The Persistent Effect of Being Old for Grade on Social-Emotional Skills*

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October 31, 2023

Abstract

I examine the persistence of old-for-grade effects in secondary education on social-emotional skills, measured by self-esteem, friendships, learning approaches, and goal-setting mindsets. Students who are older at school entry, thereby older than their grade peers throughout school life may have a potential advantage in their social-emotional skill development. Utilizing a fuzzy regression discontinuity design and leveraging data from the Seoul Education Longitudinal Study 2010 (SELS) in South Korea, I uncover different patterns for girls and boys. I find that old-for-grade girls consistently exhibit higher self-esteem compared to young-for-grade girls during both middle and high school. I also find suggestive evidence that old-for-grade girls maintain more effective learning approaches and stronger friendships. In contrast, I do not find significant differences between old-for-grade and young-for-grade boys. These findings suggest the persistence of old-for-grade effects and gender disparities in social-emotional skill development, potentially carrying implications for future labor market outcomes.

Keywords: School Starting Age, Social-Emotional Skills, Gender Differences, Seoul Education Longitudinal Study 2010 (SELS 2010)

*I am very grateful to my advisor, Scott Carrell, for his invaluable advice and continuous support. I also deeply appreciate Marianne Bitler and Jenna Stearns for their guidance and feedback. In addition, I am thankful for the participants at the UC Davis EqualiTEA and UC Davis Applied Micro Student Talks.

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1 Introduction

Social-emotional skills are a crucial facet of human capital that affects individual prospects in the labor market. Researchers have demonstrated that cognitive skills alone cannot fully explain disparities in labor market outcomes (Heckman et al., 2006; Lindqvist and Vestman, 2011). Social-emotional skills predict labor market outcomes including employment, wages, and occupational choices.[1] While a growing body of literature in Economics delves into the impact of schools (Jackson et al., 2020), teachers (Gong et al., 2018; Kraft, 2019), and peers (Gong et al., 2021) on social-emotional skills, there remains a considerable gap in our understanding of the factors that shape these skills.

In this study, I examine whether the effects of being old for grade on social-emotional skills persist throughout middle school and high school. Being old for grade refers to students who are older when they start school, thereby remaining older than their grade peers throughout their school life. As students develop social-emotional skills in school, these developments are influenced by their ages within the same grade. Potential disparities are less problematic if the gap in social-emotional skills between old-for-grade and young-for-grade students naturally fades out over time. However, if these effects persist over time, it becomes necessary to take into account the disadvantages faced by young-for-grade students when designing educational programs aimed at enhancing social-emotional skills.

Students who start school at an older age often possess advantages in cognitive, physical, social, and emotional abilities.[2] However, as students progress into adolescence, it remains

[1]Examples include noncognitive measures combining locus of control and self-esteem (Heckman et al., 2006), social skills (Deming, 2017; Weinberger, 2014), interpersonal skills (Borghans et al., 2008).

[2]Students who start at an older age are more ready for kindergarten (Dhuey et al., 2019), achieve better test scores (Datar, 2006; Elder and Lubotsky, 2009; Cascio and Schanzenbach, 2016), and exhibit fewer problem behaviors and pro-social skills (Datar and Gottfried, 2015; Lubotsky and Kaestner, 2016) during

uncertain how these age-related effects change. On one hand, the observed differences in skill levels between old-for-grade and young-for-grade students fade out if the differences are mainly attributable to a one-year age gap at the same grade. On the other hand, the initial advantages may persistently influence skill development throughout students' education journeys. Old-for-grade students may engage with educational environments that foster social-emotional skill development more effectively (dynamic complementarity).

Previous studies find that the positive effects on approaches to learning and interpersonal skills tend to diminish by the eighth grade in the United States (Datar and Gottfried, 2015; Lubotsky and Kaestner, 2016). Conversely, Crawford et al. (2014) finds no significant effect on self-esteem at age 8, while Datar and Gottfried (2015) finds a higher self-concept among older entrants in the eighth grade, suggesting that not all effects necessarily fade out. By focusing on middle school and high school years, this study provides a deeper understanding of whether the effects of being old for grade on social-emotional skills, measured by self-esteem, friendship, learning approaches, and goal-setting mindsets, persist or fade out.

To investigate this question, I use data from the Seoul Education Longitudinal Study 2010 (SELS), leveraging a unique educational context in Seoul, South Korea. This setting offers several advantages: random middle school assignments, minimal grade repetition, and compulsory middle school. First, the random school assignments, which are uncommon in many other settings, circumvent potential biases in the estimates from sorting into better schools. If old-for-grade outperform their younger peers and are sorted into higher-quality schools, this could change the development of social-emotional skills.[3] Second, the rare

kindergarten.

[3] High school assignment is based on preference in Seoul. Nevertheless, the consistency of the estimates across both middle school and high school indicates that this preference-based assignment does not significantly alter the effects of being old-for-grade in high school. The estimates are also robust to the inclusion

repetition of grades prevents the potential biases that might arise if young-for-grade students are more likely to have lower test scores, resulting in grade repetition and its differential effect on social-emotional skills. Third, compulsory middle school education, with a substantial rate of advancement to high school, ensures that school starting age does not confound the lengths of schooling. If compulsory education is based on the minimum school leaving age, schooling duration can be affected by school starting age, leading old-for-grade students to receive less education.

I employ a fuzzy regression discontinuity design, instrumenting being old for grade with being born after the school entry age cutoff, following the approach used in previous studies.[4] This is necessary because delayed entry is common in my study period, so that decision of school starting age is endogenous. This is less likely to violate the monotonicity assumption, which must hold to interpret the estimates as local average treatment effects and essentially means that students born around the cutoff should be affected in the same direction – becoming older at school entry. Thus, I can interpret my estimates as local average treatment effects.

I find that old-for-grade students exhibit higher levels of social-emotional skills compared to young-for-grade students during middle school and high school. These effects are concentrated among girls. Girls who are old for grade have higher self-esteem than their younger counterparts during both middle and high school. Additionally, there is also suggestive evidence for friendships and learning approaches. Old-for-grade girls exhibit better friendships, indicating stronger social and interpersonal abilities in their relationships with peers, and

of school fixed effects.

[4] Elder (2010); Evans et al. (2010); Landersø et al. (2017, 2020); Johansen (2021)

better learning approaches, indicating increased motivation, engagement, and effective study skills. Notably, the magnitude of these effects during high school is similar to during middle school, suggesting the persistence of the old-for-grade effects. In contrast, there are no significant differences in the social-emotional skills of boys who are old for grade compared to their younger counterparts, except for suggestive evidence of better friendships during middle school. Importantly, these gender-related effects cannot be attributed to differences in contemporary test scores or physical development.

Next, I explore one potential channel for the fadeout of effects. Young-for-grade students may naturally exhibit lower levels of social-emotional skills simply because they are one year younger at the time of the survey. To investigate this possibility, I reconstruct the outcome variables to be measured at the same age. This way, young-for-grade students are at the same age as old-for-grade counterparts and have an additional year of education. If the age at the survey is the primary driver of the effect, or if the extra year of schooling compensates for the advantages of being one year older at the time of the survey, then the effect should be close to zero. I find that the effects are slightly smaller but remain positive and statistically significant when using outcomes measured at the same age. This suggests that the one-year age difference at the time of the survey and one additional year of schooling only partially mitigates the effect of being old for grade on social-emotional skills.

In terms of magnitudes, the old-for-grade effects on social-emotional skills appear to be larger than the effects of high school or peer gender on similar outcomes. For instance, the effects on girls' friendships, ranging from 0.683 to 0.964 standard deviations, align with the effect of increasing the proportion of female peers in the classroom from zero to one (Gong et al., 2021). Additionally, the effects on girls' learning approaches, ranging from 0.536 to 0.916

standard deviations, closely mirror the effect of school starting age in kindergarten, which is 0.701 standard deviation according to Lubotsky and Kaestner (2016). These substantial effect sizes may, in part, be attributed to the local nature of both regression discontinuity and instrumental variable designs.

My findings hold important implications for post-secondary education and the labor market prospects, particularly for old-for-grade girls. While I cannot directly observe students after their high school graduation, previous studies indicate that enhanced social-emotional skills play a vital role in labor market outcomes. Back-of-the-envelope calculations suggest that a one standard deviation increase in self-esteem is associated with approximately a 25.06 percent increase in wages for females (de Araujo and Lagos, 2013), and a one standard deviation increase in social skills is associated with a 3.0 percentage points increase in full-time employment across genders (Deming, 2017). Moreover, higher levels of learning approaches have the potential to enhance post-secondary educational attainment. In summary, the improved social-emotional skills among old-for-grade girls provide a promising path towards enhanced labor market outcomes. Given the importance of social-emotional skills, it is crucial to consider the potential disadvantages faced by young-for-grade students when developing programs aimed at fostering social-emotional development.

There are several contributions of my paper. First, by focusing on middle school and high school, I demonstrate the persistence of being old-for-grade effects in secondary education. The inclusion of high school in the analysis extends beyond previous research, allowing for the observation of these effects closer to labor market entry. Second, I uncover distinctive patterns in the development of social-emotional skills among girls and boys, providing evidence that old-for-grade girls persistently experience positive effects on their social-emotional skills during adolescence, whereas such trends are not observed among boys. Third, I analyze whether one-year age differences can account for the skill gap measured at the same grade. My findings suggest that these differences do not entirely explain this gap. Lastly, my study provides robust causal evidence regarding the effects of being old for grade, leveraging the random assignment of middle schools, rare grade repetition, and fixed years of compulsory education, and employing an instrument that satisfies necessary identifying assumptions.

The remainder of this paper is organized as follows. Section 2 describes the educational system in South Korea and the data I use. Section 3 explains the identification strategy, and Section 4 presents the results and interpretation. Section 5 presents robustness checks. Section 5 concludes.

2 Educational System and Data

Educational System in South Korea

Education in South Korea consists of six years of primary school, three years of middle school, and three years of high school. The academic year begins in March, and the school starting age cutoff date was March 1st before 2009.[5] Children become eligible to enter primary school in March following their 6th birthday. If children enter school on time, March-born children turn 7 years old, while February-born children are 6 years old at school entry. Although it is possible to enter school early or delay entry, early entry is relatively

[5]School starting age cutoff moved from March 1st to January 1st in 2008, and January 1st cutoff was enforced starting in 2009. Children who are 6 years old by January 1st are eligible to enter primary school in March of that year. In other words, they enter school in the calendar year of their 7th birthday. The sample I use in this paper entered school when March 1st was the school starting age cutoff.

rare, with only around 0.3 - 0.6 percent of children in Seoul entering school early each year.[6] On the other hand, late entry to school is more common, with approximately 5.4 percent in 2004 and about 8.7 percent in 2007 delaying their school entry in Seoul.[7] [8]

Before entering primary school, children in South Korea typically attend either kindergarten or daycare center. While kindergarten is not entirely free when the children in my sample are aged 3 to 5, the share of children attending either kindergarten or daycare center at the age of 5 was 76.3 percent in 2004 and 87.9 percent in 2007 in Korea. Among children aged 5 in South Korea who attend kindergarten or daycare centers, approximately 60 percent attended kindergarten, while the remaining attended daycare center. Most children are enrolled in one of these programs, which indicates that many old-for-grade children have one more year of experience in pre-primary education before school entry. This also indicates that old-for-grade and young-for-grade children experience different education cycles at the same age.[9]

Grade repetition is infrequent in South Korea. In 2010, only a small number of students, 12 in primary school and 45 in middle school, repeated grades.[10] Grade repetition may have differential impacts on the development of social-emotional skills when compared to students

[6] In the population level data in Seoul, 779 out of 124,209 children entered school early in 2004, and 377 out of 111,496 students entered early in 2007. The share of early entrants was stable until the school entry cutoff moved to January 1st. Source: Statistical yearbook of Seoul education 2005, 2008

[7] To delay school entry, parents need to file an application for reason such as child development, and the primary school headmaster decide whether to accept the application following the deliberation of the compulsory education management committee.

[8] Nationwide delayed entry rates in the United States are similar to those in Korea. In the United States, delayed entry rates range from 5 percent to 7 percent in recent years (Datar, 2006; Bassok and Reardon, 2013; Snyder and Dillow, 2013). Delayed entry in the United States was more prevalent in the 1970s and 1980s, with 12 percent on average, but has declined over time (Huang, 2015).

[9] Kindergarten provides care for children from age 3 until they transition to primary school, while daycare center provides care for children aged 0-6. These two types of early childhood education and care facilities operate under different laws and government supervision.

[10] Source: Statistical yearbook of education

advancing to higher grades. Additionally, young-for-grade students are more likely to have lower test scores and thus repeat a grade (Dhuey et al., 2019). In my setting, the estimates remain unbiased given uncommon grade repetition.

South Korea mandates six years of primary school and three years of middle school. Nearly all middle school graduates (99.7 percent) progressing to high school, and an annual high school dropout rate of only one percent.[10] While the minimum school leaving age can potentially influence the length of schooling based on when students start school (Barua and Lang, 2016), the combination of nine years of compulsory education and a substantial advancement rate to high school reduces concerns related to dropout and its impact on social-emotional development.

In Seoul, middle school assignments are random within 11 school districts. High school assignments are based on on student preferences. Students can choose between academic and vocational high schools, and even within academic high schools, they submit their preferences. Thanks to the random assignment in middle schools, my estimates are not confounded by the effect of school.

Data

I use the Seoul Educational Longitudinal Survey 2010 (henceforth SELS 2010) for this study. SELS 2010 samples fourth, seventh, and tenth grade students in 2010 and surveys them annually until their high school graduation.[11] I use the fourth grade and seventh grade cohorts to study the effects in their high school years (grades 10-12) as well as middle school

[11]SELS 2010 uses a stratified two-stage cluster sampling. In the first stage, schools are randomly sampled based on the number of schools within each school district. In the second stage, Two classes are randomly selected within each school.

years (grades 7-9). After dropping students with missing dates of birth, there are 3,834 students in the fourth grade cohort and 4,515 students in the seventh grade cohort.[12] To address concerns about potential non-random attrition in the panel survey, I check whether attrition is related to being born after March 1st or old-for-grade. However, the correlation between attrition and being born after cutoff or being old for grade is close to zero, suggesting that attrition is unlikely to bias the results significantly.

