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The effects of single-sex versus coeducational schools on adolescent peer victimization and perpetration

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Abstract

Bullying is a growing public health concern for South Korean adolescents. In our quantitative investigation, we analyze the frequency with which Korean adolescents in single-sex versus coeducational schools are targets of or engage in three peer aggressive behaviors (verbal, relational (social exclusion), and physical (including theft)). We use two nationally representative datasets, the 2011 Trends in International Mathematics and Science Study (TIMSS) and the 2005 Korea Education Longitudinal Study (KELS), and rely on propensity score matching (PSM). For adolescent girls, we find that being in all-girls schools mitigates both their exposure to and engagement in peer victimization. For adolescent boys, we find that boys in all-boys schools have significantly higher odds of experiencing more frequent verbal and physical attacks versus their counterparts in coeducational schools. Our findings strongly suggest that interventions to mitigate peer victimization and aggression in Korea should consider the gendered schooling contexts in which they are implemented.

Keywords: South Korea; Peer Aggression; Peer Victimization; Single-Sex Schools; Propensity Score Matching; Ordered Logistic Regression

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Introduction & Motivation

Peer victimization has become a significant public health concern for South Korean adolescents, placing not only their physical and psychosocial well-being in jeopardy, but resulting in tragic suicides that have captured national attention. In March 2013, a 15 year old boy from Gyeongsan and a 12 year old girl from Busan took their lives, both expressing in their suicide notes how bullying made their lives unbearable (Woo, 2013; Yoo, 2013). Though the consequences of peer victimization are well established (Gini & Pozzoli, 2009; Rigby, 2002; Smokowski & Kopasz, 2005), the underlying determinates of peer victimization are less clear. They are multifaceted and interconnected, including myriad factors ranging from psychological traits at the individual-level (Cook, Williams, Guerra, Kim, & Sadek, 2010; Smokowski & Kopasz, 2005; Veenstra et al., 2005) to societal factors at the broader macro-level (Cook et al., 2010; Espelage & Swearer, 2010; Hong & Espelage, 2011). Identifying and increasing our understanding of these determinants can help stem the rising tide of peer victimization and, most importantly, mitigate its potentially negative consequences on the development of Korean youth.

An important micro-level (Bronfenbrenner, 1994) factor highly influential in explaining peer victimization experiences among adolescents are children's school environments (Hong & Espelage, 2011; Olweus & Limber, 2010). The school environment, or *social milieu* (Olweus & Mortimore, 1993), includes children's peers and teachers who can provide supportive relationships that can potentially mitigate the harmful effects of peer victimization (Barr & Parrett, 2001; Garandeau & Cillessen, 2006; Holt & Espelage, 2007). Yet, one feature of the school environment remains less well understood: the gender composition of schools (Silbaugh, 2013). Importantly, whether the gender context of schools matters for peer victimization is an unresolved question lacking solid empirical footing (Mael, Alonso, Gibson, Rogers, & Smith,

2005; Silbaugh, 2013). Furthermore, there are no prior quantitative investigations situated in the Korean context examining how the gender composition of schools impacts the frequency of *both* peer victimization and peer aggression. This is critical to understand given Korea's national school assignment policy known as the *equalization policy* (EP) (T. Kim, Lee, & Lee, 2008) that randomly assigns children to either coeducational or single sex schools. Importantly, if a school's gender composition matters for peer victimization and aggression, then Korea's school assignment policy may have far-reaching unintended negative or positive consequences, particularly on the specific types of peer aggressive behaviors adolescents engage in and/or experience. Accordingly, in our study—which is the first to our knowledge—we ask a critical albeit unresolved question: How do single-sex schools (all-boys or all-girls schools) versus coeducational schools differentially impact peer victimization and aggression among Korean adolescents?

Understanding how the gender environments of schools influences the incidence of peer victimization and aggression can reveal whether school contexts have the potential to either mitigate or exacerbate its harmful psycho-social and physical effects. Moreover, a deeper understanding of the gender contexts of peer victimization and aggression can ultimately lead to interventions specifically tailored to intervene in those contexts.

Background and Context

Peer Victimization and Aggression

For the purposes of this study, we define *peer victimization* as the phenomenon of children being targeted by the aggressive behaviors of another student or groups of students (Hawker & Boulton, 2000, p. 441; Kochenderfer & Ladd, 1996). Aggressions can range in type

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including direct (e.g., physical confrontations or theft) (Perry, Kusel, & Perry, 1988), verbal, and indirect (e.g., social exclusion) (Craig, 1998). *Peer aggression* refers generally to children's engagement in aggressive behaviors towards other children. An associated term used in the peer victimization and aggression literature is *bullying* which is recognized as a subtype of aggression (Perry et al., 1988, p. 807) that is intentional, repeated, and characterized by an asymmetric power relationship in which the bully is dominant relative to the victim (Olweus, 1994, p. 1174).

Peer aggression in Korean schools is often regarded as collectivistic (i.e., group- versus individual-based) in nature, consisting of verbal abuse or social exclusion rather than physical abuse (Y. S. Kim, Koh, & Leventhal, 2004; Koo, Kwak, & Smith, 2008; S. Lee, Smith, & Monks, 2012). The term widely used to describe peer victimization in Korean, *wang-ta*, means "severe exclusion" but refers more broadly to either a socially excluded person or the excluding behavior (Lee, Smith, & Monks, 2012). Koo, Kwak, & Smith (2008) found that the number of *wang-ta* aggressors were larger than the number of victims confirming the collectivist nature of victimization in Korea. Also, both the aggressors and victims were almost always found to be in the same grade and more than three quarters of the time they were in the same classroom (Koo, Kwak, & Smith, 2008). Gender differences in the prevalence rates of peer victimization have been mixed in Korea especially by the type of victimization. That is, although research has consistently shown Korean boys to be more frequently engaged in and victims of physical or verbal aggression than girls, findings on social exclusion have been more mixed (Kim, Koh, & Leventhal, 2004; Koo, Kwak, & Smith 2008; Shin, 2010; Yang et al., 2006). Lastly, research examining the relationship between peer victimization and student background characteristics indicates that low socio-economic status, low parental education levels, and single parenthood are all risk factors for peer victimization in Korea (Kim et al., 2009).

Victimization Within Single-sex Versus Co-Educational Environments: Rationales and Evidence

Though there is a substantive body of literature on gender dimensions of peer victimization (Felix & Green, 2010), the bulk of gender related bullying and victimization research within schools tends to examine gender only at the *individual level*. Research examining the broader gendered contexts and how that might shape victimization and aggression behaviors is limited, especially work related to the incidence and experience of victimization for boys and girls under single-sex and co-educational environments (Silbaugh, 2013). Of the evidence that does exist, overall, single-sex environments for girls appear to be an overwhelmingly protective factor from victimization. Below, we synthesize from the extant literature the underlying theoretical rationales behind differential rates and forms of victimization and aggression in single-sex versus co-educational school environments and provide an overview of the empirical evidence documenting these differences.

