

Unreasonable Curriculum Content for Inclusive Instruction

A legitimate, inclusive education curriculum is crucial for meeting the needs of special education students as well as supporting their all-round development. Nevertheless, there is a dearth of consideration for the special needs of disabled children in the current inclusive education curriculum, which typically adopts the uniform teaching materials developed for ordinary students (Wang, 2021). Moreover, current teaching in the inclusive class is still fo-

cused on the delivery of content knowledge, disregarding the cultivation of practical competences in special education students. This is actually a deviation from one of the chief objectives of inclusive education: to prioritize fostering fundamental competences such as self-care ability, self-regulation, and social skills in special education students while also helping them develop basic knowledge foundations (Cao, 2022). In her 2022 research into the implementation of inclusive education in Shanghai, Feixian Chen (2022) discovered that there was a paucity of appropriate teaching materials for the teaching of life-based Chinese, mathematics, and practical courses in special classes within regular schools. Nearly half of the teaching protocols incorporated teaching materials that did not suit the ages of special education students; the rest adopted general education teaching materials for ordinary students.

Insufficient Inclusive Education Expertise and Skills of Teachers

The expertise and skills of inclusive education teachers are instrumental in the successful implementation of inclusive education. Qualified teaching staff in this education stream should hold an in-depth understanding of the principle of inclusive education and be able to leverage effective pedagogical approaches. While providing targeted support for students with special educational needs, they can also fuel the engagement of normal students and the constructive interaction between the two student groups (Hu, 2023). Nonetheless, the majority of teachers involved in inclusive education lack a deep understanding of its purpose and significance and has difficulty accommodating to this advanced educational paradigm (Liu, 2021). Furthermore, the lack of special education experience and skills among regular school teachers also militates against the outcomes of inclusive education. The physical and mental handicaps of special education students necessitate special instructional strategies, which require the use of relevant professional techniques by their teachers, including verbal communication, psychological counseling, rehabilitation skills, and more (Liu, 2021). Baihui Chen (2022) investigated the practice of "inclusive classes within regular schools" in W School in D County in 2022 and found that 82.18% of the teachers who had taught or were teaching in inclusive classes had never received any special education training, pre-service and in-service. All 11 teachers from the primary department of W School reported they had never had special education training experiences before or after special education students joined their classes.

Causes of Issues with Inclusive Education in China

The Low-Level Popularization of the Notion of Inclusive Education

Inclusive education is not only an alternative to educational arrangements for children with disabilities but, more importantly, signals a significant change in educational ideology and culture. It is aimed at building egalitarian and supportive educational environments for all children. Successful implementation of inclusive education is a crucial step in changing discriminatory attitudes, creating welcoming communities, and developing an inclusive society. Despite the growing knowledge about inclusive education in China, the publicity for it is still inadequate, leading to its lower-than-expected development pace in this country (Zhang, 2021). First, governmental involvement in the promotion of inclusive education remains at a minor level. With a paucity of governmental investment in propagating the notion of inclusive education, the public can hardly develop a proper understanding of it (Li, 2015). Second, schools and educators have made few efforts to enhance the comprehension of inclusive education on the part of ordinary students and their parents (Lan, 2022). Third, media outlets in China have not paid much attention to this relatively new education paradigm, let alone publishing in-depth reports on it. Discussions on this topic are rare on social media, resulting in a lack of knowledge about the significance of inclusive education among the general public (Fan, 2021).

A Lack of Consideration of the Peculiarities of Inclusive Education

While inclusive education is intended to demolish the boundaries between special and regular education to enable students with special needs to share equal schooling settings with their normal peers, it does not mean that inclusive education is equivalent to regular education. In the current implementation of inclusive education, its peculiarities are not fully accommodated due to the following reasons:

The Absence of Resource Teachers

Resource teachers are specialist educators specializing in helping children with learning difficulties develop their cognitive capacities and life skills. Responsible for the planning, operation, and management of resource classrooms, they are central to the functioning of special education resources (Chen, 2005). "The Guidelines for the Construction of Special Education Resource Classrooms in Regular Schools," issued by the Ministry of Education in China (2016), proposed to normalize the construction and manage-

ment of resource classrooms based on the requirements of the national education strategy and special education upgrading plan. The Guidelines underlined the important role of resource classrooms in advancing inclusive education by providing special education, rehabilitation training, and counseling to students with disabilities at regular schools.