One limitation of this data set is that it is not possible to observe the school starting age directly. Instead, I rely on the observed age in the first survey wave to proxy for the school starting age. If students have repeated a grade or experienced grade retention, the observed age may not perfectly align with the actual school starting age. However, this is less of a problem because repetition or retention is uncommon in South Korea. Retention typically occurs when a student's attendance rate falls below two-thirds of the total school days. In 2007, 9 primary school and 23 middle school students repeated grades in Seoul. Students can postpone being enrolled in school, but it is allowed when it is because of illness or any extenuating circumstances.[13] In this sample, the majority of students in the seventh grade cohort were born in 1997 and 1998, while the majority in the fourth grade cohort were born in 2000 and 2001. Only a small number of students are older or younger than their assigned school age. This reassures that the observed age in the fourth or seventh grade reflects the actual school starting age.

[12]Some students are added in survey waves 6 and 7. 164 students in the fourth grade cohort and 33 students in the seventh grade cohort are added for a new policy evaluation in the sixth survey wave. Another 75 students in the fourth grade cohort are additionally surveyed in the seventh survey wave.

[13]Elementary and Secondary Education Act Article 28 Paragraph (4): The head of an elementary school or a middle school shall grant the exemption or postponement of the obligation of school enrollment pursuant to paragraph (2) or (3) only where the application thereof is filed because of illness or any extenuating circumstances determined by the superintendent of education.

The main outcomes of interest are self-esteem, friendship, learning approaches, and goal-setting mindsets. These social-emotional skills have been demonstrated to have an effect on academic attainment and labor market outcomes in previous studies. Studies have shown that self-esteem affects educational attainment, wage, employment, and occupational choices (Heckman et al., 2006; Waddell, 2006; de Araujo and Lagos, 2013). The friendship index measures a student's social skills, which play an important role in employment and occupational choices (Deming, 2017; Weidmann and Deming, 2021; Lindqvist and Vestman, 2011; Borghans et al., 2008). The learning approaches index measures students' learning strategies, effort, and aspirations, all of which can positively affect their educational attainment. Lastly, the goal-setting mindsets index measures whether students have clear goals, know how to achieve them and work hard to attain them, indicating a connection to motivation.

Self-esteem index includes five questions from the Rosenberg Self-Esteem scale, which is widely used in Economics research. Questions are as follows: *I feel that I have a number of good qualities. I am able to do things as well as most other people. I feel that I'm a person of worth. I take a positive attitude toward myself. On the whole, I am satisfied with myself.*

Friendship index includes four questions of the following: *I have a friend whom I can trust and talk to. Rather than being alone during breaks or lunchtime, I spend time with my friends. Even if I have arguments with my friends, we make up quickly. I help my friends who need assistance.*[14]

Self-directed learning approach index includes nine questions based on the motivated strategies for learning questionnaire (MSLQ) (Pintrich et al., 1993), which include: *I think*

[14] These questions are similar to the interpersonal skill survey measures in Jackson et al. (2020) and Datar and Gottfried (2015); Lubotsky and Kaestner (2016).

about how to connect newly learned information with what I already know. I study important materials by summarizing key points or organizing them in tables or mind maps. I check myself to see if I understand the class materials well. I try my best to fully understand the school materials. I try to stick to the study schedule I planned as much as possible. If there is anything I don't understand while studying or doing assignments, I look it up in books or online. I believe I will eventually understand any difficult material. I find studying enjoyable. I can handle my own work well without anyone telling me what to do.[15]

Goal-setting mindset index includes five questions that are based on the presence of and search for meaning in life (Steger et al., 2006), which are: *I have a clear goal that I want to achieve. I know what I need to do to achieve my goals. I am working hard to achieve my goals. The study I am doing now will help me achieve my future goals. If I achieve my future goals, I believe I can also contribute to society.*

Students respond to each question using a 5-point Likert scale, ranging from 1 being 'strongly disagree' to 5 being 'strongly agree.'[16] A higher score means better social-emotional skills. I present average outcome indices by gender and cutoff among those born between January and April in Table 1. Across all grades, ages, and outcomes, Girls born in March or April, and thus more likely to be older, have higher indices on average than those born in January or February. On the other hand, boys born after March 1st do not necessarily have higher indices on average. Between gender, girls consistently have lower self-esteem than

[15]Questions used to measure the learning approach index are similar to academic effort (work hard index) in Jackson et al. (2020).

[16]Cronbach's α is reported for the reliability of these measures in the fourth survey wave. For self-esteem, they are 0.941 in middle school and around 0.90 in high school. For friendship, they are 0.782 in middle school and 0.786 in high school. Cronbach's α for learning approaches ranges from 0.776 to 0.825 in middle school and from 0.655 to 0.767 in high school. Lastly, they are 0.902 in middle school and around 0.86 in high school for goal-setting mindsets.

boys, but there is no consistent pattern of girls scoring higher or lower than boys in other social-emotional skills.

To better interpret estimates, I standardize each survey response to mean zero and unit variance within each survey wave and sum relevant questions. I average each outcome over middle school years (grades 7 to 9), high school years (grades 10 to 12), across all grades (grades 7 to 12), and across all ages (ages 13 to 17) to reduce noise from a small sample size.[17] All outcomes are standardized again afterward. I use ages 13 to 17 when averaging across ages because data are unavailable for younger students at age 18 and older students at age 12.[18] Young-for-grade students are in grade 8 at age 13 and grade 12 at age 17, while old-for-grade students are in grade 7 at age 13 and in grade 11 at age 17.

3 Identification Strategy

I use a fuzzy regression discontinuity design to investigate the effects of age for grade on social-emotional skills. The timing of children's school entry is endogenous to their birthday, as parents may choose to delay their child's school entry if they believe the child is not sufficiently ready for school. Therefore, I use being born after school entry cutoff as an instrument variable for a binary variable of being old-for-grade, similar to Evans et al. (2010), Elder (2010), Page et al. (2017), Landersø et al. (2017, 2020), and Johansen (2021).

I define $oldforgrade_i$ to be a binary variable equal to one if the school starting age is 7 and zero if the school starting age is 6. Figure 1 shows the share of old-for-grade children

[17] I also estimate the effects on outcomes at a specific grade or a specific age, but estimates are consistent with those using pooled averages.

[18] The survey was conducted in July every year, so the age is calculated based on the survey time.

among girls and boys separately.[19] Children born in January and February are increasingly more likely to delay their entry as their date of birth gets closer to the cutoff. There is a jump in the share of old-for-grade children at the March 1st cutoff, and most children born in March and April are old for grade. Consistent with previous literature, boys are more likely to delay school entry than girls.

I estimate the following equations in the reduced form and in the first stage:

$$Y_ic = \beta_1 + \beta_2 cutoff_i + \beta_3 d_i + \beta_4 d_i * cutoff_i + \lambda_c + X_i' \gamma_1 + \epsilon_i$$

$$oldforgrade_{ic} = \alpha_1 + \alpha_2 cutoff_i + \alpha_3 d_i + \alpha_4 d_i * cutoff_i + \lambda_c + X_i' \gamma_2 + e_i$$

where Y_i is the outcome of interest, which includes self-esteem, friendship, learning approaches, and goal-setting mindsets. d_i is the date of birth relative to the March 1st cutoff. It is equal to zero when a child is born on March 1st, 1 if born on March 2nd, and -1 if born on February 28th. $cutoff_i$ is an indicator variable equal to one if children were born after March 1st. I also include an interaction of d_i and $cutoff_i$. λ_c is the survey cohort fixed effect. X_i is predetermined individual characteristics, including gender, firstborn, parents' educational attainment (categorized as less than high school, high school graduates, and more than high school), and indicators for missing covariates. In the main specification, I do not include individual controls because the estimates remain robust to the inclusion of controls.

I use a triangular kernel, which is optimal for boundary estimation, using local linear regression (Fan and Gijbels, 1996). In the main analysis, I choose 60-day bandwidths to en-

[19] Share of old-for-grade students can be interpreted as old-for-grade within the class in the first survey wave, but it no longer reflects the actual share in the following years.

sure the comparability of results across various outcomes. Importantly, I conduct additional analyses using bias-corrected estimates and robust confidence intervals, utilizing bandwidths that minimize the mean squared errors (MSE) following Calonico et al. (2014). The results are not significantly different. To further validate my approach, I explore the optimal local polynomial order that minimizes asymptotic mean squared errors, following Pei et al. (2022). Results are shown in Tables A1 and A2. I find that local linear estimators consistently have lower asymptotic mean squared errors than local quadratic or cubic estimators.

I cluster the standard errors at the date of birth level. Additionally, I consider alternative clustering at the school level, given that the sampling in my data is at the school level, and students in the same school may be exposed to common shock. However, the alternative clustering does not yield significantly different results compared to my main specification. Moreover, standard errors are larger when clustering at the date of birth level. This suggests that clustering at the date of birth level provides more conservative results. Therefore, in my main results, I present standard errors clustered at the date of birth level to ensure robustness and conservative estimates.

The regression discontinuity design relies on the assumption of continuous running variables and the smoothness of the regression functions for potential treatment and potential outcomes near the cutoff. One possible threat to identification is that parents may manipulate the date of birth around the school entry cutoff (Shigeoka, 2015). To address this concern, I check whether the density of the running variable around the cutoff changes smoothly (McCrary, 2008). Figure 2 presents the density of births within a 60-day bandwidth around the cutoff with two-day bins. The number of births is not significantly different before and after the cutoff. I formally test the manipulation using the method proposed by

Cattaneo et al. (2020). Results shown in Figure 3 do not reject that the density around the cutoff is smooth. I also do the same analysis separately for girls and boys in the Appendix Figures A1 and A2.[20] In the robustness check, I re-estimate the effects with the donut regression discontinuity design excluding one, four, and seven days around the cutoff. Results are shown in Appendix Figures A9 and A10. The magnitudes do not change significantly, but they become somewhat noisy.

Since I use only a sample of students from just two school cohorts, it is possible that specific birth patterns in certain years might bias the birth density in my data set. To address this, I examine whether residuals after regressing running variables on day-of-week and holiday fixed effects are balanced around the cutoff. Results are shown in Appendix Figure A3. The estimates are robust to the inclusion of day-of-week fixed effects. Additionally, Kim (2021) finds that the adjustment of birth timing between February and March is small and not statistically significant between 1997 and 2007, based on administrative birth certificates in Korea.[21] This provides supporting evidence that the birth patterns of the two school cohorts are not different from those of other cohorts and also from those at the population level.

Another way to assess the validity of regression discontinuity design is to check whether individual predetermined characteristics are similar around the cutoff. Figure 4 presents the distribution of female, firstborn, and parents' educational attainment for students born

[20] One possible concern related to my data is that the distribution of births around the cutoff date might differ from that at the population level. If, for instance, time-specific events impact the two school cohorts in my data, my estimates could be biased. While I do not have access to the daily number of births, I find that the share of births by month in my data is similar to that at the population level in Seoul. This evidence assures that the cohorts in my sample are not drastically different from the overall population regarding birth patterns.

[21] One explanation provided by Kim (2021) is that school starting age enforcement is flexible, so parents can adjust the timing of their child's school entry when the child is eligible to enter school. This gives less incentive for parents to adjust birth timing.

between January and April. The bin size is set to two days due to the small sample size. Overall, the predetermined characteristics of children appear to be similar before and after the March 1st cutoff, suggesting no significant imbalance in these characteristics. One exception is that there is a slightly greater proportion of girls among January and February-born children compared to those born in March and April. This is consistent with previous studies that show boys are more likely to start school late (Fredriksson and Öckert, 2014; Landersø et al., 2017; Cook and Kang, 2020). For this reason, I present the results separately for girls and boys, in addition to the entire sample.

Since I am using the instrument, standard instrument variable assumptions including the relevance of the instrument variable and the exclusion restriction must also be satisfied. Additionally, the monotonicity assumption is necessary to evaluate the local average treatment effect (LATE). In my context, students born around the cutoff should exhibit the same directional effect – being old-for-grade at school entry. The monotonicity assumption is violated when the distribution of school starting ages for students born after the cutoff does not stochastically dominate the distribution of school starting ages for those born before the cutoff (Aliprantis, 2012; Barua and Lang, 2016; Fiorini and Stevens, 2021). Children born around the cutoff are either 6 or 7 years old when they start school. Because I instrument a binary variable old-for-grade with being born after the cutoff, those born after March 1st are young-for-grade only when they enter school early. With this instrument variable, 'defiers' refers to parents and children who delay the school entry if the child is born before the cutoff and enter early if the child is born after the cutoff. Figure 1 illustrates that the majority of children comply with the school entry age rule if they are born after the cutoff, with only a small number of early entrants. Hence it is not likely that the monotonicity assumption is violated.

4 Results

First Stage

I present the first-stage regression results in Table 2. All regressions include cohort fixed effects. Columns 1 and 2 show estimates for the entire sample. Columns 3 and 4 show estimates for girls, while columns 5 and 6 show estimates for boys. The results show that children born after March 1st are 32.3 percentage points more likely to be the oldest within their grade cohort at school start. The effects are larger for girls with 37.6 percentage points compared to boys with 27.8 percentage points. Given that 44.6 percent of girls and 55.3 percent of boys born in January and February delay their entry, boys are more likely to be old for grade when they are born before cutoff. The estimates are significant in all regressions and remain consistent with and without individual controls. In the following results, I only present results without controls.

Main Results

Table 3 presents the main estimation results for social-emotional skills during middle school and high school. Odd columns present the effects during middle school (grades 7 to 9), while even columns present the effects during high school (grades 10 to 12). Panel A reports the results for girls, Panel B for boys, and Panel C for the entire sample. Columns 1 and 2 show the effects of being old-for-grade on self-esteem. Girls who are old for grade are more likely to exhibit higher self-esteem compared to younger girls in both middle school and high school. Magnitudes are similar in both periods as well, suggesting persistence of the effects. On the other hand, the effect on self-esteem for old-for-grade boys is relatively smaller and statistically insignificant. Panel C suggests that students who are old for their grade generally exhibit higher self-esteem. However, Panel A and B indicate these effects are primarily driven by girls.

