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Özel Eğitim Öğretmenlerinin Matematik Öğretimine Yönelik Özyeterlilik Algıları*

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ÖZET

Çalışma ile özel eğitim öğretmenlerinin matematik öğretim özyeterlilik algılarına yönelik bir ölçme aracının geliştirilmesi amaçlanmıştır. Geliştirilen ölçek kullanılarak özel eğitim öğretmenlerinin bu alanda algılanan özyeterlilik algılarının düzeylerinin farklı çeşit değişkenler üzerindeki durumu araştırılmıştır. Çalışmada yapılan geçerlik ve güvenirlik çalışmaları doğrultusunda, veri toplama aracı olarak kullanılan "Özel Eğitim Öğretmenlerinin Matematik Öğretimlerine Yönelik Özyeterlilik Algısı Ölçeğinin (ÖEÖ-MÖYÖAÖ)" kullanılabilir özelliklere sahip olduğu bulunmuştur. Araştırma, İstanbul ilinde görev yapmakta olan toplam 464 özel eğitim alan mezunu öğretmen ile yapılmıştır. Araştırma sonuçlarına göre; öğretmenlerin matematik öğretimlerine yönelik özyeterlilik algılarının yeterli düzeyde olduğu ve incelenen algıların öğretmenlerin öğrenim durumu ile anlamlı bir farklılık gösterdiği bulunmuştur. Diğer taraftan öğretmenlerin matematik öğretim özyeterlilik algılarının cinsiyet, yaş, mesleki deneyim ve öğrencinin özel gereksinim durumu ile anlamlı bir farklılık göstermediği tespit edilmiştir. Buna göre, öğretmenlerin öğrenim durumları arttıkça özyeterlilik algılarının yükseldiği söylenebilir. Öğretmenlerin kendi öğretimlerine yönelik algıları, sunacakları öğretimi şekillendirebileceği için bu konu üzerinde uygulamalı ve kuramsal çalışmalar önerilebilir.

Anahtar Sözcükler: Matematik öğretimi, matematik öğretim özyeterliliği, özel eğitim öğretmenleri, özel gereksinimli çocuklar, ölçek geliştirme

Self-Efficacy Perceptions of Special Education Teachers Regarding Teaching Mathematics

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ABSTRACT

The study was aimed developing a measuring tool intended for special education teacher on teaching maths self-efficacy perception. Then, it was investigated special education teachers' these perceived perception levels on significant kind of variables. For collecting data, the "Scale for Self-Efficacy Perceptions of Special Education Teachers Regarding Mathematics Teaching (SSEP-SET-RMT)" which was used, was found to have sufficient features in line with validity and reliability exploration. Within study, there were especially 464 special education teachers graduated related field working in İstanbul. It was detected that teachers had sufficient teaching maths self-efficacy perceptions and inspected perceptions varied by level of education of teachers significantly. But, teaching maths self-efficacy perceptions of teachers did not vary by gender, age, professional experience, and student's special education significantly. As education level increases, teachers' perceived self-efficacy perceptions increased. Because of teachers' perception towards their own teaching can form their current teaching, it can be recommended that practical and theoretical studies can made on this subject.

Keywords: Mathematics teaching, mathematics teaching self-efficacy, special education teachers, children with special needs, scale development

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1. INTRODUCTION

The presence of individuals in need of special education has been increasing recently. In the world, there were more than a billion people experience disability nowadays (WHO, 2016), too. Among the reasons for this increase are especially structural reasons and acquired reasons that are environmental factors, premature birth, possibility of keeping babies with severe health problems alive, and rise in the number of traffic accidents (Batu, & Kırcaali-İftar, 2005). And therefore, the education to children with special needs has become important. Special education is individualization of education in accordance with students to meet the needs unique to them (Turnbull, Turnbull, & Wehmeyer, 2007).

1.1. The Children with Special Needs

An individual requiring special education is an individual who significantly differs from peers in terms of individual specifications and sufficiencies in education, too. According to this, children with special needs, considering their differences in terms of educational qualifications; "mild, moderate, severe or high severe mental deficiency (AAIDD, 2010; DSM-V), attention deficit and hyperactivity disorder, language and speech difficulties, emotional and behavioral disorder, visual impairment, hearing loss, orthopedic insufficiency, autism, special learning disability, cerebral palsy, chronic disease and gifted individuals" are separated in different forms (Eripek, & Vuran, 2008). The children who have developmental disabilities often have problems in their mental functioning or behavior (AAIDD, 2018). While having only one disability is already a considerable obstacle against meeting the conditions required by life, an individual who has a severe disability or multiple disabilities confronts even more obstacles (Cavkaytar, & Diken, 2005). Therefore, education provided to children with special needs is very important.

In our country education services mentioned are provided in general education schools, options such as inclusion or special education classes and special education schools separate from these schools (Eliçin, Dağseven Emecen, & Yıkmış, 2013). The special education services especially aims providing individuals with independent living skills which they need in order to live without dependence on others in the society (Karabulut, & Yıkmış, 2010). Actually, the higher the quantity and quality of such education is, the easier it is for students to participate in social life by gaining independent living skills (Ergül, Baydık, & Demir, 2013). To acquire these skills for children with special needs, gaining the skills they need in their daily lives is closely associated with the appropriateness of the teaching environment they are taught in and the structure of the curriculum covered there.

1.2. The Children with Special Needs and Mathematics Education

The providing students with academic maths skills are one of the aims of the implemantions in schools. Some of these academic skills include numbers, elementary operations, and calculation which children with special needs frequently encounter in their daily lives (Yıkmış, 2005). According to the individual characteristics of these students experience learning difficulty especially in mathematics and need special attention to gain basic maths skills. In this context; the way mathematics is taught is important because mathematics education improves the cognitive skills of these students.

But, it can be said that a top level of success has not been achieved for such children, since the teaching methods in general developed for children with special needs target an education limited by mental development of children and is based on the current maturation level (Erdener, 2009). As studies increase related this subject in the literature, it is necessary to take steps to support academic abilities of children with special needs (Hacısalihoğlu-Karadeniz, Akar, & Şen, 2015; Shippen, Crites, Houchins, Ramsey, & Simon, 2005), in addition to their social skills in their schools (Maag, 2005; Sazak Pınar, Sucuoğlu, & Çıkrıkçı Demirtaşlı, 2013). Vygotsky stated that children with special needs were given education focused only on the level of their mental development, and that therefore they could never make a leap forward from concrete thinking to abstract thinking in their educational process. In this context, training goals should be able always to rise above a certain level. Thus, intellectual competencies of children will be able to come to a better level by means of targeted training (Vygotsky, 1978, ctd. Erdener, 2009). In this context, it is necessary to try to achieve these high level targets by determining targets higher than expected as much as expected in the field of mathematics, which can provide especially the ability of abstract thinking, in addition to the goals that will be determined in long term.