The effects of the resource classroom are contingent on its quality of equipment as well as its proper and full exploitation under the direction of specialist teachers (Liu, 2013). Nevertheless, the absence of a resource teacher is common in most regular schools. Typically, the school appoints an ordinary teacher to take charge of the resource classroom, who may have to concurrently handle the day-to-day teaching or administrative affairs of the school. As a result, the teacher's time and energy spent in the resource classroom are limited. Worse still, due to their lack of professional expertise in special education, the psychology of children with special needs, and other relevant areas, the ordinary teacher is incapable of making the best use of the resource classroom (Yao, 2023). Thus, without the professional support of resource teachers, inclusive education can hardly be realized in its genuine sense.

A Paucity of Specialized Teaching Materials

At present, most schools that implement inclusive education stick to the uniform teaching materials for ordinary basic education students. These teaching materials give no consideration to the characteristics of special education students, thus making them unable to meet their academic needs. Without specialized teaching materials, teachers lack a framework of reference for conducting inclusive education, resulting in compromised teaching outcomes (Chen, 2022). As a result, the distinction between inclusive and regular education is blurred. According to Wu's (2014) study, the irrelevance of course designs to the needs of special education students is one of the leading reasons for the less-than-ideal effects of inclusive education. He claimed that many regular schools ignore the special learning needs of this group and have not adjusted the course content and difficulty from the standpoints of their special learning objectives, assessment methods, and learning interests. Liao (2017) noted in his study that special classes deployed in regular schools have used textbooks for regular compulsory education students over the years, resulting in the disconnection between the teaching content of special classes and the national special education curriculum as well as the poor achievements of inclusive education.

Limitations of Big-Size, Class-Based Instruction

Under the big-size-class-based instructional paradigm, the teacher tends to address the whole class with the prescribed teaching materials and pace, having difficulty accommodating the special needs of students with disabilities (Du, 2022). There are big differences in physical and mental features and learning capacities between special education students and their normal peers, which necessitate the teacher paying additional attention to the former. Yet, in a large class, the first consideration of the teacher is to keep the learning progress of the majority of students on schedule. It is impossible for the teacher to pay proper regard to the learning rate and cognitive capability of each individual student with special needs; thus, it is difficult for the latter to keep pace with their classmates and truly integrate into the class (Guan, 2022). In addition, conventional class-based instruction is typically teacher-centered, placing a biased emphasis on content knowledge imparting and test-skill training (Chu, 2021). Nevertheless, students with disabilities in inclusive education need a child-centered teaching pattern that focuses more on teacher-student interaction, hands-on experiences, and tailored tutoring. The difficulty in adapting the class-based instruction pattern to the requirements of inclusive education is a major impediment to the successful implementation of the latter (Zhu, 2023).

Unreasonable Evaluation Systems

Currently, Chinese primary and secondary schools stick to the traditional common criterion-based evaluation system, an assessment framework based on the needs of the majority of students without adequate consideration of those at the "two ends" of the normal distribution, namely gifted students and students with learning difficulties. Evaluation systems as such give little regard to the individual differences among students (Tang, 2016) but are adopted by many schools implementing inclusive education, where the performance of students with disabilities is measured mainly by their examination results rather than their development in multiple aspects, including social and emotional abilities (Zeng, 2024). Such measurement can only elicit frustration in most special education students, who are at a disadvantage compared with ordinary students in terms of academic achievements (Yin, 2023). Also, the test-results-focused evaluation system is ineffective in assessing the instructional outcomes of inclusive education, thus unfavorable to its long-term development (Huang & Du, 2022).

Insufficient Assistance from Educational Technology for Inclusive Education

In the era of information technology, educational technology plays an important role in serving the diverse needs of students and increasing educa-

tional outcomes. 2022's "The Action Plan for the Development and Improvement of Special Education in the 14th Five-Year Plan Period" advocates leveraging digital technologies, such as the Internet, cloud computing, big data, virtual reality, and artificial intelligence, to support the construction of smart campuses and classrooms for special education, where possible; promoting the exchange and sharing of data related to special education; and developing digital teaching resources for special education courses and expanding the coverage of high-quality special education resources (Ministry of Education, 2022).