Rationales. One underlying rationale for why differential rates of victimization might occur in single-sex versus coeducational environments is connected to the notion of *gender-conformity* (Silbaugh, 2013; Young & Sweeting, 2004). In general, “Students are more likely to be victimized when they do not conform to their school’s gender norms” (Silbaugh, 2013, p. 1043). This plausibly suggests that if the gender norm is predominately male as it is in all-boys schools, boys who are gender non-conforming or exhibit gender-atypical behaviors (i.e., boys who do not exhibit traditional stereotypical male traits such as athleticism or aggressiveness) may be victimized more than if they were in mixed schools. In fact, Johnson (2009) posits that “gender-non-conforming boys are likely at greater risk in single-sex school environments” (as cited by Silbaugh, 2013: 1043), while “maleness in boys” is often viewed as a trait protecting them

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against victimization (Felix & Green, 2010). The notion of gender conformity has also been applied to explain differential rates of victimization for girls between single-sex and coeducational environments. For example, Felix and Green (2010) argue that gender non-conforming girls who do not exhibit traditional female behaviors or characteristics (i.e., “tomboys”) may increase their risk for bullying and victimization. They posit that this might be particularly true for girls in all-girls schools, since in coeducational school settings gender non-conforming girls may also have opportunities to find close relationships with boys making them less subject to exclusion and bullying.

The notion of gender conformity also suggests that the gender composition of schools may influence the degree to which students participate in and/or are subjected to certain types of victimization. There are two main types of aggressive behaviors linked to gender (Hawkins, Pepler, & Craig, 2001, p. 514): (1) direct/physical which is typically associated with boys (O’Connell, 1999); and (2) indirect/social exclusion which is typically associated with girls which, according to Olweus (1994), includes, “...more subtle and indirect ways of harassment such as slandering, spreading of rumours, and manipulation of friendship relationships...” (p. 1177). According to the theory of gender conformity and peer group norms, girls’ experience of physical aggression may be higher in coeducational settings versus all girls settings since girls in coeducational settings may adapt to and adopt the more dominant aggressive norms of boys (Velasquez, 2010, p. 298). According to Velasquez (2010), “Students’ exposure to interactions between members of the other sex might inevitably decrease the salience of their own peer group norm” and thus girls would have a much higher tendency to engage in—and be targets of—physical (versus relational or indirect) forms of aggression in coeducational settings. However, there is an opposing viewpoint that girls would not necessarily engage in more aggressive

behaviors in coeducational school environments. As Killeya-Jones et al. (2007) notes, being in a “...mixed sex group enhances the display of aggression for boys and reduces the display and acceptance of aggression for girls.” (p. 559), Killeya-Jones et al. (2007) contend that, “...[the] expression of physical aggression by girls is not socially valued; rather girls are more concerned with and motivated by social acceptance...” (p. 552). Thus, girls, irrespective of their gender environment, would be more prone to be engaged in and the targets of relational aggression (social isolation or exclusion) versus direct aggression.

A second rationale is more directly related to the gender hierarchies that are present in schools. If we accept the notion that victimization can involve asymmetric power relationships (Olweus, 1994), then this might place girls in coeducational settings at a higher risk of victimization versus their counterparts in all girls schools since coeducational schools may reinforce and reproduce gender hierarchies that afford a higher status to boys relative to girls (Hubbard & Datnow, 2005). According to this notion of *gender stratification*, boys in coeducational schools would tend to target girls to maintain their status (Killeya-Jones, Costanzo, Malone, Quinlan, & Miller-Johnson, 2007). In all-girls settings, however, there is an absence of a clear gender hierarchy among students—and more importantly, all-girls schools are often seen as “relational” environments that emphasize female empowerment (V. E. Lee, Marks, & Byrd, 1994) and would, therefore, lack a strong “culture of bullying” (V. E. Lee et al., 1994, p. 95). On the other hand, for boys, the theory of gender stratification may imply a positive relationship between single-sex educational settings and victimization in contrast to the case for girls. That is, due to the absence of an explicit gender stratification system in all-boys schools, boys in non-gender conforming roles may become prime targets of bullying and victimization. Yet, in coeducational settings, the presence of females offers boys who do not conform to the

“strong” male stereotype a buffer from being victimized (Jackson, 2002).

A final rationale for why the gender context of schools may make a difference in adolescents’ exposure to and involvement in peer victimization comes from the literature on *cross-gender victimization*. Prior research has shown that, in general, victimizers of girls in coeducational settings tend to be evenly split among girls only, both girls and boys, and boys only. However, for boys, a majority were victimized by other boys only (Felix and Green, 2010). This implies that exposure to cross-gender victimization and perpetration would be greatly reduced in single-sex environments, particularly for girls in all-girls schools. Also, given that boys tend to be victimized by boys only, being in all-boys settings may exacerbate their exposure to victimization.

Empirical Evidence. Currently, there are no known peer reviewed studies, published either in English or Korean, that systematically examine the effects of school gender composition on adolescents’ engagement in or experience of peer aggression across Korea’s middle schools. One study by Kim et al. (2009), however, found peer victimization to be more prevalent among middle school students in Seoul relative to other suburban areas and further examined whether such prevalence was explained by the greater number of coeducational classes in Seoul. Kim et al. (2009) concluded that for both boys and girls, peer victimization was significantly higher in coeducational settings versus single-sex settings. However, it is important to point out that this study relied on a non-random sample of seventh and eighth grade students from a few Korean middle schools and therefore were unable to isolate the impact of gender-composition on peer victimization.

Though the empirical evidence on the impact of single-sex versus coeducational environments on victimization has been critiqued for lacking quality (Silbaugh, 2013), there are

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a handful of studies, conducted internationally, directly examining the correlational relationship between peer victimization and the gender composition of schools. For example, Delfabbro et al.'s (2010) study of 1,284 Australian adolescents (mean age of 15.4) in private urban schools found that girls in coeducational schools reported a higher frequency of peer victimization versus girls in single-sex schools (p. 81). Boys in single sex schools, on the other hand, experienced peer victimization at higher rates versus girls (p. 81). Green et al., (2010) examined 15,500 adolescents, aged 14-16, participating in the Longitudinal Study of Young People in England (LSYPE) and found that girls in single-sex versus coeducational schools reported lower incidence of physical victimization. However, they detected no difference in violence between boys in single-sex schools versus their counterparts in coeducational schools. In addition, girls, aged 15 were less likely to be called names if they were in single-sex schools while boys in all-boys schools were more like to be called names. Overall, they concluded, "all-girls' schools appear to be safer environments for girls than coeducational schools, particularly in terms of protecting them from violence." (p. 73).

Two additional studies further support the notion that all-girls environments can be protective environments. Rigby (1997) found that girls in all-girls schools in Australia were victimized less frequently (1 in 5) versus girls in coeducational schools (1 in 7) (p. 60). Finally, Chaux et al. (2009) examined peer victimization in over 24,000 9th graders in Colombia and found that rates of peer victimization were highest in all-boys schools followed by coeducational schools and then all-girls schools. Overall, the percentage of girls in a school was inversely related to peer victimization (p. 525).