The effects on friendship are generally weaker in magnitude compared to those on self-esteem. Overall, students who are old for their grade tend to have better relationships with their friends compared to the young-for-grade in the entire sample. During middle school, girls who are old for grade have a 0.683 standard deviation higher friendship than their younger counterparts. For boys, however, the estimate on friendship is not statistically significant, although the size of the effect is bigger than the effect on girls. Interestingly, as students advance to high school, the effects of each gender move in the opposite direction. The gap between old-for-grade and young-for-grade girls widens to a significant 0.964 standard deviation, while the gap between old-for-grade and young-for-grade boys almost disappears. Note that the evidence for the positive effect on friendships should be taken cautiously, as the estimates are sensitive to different specifications and the choice of bandwidth.

Columns 5 and 6 of Table 3 present the estimates of the effect of age for grade on learning approaches. Girls who are old for grade have better learning approaches than young-for-grade girls. This indicates that they have more effective study habits, are more engaged in learning, and invest greater effort. In middle school, the estimate is relatively smaller at 0.536 standard deviation and statistically significant at the 10 percent level. The estimate of 0.916 standard deviation in high school is a little bigger. One possible explanation could be that the high school years are perceived as having higher stakes, as test scores during this period can directly influence college admissions. Consequently, old-for-grade girls might exhibit enhanced self-control and study behaviors. Panel A of columns 7 and 8 suggests that old-for-grade girls tend to be somewhat better at setting goals. This implies that they are more inclined to have clear goals and actively strive to achieve them. However, the estimates are smaller, statistically significant only at the 10 percent level in middle school and losing statistical significance in high school.

In contrast, the effects on both learning approaches and goal-setting mindsets for boys are nearly negligible during middle school and even move toward a negative direction during high school, albeit without statistical significance. Taken together, old-for-grade boys are not significantly more likely to study harder or set clearer goals compared to their younger counterparts.

In summary, the effects of age for grade are more pronounced for girls who are old for grade. Old-for-grade girls exhibit higher self-esteem, stronger relationships with friends, and better approaches to learning. Notably, when assessing the estimates in middle school against those in high school, the effects tend to be slightly larger in the high school years. On the contrary, old-for-grade boys do not exhibit noticeable improvements in their social-emotional skill development. These findings suggest that the positive effects for girls persist over time rather than fade out as the students grow older.

An important question to address is whether the effects are driven by the absolute age differences at the time of survey between old-for-grade and young-for-grade students. To explore this, I can compare the estimates using outcome measures based on grade and those based on age at survey. When fixing the outcome measure at the same grade, the estimated effects reflect the combined effect of school starting age and age at survey. On the other hand, when fixing the outcome measure at the same age, the estimated effects control for the age at survey, but may include a potentially negative effect related to having one less year of schooling for old-for-grade students. For instance, at the age of 17, old-for-grade students are in eleventh grade, while young-for-grade students are in twelfth grade, indicating that young-for-grade students receive an additional year of schooling.

Ideally, it would be best to use social-emotional skill measurements in the later stages of life to fully control for years of schooling and the differences in educational cycles. However, the available data do not include information beyond high school. Nonetheless, a comparison can be made between the estimates at all grades (grades 7–12) and those at all ages (ages 13–17) to partially examine the potential influence of years of schooling. In addition, the effect of age at survey might cancel out, assuming the absolute age effect is linear in time.

Table 4 presents the results. For girls, I find that the estimates at all ages are slightly attenuated compared to those at all grades. This suggests that having one more year of schooling might partially mitigate the effect of starting school at an older age, or that the absolute age at survey contributes to some of the effects in middle school and high school years. The effects for boys are generally consistent across all grades and all ages as well .[22] This indicates that the relative age difference continues to play a role in the development of social-emotional skills.

In contrast to the findings of Crawford et al. (2014), which did not identify a significant effect of school starting age on self-worth at age 8, my study reveals that old-for-grade

[22] These findings remain consistent when I compare the estimates of skills measured at a specific grade and those measured at a specific age. Results are shown in Appendix Tables A7 to A10.

girls exhibit higher self-esteem. This discrepancy may be because adolescents might be particularly sensitive to their surroundings and environment. The effect size of 0.590–0.762 standard deviation for the entire sample is also larger than the 0.15 standard deviation found by Datar and Gottfried (2015) for eighth graders. One important thing to note is that the impact on learning approaches for old-for-grade girls does not fade out over time, which contrasts with the findings of Datar and Gottfried (2015) and Lubotsky and Kaestner (2016). Instead, the effect on learning approaches becomes slightly more pronounced during high school compared to middle school. The magnitude of the estimate during high school is similar to 0.63 standard deviation in Lubotsky and Kaestner (2016) or 0.701 standard deviation in Datar and Gottfried (2015) in the Fall of kindergarten. This suggests that the influence of age for grade on learning approaches might be malleable throughout different educational stages.

Compared to other interventions, the effects of age for grade on social-emotional skills are relatively substantial. For instance, the impact on girls' friendship is comparable in magnitude to the effect of increasing the proportion of female peers in the classroom from zero to one in Gong et al. (2021). This could improve students' social acclimation and general satisfaction index by 0.758 to 0.817 standard deviation. Furthermore, it is also larger than the school value-added of 0.0904 standard deviation on social index in ninth grade (Jackson et al., 2020). The effect on the learning approaches index, which measures students' effort, motivation, and strategy, is also larger compared to other studies. For instance, teacher value-added ranges from 0.115 to 0.183 standard deviation on students' effort in class (Kraft, 2019). Likewise, school value-added on work hard in ninth grade is 0.0639 standard deviation (Jackson et al., 2020). In contrast, my analysis identifies an effect size of 0.916 standard deviation on learning approaches during high school. I need to be cautious in comparison since differences in estimation strategies and the local nature of both regression discontinuity and instrument variable approach could be one factor in these relatively larger effect sizes.

Since there are multiple outcomes across different stages of adolescence, I also investigate the possibility of an increased number of significant results due to multiple hypothesis testing. I employ Bonferroni and Sidak corrections to adjust the p-values. I first adjust p-values across outcomes for girls. While the impact on friendship and learning approaches is not robust, the difference in self-esteem between old-for-grade girls and young-for-grade girls remains statistically significant. Moreover, these outcomes maintain their significance even after implementing corrections across both gender and outcomes. These findings further support that old-for-grade girls are more likely to exhibit higher self-esteem than young-for-grade girls, although the effects on other social-emotional skills might not be as robust.

Mechanism and Interpretation

I investigate the potential mechanisms that could explain these effects. First, I check whether old-for-grade students have higher test scores.[23] However, the estimates of being old-for-grade on the test scores do not show statistical significance during both middle school and high school. Although some estimates are positive in middle school, they tend to move toward zero in high school. This suggests that the disparities in girls' self-esteem cannot be solely attributed to differences in contemporary test performance. Secondly, I explore

[23]Test scores are from Korean, math, and English tests developed by SELS 2010 based on the first-semester curriculum of each grade in the survey year.

whether old-for-grade students possess better physical abilities. Due to data constraints, I analyze the height and weight of each cohort in the first survey wave. The estimates for girls in the fourth grade cohort are positive, although not statistically significant, while the estimates for boys are small and not statistically significant either. The estimates in the seventh grade cohort are smaller than those in the fourth grade cohort. Old-for-grade girls might be taller than their younger peers in the fourth grade, but this difference diminishes by seventh grade. It is possible that their early physical advantages influence higher self-esteem before entering middle school and persist throughout middle school and high school.

No significant effect on test scores despite the positive effect on learning approaches might seem contradictory. One plausible explanation is that the exams in the survey may not hold as high stakes. In fact, Kim (2011) finds that a one month increase in school starting age increases the likelihood of entering a 4-year college by 0.42 percentage points within two years after high school graduation in Korea. This suggests that while the direct influence on test scores might not be evident, the effects of age for grade on learning approaches could still play a role in later life.

Other social-emotional skills also have crucial implications. Self-esteem has positively correlated with post-secondary education and later labor market outcomes, including employment and earnings (Waddell, 2006; de Araujo and Lagos, 2013). Based on the estimates provided by de Araujo and Lagos (2013), a back-of-the-envelope calculation gives a one standard deviation increase in self-esteem could lead to an approximately 25.06 percent wage increase for females through an increase in years of schooling. Friendship, which can be viewed as social skills, can similarly impact employment. According to Deming (2017), a one standard deviation improvement in social skills is associated with a 3.0 percentage point rise in full-time employment. Given the 0.964 standard deviation increase in friendship for girls, this could potentially translate into a 2.89 percentage point increase in female employment. It is essential to be cautious while interpreting these findings since most previous studies are based on US data, and some date back to the 1980s and early 2000s, which may differ from the current South Korean context. Nevertheless, it remains plausible that old-for-grade girls with enhanced social-emotional skills might attain more years of education and experience improved labor market outcomes in the future.

5 Robustness Check

In this section, I demonstrate the robustness of the results through several tests. First, I redo the analyses with different bandwidths. Specifically, I employ mean squared error (MSE) optimal bandwidths for individual regressions and also for the first stage, both computed following Calonico et al. (2014). I compare bias-corrected estimates and robust confidence intervals with the main estimates. Second, I investigate the sensitivity of the results to different functional forms by estimating the effects using global linear and global quadratic regressions, also using various bandwidths (30, 60, and 90 days). Third, I assess whether a donut regression discontinuity approach, which excludes a small number of observations close to the cutoff, yields different results. Fourth, I examine whether including day-of-week and holiday fixed effects in the specification affects the main results.

To assess the sensitivity to bandwidth choices, I re-estimate the effects using MSE optimal bandwidths, following Calonico et al. (2014). I employ two approaches for computing MSE optimal bandwidths. The first minimizes the mean squared errors for fuzzy regression discontinuity design, generating different bandwidths for each regression. The MSE optimal bandwidths for fuzzy regression discontinuity range from 42 days to 78 days. The second uses the MSE optimal bandwidths computed in the first stage. Thus, I use the same bandwidths within each gender. The first-stage MSE optimal bandwidths are 38 days for girls and 40 days for boys. Results are shown in the Appendix Figures A5 and A6. The estimates maintain similar magnitudes across the different bandwidth choices. Estimates also remain statistically significant except for girls' friendships in high school and learning approaches in all grades. This indicates that the results reported earlier are robust and not sensitive to bandwidth choices.

One may be worried that dates of birth are discrete variables, which may raise questions about the applicability of non-parametric regression discontinuity methods. To address this concern, I replicate the main results using a parametric regression discontinuity design and cluster the standard errors at the date of birth level, following the approach proposed by Lee and Card (2008). The results obtained through global linear polynomials are largely consistent with those from local linear regressions. To further check sensitivity to functional form, I compare estimates using linear and quadratic control functions and different bandwidth choices (30 days and 90 days). Results are shown in the Appendix Figures A7 and A8. Some estimates become noisy when using smaller bandwidth of 30 days. This might be attributed to a small sample size due to narrower bandwidths. Although some estimates lose statistical significance, the magnitudes are consistent in general. Importantly, results for girls' self-esteem remain large and significant across different specifications. This reassures that the effects on girls' self-esteem are robust to change in functional forms.

Next, I redo the same analyses using a donut regression discontinuity approach. Although manipulation testing does not reject the smoothness of the density of births, one might be worried about the randomness of births around the cutoff, especially considering March 1st is a holiday in Korea. To examine the robustness of the results, I exclude 1 day, 4 days, and 7 days before and after March 1st. Appendix Figures A9 and A10 indicate that the coefficients are robust to the donut approach. While the effects on girls' friendship and goal-setting mindsets become larger and statistically significant when excluding 7 days before/after the cutoff, the magnitudes of other outcomes generally remain similar.

Additionally, I investigate whether the results are sensitive to including day-of-week and holiday fixed effects. Results are shown in Appendix Tables A11 to **??**. Columns 1 and 5 show estimates from my main specifications, and columns 4 and 8 show estimates with day-of-week fixed effects. The estimates remain nearly unchanged across these different specifications. The results from the donut approach and the inclusion of day-of-week fixed effects help address concerns regarding potential birth manipulation around the cutoff.

6 Conclusion

In this study, I investigate whether the effects of being old for grade on students' social-emotional skills fade out. Using a binary treatment of old-for-grade and a binary assignment of being born after the cutoff date, my identification strategy of fuzzy regression discontinuity design reduce concerns of monotonicity violation. Furthermore, the unique educational setting in Seoul, including random middle school assignment, rare grade repetition, and a substantial high school advancement rate, allow me to isolate the effect of being old-for-grade from potential confounding factors related to school sorting, repetition, and education duration.

Extending the study period to high school, closer to labor market entry, I find that old-for-grade girls persistently exhibit higher self-esteem than young-for-grade girls in both middle school and high school. There is also suggestive evidence that they maintain better friendships throughout adolescence and display better learning approaches in high school. In contrast, the effects on boys' social-emotional skills are relatively limited. Old-for-grade boys do not exhibit significantly higher social-emotional skills than their young-for-grade counterparts. They do show a slight improvement in friendship during middle school, but this effect dissipates in high school. These findings highlight distinct patterns of social-emotional skill development for girls and boys. Lastly, I compare the estimates using outcomes measured at the same age to the estimates using outcomes measured at the same grade. When absolute age at the survey is controlled, old-for-grade girls still exhibit higher social-emotional skills even though they have one less year of schooling.

However, there are several limitations to this study. First, the study lacks information on the ages of peers in the classroom or school beyond the first year of the survey. This prevents me from disentangling the absolute age and relative age effects. Consequently, the estimates only capture the combined effect of being older at school start and relatively older than their peers. Second, the data used in this study only covers the period until students graduate from high school. Therefore, it is not possible to analyze whether the positive effects of being old-for-grade translate into long-term labor market outcomes.