Unless teachers, who have a significant influence on learning and achievement, have confidence in their teaching and positive perceptions towards what they can do in that regard, it would be considerably difficult for them to achieve their teaching goals. At this point, the self-efficacy perception comes into play. Self-efficacy determines the shape of an individual's emotions and others like feelings, thoughts, motivations and behaviours (Bandura, 1994). Self-efficacy perception, which is belief of a person in his competence, may affect both the thoughts and feelings of people about themselves and their levels of motivation and behaviors regarding a specific situation.

1.3. The Teacher Self-Efficacy

Teacher self-efficacy is a kind of belief of teachers that he/she can accomplish his/her teaching job (Tschannen Moran, & Woolfolk-Hoy, 2001). Since actions and behaviors of teachers are associated with level of belief, perception, assumption, and

motivation (Chaco'n, 2005), they may not display effective behaviors if they do not have adequate self-efficacy. According to Bandura (1994), the beliefs of teachers in their personal competencies of motivating their students and accelerating learning are influential on learning environment and students' academic success.

Self-efficacy perceptions of teachers' related teaching of specific domains stand out in especially educational studies. For example, mathematics self- efficacy is stated by Hackett and Betz (1989) as situation-specific or problem-based evaluation of self-confidence of a personal in successfully performing a specific mathematical task or solving a specific mathematical problem. Also, self-efficacy related teaching maths is the belief of an individual in own capacity for effective mathematics teaching (Enochs, Smith, & Huinker, 2000). Self-efficacy of teachers is an anticipation of the effective mathematics teaching strategies, and teachers that have high self-efficacy level are more effective than teachers that have low self-efficacy level (Swars, 2005). It is reported that self-efficacy perceptions related teaching maths of teachers influence especially the teaching methods they use in the classroom (Kahle, 2008; Ware, & Kitsantas, 2007), and there is a high relationship between the plan & program activities of teachers with a high self-efficacy perception and the physical order of the classroom (Babadoğan, & Korkut, 2010). Therefore, the belief of a teacher in his/her capability to use his/her skills is more important than having these skills.

When the literature is examined, even though there are those on perception of self-efficacy of teachers/preservice teachers of children with special needs (Dimopoulou, 2012; Johnson, 2018; Kaner, 2010; Montoya, 2018; Ostendorf, 2015), it can be seen that there are no studies on self-efficacy perceptions of teachers of children with special needs towards their mathematics teaching. These studies had focused on self-efficacy perceptions of special education teachers/educators/preservice teachers working in special education schools (Dimopoulou, 2012; Johnson, 2018; Kaner, 2010; Montoya, 2018; Ostendorf, 2015), and relationships between the personal and teaching competencies of special education teachers and certain variables (Allinder, 1995). However, there are a limited number of scales that measure self-efficacy perceptions of the teachers of children with special needs in various aspects (Aksoy, & Diken, 2009; Coladarci, & Breton, 1997; Ergül, Baydık, & Demir, 2013; Hartmann, 2012; Meijer, & Foster, 1988). These scales explore the self-efficacy perceptions of school counselors regarding psychological counseling and guidance (Aksoy, & Diken, 2009), the self-efficacy perceptions of teachers regarding the education of hearing-impaired and visually-impaired children (Hartmann, 2012), and the views of pre-service and in-service special education teachers regarding the efficacy of the undergraduate program of mentally handicapped teaching (Ergül, Baydık, & Demir, 2013). In addition, Coladarci and Breton (1997) created a scale to determine teacher efficacy in special education by adapting the teacher efficacy scale developed by Dembo and Gibson (1984) to special education. Meijer and Foster (1988) also developed a teacher self-efficacy scale for special education. According to Punch (2013), it does not need to redevelop a new measuring tool if there is already an appropriate measurement instrument for relevant variable. However, there is no self-efficacy scale developed inside or outside Turkey for measuring the mathematics teaching self-efficacy of special education teachers. That made it possible to develop a new measurement instrument.

1.4. The Importance and the Purpose of the Study

Considering both the role of special education teachers in education of children with special needs, contribution of teaching mathematics to such children to their cognitive development, it is considered that quantitative studies aimed at determining the self-efficacy perceptions of special education teachers related mathematics teaching could to some extent fill that gap in the relevant literature. Since the self-efficacy perceptions of teachers of children with special needs towards their mathematics teaching are to shape their way of teaching and be effective in student learning, it could also be possible to identify the needs and deficiencies of teachers at that point. Thus, it would be possible to set high targets in teaching mathematics to children with special needs, and to raise awareness of teachers in this field through new studies, allowing considerable progress in teaching mathematics to such children. If the special education teacher is really sufficient in his/her field and in mathematics teaching and he/she is confident in transferring this to the student by believing in this competence, he/she will shape the mathematics teaching accordingly and can lead the way in achieving the achievements.

The ability of special education teachers to be able to raise their teaching objectives will be ensured by their high self-efficacy perception. In this context, this study is considered important as being the first to enable further studies on self-efficacy perceptions of special education teachers regarding mathematics teaching in the future. In this regard, this study aims to develop a measuring tool for determining perceptions of self-efficacy of special education teachers regarding teaching mathematics (Study I), to see whether the level of self-efficacy perceptions of the special education teachers regarding mathematics teaching show differences depending on a variety of variables (gender, age, educational background, professional experience, special needs of students) (Study II).

1.3.1. Sub-problems of the study

The answers to the following questions were examined in accordance with the study:
1. What are the levels of the self-efficacy perceptions of special education teachers towards their mathematics teaching?
2. Do the self-efficacy perceptions of special education teachers towards their mathematics teaching significantly vary by;
a) gender,
b) age,

c) educational background,
d) professional experience,
e) special needs of students?

