International Education Studies; Vol. 12, No. 6; 2019
ISSN 1913-9020 E-ISSN 1913-9039
Published by Canadian Center of Science and Education

The Impact of Relative Age Effect on Mathematics Achievement

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Received: December 17, 2018 Accepted: January 30, 2019 Online Published: May 29, 2019

doi:10.5539/ies.v12n6p39 URL: https://doi.org/10.5539/ies.v12n6p39

Abstract

The timing of children's start to school is the interest of researchers, policy-makers and especially parents. Researches on this issue have recently pointed to the concept of relative age effect (RAE). The purpose of this study is to determine the impact of RAE on mathematics achievement in Turkey. In order to accomplish this purpose, the question was sought: Does RAE have an impact on TIMSS 2015 the fourth and eighth grades mathematics scores of Turkey? The research was conducted in survey model. In the present study, the data obtained from the TIMSS 2015 results of Turkey was used. Totally 6456 students were sampled for TIMSS 2015 the fourth grade in 242 schools. Also, totally 6079 students (2943 girls and 3136 boys) were sampled for TIMSS 2015 the eighth grade in 218 schools. Hierarchical multiple regression analysis was used to analyze the data. In conclusion, it has been reached that RAE has an impact on TIMSS 2015 the fourth and eighth grades mathematics scores of Turkey and the youngest children born just before the cut-off date has the worst performance. The recommendations based on the results have been submitted as making the enrollment dates more flexible, especially for children in rural areas, not applying honors classes in schools, raising awareness about RAE in pre-service and in-service training programs for teachers, no pressure on children at home and at school for their lagging in competition.

Keywords: relative age effect, cut-off date, school starting age

1. Introduction

When should children start to school? This is a question that concerns not only parents but also policy makers and researchers. Those who have tried to answer the question now face the concept of relative age effect (RAE). The RAE concept has become popular with Gladwell's (2008) Outliers book. In this book, he argues that children who are older than their peers experience the success early and this achievement process continues and reinforces itself (Dixon, Horton & Weir, 2011). In this book translated into Turkish in 2016, Gladwell based his claim on the fact that Barnsley, Thompson and Barnsley (1985) decreased the number of elite ice hockey players from January to December, indicating that those born at the beginning of the calendar year were superior to those born after. Accordingly, the reason why children born at the beginning of the calendar year was superior to the children born later was that the cut-off date for hockey age groups was January 1. Since children born in the beginning of the year used the advantage of being a few months older, they were more likely to be skilled by their trainers, get coach support, and play more matches, and at the same time move to the upper leagues with coach support and extra practical advantage. After the determination on ice hockey athletes, the existence of a RAE in sports has been clearly confirmed by researches almost in all sports fields (Cobley, Baker, Wattie, & McKenna, 2009; Dixon et al., 2011).

The reason of the RAE in sports is to determine a cut-off date and place the children born in the next year from the cut-off date in the same group. Similarly, the groups are organized in every country related to start children in primary school. The age-based grouping mechanism aims to create homogeneous classes by bringing students together at similar developmental levels. In this way, it is assumed that the maturation and experience levels of children at the same age group are similar and therefore can be trained together. The similarity of children in the same class is expected to facilitate the standardization and routing of teaching. In this context, children born in a specific 12-month period are started to primary school in the same year and placed in the same class.

The 12-month age group of the children is determined by the cut-off date which determines the start date of the students who will start primary school. Each country has been applying a different cut-off date. For example, some

countries apply the cut-off date as follows: Finland, France, Iceland, and Italy - January 1; England and Slovakia - September 1; Greece and Japan - April 1; New Zealand - May 1 (Bedard & Dhuey, 2006). According to Bedard and Dhuey (2006), the determined cut-off dates are arbitrary. Turkey determined the cut-off date as December 31 until the year 2012 and after that September 30. According to the current implementation in Turkey, parents can send their 60-65 months old children to school if they wish, and children over 66 months are automatically enrolled in school. However, children aged 66-68 months may not register with the request of their parents, and those who are 69-71 months of age may not register with a medical report which documents that they are not ready to start primary school. Children older than 72 months and older absolutely are enrolled in primary school (Regulation on Pre-primary Education and Primary Education Institutions, Ministry of National Education [MoNE], 2016). According to the regulation, the child born on September 30 who is 60 months old as the cut-off date may be enrolled to the same class together with the child born on October 1 of the previous year who is 72 months old child as the cut-off date. Thus, almost one year difference may emerge between the school starting ages of children. The impact of this effect on children has been investigated in various aspects by many countries, but the studies conducted in Turkey are limited (Sürücü, Ünal, & Ünal, 2018; Ünal, 2016; Ünal & Sürücü, 2017a, 2017b). Therefore, the subject of this research has been determined as defining whether students in Turkey have RAE and if so, whether it has long-term effects or not.

1.1 The Concept of Relative Age Effect

RAE is a concept that expresses that children born just after cut-off date are more mature, have accumulated more pre-school skills and consequently over-perform in school life (Bedard & Dhuey, 2006; Elder & Lubotsky, 2009; Thompson, Barnsley & Battle, 2004). In other words, RAE means that success differences are perceived as a difference of ability due to differences in maturation, and the oldest children has advantageous while the youngest children has disadvantageous as a result of children in different age groups starting school at the same time (Patalay et al., 2015; Thompson et al., 2004). Peña (2017) reported that the difference in test scores was a reflection of maturity differences that would not be observed if students were tested at the same age, or were affected by the same educational experience, while younger students were less affected by learning than older classmates and this led to real differences in skills. In an internet forum of Turkey (Kadınlar Kulübü), "My child is young. Should I send my child to school?" the answer of one person to a mother (mavikara) confirms this statement of Peña:

> I was born at the end of the year, like your daughter, at the end of November. I don't know if I'm an idiot, but I did some things in a few months. Then I would say to myself, "Dash it! I did not understand that". Make sure that even a month makes difference.

1.2 Factors Causing Relative Age Effect

In the first year of primary school, young children in their age groups may perform lower in the same tasks (Sprietsma, 2010), they can be found less successful by their teachers (Jürges & Schneider, 2007) and the learning can be evaluated as problematic (Dhuey & Lipscomb, 2010). The fact that the teacher has low expectations about what the students can achieve and that he/she transmits this to his/her students may lead to lower motivation (Sürücü & Ünal, 2018), low effort, self-confidence and self-esteem (Thompson et al., 2004; Sprietsma, 2010). If these children are divided into groups according to their observed performance at the beginning of the school, the youngest ones take place at the end, in the low-performing groups, they take less risk of learning as time goes by and they face more of this risk in the following classes (Sprietsma, 2010). If there are diagnostic and placement procedures at school, they result in a psychologically polarizing effect on relatively young students. Those who are considered hypothetically gifted and talented acquire a sense of proficiency that is perceived by teachers' recognition skills, while others may feel the need for additional learning support or special education support (Cobley et al., 2009). Thompson et al. (2004) explained that the disadvantage of relatively young children resulted in depression and unhappiness in three stages: firstly, the RAE creates differences in achievement due to the impact of maturity, not the ability; secondly, these differences lead to low self-confidence and low self-esteem; thirdly, low self-confidence and self-esteem associated with the child's inability to compete with himself/herself or his/her classmates lead to depression and unhappiness. Pellegrini (1992) likewise states that children's social behaviors are the strong determinants of school success, and relatively young children experiencing more social limitations have lower self-esteem and lower sense of duty (as cited in Roberts & Stott, 2015).