Nonetheless, this study provides evidence that the effects of age for grade on social-emotional skills do not fade out over time. Furthermore, the findings underscore the importance of considering gender and age differences in skill development. The presence of defined cutoff dates within the school system results in students being categorized as either old-for-grade or young-for-grade around the cutoff date. Given the persistent differences between these two groups, it is crucial to address the potential disadvantages faced by young-for-grade students. This research has practical implications for educators, highlighting the importance of designing effective programs to support the development of social-emotional skills in children and adolescents, taking into account gender and age differences within the same grade.

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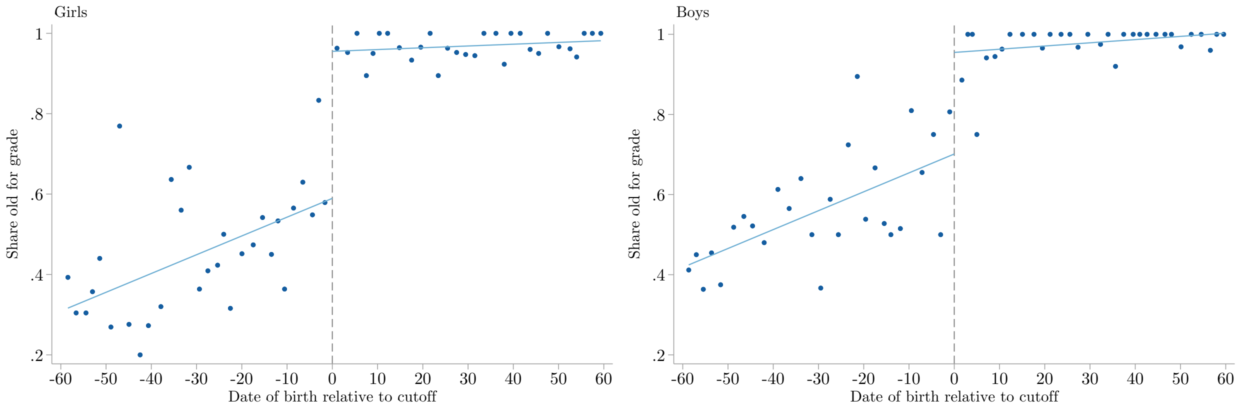
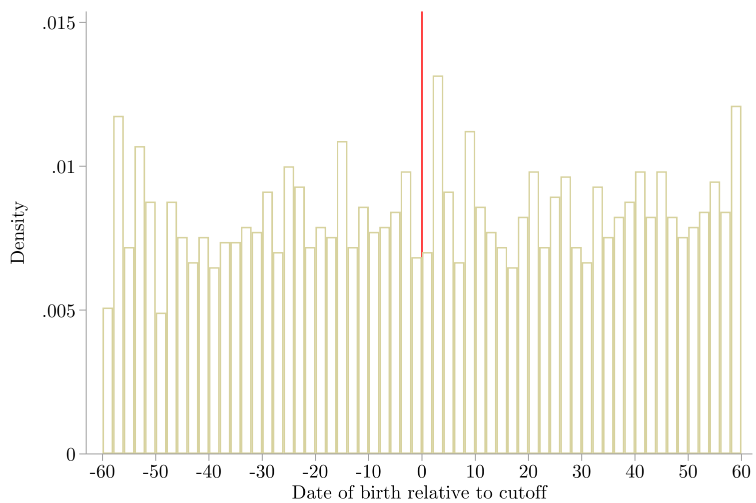
Figures

Figure 1: Share of Old-for-Grade Children among Girls (Left) and Boys (Right)



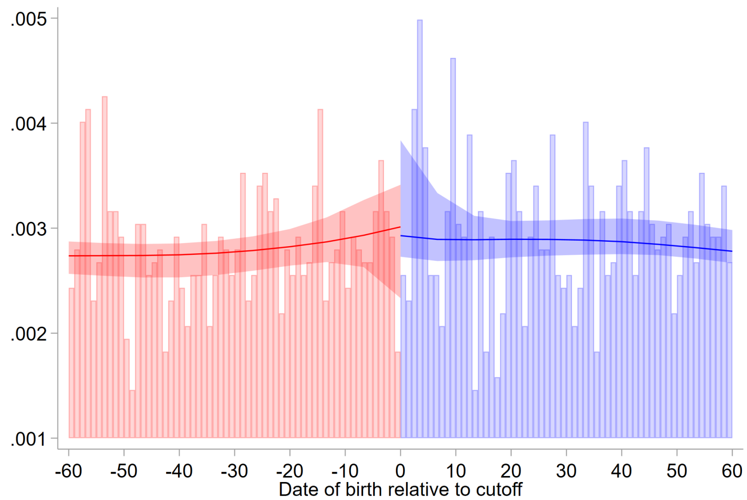
The share of old-for-grade children born between January and April is shown. The sample I use includes fourth grade and seventh grade cohorts in SELS 2010. The bin size is set to two days.

Figure 2: Density of Births Born Around the Cutoff



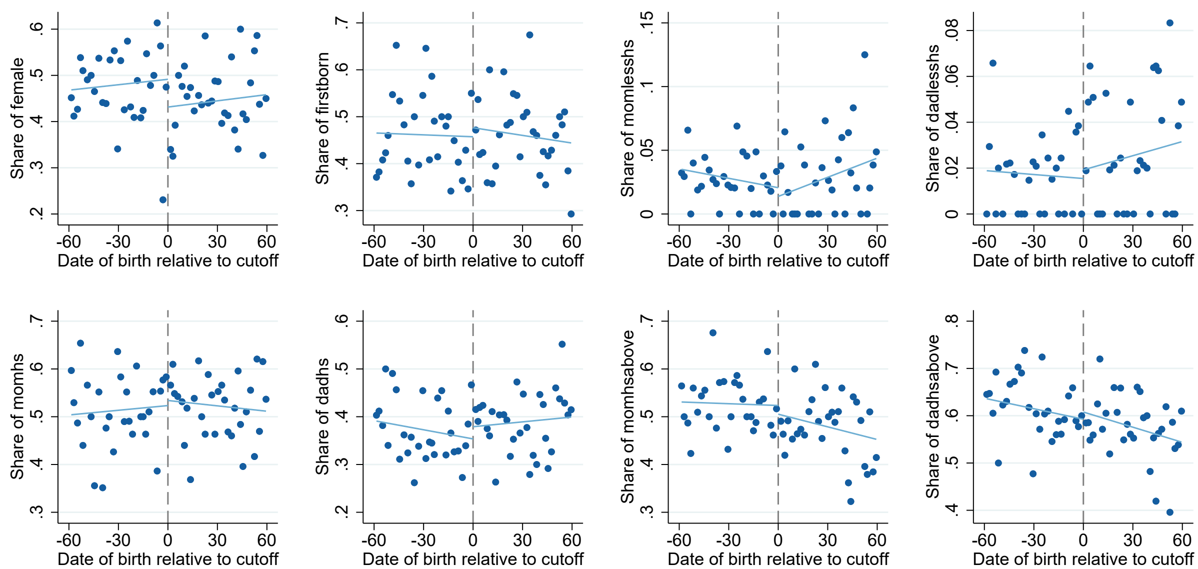
The density of births born between January and April is shown. The sample I use includes fourth grade and seventh grade cohorts in SELS 2010. The bin size is set to two days.

Figure 3: Manipulation Testing



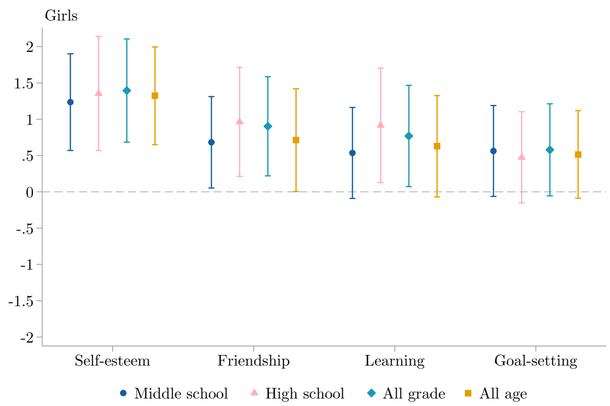
The figure shows manipulation testing around the cutoff following Cattaneo et al. (2020). I use 60-day bandwidths and fourth grade and seventh grade cohorts in SELS 2010.

Figure 4: Comparison of Predetermined Characteristics Before and After the Cutoff

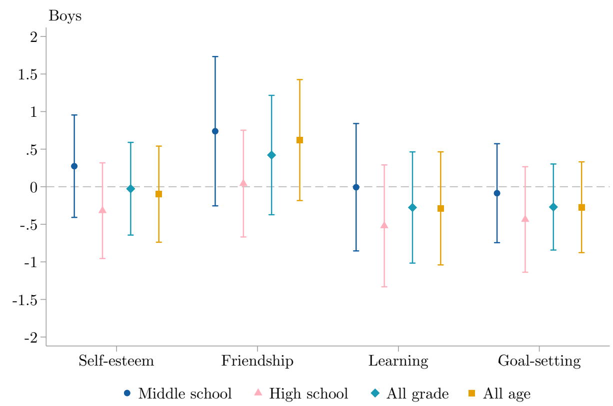


Individual predetermined characteristics include female, firstborn, and parents' educational attainment. Parents' educational attainment is divided into three categories: less than high school, high school graduates, and some college or more. I also include missing indicators for female, firstborn, and parents' educational attainment. I use 60-day bandwidths. The bin size is set to two days.

Figure 5: Effects of the School Starting Age on Girls' and Boys' Social-Emotional Skills



(a) Girls



(b) Boys

All regressions use local linear polynomials, a triangular kernel, and a 60-day bandwidth and include cohort fixed effects. Standard errors are clustered at the date of birth level. Middle school (MS) outcomes are averaged across seventh-ninth grades, high school (HS) outcomes are averaged across tenth-twelfth grades, and all grade outcomes are averaged across seventh-twelfth grades. All age outcomes are averaged across ages 13-17. All outcomes are standardized with a mean of zero and a unit variance.

Tables

Table 1: Average Outcome Indices by Cutoff and Gender: January - April Borns

	Girls		Boys	
	Before cutoff	After cutoff	Before cutoff	After cutoff
Panel A: Self-esteem				
grades 7-9	3.597	3.699	3.728	3.718
	(0.707)	(0.735)	(0.683)	(0.666)
grades 10-12	3.623	3.667	3.807	3.778
	(0.705)	(0.694)	(0.665)	(0.701)
grades 7-12	3.611	3.686	3.749	3.744
	(0.658)	(0.664)	(0.637)	(0.636)
ages 13-17	3.644	3.692	3.760	3.740
	(0.666)	(0.683)	(0.649)	(0.643)
Panel B: Friendship				
grades 7-9	4.221	4.264	4.206	4.265
	(0.497)	(0.497)	(0.557)	(0.532)
grades 10-12	4.185	4.209	4.231	4.212
	(0.508)	(0.528)	(0.525)	(0.536)
grades 7-12	4.201	4.236	4.217	4.236
	(0.463)	(0.479)	(0.500)	(0.499)
ages 13-17	4.211	4.244	4.226	4.251
	(0.476)	(0.479)	(0.505)	(0.499)
Panel C: Learning approaches				
grades 7-9	3.275	3.342	3.333	3.339
	(0.635)	(0.622)	(0.650)	(0.622)
grades 10-12	3.314	3.351	3.336	3.315
	(0.633)	(0.605)	(0.605)	(0.634)
grades 7-12	3.296	3.355	3.329	3.325
	(0.606)	(0.575)	(0.591)	(0.587)
ages 13-17	3.297	3.351	3.322	3.319
	(0.615)	(0.591)	(0.615)	(0.598)
Panel D: Goal-setting				
grades 7-9	3.695	3.744	3.791	3.745
	(0.676)	(0.698)	(0.662)	(0.666)
grades 10-12	3.704	3.748	3.731	3.693
	(0.625)	(0.630)	(0.631)	(0.701)
grades 7-12	3.714	3.753	3.759	3.729
	(0.603)	(0.632)	(0.587)	(0.630)
ages 13-17	3.706	3.743	3.739	3.723
	(0.617)	(0.647)	(0.616)	(0.636)
Observations	648	648	700	809

The table shows average and standard deviation before standardization to mean zero and a unit variance. Standard deviations in parentheses. The sample I use includes fourth grade and seventh grade cohorts born between January and April. For each survey question, student response on 5 point scale:
1 'strongly disagree' 2 'disagree' 3 'neutral' 4 'agree' 5 'strongly agree'

Table 2: First Stage Results

	Entire sample		Girls		Boys	
	(1)	(2)	(3)	(4)	(5)	(6)
Born after cutoff	0.323***	0.315***	0.376***	0.372***	0.278***	0.277***
	(0.026)	(0.026)	(0.034)	(0.033)	(0.048)	(0.048)
Observations	2825	2825	1287	1287	1494	1494
Cohort FE	Yes	Yes	Yes	Yes	Yes	Yes
Individual controls		Yes		Yes		Yes

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard errors in parentheses are clustered at the date of birth level. Each cell reports results from a separate regression with a triangular kernel and 60-day bandwidths. All regressions include cohort fixed effects. The individual-level controls include a female indicator, a firstborn indicator, parents' educational attainment (categorized as less than high school, high school graduates, and some college or more), and indicators for missing values of these controls.

Table 3: Estimation Results using Regression Discontinuity Design: Middle School and High School

	Self-esteem		Friendship		Learning		Goal-setting	
	(1) MS	(2) HS	(3) MS	(4) HS	(5) MS	(6) HS	(7) MS	(8) HS
Panel A: Girls								
Old for grade	1.237***	1.356***	0.683**	0.964**	0.536*	0.916**	0.563*	0.475
	(0.340)	(0.401)	(0.321)	(0.383)	(0.320)	(0.403)	(0.320)	(0.321)
Observations	1216	1082	1216	1082	1214	1082	1217	1082
Panel B: Boys								
Old for grade	0.275	-0.320	0.743	0.042	-0.007	-0.523	-0.087	-0.438
	(0.349)	(0.326)	(0.510)	(0.364)	(0.435)	(0.415)	(0.338)	(0.360)
Observations	1416	1206	1417	1206	1417	1206	1417	1206
Panel C: Entire Sample								
Old for grade	0.823***	0.590*	0.667**	0.485*	0.239	0.164	0.251	-0.027
	(0.271)	(0.317)	(0.318)	(0.280)	(0.279)	(0.304)	(0.179)	(0.262)
Observations	2675	2324	2676	2324	2674	2324	2677	2324
Cohort FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard errors in parentheses are clustered at the date of birth level. Each cell reports results from a separate regression with local linear polynomials, a triangular kernel, and a 60-day bandwidth. Middle school (MS) outcomes are averaged across 7th-9th grades, high school (HS) outcomes are averaged across 10th-12th grades. All outcomes are standardized with mean zero and unit variance. All regressions include cohort fixed effects.