2. METHODOLOGY

The study was performed with general survey model and was made with two-stage. In Study I, the stages of validity and reality of scale development were made for developing SSEP-SET-RMT. In Study II, functionality of scale was determined focused on data from administration of SSEP-SET-RMT.

2.1. Study I: Research Model and Study Group

In Study I, development a tool for searching special education teachers' perception of self-efficacy toward mathematics teaching. So, in this context the general survey model was preferred. The study was carried out with total of 464 teachers who graduated from the special education programme and work in province of Istanbul in 2013-2014 school year.

In study, group was divided into two. The data obtained from the first study group were used with exploratory factor analysis (EFA) while data obtained from second study group were used with confirmatory factor analysis (CFA). Accordingly, the first study group comprised 205 teachers; 133 (65%) of them were female, and 72 (35%) of them were male. The second study group, on the other hand, comprised 259 teachers; 160 (62%) of them were female, and 99 (38%) of them were male.

Because of teacher shortage in Turkey, branch teachers having a special education certificate take part in education of children with special needs besides teachers graduating a special education program. Special education teachers graduating from a special education program may differ from other teachers with their knowledge, skills, and attitudes towards their field. Therefore, teachers who graduated from a special education program were focused on while determining the domains of competence in special education mathematics teaching and exploring the self-efficacy perceptions of teachers regarding such domains. Since the adequacy of sample size is important for analyses in scale development research and there are just a limited number of teachers who graduated from a special education program, an attempt was made to access most of the predetermined teachers. And validity and reliability of SSEP-SET-RMT was investigated based on data obtained special education teachers.

2.2. Scale Development Process

2.2.1. The scale for self-efficacy perceptions of special education teachers regarding mathematics teaching (SSEP-SET-RMT): Investigation of validity and reliability

A 97-item item pool was created towards related literature to develop SSEP-SET-RMT. In this context, the existing teacher self-efficacy scales were examined; domains of competence of special education teachers in mathematics teaching were identified; and self-efficacy concept included in Social Cognitive Theory of Bandura was taken as basis in preparation of the scale items. In developing SSEP-SET-RMT, the domains of "personal competence, teacher's role in effective teaching, teaching performance, effective teaching, motivating and assuming responsibility, teaching competence, collaboration with parents, and competence in content knowledge" were used. These domains, which were formed based on the relevant literature, can be summarized as follows:

1. Personal Competence: This domain involves the professional qualification of a special education teacher for teaching mathematics to students in need of special education and the practices or activities he can employ in mathematics teaching (Geary, 2004).

2. Teacher's Role in Effective Teaching: This domain involves a teacher's behaviors towards students, skill to communicate with them, and his general competencies creating learning environment in effective way for students in need of special education (Gürsel, 2000).

3. Teaching Performance: This domain is about the mathematics teaching performance of special education teachers (Fives, & Alexander, 2004).

4. Effective Teaching: This domain refers to capability to find various ways of teaching mathematics in accordance with the needs of students and to conducting effective teaching in order to maximize student learning (Sarı, 2003).

5. Motivating and taking responsibility: This domain involves making students with special needs participate in educational activities wtih increasing their levels of motivation to learn mathematics (Yıkmış, 2005).

6. Teaching Competence: This domain refers to a special education teacher's having adequate professional knowledge and qualification to teach mathematics and his capability to use such knowledge and skills in teaching mathematics to students, to transfer these knowledge and skills to them, and to make necessary adaptations (MEB, 2010).

7. Collaboration with Parents: This domain refers to a special education teacher's capability to communicate with parents, to receive their support, and to collaborate with them to ensure permanent learning of mathematics among children in need of special education (MEB, 2010).

8. Competence in Content Knowledge: This domain refers to a special education teacher's having mathematical content knowledge to conduct mathematics teaching in accordance with levels and individual features of students (MEB, 2010).

The items created were submitted to six experts who were knowledgeable in one of the fields of mathematics education, special education, and assessment and evaluation, so that they could deliver their opinions about the content of the items and their suitability for special education teachers. The degree of agreement was found to be 92% with the formula specified by Miles and Huberman (1994). The items were scored based on a Likert-type scale through the following response choices: "I strongly disagree =1"; "I disagree=2"; "I am neutral=3"; "I agree=4"; and "I strongly agree =5". The pilot form was created based on the expert opinions and after corrections, it was administered to 17 teachers who had graduated from a special education programme and worked in the Sakarya province. After corrections were made, the scale turned out to have 54 items and be ready for the pilot study.

2.3. Data Analysis

In the study, because of exploring construct validity of SSEP-SET-RMT, exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) were used and because of exploring reliability of SSEP-SET-RMT, Cronbach's alpha, Spearman-Brown, and Guttman internal consistency coefficients and test-retest reliability were examined.

2.3.1. SSEP-SET-RMT Exploratory factor analysis (EFA)

According to Kline (1994), a 200-person sample is adequate for reliable factors (Çokluk, Şekercioğlu, & Büyüköztürk, 2012). Accordingly, 205 participants were deemed adequate for EFA made after the pilot study. The KMO value was 0.947 and the result of Bartlett's test was found to be significant with x^2= 9380.885 ($p<0.05$). Because the fact that the KMO value is higher than 0.60 and that the Bartlett test was found to be significant is an indication that data were adequate for factor analysis (Büyüköztürk, 2005), so obtained data were appropriate for factor analysis. There are 9 factors that had an eigen value over 1 and the percentages of the variances explained by the first two factors are 45.693% and 6.812% respectively.

In the line chart, because the first two break points were more evident and contributions of the factors from that point on to the total variance were very close to each other, the scale was determined to have two factors. When items were evaluated by means of overlapping and levels of acceptance of the factor loading values, it was seen that there were no problems in the items except for the item 9. It was found that factor loadings of items under the first factor varied between 0.545 and 0.845. Therefore, it can be said that factor loading values are quite good. The factor loadings of items under second factor varied between 0.328 and 0.837. The contribution of the first factor to the total variance was 45.69% and that of the second factor was 6.81%. The total contribution of these two factors to the variance was 52.50%. However, because of the fact that the reliability of the items in the second factor was low, these items were removed, procedures were repeated, and the factor structure was determined to be unidimensional.