Providing personalized instruction to various special education students is a primary aim of inclusive education; its achievement can be facilitated by the application of educational technology. Technological devices such as smart teaching platforms and virtual-reality classrooms have the potential to give special education students more choices of education resources and richer learning experiences (Ge & Hu, 2019). Nevertheless, because of financial and technical constraints, many regular schools cannot afford to adopt these advanced digital devices in their inclusive education. According to Dong's (2022) investigation of the classroom engagement of hearing-impaired students enrolled in inclusive classes at primary schools in Hefei Province, the FM wireless frequency modulation system and instant voice translation application for students with hearing impairments were not available at most ordinary schools. Student A said that he had difficulty engaging in the in-class discussion because he could not hear well in a noisy environment and that even in the pair discussion, his deskmate had to yell for him to hear clearly (Dong, 2022).

In the meantime, it is hard for inclusive schools to seek out inclusive education-targeted, high-quality applications to modernize their administration and service (Yang, 2021). In their survey of nearly 300 students from Xiangcheng District of Suzhou City enrolled under the "inclusive classes within regular schools" program, Hu et al. (2023) spotted a host of issues with the administration of inclusive education, such as complicated application procedures for the inclusive class, the lack of coordination and sharing between resource centers, the absence of supervision over the education quality of resource centers, the shortage of a window for parents into special education services, and more. Therefore, the construction of internet-based cloud service platforms for inclusive education is a critical step in improving its service system.

Issues with Inclusive Education Staff Training

Inclusive education poses higher requirements for the professional competence of teachers. In 2022, the Ministry of Education of China's Teacher Education Department and the United Nations International Children's Emer-

gency Fund jointly released "The Action Plan for Enhancing the Professional Competence of Chinese Teachers in Inclusive Education," which asserts that the strengthening of inclusive education capacities of frontline teachers is crucial for achieving high-quality inclusive education in China (China Youth Daily, 2022). Nevertheless, there are inadequacies in teacher training on inclusive education, both pre-service and in-service.

Pre-service training on inclusive education is meant to help teachers develop structured expertise and skills in this regard in order for them to better serve the needs of special education students in their future careers (Wang, 2023). Yet, the current teacher education on inclusive education in China provided by teachers' colleges and other teacher education institutions is incomplete, inducing various negative consequences. Many teacher candidates failed to develop a thorough understanding of the core idea and value of inclusive education, which led to their inability to implement it in its real sense in their future teaching practice. Also, the implementation of inclusive education entails the expertise and techniques of special education, which are somehow not seriously covered in their pre-service programs. This makes them feel incompetent in confronting children with special educational needs (Zhang et al., 2024). Furthermore, current teacher pre-service education does not mandate a placement related to inclusive education, which substantially reduces the chances for them to learn specific instructional methods and techniques in authentic inclusive education settings (Wang, 2022).

Issues with teacher in-service training on inclusive education are also pronounced. The training content is not comprehensive, with a biased emphasis on theoretical knowledge, such as special education psychology and evaluation, over practical manipulation skills. That weakens teachers' abilities to apply special education theories to their actual interactions with special education students (Guo, 2022). Furthermore, current in-service training on inclusive education is insufficiently engaging, mainly taking the form of courses and lectures, where there is a dearth of practical demonstrations and interactions (Jing et al., 2024). Additionally, there is a lack of professional training staff and other training resources, mainly due to the inadequate investment of local governments and schools in inclusive education-specific teacher training, and as a result, quality training in this area cannot be guaranteed (Chen, 2023).

Conclusion

Despite the advances China has made in enhancing educational equity and ensuring the rights of children with disabilities to education through inclusive education, there are multiple challenges it faces. These challenges are impeding the popularization and quality improvement of inclusive education.

Looking to the future, the development of inclusive education is a long-term, arduous endeavor that requires the engagement of society as a whole. It is not only an effective measure for guaranteeing children with disadvantages and disabilities equal education opportunities but also of vital significance for building a more civilized world that encourages integration and rejects discrimination.