Table 4: Estimation Results using Local Linear Regression Discontinuity Design: All Grade vs All Age

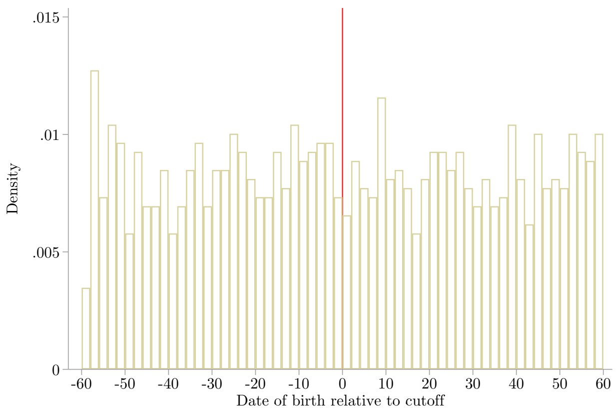
	Self-esteem		Friendship		Learning		Goal-setting	
	(1) Grade	(2) Age	(3) Grade	(4) Age	(5) Grade	(6) Age	(7) Grade	(8) Age
Panel A: Girls								
Old for grade	1.396***	1.324***	0.904***	0.712**	0.770**	0.628*	0.579*	0.515*
	(0.363)	(0.344)	(0.349)	(0.361)	(0.356)	(0.357)	(0.324)	(0.308)
Observations	1286	1274	1286	1274	1284	1273	1287	1274
Panel B: Boys								
Old for grade	-0.027	-0.099	0.423	0.624	-0.277	-0.289	-0.271	-0.274
	(0.316)	(0.328)	(0.407)	(0.413)	(0.379)	(0.385)	(0.293)	(0.310)
Observations	1493	1483	1494	1484	1494	1484	1494	1484
Panel C: Entire Sample								
Old for grade	0.762***	0.685**	0.635**	0.635**	0.217	0.131	0.130	0.0998
	(0.283)	(0.276)	(0.297)	(0.298)	(0.274)	(0.276)	(0.192)	(0.187)
Observations	2823	2801	2824	2802	2822	2801	2825	2802
Cohort FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard errors in parentheses are clustered at the date of birth level. Each cell reports results from a separate regression with local linear polynomials, a triangular kernel, and a 60-day bandwidth. All grade outcomes are averaged across 7th-12th grades, and all age outcomes are averaged across age 13-17. All outcomes are standardized with mean zero and unit variance. All regressions include cohort fixed effects.

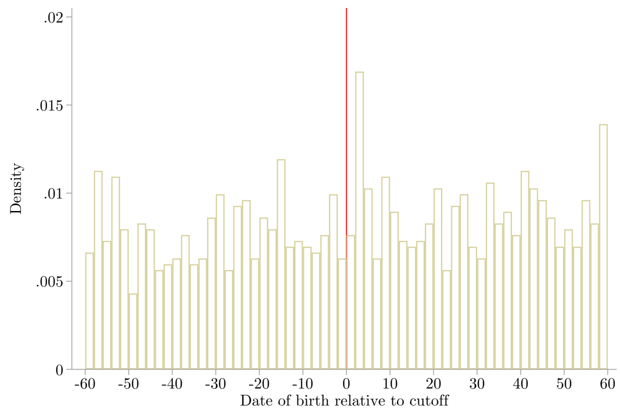
Appendix

A Appendix Figures

Figure A1: Density of Births Born Around the Cutoff by Gender



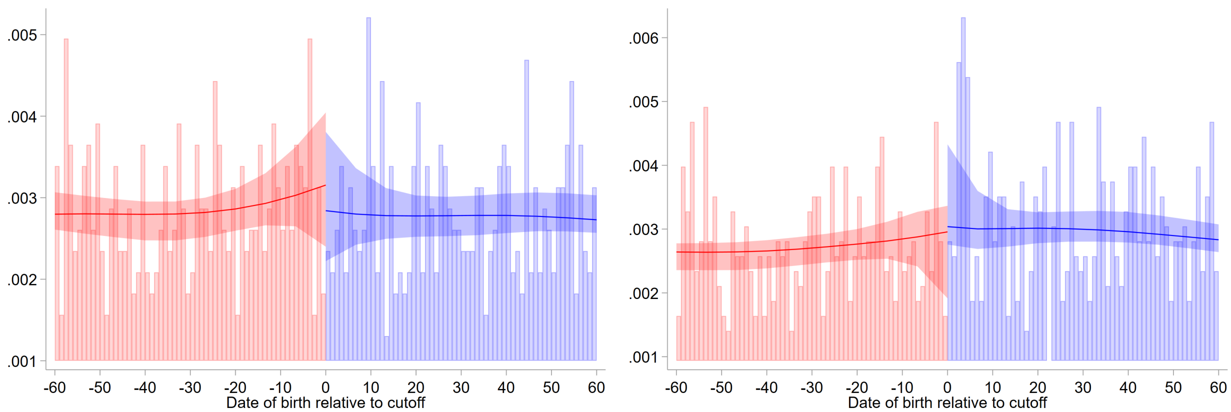
(a) Girls



(b) Boys

The figure shows the density of births born between January and April by gender. The sample I use includes girls and boys in fourth grade and seventh grade cohorts in SELS 2010. The bin size is set to two days.

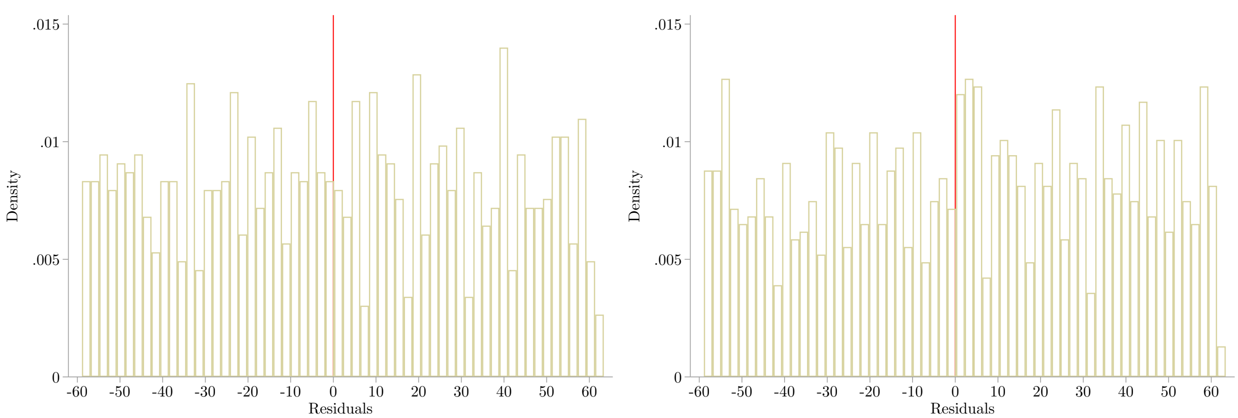
Figure A2: Manipulation Testing by Gender



(a) Girls (b) Boys

The figure shows the density of births born between January and April by gender. The sample I use includes girls and boys in fourth grade and seventh grade cohorts in SELS 2010. The bin size is set to two days.

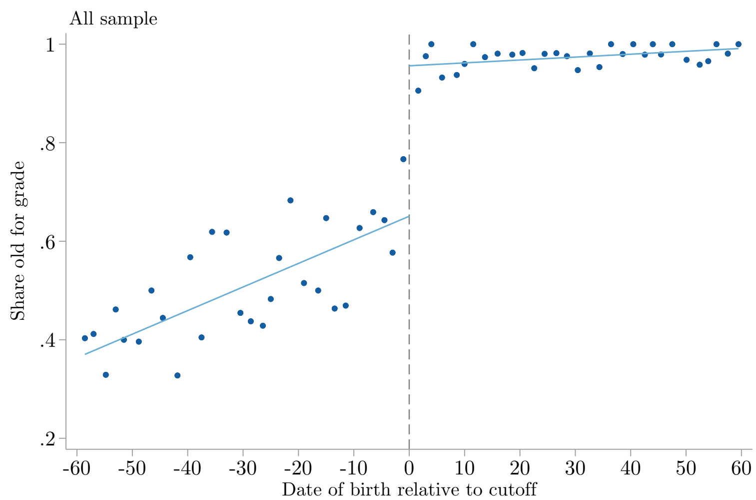
Figure A3: Density of Birth Born Around the Cutoff using Day-of-Week Fixed Effects



(a) Girls (b) Boys

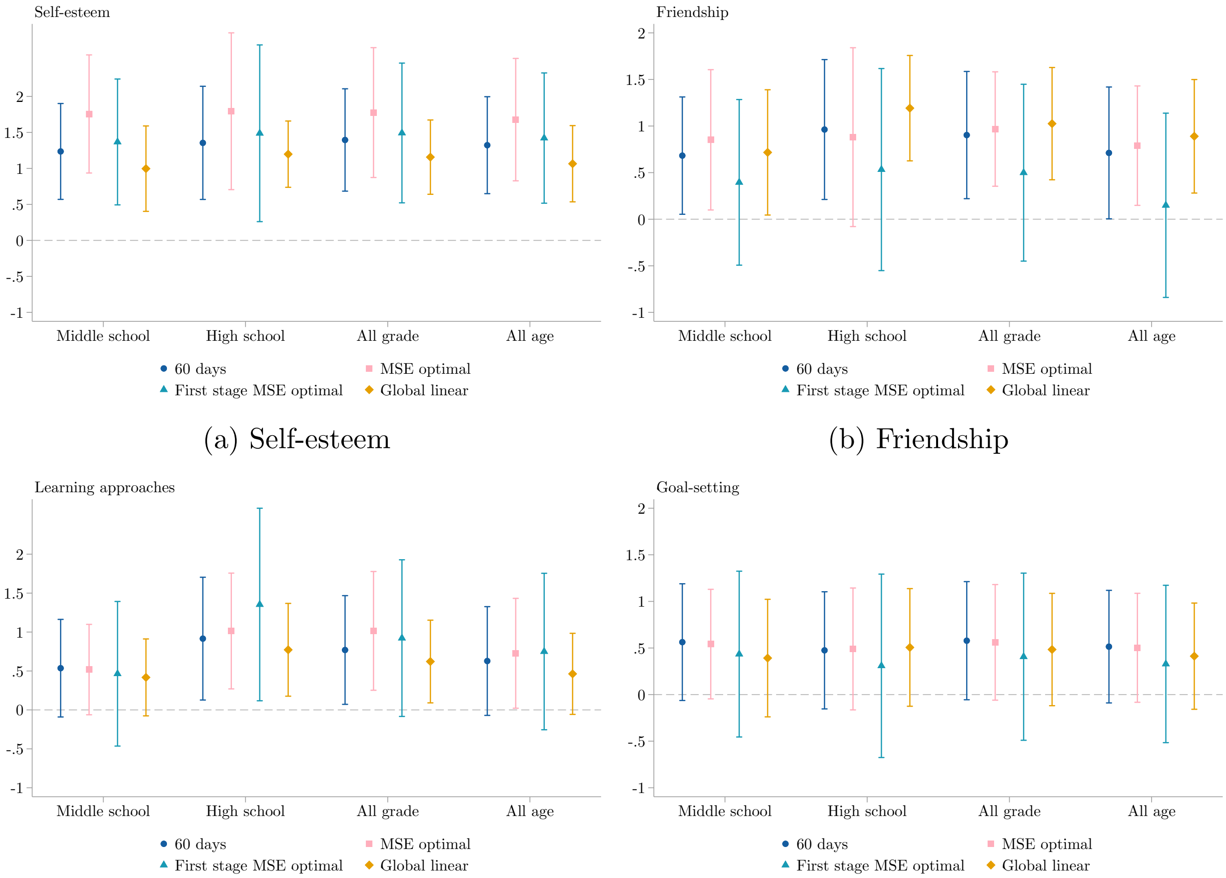
The figure shows the density of births born between January and April, using residuals from regressions incorporating day-of-week fixed effects and holidays Panel A shows the birth patterns of girls and Panel B shows the birth patterns of boys. The sample I use includes fourth grade and seventh grade cohorts in SELS 2010. The bin size is set to 2 days.

Figure A4: Share of Old for Grade Students



The share of old-for-grade children born between January and April is shown. The sample I use includes fourth grade and seventh grade cohorts in SELS 2010. The bin size is set to two days.