Finally, Olweus' (2010, pp. 26-27) findings on the relationship between same- versus cross-gender bullying among junior high students in Norway (grades 8-10) provides some

potential insight into how the types of aggressive behaviors (indirect or direct) that different genders engage in differs according to school gender composition. His study reveals that girls are more likely to have experienced verbal aggression (teasing) from boys (3.2%) versus girls (0.9%); while girls are more likely to have experienced both bullying-isolation (exclusion) or bullying-rumors (spreading false rumors) by girls rather than boys (1.1% versus 0.6% for isolation; 1.4% versus 1.0% for rumors). These empirical findings suggest two possible scenarios: (1) we might see girls in co-educational environments experience more verbal aggression versus girls in all-girls schools; and (2) girls in all-girls schools may experience more social isolation or have been targeted of false rumors at higher rates versus girls in co-educational environments.

In sum, the potential ways in which a school's gender composition influences the incidence of victimization and aggression is complex: it depends not only on students' gender but whether or not students are gender conforming or non-gender conforming. Boys who are non-gender conforming in all-boys environments may tend to be more at risk for victimization, while the risk for victimization of non-gender conforming girls in all-girls environments is unclear and remains an empirical question. The relationship is further complicated by the gender hierarchical structure of the schools—coeducational schools are assumed to be more hierarchically arranged by gender versus single-sex schools and a stronger desire to maintain a dominant “pecking order” in coeducational schools may place girls and non-gender conforming boys at a higher risk of victimization. Also, given that particular aggressive behaviors are strongly associated with girls (social-relational aggression) versus boys (physical aggression), the types of victimization and aggressions that occur in single-sex versus coeducational environments may differ as well. Finally, on the whole, the empirical evidence on school gender

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composition is relatively limited and either correlational or descriptive as best, but it does indicate that girls in all girls schools experience lower rates of victimization versus their counterparts in mixed schools.

The Korean Educational Context

The Korean formal education system begins at age 7 with six years of primary schooling, three years of lower secondary schooling (i.e., middle schools), and three years of senior secondary schooling. Compulsory education typically ends after lower secondary schooling at age 15, but a majority of students transition from lower to senior secondary schools (Koo, Kwak, & Smith, 2008). According to official estimates from the National Statistics Office, in 2013 there were a total of 3,173 middle schools in Korea – roughly 80 percent are public schools (as opposed to private schools) and the average class size is around 31 students (available at <http://kosis.kr>). Under Korea's equalization policy (EP), students are randomly assigned to both public as well as private schools and therefore socio-demographic characteristics between students in private versus public schools do not vary (Park, Behrman, & Choi, 2012). Though middle school students are randomly assigned by lottery, parents in certain school districts can rank order the schools that they want their children to attend (M. Seth, personal communication, June 9, 2013). Both public schools and private schools are similar in terms of curriculum (i.e., they utilize the same national curriculum), teacher qualifications, and cost (tuition and fees are equal in public and private schools) (Paik, 2013). Traditionally, middle schools in Korea consisted of single-sex schools only, but coeducational schools were created in 1990 and have rapidly expanded to comprise roughly 76 percent of total schools by 2013. Students in middle schools are assigned to classrooms in the beginning of each school year and are instructed using a uniform national curriculum; they remain with the same classmates for the entire year.

Research Design and Methods

Data and Sample

We conducted our analyses of peer victimization using the TIMSS 2011 and peer aggression using the KELS 2005. The incidence of peer victimization was only reported in the TIMSS while peer aggression was only reported in the KELS. The TIMSS sample (unweighted) includes 5,136 South Korean eighth graders in public and private schools and the student participation (i.e., response) rate was 98% (Joncas, 2011). The KELS is a nationally representative sample of 6,680 South Korean seventh graders in public and private schools who were first surveyed in 2005 and then resurveyed annually from 2006 to 2012. During the first wave of survey in 2005 only, students provided information on their aggressive behaviors towards others in school. The student participation rate was approximately 99%.

Outcome Variables

Peer Victimization. In the TIMSS dataset, students reported how often they experienced four incidents of peer victimization during the past school year (we include the statement students responded to followed by the variable name we use):

1. I was made fun of or called names (VERBAL)
2. I was left out of games or activities by other students (EXCLUSION)
3. Something was stolen from me (THEFT)
4. I was hit or hurt by other student(s) (e.g., shoving, hitting, kicking) (PHYSICAL)

Students reported frequencies on a four category Likert scale: (1) At least once a week; (2) Once or twice a month; (3) A few times a year; (4) Never. We reverse coded these outcomes, assigning higher values to more frequent reports of victimization.

Peer Aggression. In the KELS dataset, students reported how often they engaged in the following four behaviors:

1. I have severely made fun of others or called others names before (VERBAL)
2. I have left friend(s) out of games or activities before (EXCLUSION)
3. I borrow money or objects from others and do not return them (THEFT)
4. I have severely hit others before (PHYSICAL)

Students reported frequencies on a six category Likert scale: (1) Almost every day, (2) Once or twice a week, (3) Once or twice a month, (4) Once or twice a semester, (5) Once or twice a year, and (6) Never. We collapsed these categories into four categories to be consistent with the TIMSS reported frequencies. We combined “Almost every day” and “Once or twice a week” into the category “At least once a week” and combined “Once or twice a semester” and “Once or twice a year” into a category “A few times a year”. As with the TIMSS, we reverse coded these outcomes, assigning higher values to higher frequencies of peer aggression.

Individual- and School-Level Covariates

We used a set of individual- and school-level variables (listed in column (1) of Table 1a) in our matching analyses and in our regression models. To account for missing values, we imputed values under missing-at-random (MAR) assumptions (Royston, 2005). In the TIMSS sample, mother’s and father’s education level contained a large fraction of missing values (20.75% and 22.9%, respectively). The other variables contained less than 3% of missing values, except for school socioeconomic status which contained roughly 7% of missing values. In the KELS sample, the percentage of missing values ranges from 2% (for whether the student has ever transferred schools before) to 11.7% (for household income spent on child’s education).

Main Predictor Variable

Our main predictor variable is a dichotomous variable indicating whether a student was assigned into a single sex (= 1) or coeducational school (= 0) according to Korea's national equalization policy (EP). Although under the EP, students are randomly assigned to different schools, it is important to note that random assignment occurs within districts (also known as *enrollment zones*) with varying distributions of coeducational and single-sex schools. Often, districts offer only one type of school per district. For example, of the 46 middle school enrollment zones in Seoul, only 23 offer both a coeducational and single-sex school option. Thus, roughly half of the enrollments zones do not randomly assign students to coeducational versus single-sex schools since they do not contain both types of schools. Accordingly, unlike in a randomized experiment, students do not face an equal probability of being assigned into a single sex or coeducational school. Given this, we believe that assignment into school type is not completely exogenous, limiting our ability to make causal inferences about the impact of school gender composition on peer victimization and aggression. However, as we show, the EP helps mitigate observed bias between single sex and coeducational schools. Furthermore, as described below, we rely on propensity score matching (PSM) to further reduce the threat of selection bias.