The situation is quite the opposite for relatively older children. Teachers evaluate older children more positively, expect more and give them more challenging tasks (Daniels, Shorrocks-Taylor, & Redfern, 2000). Relatively older children receive more positive adult evaluations based on group influence within the community and provide social interactions that affect their later development, relatively higher scores, special coaching in sport, as well as special opportunities for success (Jeronimus, Stavrakakis, Veenstra, & Oldehinkel, 2015). Teachers perceive

relatively older children as more talented than young children, get into more positive expectations and choose the older children for the authority position (Dhuey & Lipscomb, 2008). It is generally accepted that teacher expectation affects student success and this acceptance is generally expressed by the Pygmalion effect or the concept of self-fulfilling prophecy (Sürücü & Ünal, 2018). The Pygmalion effect means that teachers interact with students according to their positive or negative expectations and this expectation turns into a self-fulfilling prophecy and student achievement occurs in accordance with teacher expectations (Rubie-Davies, 2010). As a result, maturity is considered as talent by teachers, peers and the individual. For this reason, Daniels et al. (2000) uses the concept of maturity effect rather than RAE. The results of positive expectations for children turn into self-fulfilling prophecy by increasing the self-confidence of children who have the advantage of maturity (Thompson et al., 2004). This situation seems to be compatible with Harter's competence motivation theory (Harter, 1978), which demonstrates that they are able to perform at a high level and children who think they are more capable of perfecting their abilities and more spending time and endeavoring.

Studies show that student achievement is influenced by Pygmalion effect, self-concept and student motivation (Chang, 2011). The teacher's interaction with his/her student based on low expectations may cause to dropping motivation of student (Sürücü & Ünal, 2018), low effort, self-confidence and self-esteem (Thompson et al., 2004; Sprietsma, 2010). In this case, it can be said that behaviors resulting in failure of young children and success of older children affect the expected success of the child; teacher expectation leads to high or low student self-esteem and motivation; student's self-esteem and motivation ultimately result in a high or low achievement experience. It is possible to summarize the process of RAE's Pygmalion effect and the process of affecting academic achievement as shown in Figure 1.

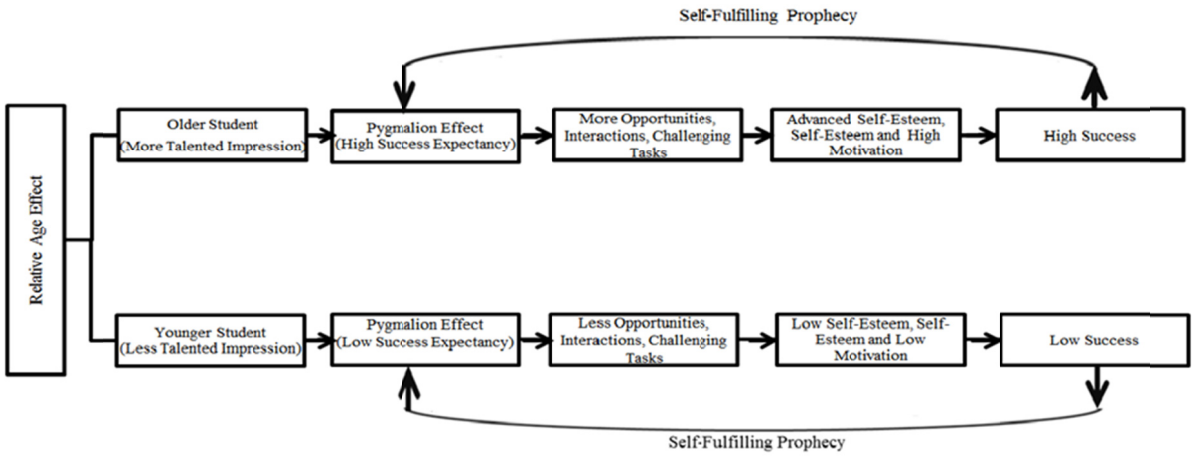

Figure 1. The influencing process of relative age effect on Pygmalion effect and academic achievement

1.3 Are Families Aware of the Relative Age Effect?

Kawaguchi (2011) reports that, in general, the public was aware of the RAE and a few selective primary schools in Japan divided children into groups by their birth months to ensure equality in entrance examinations. Taehoon (2018), in his study conducted in Korea, revealed that parents made conscious decisions about the child's choice of birth and they were careful about the timing of school entrance when they made a decision. Traditionally, the kindergarten starting age of children is five and the first grade starting age of children is six in the United States of America. However, roughly 20 percent of pre-school students are six years old. The increase in school starting age is considered as parents' quest for a developmental academic advantage (Dee & Sievertsen, 2015). In an internet forum of Turkey (Kadınlar Kulübü), a mother asks the question and another mother (Can_Duru) answers:

> My daughter also was born in September 2010. I didn't ask anyone. … enrolled in kindergarten. … My daughter is very petite. It is now 98 cm tall and 10.8 kg. I didn't spare my daughter. Physically she is small. Obviously I didn't want her to be among the youngest as her age.

It can be understood from this mother's explanation that she is concerned about the RAE although she does not name it, and she is worried that her daughter will have problems at school by thinking that her child is young. Although there is no directly research-based evidence of the extent to which parents are aware of the advantage or

disadvantage of the RAE, researches reveal that parents who are particularly socio-economical advantageous start their children (who born in the periods before the cut-off date for registration) to school one year later (Bedard & Dhuey, 2006; Elder & Lubotsky, 2009; Mühlenweg, Blomeyer, Stichnoth, & Laucht, 2012; Shigeoka, 2015; Taehoon, 2018; Ünal, 2016; Zhang & Xie, 2018). Zhang and Xie (2018) attributed this situation to the advantageous parents to get to know their children and make better choices.