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REVIEW

A Review of Inclusive Education Development in China

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***Abstract**: In recent decades, the special educational needs of children with disabilities have garnered widespread attention across the globe. There has been a growing trend towards inclusive education. China, among many other nations, has endeavored to promote inclusive education through legislation, policy, and financial support. This article is a review of inclusive education development in China, with a view to summarizing Chinese experiences in this regard to contribute to the construction of a more inclusive, equitable, and higher-quality education system.*

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Introduction

THE notion of inclusive education was first officially advanced in the Salamanca Statement adopted by the 1994 World Conference on Special Needs Education. The statement calls for promoting the approach of inclusive education, namely enabling schools to serve all children, particularly those with special educational needs (UNESCO, 1994). In the past several decades, inclusive education has become a highly valued category of special education. It aims to enable children with physical or mental disabilities to share regular learning environments with their normal peers through purposeful and systematic arrangements and to support them to achieve the fullest educational progress and social integration (Lu, 2020). In a regular school setting, the two groups of students learn to understand, accept, and cooperate with each other, working for common development. In inclusive schools, special education students are typically provided with appropriate specialized services to help them overcome learning difficulties and increase classroom engagement. These supportive services may include individualized teaching and tutoring plans, rehabilitation therapy, specialist support, and more (Lan, 2023). There are diverse forms of inclusive education, such as the inclusive class, where children with special educational needs are educated with normal students in a regular class in an ordinary school, and the specialized class for special education students in a regular school. In addition, there are individualized special education programs such as one-on-one tutoring and rehabilitation and education-integrated instruction. These forms of education can be flexibly combined to best suit the needs of special education students (Li, 2019).

Experiences in many countries demonstrate that the integration of children with disabilities is best achieved within inclusive schools that serve all children regardless of their physical, intellectual, social, emotional, linguistic, or other conditions (UNESCO, 1994). The United States, through legislation and policy, ensures children with special needs the opportunity to receive education among their normal peers. The "individualized education programs" in America provide special education students with specialized services in their attendance at inclusive schools (Peng, 2023). The UK government encourages regular schools to include children with special educational needs by offering additional financial support. Its Special Needs Education Policy Framework guarantees the education choice of this special group (Jing & Deng, 2013).

China, as a populous country, has a large number of children with disabilities, for whom the special school and inclusive school are the two chief forms of schooling at the basic education level (Xie & Lin, 2024). As of 2020, there were 439,000 special needs children receiving inclusive education, and those enrolled in inclusive classes represented roughly 50% of

the total number of special needs children (Rjzone.cn, 2022). Actively promoting and practicing inclusive education is of vital significance for the construction of a more equitable, inclusive, and efficient education system in China (Xie & Lin, 2024). This article is a review of inclusive education development in China, seeking to summarize Chinese experiences in this regard in order to provide implications for the high-quality development of special education in this country.

The History of Inclusive Education Development in China

When benefiting Chinese children with special educational needs, inclusive education also advances the entire education system of China. The principles of equity and inclusion underlying inclusive education are of vital significance for the cultivation of qualified citizens and the modernization of education in this country. The development process of inclusive education in China can be divided into four stages: initial exploration of inclusive education with Chinese characteristics (1978–1989), institutionalization of inclusive education (1990–2005), steady improvement of inclusive education (2006–2013), and high-quality development of inclusive education (2014–present), with each stage being marked by respective policy breakthroughs and major reformatory events (Zhou, 2023).

The First Stage (1978–1989): Initial Exploration of Inclusive Education with Chinese Characteristics

Prior to its reform and opening up, China underwent stagnancy in education development, and the attention paid to special education was insufficient. The initiation of national reform and opening up policy at the end of the 1970s catalyzed the rapid growth of the Chinese economy, which positively informed its special education (Hu, 2023). The state's recognition of the right of the disabled to education opportunities was a precondition for inclusive education development. The revised 1982 Constitution of the People's Republic of China affirms that every citizen of this country has the right and obligation to receive education and that the state and society have the responsibility to aid the blind, deaf, mute, and other disabled citizens in education, employment, and living (Liu, 2021). The representation of the issue of special needs education in the Constitution is a fundamental guarantee of the right of the disabled to education. In its "*Decision on Education System Reform*," released in May 1985, the central government proposed to actively develop special education for physically disabled and intellectually subnormal children. This decision marked a substantive step for special education

development and laid the groundwork for the emergence of inclusive education in China in that it officially announced the state's commitment to education for children with special needs (Jiang, 2019).