Figure A5: Sensitivity Check to Bandwidths (Girls)

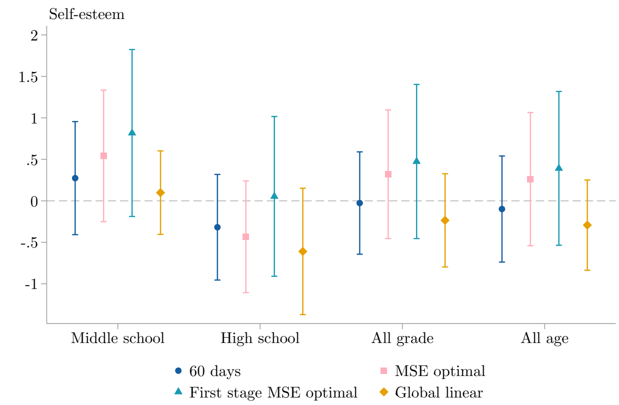


(a) Self-esteem (b) Friendship

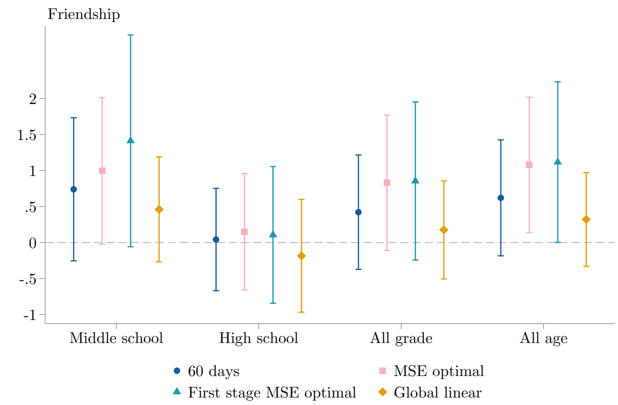
(c) Learning approach (d) Goal-setting

The estimates and corresponding 95 percent confidence intervals (CI) are shown. Circles represent estimates from the main regression using a 60-day bandwidth. Squares represent bias-corrected estimates and robust confidence intervals from the regression with mean squared error (MSE) optimal bandwidths following Calonico et al. (2014). Triangles represent bias-corrected estimates and robust confidence intervals from the regression with first-stage MSE optimal bandwidths. Lastly, diamonds represent estimates using global linear polynomials with a 60-day bandwidth. All estimates use a triangular kernel and include cohort fixed effects. Standard errors are clustered at the date of birth level. All outcomes are standardized with mean zero and unit variance.

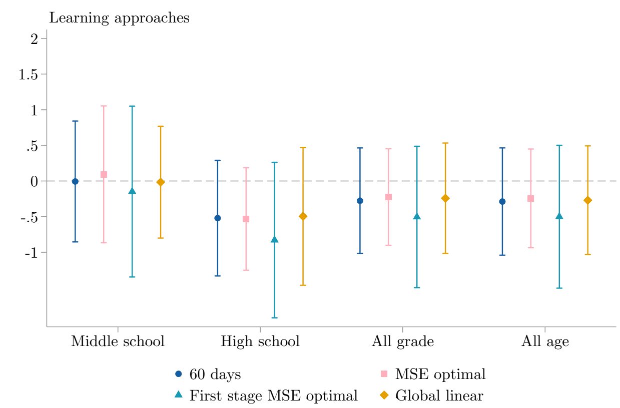
Figure A6: Sensitivity Check to Bandwidths (Boys)



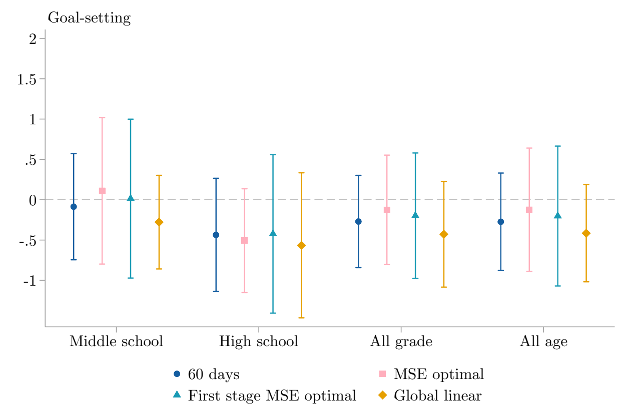
(a) Self-esteem



(b) Friendship



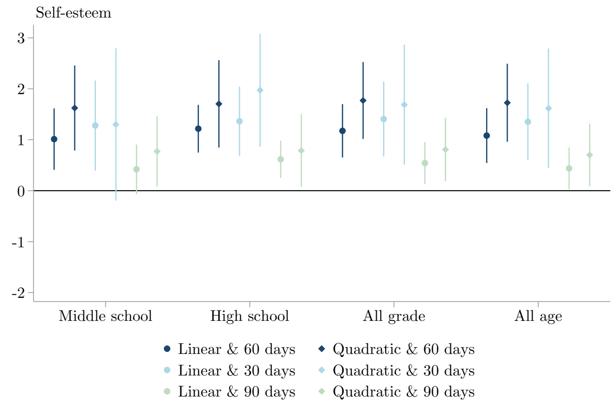
(c) Learning apprаches



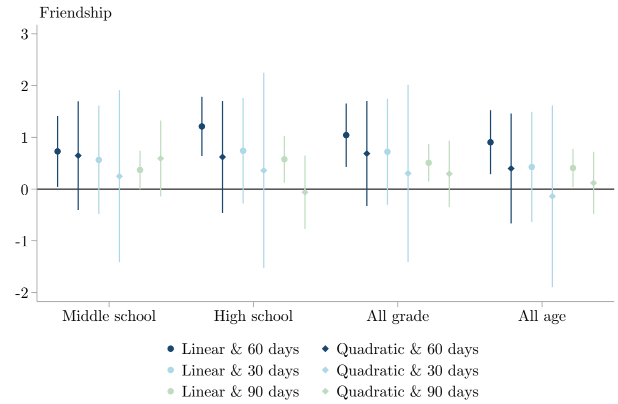
(d) Goal setting

The estimates and corresponding 95 percent confidence intervals (CI) are shown. Circles represent estimates from the main regression using a 60-day bandwidth. Squares represent bias-corrected estimates and robust confidence intervals from the regression with mean squared error (MSE) optimal bandwidths following Calonico et al. (2014). Triangles represent bias-corrected estimates and robust confidence intervals from the regression with first-stage MSE optimal bandwidths. Lastly, diamonds represent estimates using global linear polynomials with a 60-day bandwidth. All estimates use a triangular kernel and include cohort fixed effects. Standard errors are clustered at the date of birth level. All outcomes are standardized with mean zero and unit variance.

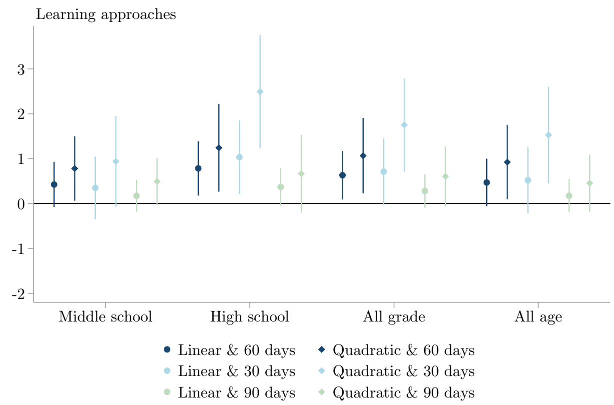
Figure A7: Sensitivity to Polynomials and Bandwidths (Girls)



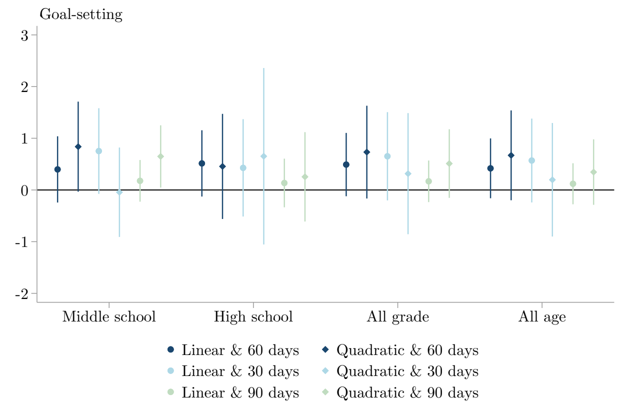
(a) Self-esteem



(b) friendship



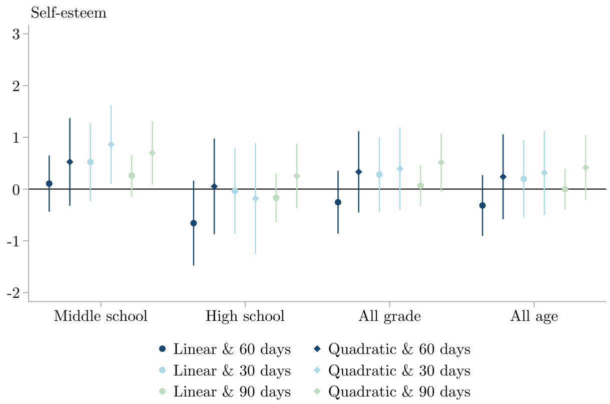
(c) Learning



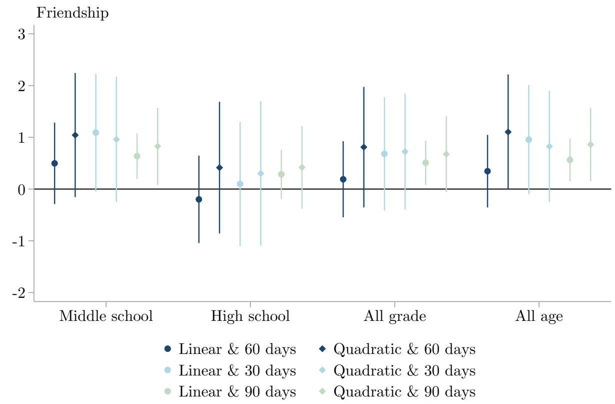
(d) Goal-setting

The estimates and corresponding 95 percent confidence intervals (CI) are shown. Circles represent the estimates using global linear polynomials. Diamonds represent the estimates using global quadratic polynomials. All estimates include cohort fixed effects. Standard errors are clustered at the date of birth level. All outcomes are standardized with mean zero and unit variance.

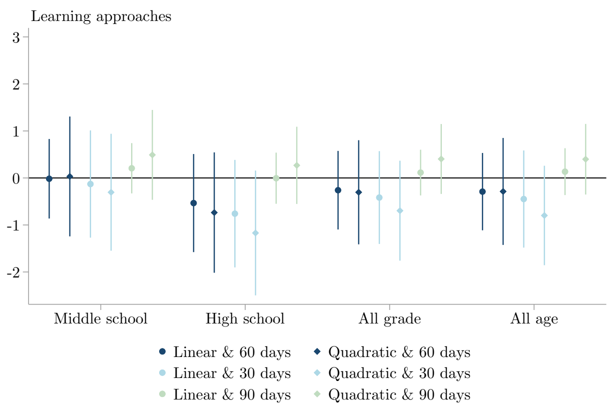
Figure A8: Sensitivity to Polynomials and Bandwidths (Boys)



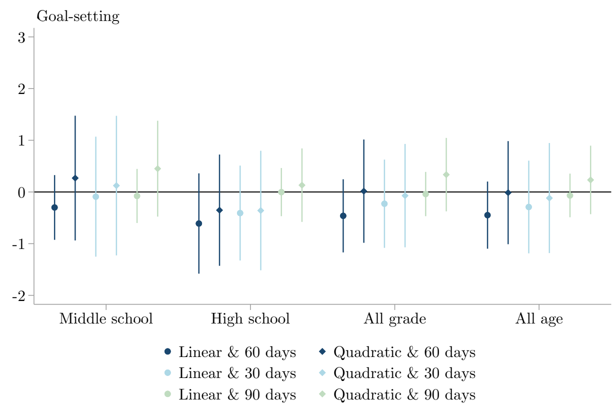
(a) Self-esteem



(b) friendship



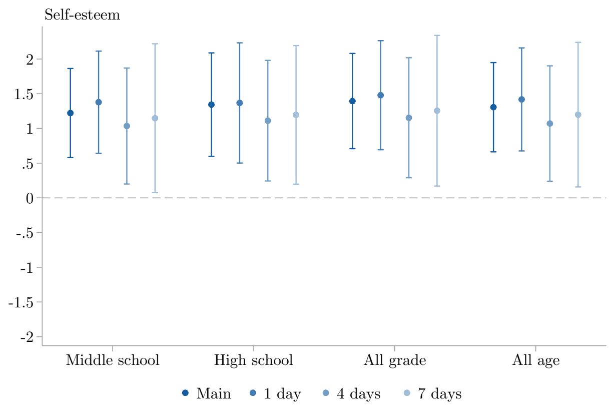
(c) Learning



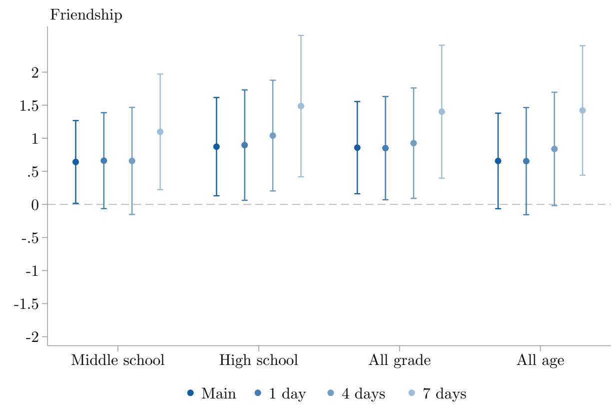
(d) Goal-setting

The estimates and corresponding 95 percent confidence intervals (CI) are shown. Circles represent the estimates using global linear polynomials. Diamonds represent the estimates using global quadratic polynomials. All estimates include cohort fixed effects. Standard errors are clustered at the date of birth level. All outcomes are standardized with mean zero and unit variance.