According to Kawaguchi (2011), relatively young children of many families start to school late because these parents are aware of the disadvantages of being young in school. Postponement of starting school is particularly common in developed countries. For example, one-fifth of boys and one-tenth of girls in Denmark and one-fifth of students in America start to school late (Dee & Sievertsen, 2015). According to Mühlenweg et al. (2012), it is not in vain that parents spend more than one year for their children due to the positive effects of starting to school one year later. Shigeoka (2015) explains the reason why socio-economically disadvantaged families do not start their children to school, because they are not aware of the academic advantage of older children, or they cannot afford their children care for one more year.

1.4 Academic and Social Outcomes of Relative Age Effect

Bedard and Dhuey (2006) investigated the relative age effect using the TIMSS results of 18 OECD countries, and found that initial maturity differences had long-term effects on students. According to the study, the scores of young students are lower 4-12% in the fourth grade and 2-9% in the eighth grade compared to the older students. Strøm (2004) in the study using Norwegian PISA 2000 data found that students born shortly after the cut-off date (in January) had a score of 0.2 standard deviations higher than the students born just before the cut-off date (in December). Mühlenweg (2010) in the study using 17 countries PIRLS 2006 data found that the test scores of one year older children were higher approximately 0.3 standard deviation than the test scores of youngest children. Sprietsma (2010) in the study of 16 countries based on PISA results reached that the older students in the group had high scores of 7.40-22.67 points in reading and 7.48-22.66 points in mathematics. However, the relative age effect is not linear as the oldest students get the highest scores. According to the Japan TIMSS results, Kawaguchi (2011) concluded that the fourth and eighth grade students who were born shortly after the cut-off date received low scores of about 0.2 standard deviations compared to those born just before the cut-off date. Ponzo and Scoppa (2014) found that older students have higher performance in mathematics, science and reading in the study using the results of Italy PIRLS 2006, TIMSS 2007 and PISA 2009. According to the findings of the study, in the fourth grade one month older children get higher scores about 1.7 points in mathematics and 1.5 points in science. The effect of being a month older in the eighth grade is between 1.3-14 points in both mathematics and science. The studies using PISA, TIMSS and PIRLS data indicate that there is a relative age effect in general and that it continues to exist even though it decreases.

Fredriksson and Öckert (2005), in the research on the population of Sweden, decided that children who were born in 1935-1984 and started school at an older age were about 6% more successful than younger children and they were more educated than their younger peers. In another study, Fredriksson and Öckert (2013) found that starting one year late to school increased the attainment by 0.159 years, and late-starters revenue surplus of 0.9% throughout life, but this difference was not significant. Fan et al. (2017), in their study on Taiwanese students, concluded that the probability of admittance of older children to university is 31-38% higher. Jürges and Schneider (2007) in their study using the German PISA 2000 (PISA-E) data found that the eleven-month difference in the relative age caused a difference of 10% in the fourth grade and a difference of 6% in the ninth grade in the Gymnasium request. Smith (2009) in the study in Canada (British Columbia) with the fourth seventh and tenth grade students, concluded that the test scores of older children was higher 0.259 - 0.400 standard deviation in the fourth grade, and was higher 0.104 - 0.242 standard deviation in the tenth grade, and RAE continued to decrease. Zhang and Xie (2018) in the study using the data from 2005 1% The Mini-census Survey and 1992 National Sample Survey of the Living Situation of Chinese Children found that individuals born one month after the cut-off date received 0.3 years of school education and 38 Yuan more than those born one month earlier. The results of the study conducted in Sweden, Taiwan, Germany and China pointed that the students who are relatively older or who are sent to school late are more likely to have higher academic achievement and more educational attainment than their younger peers. Young students are more likely to grade retention than older ones because they get lower grades (Dicks & Lancee, 2018; Elder & Lubotsky, 2009; Jeronimus et. al., 2015; Shigeoka, 2015; Madeira, 2018; Sprietsma, 2010).

Bedard and Dhuey (2006) reported that one of the results of their study was that RAE was not found in Finland and Denmark among the 18 countries they examined. Pehkonen, Viinikainen, Böckerman, Keltikangas-Järvinen, Pulkki-Råback, and Raitakari (2015) and Bedard and Dhuey (2006) attributed these results to the late onset of formal education and to the prohibition of different practices based on the ability before age 16 in these countries.

Studies on RAE now focus on the long-term impacts of the RAE on academic achievement and health rather than whether or not there is an impact, thinking that enough evidences are provided on the RAE at school entrance may affect the child (Sürücü et al., 2018). In this context, studies investigating the impact of RAE on health have focused on the diagnosis of Attention Deficit and Hyperactivity Disorder (ADHD) for the youngest children of the class and the possibility of treatment (Pottegard, Hallas, Diaz, & Zoega, 2014). The reasons for this situation are the increasing number of ADHD diagnoses worldwide (Pottegard et al., 2014), the prevalence of the differences between countries and discussion of the diagnosis and treatment of ADHD (Chen et al., 2016). The findings of the studies showed that ADHD was strongly associated with the RAE and RAE was one of the factors that increased ADHD prevalence (Chen et al., 2016; Cobley et al., 2009; Dhuey & Lipscomb, 2010; Elder & Lubotsky, 2009; Mühlenweg et al., 2012; Schwandt & Wuppermann, 2015; Sürücü et al., 2018). Researchers associate these results with crowded classes and misinterpretation by teachers and parents that young children in their class are more likely to be sloppy, more mobile and more impulsive than their older classmates (Schwandt & Wuppermann, 2015).

Three studies, which had exception results and showed there was no relationship between RAE and ADHD diagnosis, were conducted by Dalsgaard, Humlum, Nielsen, and Simonsen (2012, 2014) and Pottegard et al. (2014). These studies were conducted in Denmark. Pottegard et al. (2014) related the lack of correlation between RAE and ADHD diagnosis with a high rate of school starting of young children in the Danish school system. Pottegard et al. (2014) related the lack of correlation between RAE and ADHD diagnosis with a high rate of school starting of young children in the Danish school system.

According to the results of the study examining the relationship between socio-economic origins and the RAE, students who are younger and have insufficient socio-economic and cultural resources are more likely to fail and grade retention (Altwicker-Hámori & Köllö, 2012; Chen, 2015; Dicks & Lancee, 2018; Fredriksson & Öckert, 2013; Shigeoka, 2015). In this context, being an immigrant is a double disadvantage; when the socio-economic and migratory deficiencies are combined with the RAE, inequalities specific to immigrants are produced in schools (Dicks & Lancee, 2018). Even in cases where the RAE has disappeared and even reversed, the disadvantage of immigrant young children still continues (Thoren, Heinig, & Brunner, 2016). The results of the late onset of socio-economically disadvantaged children appear to be contradictory but contribute to a better understanding of the RAE. While Datar (2006) found that poor children who started late to school achieved more gains than socio-economically advantageous children, Chen (2015) found that deferred primary school enrollment increased the likelihood of grade repetition, reduced the likelihood of finishing primary school and enrollment in secondary school. Chen (2015) attributed this to the inadequacy of access to preschool education in rural areas and the low level of parental education. The data obtained by Altwicker-Hámori and Köllö (2012) also support this statement and suggest that pre-school education is more effective in children who have low socio-economic status. As a result of the evaluation of these data, it is clear that the only factor in being an older age big asset in the classroom is not the maturity, but whether the child receives a qualified educational support before the school.