The Compulsory Education Law of China, enacted in 1986, stipulates that regional governments at all levels shall establish special education schools (or classes) for blind, deaf, and mentally retarded children. This law first proposed the concept of "three-category special education" and placed it high on the agenda of basic education (Duan et al., 2022). In practicing "three-category special education," educational authorities realized that special education schools alone could not sufficiently address the education needs of the school-age population with disabilities and thus began to explore a more inclusive approach that had the potential to break down the boundaries between special and regular education (Yao, 2023).

In its "*Opinions on Several Issues Concerning the Implementation of the Compulsory Education Law*," the National Education Commission of China (the precursor of the Ministry of Education) noted that compulsory education for children with disabilities should be implemented in more flexible and diverse forms and that, in addition to special education schools, special teaching classes could be set up within ordinary primary and junior secondary schools to enroll children who had minor disabilities and were capable of learning in normal school settings. This is the first government paper that explicitly stipulates children with disabilities can enter ordinary schools, marking the first step in China's practice of inclusive education (Wang, 2020).

In the "*Syllabuses for Day-time Schools (Classes) for Subnormal Children (Draft for Soliciting Opinions)*," issued in December 1987, the National Education Commission claimed that in the process of primary education popularization, most children with less severe mental disabilities were admitted into inclusive classes in local regular schools and praised the inclusive class as conducive to the constructive interaction between subnormal and normal children, promoting it as an effective solution to the issue of enrollment of children with minor mental disabilities in areas where there were no special education schools, particularly in rural areas. For the first time, the notion of "inclusive classes within regular schools" appeared in a state-level education policy (Chen, 2022).

In 1989, the State Council issued "*Several Opinions on Special Education Development*," setting forth guidelines, policies, specific goals and tasks, and leadership and management mechanisms for advancing special education. The paper stressed that the popularization of special education was the priority, considering the less than 6% enrollment rate of school-age blind and deaf children in China, and set concrete targets for the enrollment rates of school-age blind, deaf, and less severely retarded children in the ensuing years (Li, 2023). The "*Outline of Five-Year Services for the Disabled*

in China (1988–1992)" advocates diverse forms of special education, including special education classes or inclusive classes in regular schools, special classes commissioned by orphanages, and formal special education schools, to ensure the provision of education to the maximum number of children with impairments (Zhang, 2022). The implementation of policies like these was a significant step towards the establishment of wider-scope inclusive education in China.

The Second Stage (1990–2005): Institutionalization of Inclusive Education

In this period, driven by the national strategy of "strengthening the nation through science and education," education development was prioritized in China. Under the goal of popularizing nine-year compulsory education, basic education reform became a primary focus. In this context, special education in China underwent accelerated advancement. In the meantime, the notion and practice of inclusive education in the international community have profoundly informed Chinese special education. Implementing special education through legislation has become a popular practice in many countries around the world, and inclusive education in China entered the process of institutionalized development under this trend (Pang, 2020).

A framework of specialized legislation on special education is crucial for guaranteeing the right of the disabled to education. It protects them from being discriminated against in their pursuit of educational resources and opportunities. Additionally, it provides explicit legal guidance for the implementation of special education, helping optimize education resource allocation and enhance education outcomes (Zhang, 2022).

In the1990 People with Disabilities Act of China, there is a separate section dedicated to the issue of special education, setting forth the policies, methods, and management requirements for special needs education. It provides that persons with disabilities can be educated in either regular or special education schools and clearly defines the roles and responsibilities of regular education institutions for the education of the disabled (NPC.cn, 2012). "Regulations on Education of Persons with Disabilities," the first binding regulations on special needs education in China, were issued in 1994, which adopted "inclusive classes within regular schools," "special classes in ordinary schools," and special education schools as the three chief forms of schooling for children with disabilities at the compulsory education level (Yang, 2021). "*Measures for Implementing the 'Inclusive Classes within Regular Schools' Initiative (Trial),*" released in the same year, stipulate the specific operational procedures of the initiative, providing legal underpinnings for the adoption of the inclusive class (National Education Commission, 1994). Acts and regulations like these constitute a comprehensive

framework of legislation for special needs education, providing institutional guarantees for the further development of inclusive education in China.

With the increased attention on special education from society, particularly from educators at regular schools, the practice of "inclusive classes within regular schools" underwent accelerated advancement. The inclusive class was well received by parents of children with special education needs in that it allowed their kids the opportunity to access education in regular school settings (Zhou, 2023).