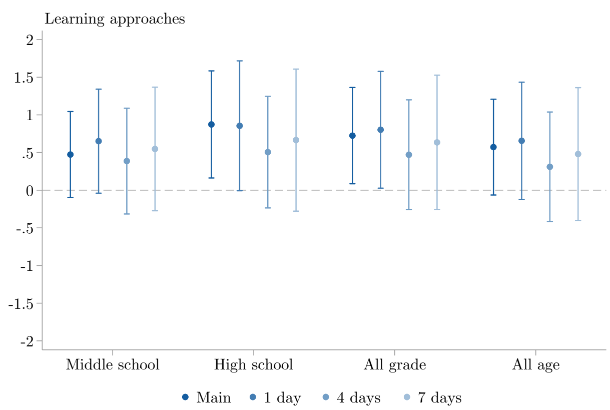
Figure A9: Estimation Results from Donut Regression Discontinuity Approaches (Girls)



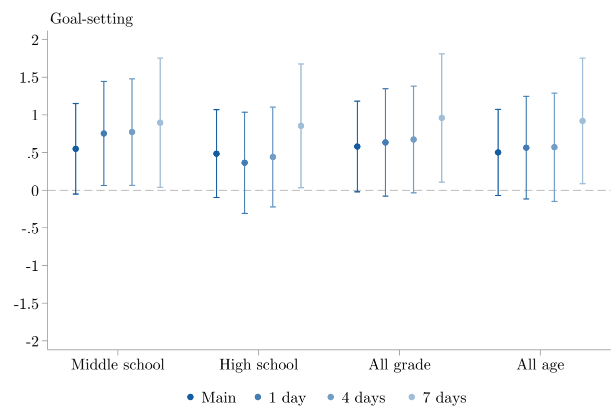
(a) Self-esteem



(b) Friendship



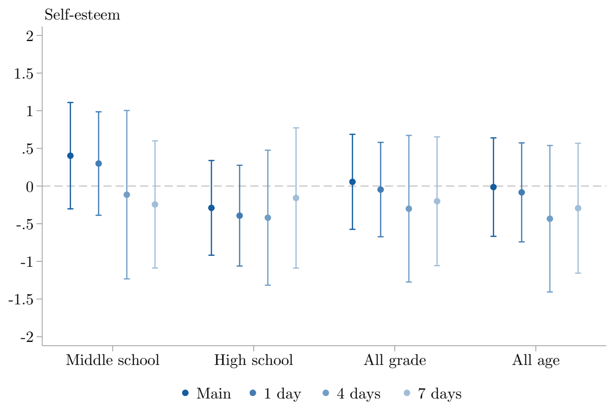
(c) Learning approach



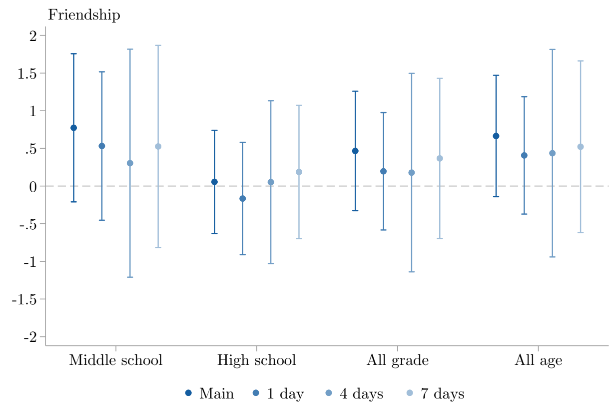
(d) Goal setting

The estimates and corresponding 95 percent confidence intervals (CI) are shown. All regressions use local linear polynomials, a triangular kernel, and a 60-day bandwidth and include cohort fixed effects. Standard errors are clustered at the date of birth level. All outcomes are standardized with mean zero and unit variance.

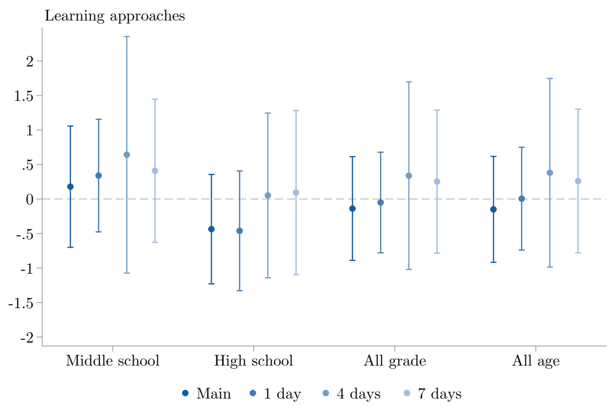
Figure A10: Estimation Results from Donut Regression Discontinuity Approaches (Boys)



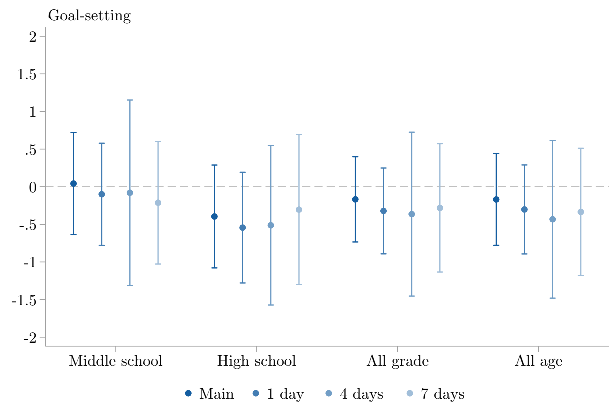
(a) Self-esteem



(b) Friendship



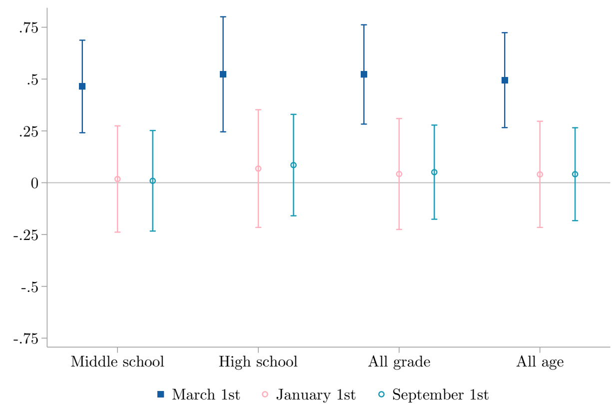
(c) Learning approach



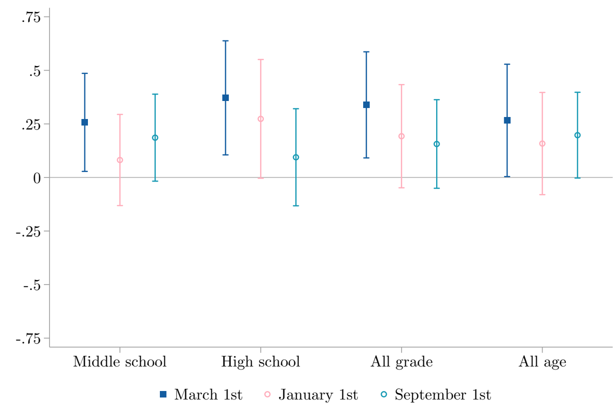
(d) Goal setting

The estimates and corresponding 95 percent confidence intervals (CI) are shown. All regressions use local linear polynomials, a triangular kernel, and a 60-day bandwidth and include cohort fixed effects. Standard errors are clustered at the date of birth level. All outcomes are standardized with mean zero and unit variance.

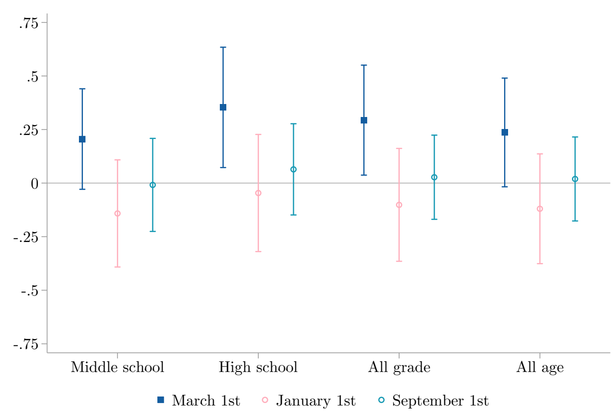
Figure A11: Comparison with Placebo Cutoffs (Girls)



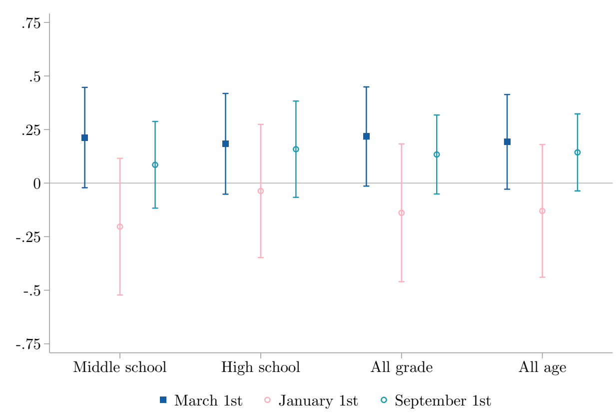
(a) Self-esteem



(b) Friendship



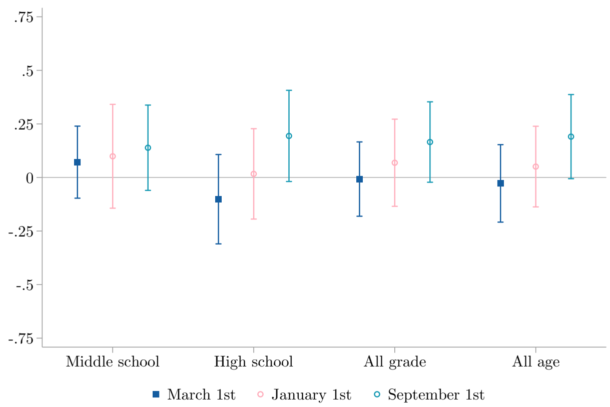
(c) Learning approach



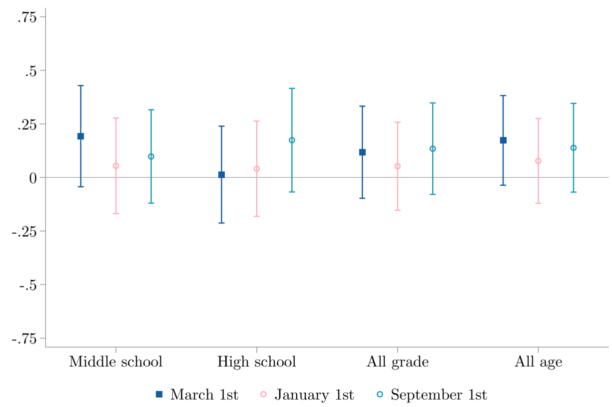
(d) Goal-setting

The reduced-form estimates and corresponding 95 percent confidence intervals (CI) are shown. Squares represent estimates from the main specification. Hollow circles represent estimates using January 1st and September 1st as a placebo cutoff. All regressions use local linear polynomials, a triangular kernel, and a 60-day bandwidth and include cohort fixed effects. Standard errors are clustered at the date of birth level. All outcomes are standardized with mean zero and unit variance.

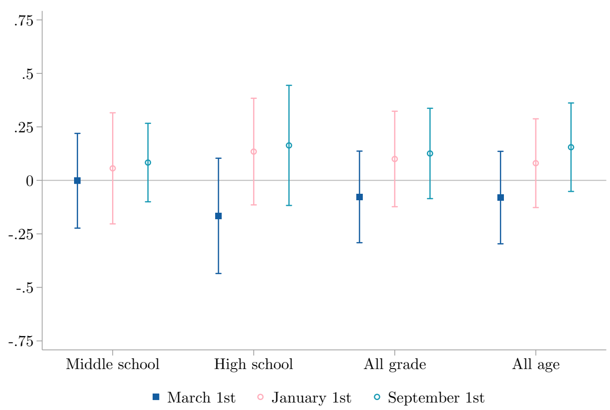
Figure A12: Comparison with Placebo Cutoffs (Boys)



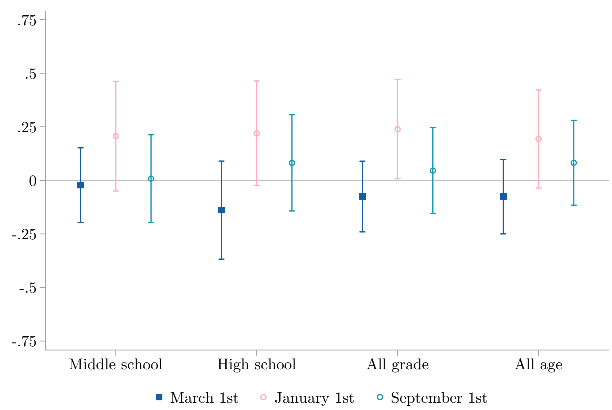
(a) Self-esteem



(b) Friendship



(c) Learning appraches



(d) Goal setting

The reduced-form estimates and corresponding 95 percent confidence intervals (CI) are shown. Squares represent estimates from the main specification. Hollow circles represent estimates using January 1st and September 1st as a placebo cutoff. All regressions use local linear polynomials, a triangular kernel, and a 60-day bandwidth and include cohort fixed effects. Standard errors are clustered at the date of birth level. All outcomes are standardized with mean zero and unit variance.

B Appendix Tables

Table A1: Root Mean Squared Error for Each Outcome: in Middle School and High School

	Self-esteem		Friendship		Learning		Goal-setting	
	(1) MS	(2) HS	(3) MS	(4) HS	(5) MS	(6) HS	(7) MS	(8) HS
Panel A: Girls								
Linear	0.155	0.183	0.146	0.288	0.115	0.331	0.127	0.128
Quadratic	0.379	0.467	0.250	0.317	0.359	1.196	0.490	0.430
Cubic	1.095	1.229	1.170	0.934	1.734	2.299	1.017	1.228
Panel B: Boys								
Linear	0.425	0.277	0.583	0.168	0.215	0.217	0.229	0.168
Quadratic	0.503	0.405	0.510	0.321	0.783	0.961	0.443	0.441
Cubic	0.803	0.929	0.854	1.201	1.094	1.223	0.704	1.225

Each cell reports a result from a separate regression with a triangular kernel and 60-day bandwidth. Middle school (MS) outcomes are averaged across 7th-9th grades, high school (HS) outcomes are averaged across 10th-12th grades. All outcomes are standardized with mean zero and unit variance.

Table A2: Root Mean Squared Error for Each Outcome: All Grades and All Ages

	Self-esteem		Friendship		Learning		Goal-setting	
	(1) Grade	(2) Age	(3) Grade	(4) Age	(5) Grade	(6) Age	(7) Grade	(8) Age
Panel A: Girls								
Linear	0.159	0.158	0.236	0.359	0.158	0.147	0.129	0.127
Quadratic	0.371	0.350	0.249	0.262	0.636	0.547	0.317	0.312
Cubic	1.085	0.993	0.981	0.870	1.989	1.886	0.871	0.784
Panel B: Boys								
Linear	0.353	0.354	0.349	0.411	0.188	0.191	0.171	0.171
Quadratic	0.370	0.356	0.394	0.406	0.880	1.011	0.406	0.378
Cubic	0.827	0.796	0.852	0.848	1.198	1.355	0.895	0.841

Each cell reports a result from a separate regression with a triangular kernel and 60-day bandwidth. All grade outcomes are averaged across 7th-12th grades. All age outcomes are averaged across age 13-17. All outcomes are standardized with mean zero and unit variance.