Data Analytic Methods

Propensity Score Matching (PSM)

Given the unequal probability of being assigned into a single-sex versus coeducational middle school, we first analyzed our data using PSM. Intuitively, by using PSM we seek to find a group of students in coeducational schools who are similar to students in single-sex schools in terms of their observed characteristics (e.g. parental education level) prior to assignment into

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school type. We then compare outcomes between these two groups. In contrast to standard multivariate regression approaches, PSM quantifies the similarities or dissimilarities of adolescents across school type, further reducing bias in the estimation of the effect of gender composition on peer victimization and aggression by preventing comparisons of adolescents who lack appropriate matches (Heckman, Ichimura, Smith, & Todd, 1998).

The propensity score is a scalar function that summarizes the information required to balance the distribution of the covariates between youths in a single-sex versus coeducational schools (Rosenbaum & Rubin, 1984). We estimated the propensity score using a logit model (Rosenbaum & Rubin, 1984) that we fitted separately for boys and girls within the TIMSS and KELS samples. Combining additional evaluation methods is a straightforward way to improve the quality of estimates especially when differences in covariates between matched pairs remain after matching (Caliendo & Kopeinig, 2008). Therefore, we weighted both the TIMSS and KELS data on the estimated propensity score, resulting in a balanced sample between youths in single-sex and coeducational schools.

Ordered Logistic Regression

Since our peer victimization and aggression outcome measures are ordered categories with arbitrary distances between categories, we estimated ordered logistic regression models (A. A. O'Connell, 2006). Using data weighted with the estimated propensity score, we fitted models separately for our sample of boys and girls, regressing each of our peer victimization and aggression outcomes on our main predictor variable—the dichotomous variable indicating assignment into single sex or coeducational school. We also included additional covariates in our models to account for differences between students in single sex versus coeducational schools

that remained after our PSM analyses. For the TIMSS analysis, we controlled for school urbanicity (i.e. urban, suburban, medium size city, or small town), school socioeconomic status (i.e. school has more affluent than disadvantaged students, school has neither more affluent nor more disadvantaged students, or school has more disadvantaged than affluent students), and province fixed effects (i.e., dummy variables for each province). For the KELS analysis, we controlled for school urbanicity (i.e., urban, suburban, or rural) and average years of teacher experience. We adjusted our standard errors to account for the clustering of students within schools. We fitted all models in Stata 12.0 using the ologit command (StataCorp, 2011).

We exponentiated our ordered logit coefficient estimates of interest, $e^{\hat{\beta}}$, and interpret them as proportional odds ratios. In cases when $e^{\hat{\beta}} < 1$, the fitted odds of experiencing or engaging in *more* frequent aggressive behavior is $e^{\hat{\beta}}$ times *lower* in all-boys (all-girls) schools versus coeducational schools, all else equal. When $e^{\hat{\beta}} > 1$, the fitted odds of experiencing or engaging in *more* frequent aggressive behavior is $e^{\hat{\beta}}$ times *higher* in all-boys (all-girls) schools versus coeducational schools, all else equal (Long & Freese, 2006). Given the proportional odds assumption (Long & Cheng, 2004; A. A. O'Connell, 2006), these relationships hold when moving from successively lower to higher reported frequencies (e.g., a few times a year versus once or twice a month); they also hold when moving from less frequent response groupings to more frequent response groupings (e.g. never *and* a few times a year versus all other higher categories) (Long & Cheng, 2004).

Results

Descriptive Statistics

In Table 1a we present descriptive statistics for covariates in our sample. As shown, despite randomization under Korea's EP policy, we do find statistically significant differences in some of the observed characteristics of adolescents by school type. In both the TIMSS and KELS samples, assignment into a coeducational school is associated with either having a very highly educated (university graduate) or poorly (some primary/lower secondary) educated parent, while average parental education (high school graduate/completed upper secondary) is more common for both boys and girls in single-sex schools. Also, across both samples, students in coeducational schools are more likely to attend schools in urban areas and less likely to attend schools in small towns or rural areas than those in single-sex schools.

The raw mean differences in our peer victimization outcomes between school type by each gender group (Table 1b) shows that boys in coeducational schools report lowered frequencies of theft, verbal and physical victimization versus boys in single-sex schools. For girls, the reported frequencies of all four peer victimization experiences were lower in single-sex than coeducational schools. For peer aggression, we find that boys in all-boys schools report fewer incidences of exclusion relative to boys in coeducational schools; yet, other aggressive behaviors such as making fun of others, physically hitting others, and stealing from others did not vary across school type. On the other hand, girls in all-girls schools report fewer incidences of making fun of or severely hitting friends, and exclusion as compared to their female counterparts in coeducational schools.

PSM Results

In this section, we present results from our PSM matching analysis to demonstrate the number of matches achieved between single sex and coeducational schools and to describe the selection of students into each school type. In Table 2, we report results of logit models we fitted

to estimate propensity scores. Among the 701 boys and 735 girls in single-sex schools in the TIMSS sample, 688 boys and 723 girls were matched to 1,786 boys and 1,914 girls in coeducational schools, respectively. We find that both boys and girls whose fathers or mothers are four-year college graduates or higher are less likely to attend single-sex schools compared to those with high school graduate fathers or mothers, respectively. Also, girls whose mothers are high school dropouts are more likely to be assigned to single-sex schools than girls with high school graduate mothers. In the KELS sample, among the 1,251 boys and 1,104 girls in single-sex schools, 1,226 boys and 1,082 girls were matched to 2,213 boys and 2,112 girls in coeducational schools, respectively. We find that boys whose fathers are four-year college graduates or higher are less likely to attend single-sex schools compared to those with high school graduate fathers. Additionally, boys who have transferred schools before and those whose parents are involved in school associations have lower odds of attending single-sex schools.

Figures 1 and 2 illustrate the distributions of the estimated propensity scores of students in single-sex versus coeducational schools for both the TIMSS and KELS sample, respectively. As shown, given the EP policy, selection into single-sex versus coeducational schools is not as severe as compared to settings where students and parents selectively choose single-sex schools. Only a few observed characteristics are statistically significant at conventional levels for boys and girls. In addition, the distributions of the estimated propensity scores between students in single-sex versus coeducational schools according to the histograms for both the TIMSS and KELS samples are not markedly different. However, the propensity scores of students in coeducational schools are still more heavily concentrated in the lower end of the distribution compared to that of students in single-sex schools. The matched sample histograms (available from authors upon request), on the other hand, present a distribution of propensity scores that are

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more aligned between the two groups for both boys and girls. These results confirm the need to control for observed differences between the two groups using an appropriate matching technique. Despite the improvement in alignment of propensity scores, there still remain differences across matches. Therefore, as mentioned previously, we estimated ordered logistic regressions with the propensity score weighted data.

Main Results

In Tables 3 and 4, we present our main results by each outcome in a taxonomy of fitted ordered regression models (1) first, without any controls; (2) then, including the estimated propensity score; and (3) finally, controlling for the estimated propensity score and school level characteristics. Except for column (1), the estimates are based upon a reweighted matched sample resulting from the estimation of the propensity score of being assigned to a single-sex school. In each Table, we first present results for boys followed by our results for girls.