2.3.2. Item-total correlations and item discrimination

In study, for indicating validity coefficients of items of SSEP-SET-RMT as values, item-total correlation values were found. Furthermore, the t-test was used for determining item discrimination for the items (Balcı, 2009). The results are presented in Table 1. It is clear from the Table 1 that some items of the scale had quite low corrected item-total correlations.

Table 1.
SSEP-SET-RMT Item Analysis Results

Item No	Item-Total Correlation	t*	Item No	Item-Total Correlation	t*	Item No	Item-Total Correlation	t*
1	0.603	-10.06	19	0.536	-9.38	37	0.736	-11.34
2	**0.010**	-0.71	20	0.640	-10.85	38	0.778	-15.10
3	0.532	-7.54	21	0.683	-12.29	39	0.634	-9.21
4	**0.274**	-4.90	22	0.700	-12.57	40	0.660	-11.87
5	0.617	-12.38	23	0.780	-15.36	41	0.787	-14.85
6	0.615	-14.35	24	0.564	-8.43	42	**0.122**	-1.68
7	0.612	-10.79	25	0.708	-15.06	43	0.813	-15.51
8	0.557	-10.09	26	0.557	-8.62	44	0.708	-10.97

9	**0.057**	-1.28	27	0.754	-14.79	45	0.727	-13.71
10	0.725	-12.91	28	0.714	-13.76	46	0.653	-10.70
11	0.759	-13.43	29	0.635	-10.33	47	**0.180**	-2.64
12	0.756	-14.49	30	0.779	-15.46	48	0.796	-15.36
13	0.532	-8.94	31	0.755	-11.78	49	0.813	-17.52
14	0.675	-11.34	32	0.756	-13.52	50	0.804	-15.96
15	**0.294**	-4.44	33	0.669	-10.44	51	0.723	-11.35
16	**0.230**	-3.80	34	0.821	-17.96	52	0.815	-16.54
17	0.708	-12.02	35	0.726	-12.00	53	0.723	-12.56
18	**0.223**	-3.69	36	0.776	-12.35	54	0.785	-16.41

r: (n=203) t: (n1=n2=55) *** p<0.01

Accordingly, since the items 2, 4, 9, 15, 16, 18, 42, and 47 had an item-total correlation below 0.30, so obtained items were removed from SSEP-SET-RMT. The corrected item-total correlations of items remaining vary between 0.534 with 0.832 and t-values are significant (p<0.001). Since the higher the t-value is, the higher the discrimination an item provides (Tavşancıl, 2006), it can be said that all items in the scale have item discrimination.

2.3.3. The confirmatory factor analysis (CFA) of SSEP-SET-RMT

SSEP-SET-RMT was administered to a new sample group comprising 259 participants in order to test correctness of structure which was seen to be composed of 46 items and have just one dimension at the end of EFA. As χ^2/df ratio was found to be 3.87 in the first analysis, there was a moderate fit (χ^2=3833.37; df=989; p<.001; χ^2/df=3.876). In terms of RMSEA, a fit index of 0.10 was obtained, there was a low fit (Tabachnick & Fidel, 2001; ctd. Çokluk, Şekercioğlu & Büyüköztürk, 2012). The following fit index values were found: NFI=0.95; CFI=0.96; IFI=0.96; RFI=0.94; GFI=0.60; AGFI=0.57; SRMR=0.048; and PGFI=0.63.

In general, 0.90 refers to acceptable and 0.95 to a perfect fit for the indices of GFI, CFI, NFI, RFI, and IFI; for AGFI, 0.85 refers to acceptable and 0.90 to a perfect fit; for RMSEA, 0.08 refers to acceptable and 0.05 to a perfect fit; for SRMR, 0.05 refers to perfect and 0.10 to an acceptable fit (Schermelleh-Engel & Moosbrugger, 2003; ctd. Meydan, & Şeşen, 2011). In other words, though NFI, CFI, IFI, RFI, SRMR, and PGFI values indicated good fit, RMSEA, GFI, and AGFI values indicated poor fit. Then break point was taken as 0.63 in order to obtain better results in CFA and 10 items with a factor loading not above this value were removed from the scale. 36 factors remaining in the scale were subjected to CFA again. The CFA results of scale are given in Table 2.

When Table 2 is analyzed, in the 36-item model it was found that NFI, CFI, IFI, RFI, SRMR, and PGFI indicated a good fit. GFI and AGFI values increased. Because these indexes should be evaluated together with other goodness-of-fit indices (Çapık, 2014), it was found that model was a good fit. In this regard, the unidimensional structure of SSEP-SET-RMT was confirmed to be fit for the model.

Table 2.
The Confirmatory Factor Analysis Results of the SSEP-SET-RMT

Models	**χ^2/df**	**RMSEA**	**NFI**	**NNFI**	**PNFI**	**CFI**	**IFI**	**RFI**	**GFI**	**AGFI**
46-item model	3.876	0.106	0.95	0.96	0.90	0.96	0.96	0.94	0.60	0.57
36-item model	3.660	0.10	0.95	0.96	0.89	0.96	0.96	0.95	0.68	0.64

2.3.4. The internal consistency level of the SSEP-SET-RMT

To determine the reliability of SSEP-SET-RMT, Cronbach's alpha, Spearman-Brown, and Guttman internal consistency coefficients, as well as test-retest reliability, were analyzed. Cronbach's alpha value was found to be 0.979; Spearman-Brown value was found to be 0.937; and Guttman value was found to be 0.937. Since all the internal consistency coefficients are over 0.80, it can be said that the scale has high reliability. Test-retest reliability was also used. 4 weeks after the first administration, the scale was administered to 53 teachers and it was found to be, r =0.668, p<0.001. There were no significant differences between the mean scores obtained in two administrations (t=1.557; p>0.05). Therefore, SSEP-SET-RMT is a reliable tool.

2.4. Study II: Research Model and Study Group

The purpose of Study II is to show whether the mathematics teaching self-efficacy perceptions of special education teachers vary in terms of various variables (gender, age, educational background, professional experience, and special needs of student). This study is designed based on "relational survey model", which is among the survey models. The study group comprised of 259 special education teachers working in public schools and special rehabilitation institutes in Istanbul.