There are some interesting studies about the social consequences of the RAE. Relatively young students are exposed to more school violence and become victims of bullying (Mühlenweg, 2010), experience more adolescent pregnancies (Black, Devereux, & Salvanes, 2008), the risk of youth suicide increases (Matsubayashi & Ueda, 2015); relatively large children have more leadership positions (Dhuey & Lipscomb, 2008) and are less likely to commit crime. Besides, women are affected from the RAE more adversely than men. The older boys are more successful, while the younger girls are more unsuccessful (Fredriksson & Öckert, 2013). Women with a poorly educated family are more affected than those with a highly educated family (Fredriksson & Öckert, 2013).

There are also research findings that the RAE has psychological implications that can affect the student's long-term behavior and academic success. Thompson et al. (2004) in his study revealed that being relatively young was associated with decreased self-esteem after a few years. Patalay et al. (2015) found that relatively young children had emotional problems and peer problems on their mental health. Liu and Li (2015) found that younger children had lower self-esteem, were more likely to be dependent on internet games, had more frequent psychiatric support, and had more health problems. Mühlenweg et al. (2012) found that relatively young children starting school could harm their development of non-cognitive skills like activity, approach/withdrawal, soothability, adaptability, emotionality/persistence, and intensity of reaction, rhythmicity, order of biological function and threshold of responsiveness. However, the results of the other researches indicate that relative age differences do not systematically direct behavioral characteristics such as self-confidence, competition preference, risk attitude and occupational expectations (Lionel, Dipanwita, & Silva-Goncalves, 2017) or that there is no relationship or persistence with mental health structures such as emotional symptoms, behavior/management problems, peer problems, and prosocial behavior (Dee & Sievertsen, 2015).

1.5 Long-Term Results of the Relative Age Effect from the Viewpoint of Academic Success

The data on the long-term results of the relative age effect in terms of academic achievement are complex. As presented in the previous section, many researches using PIRLS, TIMSS and PISA data suggest that RAE may have a prolonged effect even though it has been decreasing until the beginning of university (Bedard & Dhuey, 2006; Kawaguchi, 2011; Mühlenweg, 2010; Ponzo & Scoppa, 2014; Strøm, 2004). In addition, similar results have been achieved in studies conducted in different countries (Fan et al., 2017; Fredriksson & Öckert, 2005; 2013; Jürges & Schneider, 2007; Smith, 2009; Zhang & Xie, 2018). Smith (2009) determined that the long-term decrease in the impacts of RAE was higher in lower-income students than in lower-income students, although not linear. Smith explained this situation by supporting the students with high socio-economic status them with extra resources, supporting classes and private lessons and continuing this during the education.

A number of studies indicate that although the RAE has an impact in the short term, it does not have long-term effect or the effect tails off. In this context, Elder and Lubotsky (2009) shows that the effects of relative age have disappeared until the fifth grade; other studies show that the effect has disappeared from the the eighth grade and started to reverse (Nam, 2014; Thoren et al., 2016). In their studies conducted with university students, Billari and Pellizzari (2008) and Roberts and Stott (2015) proved that the RAE could be reversed and young students were more successful. Pehkonen et al. (2015) found that there was a relationship between school starting age and school performance in the sixth grade, it was not in the ninth grade, and the maturity advantage at school entrance was short-lived; the relative age had no effect on the period of formal education, grown-up and employment. According to Nam (2014), the reversal of the RAE is related that young children in secondary schools exhibit less social behaviors such as making sports, going to the disco and establishing romantic relations, and exhibit more course work behavior to compensate for their low achievements.

Based on the research results given above, there are three characteristics about RAE. First, there is RAE naturally in the beginning years of the school. The reason for RAE's existence at school is that a cut-off date is determined and children born one year after this date start school at the same time. As a result of the application of the cut-off date, children in the first class with an age difference of 11 months can be in the same class. Students who are older in the classroom exhibit higher performance than younger students because of their maturity difference. When these performance differences are evaluated by the student himself, teachers and parents as the difference of ability, the positive/negative expectations created for children cause RAE. Second, the structure of education systems and practices at school can lead to the elimination of the impact of RAE in the fifth grade, but this may cause the effect to continue to the eighth grade or even to the beginning of the university. The third characteristic is that it is not fate for students who are younger than their peers in their class to experience negative results of RAE. Late initiation of formal education in Denmark and Finland, and lack of ability-based practices prior to the age of 16 (Bedard & Dhuey, 2006; Dalsgaard et al., 2012; 2014; Pottegard et al., 2014) etc. practices suggest that RAE can be prevented by changes in education systems and school practices.

After all, the results of the studies show that the RAE at the beginning of formal education is in favor of the older students and that the RAE diminishes over time in countries that provide flexibility to start school and do not allow early grouping based on ability. These results point to the importance of researchers, teachers and educational policy makers to be aware of RAE in terms of both practical use and evaluation of test results. From the perspective of Turkey, it can be said that the researchers do not show enough interest in RAE, therefore policy makers, principals and teachers are not aware of it. For this reason, the studies which will be conducted in Turkey have importance to attract the attention of the researchers, inform the public and contribute to the related literature. The purpose of this study was to determine the impact of RAE on mathematics achievement in Turkey. In order to accomplish this purpose, the question was sought: Does RAE have an impact on TIMSS 2015 the fourth and eighth grades mathematics scores of Turkey?

2. Method

The research was conducted in survey model. In the model, it has been considered that 2015 TIMSS (Trends in International Mathematics and Science Study) the fourth and eighth grade mathematics scores of Turkey is the dependent variable; the birth month of the student is the independent variable; the student's gender, home support, parental education and receiving additional support are the control variables.

2.1 Data Collection

In this study, the data obtained from TIMSS 2015 results of Turkey was used. TIMSS, which is running by the International Association for the Evaluation of Educational Assessment (IEA), is an independent non-profit organization headquartered in Netherlands. Since 1995, TIMSS measures mathematics and science achievement trends in the fourth and eighth grades every four years. The evaluation of the fourth grade students is expected to

provide an early warning for the necessary program reforms and to follow these reform activities in the eighth grade. In TIMSS, contextual information on teaching and learning is collected from students, teachers and school surveys at school (MoNE, 2016).