<<Insert Table 3>>

Peer Victimization: Results from the TIMSS

As we report in column (1) of Table 3, boys in single-sex schools have higher expected odds of reporting more frequent experiences of verbal and physical victimization as well as theft versus boys in coeducational schools. This relationship holds even after controlling for observed demographic differences across students via propensity score matching (column (2)) as well as for school level characteristics such as school urbanicity, school socioeconomic status and province fixed effects (column (3)). Interestingly, the frequency of being socially excluded does not vary across school type. Overall, the fitted odds of boys experiencing more frequent verbal aggression, theft, and physical victimization are 1.32 ($p<.05$), 1.51 ($p<.001$) and 1.28 ($p<.10$)

times *higher*, respectively, in all-boys schools versus their counterparts in coeducational schools holding all else constant.

Girls, on the other hand, display an opposite pattern. The fitted odds of experiencing more frequent verbal aggression, theft, and physical victimization are 0.66 ($p < .001$), 0.67 ($p < .05$) and 0.54 ($p < .01$) times *lower*, respectively, for girls in all-girls schools versus their counterparts in coeducational schools. Though the odds of being more frequently socially excluded are lower for girls in all-girls schools, the relationship is not statistically significant. Again, these relationships remain robust to the addition of school-level control variables.

Peer Aggression: Results from the KELS

As shown in Table 4, we find that boys in all-boys schools have lowered odds of more frequently excluding others versus boys in coeducational schools. The odds are approximately 0.80 ($p < .05$) times lower, all else constant. Yet, there is no significant difference in the odds with which boys more frequently engage in theft or verbal/physical aggression. On the other hand, girls in single-sex schools report a lower incidence of engaging in three of the four aggressive behaviors versus their counterparts in coeducational schools. This is consistent with our findings on victimization and school type. Specifically, the expected odds of engaging in more frequent verbal aggression, theft, and physical aggression behaviors are 0.66 ($p < .001$), 0.47 ($p < .001$) and 0.64 ($p < .01$) times lower, respectively, for girls in all-girls schools versus their counterparts in coeducational schools, all else equal.

Discussion & Conclusion

Peer victimization among South Korean adolescents has become increasingly commonplace within schools (Y. S. Kim, Leventhal, Koh, & Boyce, 2009). Several well-known cases of bullying and victimization leading to tragic suicides across the nation have sparked intense interest in developing ways to curb peer aggressive behaviors. Despite a call for a nationwide rollout of programs to address peer victimization by 2017 modeled after Finland's anti-bullying program *Kiva Koulu* ("Korea to strengthen fight against bullying," 2013), there are broader contextual factors that can play an equally important role in either mitigating or exacerbating peer aggressive behavior.

As our results show, the gender composition of schools has important ramifications. In our study, we find strong evidence consistent with the extant empirical literature on school gender composition and peer victimization and aggression: girls in all-girls schools are less likely to experience verbal, theft and physical victimization in all-girls environments versus coeducational environments; at the same time they are also less likely to be aggressors of these same behaviors if they are in single-sex environments. This lends credible evidence supporting prior findings that all-girls environments tend to lack a strong "culture of bullying" (Unnever & Cornell, 2003) and, in fact, can plausibly mitigate both peer victimization and aggression. For boys, reported frequency of peer victimization (particularly for verbal, theft, and physical victimization) is higher in all-boys schools versus coeducational schools; furthermore, with the exception of relational aggression, aggression does not significantly vary between boys in all-boys schools versus coeducational schools. In addition, although we find evidence that selection into single-sex schools was non-random, such selection effects do not seem to influence our estimates of the effect of single-sex schooling on peer victimization and aggressive behaviors (i.e., the coefficient estimates on single-sex schools do not vary much across models in Tables 3

and 4 for both girls and boys). This implies that the correlation between the individual/school level observed characteristics and student victimization/aggression outcomes is relatively weak. As a result, such observed characteristics are likely not to be driving much of the differences we detect and that the gender environment does play a role in differential rates of victimization and aggression. Finally, we find that peer aggression tends to consist of verbal name calling and exclusionary practices which is consistent with *wang-ta*. For girls, we find significant effects on verbal attacks based on both victim and aggressor perspectives. For boys, we find significant effects for aggressors of exclusion.

Our findings that school gender composition matters for both the victimization and aggression of adolescent girls and boys appears can be explained, in part, by insights from prior theoretical literature. Our finding that girls' experience of physical victimization and aggression tends to be higher in coeducational schools versus all-girls schools may be explained by the fact that girls in coeducational schools might adapt to and adopt the more dominant aggressive norms of boys (Velásquez, Santo, Saldarriaga, López, & Bukowski, 2010, p. 298). Thus, the relational type norms that exist in all-girls schools may not be dominate in coeducational environments, placing girls at higher risk for engaging in and experiencing more physical forms of victimization typically associated with boys (P. O'Connell, Pepler, & Craig, 1999). In addition, our finding that all-girls schools are more protective environments for girls (compared to coeducational environments) is also supported by the gender stratification rationale (Hubbard & Datnow, 2005) which posits that boys in coeducational settings would target girls for victimization to maintain their higher status. For boys, our finding that all boys environments can exacerbate their exposure to bullying victimization, particularly physical bullying, is consistent not only with the notion that boys tend to engage in more physical rather than relational forms of

bullying (Felix & Green, 2010) but also that among boys, "...physically aggressive ways of being together are more common and also more approved of—even expected; boys use aggression to create social order." (Salmivalli et al., 1996, p. 11). This is also supported by the gender stratification rationale which posits that the absence of an explicit gender stratification system in all-boys schools will likely expose boys in non-gender conforming roles to become prime targets of bullying and victimization.

There are several key limitations of our study. First, although we find strong evidence relating the gender environments of schools to peer victimization and aggression, we do not go so far as to make strong *causal* inferences. This is due to the limited number of pretreatment covariates available in our datasets we could match on; thus, differences, both observable and unobservable between adolescents in single-sex and coeducational schools remain. However, as we show, Korea's EP policy coupled with matching done via PSM attenuates some of the observable bias between adolescents in single sex versus coeducational schools; this is a substantial improvement over prior correlational studies of school gender environment and peer victimization. Second, due to limitations of our data, there are several important aspects of peer victimization and aggression that we are unable to examine in the current study. For example, we are unable to identify students who are both aggressors and victims; we do not have any information on the aggressor (or victim) for each student reporting victimization (or aggression). Third, it is important to point out that our measures of peer victimization and aggression come from two different datasets and therefore are not perfectly aligned. Specifically, the TIMSS does not use the term "severely" when asking students about being victim to verbal or physical aggression, but the KELS does. Also, when measuring social exclusion, the KELS restricts the target of aggression to "friends" while the TIMSS asks if "other students" left them out of games

or activities. And lastly, in terms of measuring theft, the KELS indirectly asks about borrowing and failing to return money or objects whereas TIMSS directly asks students if something was stolen from them. Such differences in wording could potentially influence the way in which children perceive peer victimization and aggression leading to the under-reporting (e.g. verbal, physical, and social exclusion) or over-reporting (e.g. theft) of peer aggression in the KELS as opposed to measures of peer victimization in the TIMSS. Fourth, the two datasets were collected at different time periods with a six year time lag. This could be part of the reason why rates of victimization are generally higher than rates of aggression across school types since school violence has become increasingly more commonplace in Korea during such times. Of course, another explanation may be that students are less likely to report aggression than victimization. Finally, we do acknowledge that the peer victimization and aggression behavioral outcomes are self-reported which introduces measurement error into our results (Bovaird, 2010). For example, if one assumes that being victimized (or being the aggressor) is perceived differently across single-sex versus coeducational schools, and if such perception leads to divergent reporting on the frequency to which one is exposed to (or engaged in) such activity, our behavior-based self-report measure of prevalence may systematically over- or under-report the incidence of peer victimization (or aggression) in one educational setting versus the other thereby biasing our results.