Of teachers, 160 (61.8%) were female, and 99 (38.2%) were male. Of the teachers, 154 (59.5%) were in the age group of 21-30; 82 (31.7%) were in 31-40; 22 (8.5%) were in 41-50; and 1 (0.4%) was in 51-60. 236 (91.1%) teachers graduated from an undergraduate program; 22 (8.5%) teachers graduated from a master program; and 1 (0.4%) teacher graduated from another field. 138 (53.3%) teachers had a professional seniority of 1-5 years; 66 (25.5%) teachers had 6-10 years; 32 (12.4%) teachers had 11-15 years; 15 (5.8%) teachers had 16-20 years; and 8 (3.1%) teachers did not have fewer than 21 years. Of the teachers, 134 (51.7%) worked with students with mental disabilities; 11 (4.2%) worked with hearing-impaired students; 55 (21.2%) worked with students with autism; 11 (4.2%) worked with visually-impaired students; 46 (17.8%) worked with students with multiple disabilities; and 2 (0.8%) worked with students with other disabilities.

2.5. Data Collection Tool and Data Collection: The Scale for Self-Efficacy Perceptions of Special Education Teachers Regarding Mathematics Teaching (SSEP-SET-RMT)

The data obtained by use of SSEP-SET-RMT were also used in Study II.

2.6. Data Analysis

Firstly, all of the obtained data (270 data) were examined one by one to determine whether or not there was any data loss. It was seen that while some teachers gave uniform responses, some others just left the pages blank. The data obtained from the responses of these teachers were excluded from analysis. All in all, 11 scale forms were excluded from evaluation. Thus, the data obtained from the remaining 259 scale forms were subjected to analyses. In regard to study problems, one-way analysis of variance (ANOVA) was employed in the groups with a normal distribution; Mann Whitney-U test and Kruskal Wallis technique were used in the groups without a normal distribution.

Kolmogorov-Smirnov (K-S) test, which is a non-parametric test, was used for testing the suitability of SMTSEP-SET scores for normal distribution before the analyses. When a significant difference was found between the groups through ANOVA, post hoc tests were used for identifying the source of such difference and the groups between which such difference existed. Tukey's test is used when the number of groups subjected to comparison is great. Scheffe's test, however, is used when groups have different sample sizes (Sipahi, Yurtkoru, & Çinko, 2008). Significance level was taken as 0.05 in all statistical procedures in this study, and the results at .01 significance level were deemed significant. SPSS 20.0 package was used in the analyses carried out.

3. FINDINGS

The first sub-question of this research is as follows: "*What are the mathematics teaching self-efficacy perception levels of special education teachers?*" Table 3 presents minimum, maximum, and actual scores and standard deviation values concerning the mathematics teaching self-efficacy perception levels of the special education teachers.

Table 3.
The Descriptive Statistics Concerning the Responses of the Special Education Teachers to the Scale and the Entire Scale

	N	Min	Max	XM.	Dev
Group	255	100	180	149.82	17.42

When Table 3 is analyzed, it is seen that the special education teachers obtained a score higher than half of the top score that can be obtained from the entire scale (total score: 180). The lowest mathematics teaching self-efficacy perception score obtained by the study group was 100 while the highest one was 180. The lowest score that can be obtained from the scale is 36 while the highest score is 180, arithmetic mean is 149.82, and standard deviation is 17.42. In this regard, it is evident that the special education teachers had an adequate level of mathematics teaching self-efficacy perception.

The second sub-question of this research is as follows: "Do the mathematics teaching self-efficacy perception levels of special education teachers significantly vary by a) gender, b) age, c) education level, d) professional experience, e) student's special need?" The normality test results indicated that SSEP-SET-RMT total scores did not have normal distribution for gender, age, education level, professional experience and student's special need. Thus, Mann Whitney-U test and Kruskal Wallis technique were used. In the first place, whether or not the mathematics teaching self-efficacy perception levels of the special education teachers significantly varied by gender was investigated. To this end, Mann Whitney U test, which is a non-parametric test, was carried out. The obtained results are given in Table 4 below.

Table 4.
Gender-Based Mann-Whitney U Test Result Concerning the Scores Relating to the Mathematics Teaching Self-Efficacy Perceptions of the Special Education Teachers

Gender	N	Mean Rank	Rank Sum	U	p
Female	160	126.93	20308.00	7428.00	0.401
Male	99	134.97	13362.00		

It is clear from the Table 4 that the mean scores concerning the responses of the special education teachers to SSEP-SET-RMT did not vary by gender (U=7428.00; p>0.05).The results of SSEP-SET-RMT scores related with age variable are presented in the Table 5.

Table 5.
Age-Based Kruskall Wallis Test Result Concerning the Scores Relating to the Mathematics Teaching Self-Efficacy Perceptions of the Special Education Teachers

Age	N	Mean Rank	Sd	χ^2	p
21-30	154	127.95	3	4.99	0.173
31-40	82	140.32			
Not younger than 41	22	110.45			
Older	1	29.00			

It is clear from the Table 5 that the scores concerning the responses given by the special education teachers to SSEP-SET-RMT did not vary by age (p>0.05). The results of SSEP-SET-RMT scores related with education level variable are presented in the Table 6.

Table 6.
Education Level-Based Mann-Whitney U Test Result Concerning the Scores Relating to the Mathematics Teaching Self-Efficacy Perceptions of the Special Education Teachers

Education Level	N	Mean Rank	Rank Sum	U	p
Undergraduate	236	126.26	29796.50	1830.500	0.022
Master	22	164.30	164.30		

It is clear from the Table 6 that the total scores concerning the responses of the special education teachers to SSEP-SET-RMT significantly varied by education level (U=1830.500; p<0.05). It can be said that the teachers attending a master program had a higher mathematics teaching self-efficacy perception in comparison to the teachers who graduated from an undergraduate program. The results of SSEP-SET-RMT scores related with professional experience variable are presented in the Table 7.

Table 7.
Professional Experience-Based Kruskall Wallis Test Result Concerning the Scores Relating to the Mathematics Teaching Self-Efficacy Perceptions of the Special Education Teachers

Professional Experience	N	Mean Rank	Sd	χ^2	p
1-5 years	138	123.49	4	6.65	0.155
6-10 years	66	147.48			
11-15 years	32	122.56			
16-20 years	15	114.37			
20 years and upper	8	157.13			

It is clear from the Table 7 that the mean scores concerning the responses of the special education teachers to SSEP-SET-RMT did not significantly vary by professional experience (p>0.05). The results of SSEP-SET-RMT scores related with student's special need variable are presented in the Table 8.