Both "*The Outline of the Plan for the Work on Persons with Disabilities in China during the Eighth Five-Year Plan Period (1991-1995)*" (Shenzhen Disabled Persons' Federation, 2004) and "*The Implementation Plan for Compulsory Education of Children and Adolescents with Disabilities during the Ninth Five-Year Plan Period*" (China Disabled Persons' Federation, 2007), released in 1991 and 1996, respectively, proposed to popularize the practice of "Inclusive Classes within Regular Schools," placing it in a leading position in the special education system. The 5th International Conference on Special Education 2000 focused on the issue of inclusive education and held thorough discussions about the policies, conceptions, and practices of this form of education in various countries, with particular attention paid to how to change the role of special education schools to better promote the development of inclusive education. China's practice of "inclusive classes within regular schools" was well acclaimed at the conference (China Education and Research Computer Network, 2001).

Between 2001 and 2005, the Chinese government continued to actively popularize inclusive classes to increase the enrollment rate of children with disabilities at the compulsory education level (Wang, 2022). The local education departments began to routinize their management of inclusive classes, which means they would include the following aspects in their routine administration of inclusive classes: curriculum design and teaching organization, analysis and exploitation of educational resources, tests and assessment, education and teaching research, student management and services, teacher education and training, etc. (Zhu, 2023). In 2003, the Ministry of Education held a specialized conference on the program of "Inclusive Classes within Regular Schools" for all actors from around the country to exchange experiences and proposed to accelerate the construction of supporting and guaranteeing mechanisms for the program. Specific arrangements in terms of supporting networks, resource centers, and financial investment were made to improve the enrollment, retention, and performance of children with disabilities (Ministry of Education of China, 2003). The popularization of inclusive classes and the introduction of supporting and guaranteeing mechanisms significantly bolstered the schooling conditions for special education students, and their right to education was better fulfilled (Yao, 2023).

The Third Stage (2006–2013): Steady Improvement of Inclusive Education

Amid rapid economic growth in this period, the Chinese government increased investment in social development, particularly national education (Zhang & Fan, 2019). Meanwhile, the progress in human rights protection for persons with disabilities in China and around the world opened up new opportunities for the welfare of the disabled, including inclusive education. The conception, institution, and practice of inclusive education were steadily improved. The government and society at large made more efforts to fix problems arising in its implementation (Pang, 2020).

The enhanced conception of inclusive education places more emphasis on its potential contribution to social and educational justice. It is expected to play a crucial role in ensuring diversity-valued, equal education for children and facilitating the self-fulfillment of every individual (Zhao, 2022), as well as eliminating prejudices and discrimination of all forms and boosting mutual understanding and respect among all social members (Zhang & Ding, 2022).

2009's "Opinions on Accelerating the Development of Special Education" (Ministry of Education of China, 2009) and 2011's "*The Outline of the Development Plan for the Welfare of Persons with Disabilities in China's 12th Five-Year Plan Period*" (China Disabled Persons' Federation, 2011) propose that compulsory education of children with special needs should be funded by the public service system. Additionally, in 2008, China became a signatory to the *Convention on the Rights of Persons with Disabilities*, which means that it has the obligation to implement the provision in the Convention that the state parties should adopt inclusive education at all education levels and provide persons with disabilities with necessary resources and conveniences (State Council of China, 2008). China's accession to the Convention marked the onset of its pursuit of rights-based welfare for the disabled, eliciting fundamental changes in attitudes towards this special group as well as inclusive education (Pang & Zhang, 2018).

Driven by the updated conception of special education, legislation and regulations related to inclusive education were revised and improved. Based on the original provision on "three-category special education," the revised *Compulsory Education Law 2006* explicitly defines the practice of "inclusive classes within regular schools" as a chief form of compulsory education for children and adolescents with disabilities (State Council of China, 2006). 2009's "*Opinions on Accelerating the Development of Special Education*," a specialized policy for special needs education, presented a systematic framework of provisions on the special education system, including its funding guarantee mechanisms, education quality, teacher staffing, and more

(Ministry of Education of China, 2009). The policy had a profound impact on the further development of inclusive education for children with disabilities.