Despite these limitations, our study reveals compelling evidence supporting the notion that school gender composition matters for both peer victimization and aggression among Korea's adolescents, especially among adolescent girls. We do caution readers against interpreting our findings as suggesting that children who do experience victimization should be assigned or reassigned to different schools based on school gender composition; this is overly

simplistic and inaccurate. Rather, given Korea's de facto assignment of children into single sex or coeducational schools, we believe our findings are most applicable when thinking about designing and implementing school-based programs and interventions to reduce the incidence of victimization and aggression. Our findings strongly suggest that interventions should be tailored to the gendered contexts in which anti-bullying interventions are implemented. As Hong and Espelage (2012) note, interventions should be designed to include "ecological-based components" (p. 318) and this is especially critical given the heterogeneity of peer victimization and aggression experiences tied to the gendered microsystem of schools we detected through our study. Though the question of exactly how to tailor interventions to different gendered schooling contexts is open for further exploration, we recommend as a starting point, focusing on adapting whole school approaches. Such whole-school approaches, which have demonstrated to be successful with victims and aggressor alike (P. O'Connell et al., 1999; Salmivalli, Kaukiainen, & Voeten, 2005) should be adapted to the gender environment, particularly in the Korean context. For example, strategies for handling victimization and aggression in a co-educational (versus single-sex) setting may involve engaging boys and girls in workshops and activities separately (Safran, 2008, p. 61). Similarly, given the more relational nature of aggression among girls, interventions targeted to girls in all-girls environments may be developed to focus mainly on, "the formation and development of the friendship skills" (Besag, 2006). Obviously, further research and inquiry on designing whole school interventions which account for the gender composition of the school is necessary to develop a clear evidentiary base that can be potentially useful in shaping policy and practice. Overall, the implication of our research is clear: the gender environment of schools is a critical factor that must be carefully interwoven into the design of school-based interventions to stem the rising tide of peer victimization in Korea.

Running header: The effects of single-sex versus coeducational schools on adolescent peer victimization and perpetration

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Tables and Figures

Table 1a. Descriptive statistics (means) of covariates.

Covariate	TIMSS 2011				KELS 2005			
	Boys		Girls		Boys		Girls	
	Coed Schools ^a	All-Boys Schools	Coed Schools ^a	All-Girls Schools	Coed Schools ^a	All-Boys Schools	Coed Schools ^a	All-Girls Schools
<i>Father's Highest Education Level</i>								
Completed University or Higher	0.506***	0.405	0.470***	0.332	0.334***	0.262	0.322**	0.274
Completed Post-Secondary	0.080	0.084	0.084	0.080	0.117	0.129	0.108	0.120
Completed Upper-Secondary	0.363**	0.432	0.407***	0.509	0.451**	0.498	0.474*	0.515
Completed Lower-Secondary	0.034	0.047	0.028**	0.050	0.072 ⁺	0.090	0.063 ⁺	0.078
Some Primary, Lower-Secondary or No School	0.017*	0.031	0.010***	0.029	0.025	0.021	0.033**	0.014
<i>Mother's Highest Education Level</i>								
Completed University or Higher	0.395***	0.284	0.359***	0.227	0.187***	0.133	0.179*	0.148
Completed Post-Secondary	0.073	0.081	0.063	0.075	0.096	0.099	0.096	0.089
Completed Upper-Secondary	0.479***	0.569	0.538*	0.589	0.617*	0.660	0.616**	0.671
Completed Lower-Secondary	0.032	0.041	0.024***	0.071	0.077	0.086	0.080	0.076
Some Primary, Lower-Secondary or No School	0.021	0.024	0.016***	0.038	0.023	0.022	0.029*	0.016
<i><u>TIMSS Specific Covariates</u></i>								
<i>Year of Birth</i>								
Born in 1995/6	0.899	0.887	0.873	0.880				
Born in 1997/9	0.101	0.113	0.127	0.120				
<i>Korean Language Used at Home</i>								
Never	0.002	0.003	0.000	0.000				
Sometimes	0.002	0.001	0.003	0.001				
Almost Always	0.180	0.193	0.131	0.124				
Always	0.816	0.803	0.866	0.875				
<i>School-level Characteristics</i>								
Urban	0.464	0.481	0.483***	0.367				
Suburban	0.274***	0.150	0.238***	0.086				
Medium Size City	0.206*	0.243	0.207***	0.316				
Small Town	0.055***	0.127	0.072***	0.231				
School SES: More Affluent than Disadvantaged Students	0.242***	0.000	0.263***	0.050				
School SES: Neither More Affluent nor More Disadvantaged Students	0.470***	0.583	0.478***	0.586				

Running header: The effects of single-sex versus coeducational schools on adolescent peer victimization and perpetration

School SES: More Disadvantaged than Affluent Students 0.288*** 0.417 0.260*** 0.363

KELS Specific Covariates

Parents are Married	0.902	0.894	0.903	0.891
Monthly Household Income ^a	361.91*	344.43	346.70*	328.24
Fraction of Household Income Spent on Child's Education	0.207	0.212	0.208	0.211
Disabled	0.047	0.042	0.035*	0.020
Ever Transferred Schools Before	0.400***	0.343	0.418	0.389
Involved in School-Parent Association	0.290***	0.217	0.237	0.212
Sixth Grade Performance	6.00	6.01	5.91	5.92

School-level Characteristics

Urban	0.492***	0.389	0.484***	0.423
Suburban	0.440	0.450	0.435**	0.492
Rural	0.068***	0.161	0.080	0.085
Avg Teacher experience	15.13***	15.97	15.08***	14.50

N of Observations	1786	701	1914	735	2213	1251	2112	1104
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Note: All estimates are based on the final dataset with imputed missing values.

^a Monthly household income is measured in Korean currency. The unit is 10,000 won which is equivalent to 9.4 US dollars (in November, 2013).

⁺< $p < 0.10$; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

Running header: The effects of single-sex versus coeducational schools on adolescent peer victimization and perpetration

Table 1b. Descriptive statistics (means) of peer victimization (TIMSS 2011) and aggression (KELS 2005) outcomes.