Table 8.
Student's Special Need-Based Kruskall Wallis Test Result Concerning the Scores Relating to the Mathematics Teaching Self-Efficacy Perceptions of the Special Education Teachers

Student's Special Need	N	Mean Rank	Sd	χ^2	p
Intellectual disabilities	134	119.54	5	7.08	0.215
Hearing-impaired	11	157.95			
Autism	55	142.16			
Visually-impaired	11	146.32			
Multiple disabilities	46	133.16			

It is clear from Table 8 that mathematics teaching self-efficacy perception levels of the special education teachers did not vary by student's special need (p>0.05). In other words, there is no significant relationship between mathematics teaching self-efficacy perceptions of special education teachers and their students' special needs.

4. RESULTS, DISCUSSION AND RECOMMENDATIONS

4.1. Study I

In many countries there are obstacles to ensuring the quality of education for children with special needs. With more qualified education and growing in accordance with individual differences, children with special needs can adapt their communities easily and become more productive individuals (Donohue & Bornman, 2014). Because the role of special education teachers in education of children with special needs and belief of teachers towards their teaching is an important factor in shaping their teaching-related behaviours (Huinker & Madison, 1997), there is a need to learn their self-efficacy beliefs.

There are different developing or adapting of scale studies about teacher self-efficacy in literature (Dembo & Gibson, 1984; Hoy & Woolfolk, 1993; Tschannen Moran & Woolfolk Hoy, 2001), but there are a limited number of scales developed related special education (Aksoy & Diken, 2009; Coladarci & Breton, 1997; Ergül, Baydık, & Demir, 2013; Hartmann, 2012; Meijer & Foster, 1988). Also, there is no scale that is capable of measuring the mathematics teaching self-efficacy levels of the teachers of children with special needs.

So, the first aim of current study was to develop a scale for measuring self-efficacy perceptions of special education teachers towards mathematics teaching. Therefore, Bandura's self-efficacy concept was taken as basis, and within the framework of the literature, the professional competence domains (Güleç-Aslan, Özbey, Sola-Özgüç, & Cihan, 2014) and mathematics teaching competence domains (Geary, 2004; Gürsel, 2000; Fives & Alexander, 2004; MEB, 2010; Yıkmış, 2005) were determined and items were thus created. And findings related exploratory factor analysis indicated that it had a unidimensional structure. In study, item-total correlation and corrected item-total correlation of scale was in sufficient level. After confirmatory factor analysis, scale was determined by a 36-item new structure and it was determined to have adequate fit indices. The fit values were found to be within acceptance boundaries in the Table 2. Because of reliability analyses of scale, all internal consistency coefficients are over 0.80, thereby it can be said that SSEP-SET-RMT is a valid and realiable measuring tool with high reliability.

In fact, teachers' beliefs regarding teaching are highly effective in creating of teaching-related behaviours (Huinker & Madison, 1997), so the domains in which special education teachers have inadequate self-efficacy perception may be determined through SSEP-SET-RMT that was developed. And a comparison may be made between the suggested situation and the current situation through observation of the in-class teaching processes of teachers.

4.2. Study II

Although self-efficacy studies are limited that are related special education teachers' or preservice teachers' perceptions (Johnson, 2018; Kaner, 2010), it needs to be investigated self-efficacy beliefs that are regarding mathematics teaching of special education teachers. In recently, the studies on self-efficacy in special education have investigated relation between self-efficacy and struggling with student problem or effect of self-efficacy on attitudes related inclusive education (Malinen, et al., 2013). In literature there is a gap about special education teachers' self-efficacy related maths teaching. Therefore, study was also aimed to determine the maths teaching self-efficacy perception levels of special education teachers and to reveal whether these beliefs vary in terms of various variables.

The special education teachers were found to have an adequate level of mathematics teaching self-efficacy perceptions. There are behavioural differences between teachers with a high or low self-efficacy perception in terms of trying to use instructional innovations, preventing undesirable student behaviours, giving feedback to students having learning difficulties, effective teaching qualifications and these are also influential on student motivation and achievement (Johnson, 2010). In order to prevent negative behavior on the part of children with special needs, special education teachers should motivate them to learn more effectively. This is a pleasing result that teachers have sufficient self-efficacy perception.

It was found out in this study that the mathematics teaching self-efficacy perceptions of the special education teachers did not significantly vary by gender, age, professional experience, and special needs of students, but significantly varied by educational background. The literature does not contain any study in which the mathematics teaching self-efficacy perceptions of the special education teachers are explored in terms of various variables. The results of the studies on the special education self-efficacy levels of special education teachers' and preservice teachers' self-efficacy ratings (Johnson, 2018), school counsellors (Özgün, 2007), and special education competences of teachers (Karahan, & Balat, 2011) indicate that there are no significant relationships between self-efficacy perception and gender. The result of the present study is consistent with this finding. A similar result was obtained also by Kaner (2010) that explored the self-efficacy perceptions (self-efficacy beliefs) of both the teachers of students in need of special education and the teachers of students not in need of such education.

In this study, there was no significant relationship between the mathematics teaching self-efficacy perceptions of special education teachers and age. The literature contains no studies that involve a result supporting or contrary to this result of the present study. It is thought that search of relationships between the self-efficacy perceptions of teachers in specific fields and

various variables will contribute to the literature in this field. In the other hand, Johnson (2018) indicated that significant differences were found in special education teachers' self-efficacy ratings and age.

It was discovered that there was a significant relationship between mathematics teaching self-efficacy perceptions of special education teachers and educational background. The teachers attending a master program were found to have higher mathematics teaching self-efficacy scores in comparison with the teachers who graduated from an undergraduate program. When individuals get education in a particular field, they develop themselves and they increase perfections in this fields (Karahan, & Balat, 2011), it is clear that special education teachers should be created possibilities to develop themselves in their own fields (i.e. special education) and in the field of mathematics teaching.