Turkey participated the researches in the eighth grade in 1999 and 2007, and in the fourth grade and eighth grades in 2011 and 2015 (MoNE, 2016). While the data is publicly available on the IEA website, the birth dates of students included in the data collection are restricted by the IAE for general use, and the required permission has been received for the use of restricted data in the files of ASGTURM6 and BSGTURM6 which contain data of Turkey. At the time of TIMSS 2015 research, there were 1 108 572 the fourth grade students and 1 187 893 the eighth grade students in Turkey (MoNE, 2016). Totally 6456 the fourth grade students (3178 girls and 3278 boys) were sampled for TIMSS 2015 in 242 schools. Also, totally 6079 the eighth grade students (2943 girls and 3136 boys) were sampled for TIMSS 2015 in 218 schools. While the number of students in the fourth grade is at least 4 and at most 52, it is at least eighth and at most 63 in the eighth grade. According to the legal texts in 2015, based on the 31 December cut-off date, the students who were born in 2005 must be in the fourth grade and students who were born in 2001 must be in the eighth grade. In TIMSS 2015 implementation, it was determined that the birth years of the students in the sample group were 625 in the fourth grade and 1217 students in the eighth grade were different from the legally required years of birth, and the data of these students were deleted. The reason why these data were not used was the expectation that the RAE would occur in theoretically born in the same year. As a result, the data of 5831 students in the fourth grade and 4858 students in the eighth grade were used in the present study.

2.2 Data Analysis

Hierarchical multiple regression analysis was used to analyze the data. In a hierarchical multiple regression called sequential regression, variables or variable groups were entered in step by step, and entered variables were controlled, the contribution of each independent variable to the predictive variable was evaluated (Pallant, 2015). The sample size, the independence, normality, collinearity and homoscedasticity of residuals, the assumptions of outlier values, multicollinearity and singularity are need to be examined to perform multiple regression analysis (Tabachnick & Fidell, 2015).

Tabachnick and Fidell (2015) proposed a minimum of 104 sample size for multiple regression use. Accordingly, it can be said that the sample size of present study is sufficient. According to Tabachnick and Fidell, the analysis of scatter plots of residuals allows testing of the assumptions of normality, collinearity and homoscedasticity between dependent variable scores and predictive errors. Normal Probability Plot (P-P) of the Regression Standardized Residual and scatter plots were examined. It was found that the points obtained in the Normal P-P Plot were lying in the form of a straight diagonal line from the lower left side to the upper right side and that most of the points were collected in the center in scatter chart and the residuals were distributed in the rectangular form, and it was concluded that the data met the assumptions of normality, collinearity and homoscedasticity. It was determined by Mahalanobis distance whether there was an outlier value in the data. According to the Chi-Square Critical Values table, at the P = 0.001 level, Mahalanobis distances over 13.816 for the fourth grade, and over 20.515 for the the eighth grade are the outlier values (Tabachnick & Fidell, 2015). Mahalanobis distance was calculated as 1,262-7,819 for the fourth grade and 1.755-19,301 for the eighth grade. Another assumption that needs to be examined is multicollinearity and singularity together. When there are multicollinearities, the variables are highly correlated with each other. In singularity, one of the variables is a combination of two or more variables. When there is both multicollinearity and singularity, variables contain repetitive information, and using them together can cause logical and statistical problems. The R^2 value is checked for the singularity. If R^2 value is 1, there is a singularity problem (Tabachnick & Fidell, 2015). Since R^2 value is less than 1 in all analyzes, it can be said that there is no singularity problem. In order to avoid multicollinearity problems, it is recommended that the correlation between the independent variables is smaller than .7, the tolerance value is greater than .10, and the value of VIF (variance inflation factor) is less than .10 (Pallant, 2015). The highest correlation between the independent variables was -.028 for the fourth grade and .095 for the eighth grade. Tolerance values were calculated at most .999 and at least .974, and VIF values were calculated at most 1.027 and at least 1.01. As a result, it was found that there was no multicollinearity and singularity problem.

In hierarchical regression analysis, the researcher determines the order and blocks of the independent variables in the model depending on a theoretical or logical basis. In this type of regression, after the block one is checked, the amount of variance explained by the block two in the dependent variable is examined, and each independent variable is evaluated according to how much it contributes to the equation at its point of entry (Tabachnick and Fidell, 2015). In this research, as the variables that need to be checked for the purpose the gender and home support of student in the fourth grade; the gender, home support, parental education and receiving additional support of

student in The eighth grade were coded as dummy variables in the first block; the birth month variable was entered for both classes in the second block.

3. Results

In this study, it was aimed to determine whether the long-term impact of RAE on mathematics achievement of Turkey using TIMSS 2015 mathematics results. Descriptive statistics related to students who participated in TIMSS 2015 application were given in Table 1.

Table 1. Descriptive statistics of variables

Variables		The fourth grade			The eighth grade		
		N	Mean	SD	N	Mean	SD
Birth Month	1	681	491.19	100.75	562	472.39	104.63
	2	448	488.07	95.02	380	464.16	106.33
	3	453	496.49	86.67	439	457.59	100.68
	4	480	491.44	93.48	430	475.35	102.68
	5	594	492.34	94.43	460	468.41	98.03
	6	546	487.19	92.48	452	471.72	102.68
	7	571	492.73	91.20	492	468.80	98.67
	8	540	485.62	88.86	452	470.22	101.43
	9	452	482.21	95.45	367	459.20	111.12
	10	451	469.86	91.61	352	458.25	100.77
	11	365	459.65	99.089	274	449.93	93.76
	12	250	457.12	92.11	198	444.16	93.15
	Total	5831	484.98	94.22	4858	465.23	101.96
Gender	Female	2898	484.06	90.82	2397	467.10	101.31
	Male	2933	485.89	97.46	2461	463.40	102.57
Educational Support at Home	Not have	1341	452.90	95.52	880	425.64	97.44
	Have	4348	497.78	88.78	3919	474.86	100.53
Educational Status of Family	Not Graduated				4163	453.78	96.03
	Graduated				637	547.63	100.52
Additional Lesson	Not have				1378	431.71	94.89
	Have				3394	480.74	100.91

As can be seen in Table 1, TIMSS mathematics scores of the students in the fourth grade and eighth grade are higher in the beginning months after the cut-off date for registration, and decrease in the following months. While the number of girls and boys participating in TIMSS implementation is close to each other, the number of those who have educational support at home (whether he/she has own room and internet connection at home) is higher than those have not. In the eighth grade, the number of students whose parents are not university graduates and those who do not take additional mathematics in the recent year is higher than others.

Table 2 depicts the relationships between TIMSS mathematics scores of the fourth grade and gender, educational support at home and birth month. As seen in Table 2, while there was no significant relationship between TIMSS fourth grade scores and gender ($r=-.008$, $p>.005$), there was a low level of significant relationship between educational support at home ($r=.206$, $p<.001$) and birth month ($r=-.092$, $p<.001$). When other variables are tested, there is a small increase in the relationship between TIMSS mathematics scores of the fourth grade and educational support at home ($r=.209$) and birth month ($r=-.099$).