Outcome	TIMSS 2011								KELS 2005							
	<i>Peer Victimization</i>								<i>Peer Aggression</i>							
	Boys				Girls				Boys				Girls			
	Coed Schools ^a		All-Boys Schools		Coed Schools ^a		All-Girls Schools		Coed Schools ^a		All-Boys Schools		Coed Schools ^a		All-Girls Schools	
<i>Made Fun Of (Verbal)</i>																
Never	0.352 ⁺	(0.478)	0.311	(0.463)	0.522 ^{***}	(0.500)	0.597	(0.491)	0.553 ⁺	(0.497)	0.584	(0.493)	0.712 ^{***}	(0.453)	0.790	(0.408)
A Few Times A Year	0.241 [*]	(0.428)	0.198	(0.399)	0.270	(0.444)	0.267	(0.443)	0.343 ⁺	(0.475)	0.314	(0.464)	0.231 ^{***}	(0.421)	0.169	(0.375)
Once Or Twice A Month	0.175	(0.380)	0.203	(0.402)	0.119 ^{**}	(0.324)	0.083	(0.276)	0.049	(0.216)	0.050	(0.217)	0.028	(0.165)	0.023	(0.149)
At Least Once A Week	0.232 ^{**}	(0.422)	0.288	(0.453)	0.089 ^{**}	(0.285)	0.053	(0.224)	0.056	(0.229)	0.052	(0.222)	0.029 ⁺	(0.169)	0.018	(0.133)
<i>Left Out of Games (Exclusion)</i>																
Never	0.751	(0.433)	0.735	(0.442)	0.819	(0.385)	0.826	(0.379)	0.765 ^{**}	(0.424)	0.812	(0.391)	0.742 ^{***}	(0.437)	0.864	(0.343)
A Few Times A Year	0.155 ⁺	(0.362)	0.183	(0.387)	0.129	(0.335)	0.133	(0.340)	0.193 ^{**}	(0.395)	0.154	(0.361)	0.238 ^{***}	(0.426)	0.125	(0.331)
Once Or Twice A Month	0.071	(0.257)	0.066	(0.248)	0.032	(0.177)	0.033	(0.178)	0.018	(0.132)	0.016	(0.125)	0.009	(0.094)	0.005	(0.067)
At Least Once A Week	0.024	(0.152)	0.017	(0.130)	0.019 [*]	(0.138)	0.008	(0.090)	0.023	(0.152)	0.018	(0.131)	0.010	(0.102)	0.006	(0.079)
<i>Theft</i>																
Never	0.512 ^{***}	(0.500)	0.375	(0.485)	0.545 [*]	(0.498)	0.595	(0.491)	0.792	(0.406)	0.800	(0.400)	0.825	(0.380)	0.830	(0.376)
A Few Times A Year	0.344	(0.475)	0.374	(0.484)	0.355	(0.479)	0.343	(0.475)	0.168	(0.374)	0.165	(0.371)	0.147	(0.354)	0.143	(0.350)
Once Or Twice A Month	0.116 ^{***}	(0.320)	0.204	(0.403)	0.086 ^{**}	(0.280)	0.053	(0.224)	0.020	(0.140)	0.019	(0.137)	0.019	(0.136)	0.017	(0.130)
At Least Once A Week	0.029 [*]	(0.167)	0.047	(0.212)	0.014	(0.118)	0.010	(0.097)	0.020	(0.140)	0.016	(0.125)	0.009	(0.097)	0.010	(0.099)
<i>Hit or Hurt (Physical)</i>																
Never	0.688 ^{**}	(0.464)	0.619	(0.486)	0.906 [*]	(0.292)	0.933	(0.250)	0.738	(0.440)	0.726	(0.446)	0.896 ^{***}	(0.305)	0.932	(0.252)
A Few Times A Year	0.198	(0.398)	0.221	(0.415)	0.060	(0.238)	0.052	(0.222)	0.226	(0.418)	0.237	(0.425)	0.090 ^{**}	(0.286)	0.058	(0.234)
Once Or Twice A Month	0.064 [*]	(0.246)	0.093	(0.290)	0.017	(0.128)	0.011	(0.104)	0.017	(0.130)	0.018	(0.131)	0.005	(0.072)	0.004	(0.060)
At Least Once A Week	0.050	(0.219)	0.067	(0.250)	0.017 ^{**}	(0.130)	0.004	(0.064)	0.019	(0.136)	0.020	(0.140)	0.009	(0.092)	0.006	(0.079)
N of Observations	1786		701		1914		735		2213		1251		2112		1104	

Note: All estimates are based on the final dataset with imputed missing values. Standard deviations in parentheses.

⁺< $p < 0.10$; ^{*} $p < 0.05$; ^{**} $p < 0.01$; ^{***} $p < 0.001$

Table 2. Logit models for the probability of selection into single sex schools.

Variables	TIMSS 2011				KELS 2005			
	All-Boys School		All-Girls School		All-Boys School		All-Girls School	
<i>Father's Highest Education Level</i>								
Completed University or Higher	-0.20 ⁺	(0.12)	-0.34 ^{**}	(0.12)	-0.23*	(0.11)	-0.15	(0.12)
Completed Post-Secondary	-0.09	(0.18)	-0.25	(0.17)	-0.05	(0.12)	0.05	(0.13)
Completed Lower-Secondary	0.17	(0.23)	0.17	(0.23)	0.13	(0.16)	0.23	(0.17)
Some Primary, Lower-Secondary or No School	0.48	(0.31)	0.57 ⁺	(0.33)	-0.28	(0.30)	-0.78*	(0.36)
<i>Mother's Highest Education Level</i>								
Completed University or Higher	-0.38**	(0.12)	-0.33 ^{**}	(0.13)	-0.18	(0.13)	-0.08	(0.14)
Completed Post-Secondary	0.00	(0.18)	0.23	(0.18)	0.09	(0.13)	-0.05	(0.14)
Completed Lower-Secondary	-0.10	(0.25)	0.90***	(0.21)	-0.06	(0.16)	-0.24	(0.16)
Some Primary, Lower-Secondary or No School	-0.18	(0.31)	0.58)*	(0.28)	-0.05	(0.31)	-0.33	(0.34)
<i><u>TIMSS Specific Covariates</u></i>								
<i>Year of Birth</i>								
Born in 1997/99	0.13	(0.14)	-0.09	(0.14)				
<i>Korean Language Used at Home</i>								
Sometimes	-0.63	(1.43)	-0.72	(1.15)				
Almost Always	-0.29	(0.88)	0.01	(0.13)				
Always	-0.43	(0.88)	n/a	n/a				
<i><u>KELS Specific Covariates</u></i>								
Parents are Married					-0.03	(0.12)	-0.12	(0.13)
Monthly Household Income ^b					0.00	(0.00)	-0.00	(0.00)
Fraction of Household Income Spent on Child's Education					0.17	(0.27)	0.01	(0.28)
Disabled					-0.13	(0.18)	-0.51*	(0.25)
Ever Transferred Schools Before					-0.22**	(0.08)	-0.11	(0.08)
Involved in School-Parent Association					-0.36***	(0.09)	-0.12	(0.09)
Sixth Grade Performance					0.03	(0.02)	0.02	(0.02)
N of Observations	2487		2649		3464		3216	

⁺< $p < 0.10$; ^{*} $p < 0.05$; ^{**} $p < 0.01$; ^{***} $p < 0.001$

Note: For the TIMSS analyses, the omitted categories are completed upper-secondary (high school) for father's and mother's highest education level; born in 1995/6; and never speaks Korean at home. For the KELS analyses, the omitted categories are completed upper-secondary (high school) for father's and mother's highest education level, parents are not married, youth is not disabled, youth has not transferred schools before (during elementary school), and parents are not involved in any school associations. Standard errors in parentheses.

n/a: estimate not applicable for this group

Table 3. The impact of school gender composition (single-sex versus coeducational middle schools) on peer victimization (TIMSS 2011).