Table A3: First Stage Results using MSE Optimal Bandwidths

	All sample			Girls			Boys		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Born after cutoff	0.295***	0.283***	0.294***	0.359***	0.359***	0.357***	0.271***	0.270***	0.271***
	(0.033)	(0.034)	(0.033)	(0.043)	(0.041)	(0.044)	(0.073)	(0.072)	(0.072)
Bandwidth	31	32	31	38	38	37	40	40	40
Observations	1,505	1,548	1,505	834	834	813	1,014	1,014	1,014
Cohort FE	Yes	Yes		Yes	Yes		Yes	Yes	
Individual controls		Yes			Yes			Yes	

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. This table presents bias-corrected estimates and robust standard errors using the mean squared error optimal bandwidths. Standard errors in parentheses are clustered at the date of birth level. Each cell reports results from a separate regression with a triangular kernel and linear polynomials. The individual-level controls include a female indicator, a firstborn indicator, parents' educational attainment (categorized as less than high school, high school graduates, and some college or more), and indicators for missing values of these controls.

Table A4: Estimation Results using MSE Optimal Bandwidths: Middle School and High school

	Self-esteem		Friendship		Learning		Goal-setting	
	(1) MS	(2) HS	(3) MS	(4) HS	(5) MS	(6) HS	(7) MS	(8) HS
Panel A: Girls								
Old for grade	1.296***	1.390***	0.657**	0.826**	0.429*	0.738**	0.444*	0.441
	(0.361)	(0.456)	(0.334)	(0.407)	(0.256)	(0.331)	(0.263)	(0.292)
Bandwidth	51	48	54	49	73	70	72	66
Observations	1035	870	1113	886	1487	1273	1478	1203
Panel B: Boys								
Old for grade	0.320	-0.402	0.672	0.036	-0.002	-0.439	-0.015	-0.452
	(0.359)	(0.296)	(0.467)	(0.362)	(0.424)	(0.326)	(0.396)	(0.295)
Bandwidth	56	69	66	60	62	78	42	77
Observations	1322	1396	1549	1224	1471	1546	1000	1538
Panel C: Entire Sample								
Old for grade	0.968***	0.645*	0.707**	0.388*	0.244	0.122	0.231	-0.046
	(0.318)	(0.366)	(0.336)	(0.230)	(0.281)	(0.238)	(0.192)	(0.215)
Bandwidth	42	46	55	72	61	74	42	73
Observations	1891	1800	2475	2789	2752	2862	1893	2829
Cohort FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard errors in parentheses are clustered at date of birth level. Each cell reports results from a separate regression with a triangular kernel. All regressions include cohort fixed effects. Middle school (MS) outcomes are calculated as the average across 7th to 9th grades, while high school (HS) outcomes are calculated as the average across 10th to 12th grades. All outcomes are standardized with a mean of zero and a unit variance.

Table A5: Estimation Results using MSE Optimal Bandwidths: All Grade vs All Age

	Self-esteem		Friendship		Learning		Goal-setting	
	(1) Grade	(2) Age	(3) Grade	(4) Age	(5) Grade	(6) Age	(7) Grade	(8) Age
Panel A: Girls								
Old for grade	1.435***	1.368***	0.747***	0.624**	0.754**	0.591*	0.485*	0.425
	(0.395)	(0.373)	(0.272)	(0.281)	(0.348)	(0.340)	(0.278)	(0.262)
Bandwidth	47	47	75	75	62	63	70	70
Observations	1016	1007	1628	1616	1353	1354	1521	1508
Panel B: Boys								
Old for grade	0.113	0.077	0.530	0.729*	-0.229	-0.245	-0.207	-0.211
	(0.339)	(0.358)	(0.427)	(0.429)	(0.309)	(0.317)	(0.307)	(0.340)
Bandwidth	50	47	52	53	75	75	46	44
Observations	1246	1178	1296	1306	1825	1814	1161	1102
Panel C: All Sample								
Old for grade	0.880***	0.799**	0.574**	0.579**	0.198	0.128	0.138	0.102
	(0.338)	(0.323)	(0.264)	(0.266)	(0.232)	(0.250)	(0.200)	(0.198)
Bandwidth	41	41	68	68	71	68	51	49
Observations	1965	1952	3210	3188	3324	3187	2407	2304
Cohort FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard errors in parentheses are clustered at date of birth level. Each cell reports results from a separate regression with a triangular kernel. All regressions include cohort fixed effects. All grade outcomes represent the average across 7th to 12th grades. All age outcomes are averaged across the ages of 13 to 17. All outcomes are standardized with a mean of zero and a unit variance.

Table A6: Difference in Height and Weight

	Fourth grade cohort		Seventh grade cohort	
	(1) Height(cm)	(2) Weight(kg)	(3) Height(cm)	(4) Weight(kg)
Panel A: Girls				
Old for grade	5.878	-5.418	1.235	3.220
	(4.507)	(7.120)	(1.625)	(2.715)
Baseline mean	137.318	33.866	156.441	46.101
Observations	575	575	622	578
Panel B: Boys				
Old for grade	3.445	3.252	-1.059	1.634
	(3.356)	(4.151)	(5.681)	(11.608)
Baseline mean	137.196	35.455	156.936	49.096
Observations	605	605	778	758

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard errors in parentheses are clustered at the date of birth level. Each cell reports results from a separate regression with local linear polynomials, a triangular kernel, and a 60-day bandwidth. 2.54cm = 1in & 1kg = 2.205lb

Table A7: Fix Grade vs Fix Age: Self-esteem

	(1) 7th	(2) age 13	(3) 8th	(4) age 14	(5) 9th	(6) age 15	(7) 10th	(8) age 16	(9) 11th	(10) age 17	(11) 12th
Panel A: Girls											
Old-for-grade	1.074***	0.957***	0.965***	0.844**	0.955***	1.006***	1.259***	1.399***	1.386***	1.273***	0.977**
	(0.300)	(0.301)	(0.320)	(0.344)	(0.360)	(0.356)	(0.395)	(0.405)	(0.387)	(0.418)	(0.411)
Observations	1206	1190	1157	1152	1128	1116	1072	1055	1031	1022	1010
Panel B: Boys											
Old-for-grade	0.239	-0.0925	0.044	0.166	0.373	-0.155	-0.145	0.057	-0.468	-0.398	-0.207
	(0.426)	(0.456)	(0.323)	(0.277)	(0.408)	(0.358)	(0.339)	(0.394)	(0.408)	(0.388)	(0.344)
Observations	1392	1381	1328	1325	1296	1276	1192	1180	1150	1143	1106
Cohort FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard errors in parentheses are clustered at the date of birth level. Each cell reports results from a separate regression with local linear polynomials, a triangular kernel, and a 60-day bandwidth. All outcomes are standardized with mean zero and unit variance. All regressions include cohort fixed effects.

Table A8: Fix Grade vs Fix Age: Friendship

	(1) 7th	(2) age 13	(3) 8th	(4) age 14	(5) 9th	(6) age 15	(7) 10th	(8) age 16	(9) 11th	(10) age 17	(11) 12th
Panel A: Girls											
Old-for-grade	0.580	0.503	0.452*	0.396	0.622**	0.584*	0.691*	0.679	0.487	0.693*	1.318***
	(0.357)	(0.357)	(0.256)	(0.281)	(0.312)	(0.329)	(0.399)	(0.414)	(0.456)	(0.394)	(0.344)
Observations	1211	1195	1160	1153	1125	1114	1070	1052	1030	1024	1014
Panel B: Boys											
Old-for-grade	0.199	0.845*	0.866*	1.067**	0.688	0.239	0.0245	-0.251	0.284	0.498	-0.169
	(0.432)	(0.459)	(0.502)	(0.496)	(0.533)	(0.411)	(0.406)	(0.369)	(0.468)	(0.411)	(0.402)
Observations	1405	1390	1335	1330	1299	1278	1185	1177	1150	1143	1108
Cohort FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard errors in parentheses are clustered at the date of birth level. Each cell reports results from a separate regression with local linear polynomials, a triangular kernel, and a 60-day bandwidth. All outcomes are standardized with mean zero and unit variance. All regressions include cohort fixed effects.

Table A9: Fix Grade vs Fix Age: Learning Approaches

	(1) 7th	(2) age 13	(3) 8th	(4) age 14	(5) 9th	(6) age 15	(7) 10th	(8) age 16	(9) 11th	(10) age 17	(11) 12th
Panel A: Girls											
Old-for-grade	0.553**	0.544*	0.481	0.290	0.339	0.323	0.765**	0.828**	0.837**	0.719*	0.905**
	(0.270)	(0.328)	(0.326)	(0.325)	(0.348)	(0.313)	(0.344)	(0.402)	(0.426)	(0.436)	(0.458)
Observations	1199	1183	1157	1154	1129	1112	1065	1051	1032	1022	1009
Panel B: Boys											
Old-for-grade	0.317	0.301	-0.022	0.100	-0.349	-0.699**	-0.456	-0.253	-0.825**	-0.678	-0.094
	(0.467)	(0.466)	(0.454)	(0.453)	(0.384)	(0.336)	(0.426)	(0.454)	(0.420)	(0.481)	(0.457)
Observations	1387	1375	1325	1322	1291	1270	1186	1177	1147	1140	1106
Cohort FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard errors in parentheses are clustered at the date of birth level. Each cell reports results from a separate regression with local linear polynomials, a triangular kernel, and a 60-day bandwidth. All outcomes are standardized with mean zero and unit variance. All regressions include cohort fixed effects.

Table A10: Fix Grade vs Fix Age: Goal-setting Mindsets

	(1) 7th	(2) age 13	(3) 8th	(4) age 14	(5) 9th	(6) age 15	(7) 10th	(8) age 16	(9) 11th	(10) age 17	(11) 12th
Panel A: Girls											
Old-for-grade	0.399	0.449	0.507*	0.297	0.474	0.454	0.591**	0.587*	0.216	0.228	0.405
	(0.297)	(0.318)	(0.276)	(0.284)	(0.370)	(0.355)	(0.265)	(0.301)	(0.365)	(0.375)	(0.394)
Observations	1199	1181	1154	1152	1128	1115	1070	1053	1033	1024	1010
Panel B: Boys											
Old-for-grade	0.005	-0.288	-0.370	0.093	0.137	-0.454	-0.606	-0.325	-0.323	-0.113	-0.129
	(0.385)	(0.343)	(0.301)	(0.294)	(0.365)	(0.357)	(0.386)	(0.422)	(0.378)	(0.379)	(0.343)
Observations	1397	1385	1327	1323	1298	1274	1190	1182	1150	1143	1108
Cohort FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard errors in parentheses are clustered at the date of birth level. Each cell reports results from a separate regression with local linear polynomials, a triangular kernel, and a 60-day bandwidth. All outcomes are standardized with mean zero and unit variance. All regressions include cohort fixed effects.

Table A11: Sensitivity Check: Self-esteem in Middle School and High School

	Middle school				High school			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: Girls								
Old for grade	1.236***	1.180***	1.229***	1.276***	1.355***	1.306***	1.311***	1.411***
	(0.340)	(0.327)	(0.334)	(0.338)	(0.401)	(0.382)	(0.386)	(0.386)
Observations	1216	1216	1216	1216	1082	1082	1082	1082
Panel B: Boys								
Old for grade	0.273	0.401	0.271	0.235	-0.319	-0.250	-0.315	-0.296
	(0.348)	(0.355)	(0.344)	(0.314)	(0.325)	(0.328)	(0.321)	(0.309)
Observations	1416	1416	1416	1416	1206	1206	1206	1206
Cohort FE	Yes	Yes		Yes	Yes	Yes		Yes
Individual controls		Yes				Yes		
Day-of-week FE				Yes				Yes

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard errors in parentheses are clustered at the date of birth level. Each cell reports results from a separate regression with local linear polynomials, a triangular kernel, and a 60-day bandwidth. Middle school outcomes are averaged across 7th-9th grades, and high school outcomes are averaged across 10th-12th grades. All outcomes are standardized with mean zero and unit variance.

Table A12: Robust to Inclusion of School Fixed Effects: Self-esteem

	Middle school			High school			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A: Girls							
Old for grade	1.237***	1.237***	1.105***	1.356***	1.357***	0.971***	1.300***
	(0.340)	(0.336)	(0.219)	(0.401)	(0.388)	(0.223)	(0.263)
Observations	1,216	1,216	1,216	1,082	1,012	1,012	1,077
Panel B: Boys							
Old for grade	0.275	0.275	0.474	-0.320	-0.175	-0.109	-0.531*
	(0.349)	(0.422)	(0.340)	(0.326)	(0.434)	(0.319)	(0.295)
Observations	1,416	1,416	1,416	1,206	1,129	1,129	1,204
Cohort FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Middle school FE			Yes			Yes	
High school FE							Yes
Cluster	DOB	MS	MS	DOB	MS	MS	HS

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard errors in parentheses are clustered at the date of birth level (DOB), middle school level (MS), and high school level (HS). Each cell reports results from a separate regression with local linear polynomials, a triangular kernel, and a 60-day bandwidth. Middle school outcomes are averaged across 7th-9th grades, and high school outcomes are averaged across 10th-12th grades. All outcomes are standardized with mean zero and unit variance. All regressions include cohort fixed effects.

Table A13: Reliability Measures: Cronbach's α

	Middle school	High school	
		Academic	Vocational
Self-esteem	0.941	0.911	0.907
Friendship	0.782	0.785	0.787
Learning method	0.835	0.760	0.723
Learning effort	0.823	0.767	0.721
Learning attitude	0.776	0.717	0.655
Goal-setting	0.902	0.861	0.858

Cronbach's α is measured in the fourth survey wave.