Table 2. Hierarchical multiple regression analysis results related to predicting timss scores (the fourth grade)

Variables	B	SE	β	t	r (zero-order)	r (partial)
Intercept	469.17	3.49		134.55*		
Gender (Female)	-.48	2.39	-.003	-.20	-.008	-.003
Educational Support at Home	45.34	2.81	.208	16.12*	.206*	.209
Birth Month	-2.73	.36	-.097	-7.50*	-.092*	-.099
R=.228, R^2 = .052, ΔR^2=.009						

Note. *p<.001, **p>.05.

In the hierarchical multiple regression analysis performed to determine the role of variables in predicting TIMSS fourth grade scores, gender and educational support at home (whether he/she has own room and internet connection at home) variables were first tested. These two variables explain 4.3% of the variance for mathematics scores. Secondly, the variance of the birth month of the students was added to the analysis. When the variables of gender and educational support at home were examined, the explained variance increased to 5.2% (R squared change = .009; F change (1.5685) = 56.3, p<.001). The ANOVA table showed that both models containing the block of both variables were significant (F (3.5685) = 103.74, p<.001). When the Adjusted R Square (β) is examined, the relative importance of the predictive variables on the TIMSS mathematics score of the fourth grade can be listed as educational support at home and birth month When the t-test results for the significance of the regression coefficients were examined, it was observed that educational support at home and birth month were significant predictors of TIMSS mathematics scores of the fourth grade, but gender were not.

Taking into account that the mean of TIMSS mathematics scores of the fourth grade students 487.2 (SD = 92.39), according to the calculation (92.39* -. 097 = -8.96/3(28) based on the value of β = -. 097 given in Table 2, it was found that each standard deviation of the student's age (SD = 3.28) resulted in a decrease of 8.96 points in the students' score and a decrease of 2.73 points monthly. When Table 1 is examined, it is seen that the decrease in scores is linear for those born in August-December but not linear for those born in January-July as in fourth grade.

The relationship between TIMSS mathematics scores of the eighth grade and gender (girls), educational support at home (whether he/she has own room and internet connection at home), educational status of family (whether or not parents are university graduates), taking additional lesson and birth month was depicted in Table 2. While there is no significant relationship between TIMSS eighth grade scores and gender (r=-.014, p>.005), there is a low-level significant relationship between TIMSS eighth grade scores and educational support at home (r=-.180, p<.001), educational status of family (r=-.319, p<.001), additional lessons (r=-.220, p<.001) and birth month (r=-.045, p<.001). When other variables are tested, there is a small reduction in all of the relationships between TIMSS eighth grade mathematics scores and variables.

Table 3. Hierarchical multiple regression analysis results related to predicting timss scores (the eighth grade)

Variables	B	SE	β	t	r (zero-order)	r (partial)
Intercept	405.656	4.623		87.749*		
Gender (Female)	1.792	2.726	.009	.657	.014	.010
Additional Lesson	40.893	3.033*	.182	13.482*	.220*	.193
Educational Status of Family	84.707	4.058*	.284	20.873*	.319*	.292
Educational Support at Home	34.195	3.581*	.130	9.548*	.180*	.138
Birth Month	-1.243	.419**	-.040	-2.969**	-.045*	-.043
R=.395, R2 = .156 ΔR^2=. ,002						

Note. *p<.001, **p>.05.

Hierarchical multiple regression analysis was performed to determine the role of variables in predicting TIMSS eighth grade scores. As a result of the analysis, the ranking was determined as follows: gender (girls), educational support at home (whether he/she has own room and internet connection at home), educational status of family (whether or not parents are university graduates), and taking additional lesson (in the last year). These four

variables explain 15.4% of the variance for eighth grade mathematics scores. The birth month variable was added in the second part of the analysis. When the variables of taking additional lessons in the recent year, educational status of parents, gender (female), educational support at home were examined, the explained variance increased to 15.6% (R squared change = .002; F change (1.4691) = 8.81, p <.05). The ANOVA table also showed that both models containing the block of both variables were significant F (5.4691) = 171.19, p<.001). According to Adjusted R-Square (β), the relative importance order of predictor variables on TIMSS mathematics scores of the eighth grade is as follows: university graduated parents, educational supoort at home, additional lessons and birth month. When the t-test results for the significance of the regression coefficients are examined, it is seen that university graduated parents, having educational support at home, taking additional lessons and the birth month are significant predictors, but the gender variable is not on TIMSS mathematics score of the eighth grade.

Taking into account that the mean of TIMSS mathematics scores of the eighth grade students 467.75 (SD = 101.32), according to the calculation (101.32* - .040=-4.05/3.25) based on the value of beta = -.040 in Table 3, it was found that each standard deviation of the student's age (SD = 3.25) resulted in a decrease of 4.05 points in the students' score and a decrease of 1.25 points monthly. When Table 1 is examined, it is seen that the decrease in scores is linear for those born in August-December but not linear for those born in January-July as in fourth grade.

4. Discussion

In this study conducted to determine the impact of RAE's on mathematics achievement in Turkey, it was found that there was a low level significant negative correlation between the birth month of students and the fourth and eighth grade mathematics scores of TIMSS 2015. This finding is not consistent with the data from Finland and Denmark (Bedard & Dhuey, 2006) but it is consistent to the findings obtained in other countries (Bedard & Dhuey, 2006; Kawaguchi, 2011; Mühlenweg, 2010; Ponzo & Scoppa, 2014; Smith, 2009 Sprietsma, 2010; Strøm, 2004). The decrease in the age of the student causes monthly decrease 2.73 points in the fourth grade and 1.25 points in the eighth grade in the TIMSS mathematics scores. However, the decrease in mean scores is not linear for those born in the January-July and it is linear for those born in August-December. The finding that the decrease in mean scores did not decrease linearly as the student age decreased was consistent with the finding obtained by Sprietsma (2010). The fact that the decrease in the scores of the students who were born between January and July is not linear can be interpreted that the seven-month maturity differences between the students do not have a significant effect on the occurrence of RAE, and that RAE has emerged as from students younger than eight months compared to the oldest students.