In addition, no significant relationships were found between special education teachers' mathematics teaching self-efficacy perceptions and professional experience. This case is consistent with the opinion of Bandura (1997) that when self-efficacy is formed once, it becomes quite stable. The successes or failures in teachers' experiences affect self-efficacy. Also, low self-efficacy causes a person to give up easily and make little efforts (Hoy, & Woolfolk, 1993). Special education teachers should teach mathematics to students with special needs effectively, so they have to persist and be determined in teaching. Because individuals observe, imitate, and use internal cognitive processes to learn the behaviors of others and can indirectly learn by observing others' behaviours or the consequences of others' behaviours (Liu, Lou and Shih, 2014, p. 2), special education teachers should be provided with effective models, so that they gain positive professional experience and increase their self-efficacy perceptions. Also, the finding that was no statistically significant differences were found between special education teachers' self-efficacy ratings and previous experience (Johnson, 2018) is consistent the current study's related finding. Montoya (2018) compared sense of self-efficacy of special education teachers ratings of novice and experienced special education teachers. In this study, statistically significant differences between the 2 groups of teachers were not found.

Lastly, in this study, no significant relationships were found between the mathematics teaching self-efficacy perceptions of the special education teachers and special needs of students. It is reported that the self-efficacy perceptions of teachers do not change depending on the type of students they work with (Kaner, 2010). The finding obtained in the present study is consistent with this finding.

Children with special needs vary in a wide spectrum. These children can show different successes in verbal or numerical areas. Because mathematics is generally accepted as hard for everyone, lower goals can be set for children with special needs in the context of this course. It is thought that this gap will be closed with special education teachers who have high mathematics self-efficacy. For this reason, in order to educate special education teachers with high mathematics self-efficacy, it is suggested that the mathematics course contents in the undergraduate programs are broader and necessary studies should be conducted to increase the course hours.

In areas where special education teachers do not feel sufficient in the field of mathematics, higher targets can be set for children with special needs by cooperating with field experts. It can be suggested that theoretical studies will be done to reveal the profiles of special education teaching students in mathematics self-efficacy without teaching. In addition, new curriculum programs in mathematics can be made for children with special needs by evaluating the study results.

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6. GENİŞ ÖZET

Özel gereksinimli çocuklar, her ne kadar bireysel özellikleri ile akranlarından farklılık gösterse de eğitim açısından donanımlı ve yüksek yeterlikli öğretmenlere ihtiyaç duymakta, toplum koşullarına uyum sağlamada daha fazla özveriyle desteklenmeyi haketmektedirler. Özellikle eğitimsel ihtiyaçlarının giderilerek standartlarının yükseltilebilmesi, karşılaştıkları engelleri giderebilmede kendilerine ve ailelerine katkı sağlayabilecektir. Günümüzde de bu alana talebin artması, yapısal veya sonradan edinilmiş nedenlerle engelli bireylerdeki artış bu durumun oluşmasına sebebiyet vermektedir. Bu bağlamda, özel gereksinimli çocuklara verilen eğitim önem kazanmaktadır.

Okullarda uygulanan programların amaçlarından biri de matematik akademik becerisi kazandırmaktır. Özellikle matematik eğitimi ile bu öğrencilerin bilişsel gelişimleri sağlanabileceğinden, matematik yeterliklerinin artırılması ile akademik ve mesleki alanda dahi ilerleme kaydedilebilecektir. Bu noktada, özel gereksinimli çocuklara matematik eğitiminin önemi bir kez daha vurgulanmalı ve öğretimin nasıl yapıldığı ve yapılması gerektiği üzerinde önemle durulmalıdır. Vygotsky (1978), esasında özel gereksinimli çocukların içinde bulundukları zihinsel gelişimleri referans alınarak bu çizginin dışına çıkılmadığını ve süreç boyunca somutlaştırmadan soyutlamaya doğru bir yönelimin yapılamadığını (Erdener, 2009) belirtmiştir. Yenilenen eğitim programları ve güncel değişimler takip edildiğinde bu durumun pek de farklılaşmadığı ve bu alanda ciddi ilerlemelerin yapılması gerektiği gözlenmektedir. Bu bağlamda, özel gereksinimli çocukların eğitimsel yeterliklerinin artırılabilmesi için hedeflenen eğitimin eşiğinin çocukların gelişim düzeylerinin ötesinde yüksek tutularak zihinsel potansiyellerinin eğitimle daha iyi duruma getirilmesi sağlanabilecek ve farklı seviyelere ulaşabilmede öncü olunabilecektir. Bu kapsamda özel gereksinimli öğrenciler için belirlenecek hedeflerin uzun vadeli sadece bireysel gereksinimlerini yerine getirebileceği hedeflerin dışında, özellikle soyut düşünme becerisini kazandırabilecek matematik alanında da mümkün olabildiğince beklenilenden daha yüksek hedefler belirlenerek bu üst düzey hedeflere ulaşabilmek için gerekli çabaların gösterilmesine çalışılmalıdır. Bütün bu hedeflerin yakalanması özel eğitim öğretmenlerinin kendi alanlarının yanı sıra hem matematik öğretiminde yeterli olmalarını hem de özyeterliliklerinin yüksek olmasını gerekli kılmaktadır.

Özel gereksinimli çocukların eğitiminde gerek özel eğitim öğretmenlerinin rolü gerekse bu çocuklara matematik öğretiminin onların bilişsel gelişimine katkısının önemli olduğu düşünülürse, özel eğitim öğretmenlerinin matematik öğretimlerine yönelik özyeterlilik algılarının belirlenmesine ilişkin yapılacak nicel çalışmaların alan yazındaki bu boşluğu bir nebze olsun gidereceği öngörülmektedir. Özel gereksinimli çocukların öğretmenlerinin matematik öğretimlerine yönelik özyeterlilik algıları, öğretimlerini şekillendireceğinden ve öğrenci öğrenmesinde etkili olacağından öğretmenlerin bu noktadaki gereksinimlerinin ve eksiklerinin tespit edilebilmesi de olasıdır. Bu şekilde özel gereksinimli çocuklara matematik öğretiminde yüksek hedefler konulabilecek ve öğretmenlerin bu alandaki farkındalıkları yeni çalışmalarla sağlanarak matematik öğretiminde ilerleme kaydedilebilecektir. Öğretmen, gerçekten alanında ve matematik öğretiminde yeterli olur ve bu yeterliliğine inanarak öğrenciye aktarmada kendine güvenirse öğrencinin matematik öğretimini buna göre şekillendirecek ve kazanımlara ulaşmada yol katedebilecektir. Bu kapsamda çalışma, ileride yapılacak olan özel gereksinimli çocukların öğretmenlerinin matematik öğretim özyeterlilik algıları ile ilgili çalışmaların yapılmasına olanak tanıması açısından ilk çalışma olması nedeniyle önemli görülmektedir. Bu çerçevede çalışma ile özel eğitim öğretmenlerinin matematik öğretimlerine yönelik özyeterlilik algı düzeylerini ölçmede kullanılabilecek bir ölçme aracının geliştirilmesi (Çalışma I) ve öğretmenlerin bahsedilen algılarının düzeyleri ile çeşitli değikenlere göre farklılık gösterip göstermediğinin incelenmesi