Peer Victimization Outcome ^a	Made Fun of by Others (Verbal)			Left Out of Games (Exclusion)			Stolen From (Theft)			Hit or Hurt by Others (Physical)		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
<i>All-Boys School</i>	1.31** (0.12)	1.30** (0.12)	1.32* (0.17)	1.06 (0.12)	1.05 (0.12)	1.14 (0.13)	1.82*** (0.21)	1.79*** (0.21)	1.51*** (0.19)	1.37** (0.14)	1.36** (0.14)	1.28+ (0.17)
Estimated Propensity Score		3.73* (2.42)	6.39** (4.59)		2.06 (2.18)	4.47 (5.14)		0.60 (0.54)	0.49 (0.47)		3.26 (2.82)	2.23 (2.07)
Suburban			1.13 (0.23)			1.05 (0.23)			1.75* (0.46)			1.17 (0.19)
Medium Size City			1.19 (0.18)			0.92 (0.20)			1.89* (0.59)			1.23 (0.23)
Small Town			1.13 (0.25)			1.09 (0.28)			1.44 (0.50)			1.46 (0.45)
Neither More Affluent nor More Disadvantaged Students			1.08 (0.11)			0.99 (0.13)			1.43** (0.19)			0.94 (0.12)
More Disadvantaged than Affluent Students			1.08 (0.15)			0.84 (0.13)			1.69** (0.30)			0.98 (0.16)
Province Fixed Effects	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
<i>All-Girls School</i>	0.70** (0.08)	0.68*** (0.08)	0.66*** (0.07)	0.94 (0.12)	0.95 (0.12)	0.96 (0.11)	0.79 (0.14)	0.75+ (0.13)	0.67* (0.11)	0.68* (0.12)	0.60** (0.10)	0.54** (0.13)
Estimated Propensity Score		2.60+ (1.30)	2.65* (1.31)		0.34 (0.28)	0.21+ (0.19)		4.01** (2.07)	2.86* (1.45)		6.50* (5.89)	4.50 (4.47)
Suburban			0.69+ (0.14)			0.55** (0.11)			0.46* (0.14)			0.35** (0.12)
Medium Size City			0.70+ (0.14)			0.64* (0.12)			0.88 (0.28)			0.32*** (0.11)
Small Town			0.67+ (0.16)			0.59* (0.13)			0.99 (0.34)			0.49+ (0.19)
Neither More Affluent nor More Disadvantaged Students			1.25 (0.21)			1.26 (0.21)			1.35 (0.30)			2.07** (0.57)
More Disadvantaged than Affluent Students			1.27 (0.19)			1.75*** (0.27)			1.38 (0.32)			2.04* (0.57)
Province Fixed Effects	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes

Note: Standard errors in parentheses. All estimates are based on the final dataset with imputed missing values. Estimates are exponentiated coefficients interpreted as the proportional odds ratio. Omitted categories are urban school and school socioeconomic status indicating that the school has more affluent than disadvantaged students.

^a The frequency of peer victimization is coded as: 1 'Never', 2 'A few times a year', 3 'Once or twice a month', and 4 'At least once a week'.

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

Table 4. The impact of school gender composition (single-sex versus coeducational middle schools) on peer aggression (KELS 2005).

Peer Aggression ^a Outcome	Make Fun of Others (Verbal)			Leave Others Out (Exclusion)			Steal From (Theft)			Severely Hit Others (Physical)		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
<i>All-Boys School</i>	0.89 (0.08)	0.89 (0.09)	0.89 (0.09)	0.76* (0.09)	0.78* (0.09)	0.79* (0.09)	0.95 (0.10)	0.93 (0.09)	0.92 (0.09)	1.06 (0.10)	1.06 (0.10)	1.06 (0.10)
Estimated propensity score		3.02 (2.18)	3.18 (2.28)		1.16 (0.79)	1.22 (0.83)		4.20 (3.41)	4.07 (3.28)		3.27 (2.23)	3.26 (2.21)
Suburban			1.04 (0.10)			0.92 (0.10)			1.07 (0.11)			0.92 (0.09)
Rural			0.88 (0.18)			0.81 (0.22)			1.16 (0.20)			0.94 (0.17)
Average teacher experience in years			1.01 (0.01)			1.01 (0.02)			0.99 (0.02)			1.00 (0.01)
<hr/>												
<i>All-Girls School</i>	0.66*** (0.06)	0.66*** (0.07)	0.66*** (0.06)	0.45*** (0.06)	0.46*** (0.06)	0.47*** (0.06)	0.97 (0.13)	0.97 (0.14)	0.97 (0.13)	0.63** (0.09)	0.65** (0.09)	0.64** (0.09)
Estimated propensity score		1.01 (1.36)	0.91 (1.21)		0.20 (0.22)	0.24 (0.28)		0.88 (1.12)	0.84 (1.10)		0.05 (0.08)	0.05 (0.08)
Suburban			1.10 (0.11)			0.90 (0.11)			1.03 (0.15)			0.99 (0.13)
Rural			1.33 (0.23)			0.59** (0.11)			1.12 (0.30)			0.96 (0.32)
Average teacher experience in years			1.02 (0.01)			1.02 (0.01)			1.00 (0.02)			0.97 (0.02)

Note: Standard errors in parentheses. All estimates are based on the final dataset with imputed missing values. Estimates are exponentiated coefficients interpreted as the proportional odds ratio. Omitted category is urban school.

^a The frequency of peer aggression is coded as: 1 'Never', 2 'A few times a year', 3 'Once or twice a month', and 4 'At least once a week'.

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

Figure 1. Distribution of the estimated propensity scores for both boys and girls in the TIMSS 2011 sample

Note: The x -axis represents the lower bound of the propensity score. The intervals of the x -axis are chosen to ensure that the two groups do not differ in propensity scores within each interval at the 1 percent significance level. The mean of each covariate included in the propensity score model is not different at the 1 percent significance level between boys in all-boys (single-sex) and coeducational schools.

Note: The x -axis represents the lower bound of the propensity score. The intervals of the x -axis are chosen to ensure that the two groups do not differ in propensity scores within each interval at the 1 percent significance level. The mean of each covariate included in the propensity score model is not different at the 1 percent significance level between girls in all-girls (single-sex) and coeducational schools.

Figure 2. Distribution of the estimated propensity scores for both boys and girls in the KELS 2005 sample

Note: The x -axis represents the lower bound of the propensity score. The intervals of the x -axis are chosen to ensure that the two groups do not differ in propensity scores within each interval at the 1 percent significance level. The mean of each covariate included in the propensity score model is not different at the 1 percent significance level between boys in all-boys (single-sex) and coeducational schools.

Note: The x -axis represents the lower bound of the propensity score. The intervals of the x -axis are chosen to ensure that the two groups do not differ in propensity scores within each interval at the 1 percent significance level. The mean of each covariate included in the propensity score model is not different at the 1 percent significance level between girls in all-girls (single-sex) and coeducational schools.