The relationship between TIMSS 2015 mathematics scores of the fourth and eighth grades and the socio-economic status of their families (educational status of family, educational support at home, taking additional lesson) is higher than the birth month. On the other hand, the results showed that the total variance in mathematics scores was explained by only 5.2% of the fourth grade and only 15.6% of the eighth grade was explained by the variables studied. When the date of birth is examined by other variables, the variance related to the TIMSS mathematics scores is explained as .09% in the fourth grade and .02% in the eighth grade. Based on the regression model, three results can be obtained. First, all variables examined contribute significantly to predicting TIMSS mathematics scores, except for gender. Second, the variables examined reveal a small portion of the total variance in mathematics scores, especially in the fourth grade. Third, the birth month of students contributes to the variance very little. The shortness of the explained variance can be explained by the multiplicity of educational problems in Turkey. For example, Ünal and Sürücü (2018) determined the educational problems of Turkey as crowding of classes, lack of professional development and supervision of teachers, high teacher turnover rate in schools, psychological pressure of education on students, emphasis on religious education and directing students to private school. In addition, when Table 1 is examined, it is observed that the difference between the points of the oldest students born in January and the points of the youngest students born in December is 34 (491-457) in the fourth grade and 28 (472-444) in the eighth grade. These point differences correspond to approximately 6-7% TIMSS mathematics scores among the oldest and youngest students. Therefore, it can be said that the research results are important for researchers and policy makers taking into account the significant contribution of birth date to TIMSS mathematics scores without considering the effect size.

Although many factors can be mentioned about RAE's impact on TIMSS 2015 mathematics scores of the fourth and eighth grades of Turkey, it can be said that the main factor is teacher behaviors. Teachers are responsible for ensuring that all children in the classroom achieve a predetermined learning goal, regardless of their birth dates (Norbury et al., 2016). In performing these tasks, it is difficult for the teacher to distinguish between a child's behavior and the difference in maturity (Allen & Barnsley, 1993; as cited in Sprietsma, 2010). As a result of this difficulty, while teachers consider the older children to be more talented than the younger children who have the same ability with the impact of their maturation (Thompson et al., 2004; Dhuey & Lipscomb, 2008), they can

evaluate young children as learning problematic and even ADHD (Dhuey & Lipscomb, 2010; Sürücü et al., 2018). As a matter of fact, studies show that teachers generally do not tolerate young students; they expect the same expectations from young children and anticipate them to fail (Goodman, Gledhill & Ford, 2003). According to the result summarized in Figure 1, teachers' expectation of success or failure for students may turn into a self-fulfilling prophecy and result in a successful or unsuccessful student.

One of the reasons of behavior that led to the emergence of RAE on teachers may be the lack of knowledge of teachers about it. In the literature, it is seen that the research on RAE are very limited in Turkey and the information about RAE is not included in the textbooks used in the faculties of education. Therefore, it can be said that teachers were not given information about RAE in their programs for pre-service and in service and their attention was not taken to it. In this case, teacher behavior can only be solved through primary and secondary school teachers, primarily primary school teachers of first grade, through common sense and reasoning, by recognizing that younger children can learn more lately than their peers in the classroom, they can behave more impulsively and adjust their behavior accordingly. Many teachers can undoubtedly make behavioral adjustments, but there are also teachers who do not have common sense, do not reason or cannot. On the other hand, it is necessary to consider the existence of factors such as crowded classes that force teachers to do this. In crowded classrooms, it may be difficult for teachers to recognize students who are young compared to their peers and adjust their behavior accordingly. One of the reasons for the results may be the strict cut-off date application. In Turkey, children born within one calendar year prior to the year 2013 (January 1 - December 31) was launched as a compulsory school in the same period. Considering that many families had relatively young children sent their children to school late (Bedard & Dhuey, 2006; Dee & Sievertsen, 2015; Elder & Lubotsky, 2009; Kawaguchi, 2011; Mühlenweg et al., 2012; Shigeoka, 2015; Taehoon, 2018; Ünal, 2016; Zhang & Xie, 2018), the RAE may have arisen since parents were not aware of RAE or thought to comply with legal boundaries and start their children to school without considering their developmental characteristics according to this inelastic cut-off date (Sürücü et al., 2018). After the year 2013, leaving the decision of whether to send 60-65 months old children to primary school, the implementation of a more flexible application at the time of registration can reduce the impact of RAE. However, it should be noted that flexible registration dates may create a limitation of the socio-economic characteristics of parents in reducing the impact of RAE. The reason for this emphasis is that the socio-economically advantageous parents start their children to school one year late for their children to have no age advantage or disadvantage; the difference in success at the beginning may increase in the long term as a result of disadvantageous parents do not make late start application or fail (Shigeoka, 2015). The children of disadvantageous families may experience both the disadvantage of being relatively young at school and coming from a family with low socio-economic status.

On the other hand, being a child of well-educated families can have a triggering effect on the persistence of RAE. Schwandt and Wuppermann (2015) state that in Germany, when well-educated parents are concerned about their children's education, they are working to eliminate possible performance problems due to the young age of their children; in this way, the ambitions of parents and teachers who want to develop and improve education can be effective in the misdiagnosis of ADHD. Likewise, if well-educated families send their young children to school compared to their peers, they are likely to press both children and teachers to succeed in the central examinations as described above. If the student's performance is lower than his older friends, this form of oppression may take different forms depending on the point of view of parents and teachers. If parents and teachers choose to support the student in order to overcome the lack of performance, RAE will disappear in time. Parents and teachers exert pressure on the student to work more in order to overcome the lack of performance; if they cause the student to experience failure, this may require the child to study more in order to capture his or her older peers, or may affect the child's self-confidence, self-esteem, emotional problems, peer problems (Thompson et al., 2004; Liu & Li, 2015; Mühlenweg et al., 2012; Patalay et al., 2015) and permanence of RAE by performing poorly.

Another finding is that RAE affects the students' mathematics achievement in the fourth grade and continues to decrease in the eighth grade. The finding that the impact of RAE on mathematics achievement continues to decrease from fourth grade to eighth grade is supported by other studies (Bedard & Dhuey, 2006; Cobley et al., 2009; Datar, 2006; Fan et al., 2017; Jürges & Schneider, 2007; Kawaguchi, 2011; Liu & Li, 2015; Madeira, 2018; Norbury et al., 2016; Ponzo & Scoppa, 2014; Sprietsma, 2010; Strøm, 2004; Zhang & Xie, 2018). It can be said that the finding of RAE impact continue albeit at a diminishing pace from the fourth grade to the eighth grade is generally consistent with the expectation that the difference in the initial maturity difference will disappear as the age difference between the children increases and the age difference ratio decreases (Kawaguchi, 2011). However, considering studies showing that the RAEs have disappeared or even reversed from the fifth grade (Elder & Lubotsky, 2009; Nam, 2014, Thoren et al., 2016), the continuation of the RAE in the eighth grade will lead to some wrong practices in Turkey. The first of these applications may be the central examinations to select and place

students in the upper education institution (secondary education-university). Central examinations can have two kinds of negative effects. The first may be the implementation of teaching programs based on exams and the teachers' work towards centralized examinations instead of student-centered practices, as a result of the implicit but familiar pressure of the central examinations on how the lessons will be taught and the use of centralized exams as the sole indicator for determining the success of school and teacher (Çetin & Ünsal, 2018). In the study conducted for central examinations, it is possible that the school principals and teachers ignore the students who are considered to be successful in the exam, and do not work to improve their performance. As a matter of fact, it is a reality that everyone knows about the subject which both public and private schools emphasize successful students and use their students as advertising face in order to prove that their schools are successful, and they never for the rest. In this context, it can be said that the probability of being ignored by the school and its teachers due to the maturity difference of the students who are young compared to their peers is likely to be retarded.