To improve the quality of inclusive education, the Chinese government developed a series of practical measures that pertain to specific groups of special education students and special education categories. For example, "*The Outline of the Development Plan for the Welfare of Persons with Disabilities in China during the 12th Five-Year Plan Period*" recommends alternative special education forms, such as community-assisted education, home-delivery teaching, and cross-regional enrollment, to ensure the delivery of special education for children and adolescents with severe disabilities (China Disabled Persons' Federation, 2011). By implementing policies such as "*Measures for Managing Central Subsidy Funds Specialized for Ethnic Minority Education and Special Education (2006)*" (Ministry of Finance of China, 2008) and "*The Plan for the Construction of Special Education Schools in Central and Western Regions in the Eleventh Five-Year Plan Period (2008-2010)*" (Ministry of Education, 2007), China significantly reduced the inter-regional disparities in special education. At this stage, more attention was paid to the fulfillment of potential, character building, and holistic growth in special education students; the special education curriculum programs continued to be optimized; and special education teacher training was considerably strengthened. As a result, the quality of inclusive education was comprehensively enhanced (Pang, 2020).

The Fourth Stage (from 2014 to the Present): High-quality Development of Inclusive Education

In 2014, inclusive education was officially established as the direction of special education development. "The 2014 and 2017 Plans for Upgrading Special Education" both emphasize the nationwide introduction of inclusive education for ensuring the provision of proper education to every child with special needs (State Council of China, 2014; Ministry of Education of China, 2017). The two plans affirmed the necessity of further popularizing the practice of "inclusive classes within regular schools" as the chief measure of inclusive education and promoting cooperation between special and regular education schools. In "*The Outline of the Plan for Supporting the Disabled in Building a Well-Off Life in the 13th Five-Year Plan Period*" released by the State Council in 2016, "inclusive education" was the frequent phrase, being mentioned many times in statements such as "vigorously introducing inclusive education," "continuously expanding the scale of inclusive education," "improving action plans for inclusive education at the secondary and tertial education levels," and "increasing special education schools' guidance and backing for regular schools in implementing inclusive education," to

name a few (State Council of China, 2016). In the revised "*Regulations on Education of Persons with Disabilities (2017)*," the State Council stressed the necessity of prioritizing the regular schooling method in special education by actively promoting inclusive education (Ministry of Education of China, 2017). They are the first binding regulations that establish inclusive education as the mainstream of special education.

Advances in special education policy have improved education opportunities for children with disabilities. Since 2014, the enrollment of compulsory education-age children in this group has undergone rapid growth. In 2015, 2017, and 2019, it surpassed 400,000, 500,000, and 700,000, respectively. 2019's enrollment of 794,600 was an increase of 115.9% from 368,100 in 2013 (Ministry of Education of China, 2021). The number of special education students enrolled under the "Inclusive Classes within Regular Schools" program progressively climbed from 191,000 in 2013 to 332,000 in 2018, an increase of 73.8% (State Council of China's Information Office, 2020). The enrollment of children with visual and hearing impairments remained stable, but that of children with mental retardation, autism, and other types of disabilities saw significant boosts in this period (Ministry of Education of China, 2020).

Along with the expansion of the scale of inclusive education, more emphasis has been placed on the improvement of its quality standards. In 2016, the Ministry of Education released the curriculum standards for "three-category special education" and underlined the learning outcomes of students as the primary indicator of its education quality (Ministry of Education of China, 2016). 2020's "*Guiding Opinions on Strengthening the Implementation of the 'Inclusive Classes within Regular Schools' Program for Compulsory Education of Children and Adolescents with Disabilities*" set forth detailed provisions on inclusive education, covering evaluation and accreditation, student enrollment in the proximate school, resource classrooms, curricular content, individualized education schemes, comprehensive assessment of students, and the creation of inclusive campus culture (Ministry of Education, 2020). Comprehensive stipulations in these aspects are meant to ensure the quality standards of inclusive education, taking its development one stage further.

Conclusion

High-quality inclusive education serves to cater for the individual needs of special education students, help them achieve social integration, and provide effective support for their future development. The development of inclusive education also contributes to the advancement of the entire education system, consolidating the foundation of a more harmonious, inclusive, and equitable society. The issue of inclusive education has been high on the educational

agenda of the Chinese government. The success of inclusive schools requires a concerted endeavor by teachers, schools, families, and communities. With continued policy support and increased social concern, more Chinese children with disabilities will benefit from inclusive education, which gives them the opportunity to share quality education with their normal peers.

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