(Çalışma II) amaçlanmıştır. Çalışma, iki aşamalı olarak planlanmış olup genel tarama modeli referans alınarak yapılmıştır. İlk aşamada; özel eğitim öğretmenlerinin matematik öğretim özyeterlilik algılarının tespitinde kullanılabilecek bir ölçme aracı geliştirme çalışması yürütülmüştür. Diğer aşamada ise ölçeğin kullanılabilirliği test edilerek uygulama gerçekleştirilmiştir. Bu doğrultuda İstanbul ilinde özellikle alan mezunu devlet okullarında ve özel kurumlarda hali hazırda görev yapmakta olan 464 özel eğitim öğretmeni çalışma grubuna dâhil edilmiş ve elde edilen veriler ile "Özel Eğitim Öğretmenlerinin Matematik Öğretimlerine Yönelik Özyeterlilik Algısı Ölçeği (ÖEÖ-MÖYÖAÖ)" geliştirilmiştir. Bu aşamadan sonra da geliştirilen ölçek kullanılarak 259 özel eğitim öğretmeni ile bir uygulama yapılmıştır.

Çalışma I'de yürütülen ölçek geliştirme çalışması için öncelikle ilgili alanyazın doğrultusunda tarama yapılarak kavramsal çerçeve oluşturulmuş ve Bandura'nın Sosyal Öğrenme Kuramı kapsamında özyeterlilik kavramına odaklanılarak; özel eğitim öğretmenlerinin gerek mesleki gerekse matematik öğretim alanları belirlenerek ölçek maddeleri yazılmıştır. Ölçek maddelerinin geliştirme aşamasında düzenli olarak uzman görüşleri yapılmış ve düzeltmeler güncellenerek pilot uygulama sürdürülmüştür. Uygulama bitiminde açımlayıcı faktör analizi ile faktör yapısının tespiti; doğrulayıcı faktör analizi ile de tespit edilen yapının doğruluğunun kontrolü sağlanmıştır. Bu aşamada geliştirilen ölçeğin tek faktörlü yapıda olduğu belirlenmiş ve maddelerin faktör yüklerinin 0.545 ile 0.845 arasında değiştiği ve açıklanan toplam varyansın %45.69 olduğu hesaplanmıştır. Analiz işlemlerinde madde-toplam korelasyonu ile madde-kalan korelasyon değerinin yeterli düzeyde ve maddelerin tümünün ayırt edici nitelikte olduğu belirlenmiştir. Doğrulayıcı faktör analizi ile de uyum indekslerinin geçerli aralıklarda olduğu tespit edilerek 36 maddelik ÖEÖ-MÖYÖAÖ'nin uygulamada geçerli ve güvenilir bir biçimde kullanılabilirliği onaylanmıştır.

Çalışma II'de özel eğitim öğretmenlerinin matematik öğretim özyeterlilik algılarının ne düzeyde olduğu ve çeşitli değişkenler kapsamında anlamlı farklılık gösterip göstermediği araştırılmıştır. Özellikle öğretmenlerin özyeterlilik düzeyleri yeterli olarak bulunmuştur. Özel eğitim öğretmenleri öğrencilerinin bireysel özelliklerine göre farklı yeterliklere ve donanıma sahip olarak onları öğrenmeye istekli hale getirmede daha özverili olmaları beklendiğinden elde edilen bu sonuç olumlu bir durum olarak nitelendirilebilir. Çalışmada ayrıca özel eğitim öğretmenlerinin matematik öğretimlerine yönelik özyeterlilik algılarının cinsiyet, yaş, mesleki deneyim ve öğrencinin özel gereksinim durumu ile anlamlı bir farklılık göstermediği, fakat öğrenim durumu ile anlamlı bir farklılık gösterdiği bulunmuştur. Buna göre öğretmenlerin öğrenim durumları arttıkça özyeterlilik algılarının yükseldiği söylenebilir. Bu sonuca göre özel eğitim öğretmenlerinin lisans programlarındaki matematik derslerinin önemli olduğu ortaya çıkmaktadır. Bu nedenle lisans programlarındaki matematik ders içeriklerinin zenginleştirilerek daha uzun zamana yayılarak verilmesi önerilebilir. Bu çocuklar için Vygotsky'nin de belirttiği üzere hayata hazırlanmaları açısından daha kapsamlı ve gerçekçi hedefler konularak bunun için gayret gösterecek öğretmenlerin yetiştirilmesi eğitim hedeflerimiz içinde yer almalıdır.

Özel gereksinimli çocukların her biri geniş bir spektrum içinde farklılık gösterdiğinden, bu çocuklar da kendilerine göre sözel veya sayısal alanlarda farklı başarılar elde edebilirler. Matematik genel olarak herkes için zor kabul edildiği için bu ders bağlamında özel gereksinimli çocuklar için daha düşük hedefler konulabilmektedir. Matematik öz yeterliliği yüksek özel eğitim öğretmenleri ile bu açığın hızlıca kapatılacağı düşünülmektedir. Bu nedenle matematik öz yeterliliği yüksek özel eğitim öğretmenlerinin yetiştirilebilmesi için lisans programlarındaki matematik ders içerikleri daha geniş kapsamlı ve ders saatlerinin arttırılması için gerekli çalışmaların yapılması önerilebilir.

Özel eğitim öğretmenlerinin matematik alanında yeterli hissetmedikleri noktalarda alan uzmanı kişilerle işbirliği yaparak özel gereksinimli çocuklar için daha yüksek hedefler konulabilir. Özel eğitim öğretmenliği öğrencilerinin henüz öğretmenlik yapmadan matematik özyeterlilik alanında profillerini ortaya koyacak kuramsal çalışmaların yapılması önerilebilir. Ayrıca, çalışma sonuçları değerlendirilerek özel gereksinimli çocuklar için matematik alanında yeni müfredat programları yapılabilir.