The second reason for the continuation of RAE in the eighth grade may be the practice of placement in the honors classes according to various criteria such as the academic achievement and readiness levels of the students in some schools in order to be successful in the central examinations. Although honors class implementations have been prohibited, it is still ongoing in middle and high schools in Turkey (Aslan, Küçüker, & Gürbüzler, 2014). There is no data on the prevalence of the honors class implementation. However, Aslan et al. (2014) detected that the two secondary schools and one high school was ongoing the honors class implementation in Tokat, which was relatively small province of Turkey. This determination conjures up that the implementation of honors class is common in Turkey. According to the literature of RAE, it is expected that if the children of different maturity levels are divided into groups as to their observed abilities in the beginning years of the school, the youngest ones will be in the lower performing groups at the end and the probability of failure in the following classes will increase (Sprietsma, 2010). Indeed, Mühlenweg (2010) reports that RAE is more common in countries that allow talent groupings, and the impact tends to be low in countries where children are prepared according to their different abilities and in integrated systems where individualized teaching is done. For example, in their research by conducting international comparisons, Bedard and Dhuey (2006) could not find the impact of RAE in only two countries which were Finland and Denmark. Bedard and Dhuey (2006) attributed this to the fact that compulsory education did not begin until the age of seven, and even the first classes focused on play and personal development in Finland, and the prohibition of talent-based diversification before the age of sixteen in Denmark.

5. Recommendations

It is likely that the young students will fail and the big students will be successful with the interaction of the aforementioned factors related to the emergence of RAE. It is difficult to differentiate between the factors that cause RAE. However, it is possible to group the factors that cause RAE to occur as follows: educational system factors and the teacher and parent factors depending on the educational system. In Turkey, educational system factors in the emergence of RAE may be strict cut-off dates for registration, honors class practice and central examinations as described above. Regarding the cut-off dates for registration, it can be said that after the year 2013, the application of the more flexible cut-off date for registration may partially solve the problem, but it may be useful to further expand the boundaries in the registry applications. For example, 66-72 months aged children may be enrolled in primary school depending on their parents' wishes.

The focus in policy discussions on RAE is to decide what a child will do when a school enrollment is postponed in addition to the cut-off date for registration. A policy change, based solely on the postponement of school enrollment, could result in the success of high-income children with more access to pre-school education than low-income children (Elder & Lubotsky, 2009). In fact, Chen (2015) reached that the probability of grade repetitions of children, especially boys, who did not have access to pre-school education and enrolled in school in the countryside was increased compared to the children who started school at the time. Older children are more successful since they have more time to get support from preschool educational institutions as well as being mature (Thoren et al., 2016) and they have accumulated more preschool skills when they start to school (Zhang & Xie, 2018). Therefore, the precautions are needed to be taken to ensure the continuation of a qualified pre-school education for the postponement of primary school enrollment policies to be successful. Especially, it is necessary to take precautions for disadvantaged children by considering that pre-school education institutions are more effective on the children whose families have low socio-economic status (Altwicker-Hámori & Köllö, 2012). The adoption of these measures may also contribute to the implementation of Madeira's (2018) suggestion that the idea of the kindergarten teacher may be taken in order to determine the maturity and readiness of the child. It may be invaluable to take the opinion of the kindergarten teacher because the relatively young children are more disadvantaged when they repeat the first year instead of kindergarten (Vandecandelaere, Vansteelandt, De Fraine, & Van Damme, 2016).

There are those who suggest that children enrolled in school should be divided into groups in classes according to their relative ages to prevent the emergence of RAE (Goodman et al., 2003). In small schools, it is not possible to apply this proposal, as well as the objectionable aspects and the results of the research that the younger children are more successful having older friends, it may be more useful to do applications that will eliminate the disadvantageous aspects of having older friends instead of grouping children. Another suggestion is to register the children in order of birth date or enroll the school more than once (Goodman et al., 2003). This suggestion seems rational, but is likely to lead to a lot of confusion in the school, especially in the difficulty of finding sufficient number of teachers.

Within the scope of system-based factors, first of all, the Ministry of National Education should verify the compliance with the prohibition on the honors class implementation (Aslan, Küçüker, & Gürbüzler, 2014) by making the control mechanism effective, and ensure compliance with this prohibition. One of the system-centered factors to reduce the impact of central examinations may contribute to the elimination of honors classes. In this context, Ministry of National Education's vision for the elimination of the success difference among the schools set out in the 2023 Vision Document will probably eliminate the effectiveness of central examinations and the need for honors classes.

Teachers, especially primary school teachers, should be informed about RAE in order to eliminate the teacher-related factors that cause the negative consequences of RAE to be permanent. This awareness can be provided in pre-service and in-service training programs. Primary school teachers who are aware of RAE know that relatively young students may need extra time to learn and may have difficulties in controlling themselves according to the older students; teachers are expected to be more patient assuming the idea that these features will disappear in time and young children behave like older students in the classroom. In this context, class teachers should adjust the speed of the lessons to ensure that young students are not affected negatively; they should pass on their positive expectations to the young students and try to ensure that the student is successful without linking young students' lagging to be less capable. When there are both older and young students in a classroom, the teacher can turn this situation into an advantage by ensuring that older students are being models and helpful. In this way, the teacher contributes to the helping each other, socialization and maturation of the students. In order for the teacher to carry out the proposals successfully, crowd classes must be prevented. In Turkey, there are 24 students in a class for the standard applied in private schools; it must also be applied in public schools.

One of the recommendations for parents who have relatively young children and do not want them to be affected negatively by RAE is that they should send their children to preschool education and make an effort to get a qualified pre-school education. Secondly, if their children were born in the last three months (July, August, September) prior to the registration date, they should decide whether their child achieves their first-class maturity, and whether they should register their children in the first year, considering the opinion of the preschool education teacher and the opinion of the first-year teacher at the school. Thirdly, if it was decided to enroll the child in primary school, it should be accepted that there may be age-related performance differences after school start, and parents should be more patient and allocate extra time to help children. The last suggestion for all students is that they don't have any worries about lagging from their classmates and not being successful in school exams and central examinations; the parents are advised that they do not want their children to compete with the older classmates and do not put pressure on their children to succeed as older children.

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