Co-Development of Adolescents' Cooperative and Competitive Attitudes: How it Predicts Mental Health and Academic Achievement

You-kyung Lee (iD)
Sookmyung Women's University

Eun Ha Kim
Michigan State University

Eunjin Seo
The University of Texas at Austin

This study used nationally representative longitudinal data in South Korea to examine how joint changes in adolescents' ($N = 7324$; $M_{age} \approx 11$ years) cooperative and competitive attitudes from sixth to ninth grade relate to mental health and achievement in 10th grade. The parallel process model showed that both cooperative and competitive attitudes declined over time. Higher cooperative attitudes at baseline indicated higher competitive attitudes, and a faster decline in cooperative attitudes indicated a faster decline in competitive attitudes. The intercept of cooperative attitudes was positively related to mental health but negatively related to achievement. Opposite patterns were found for the intercept of competitive attitudes. These findings highlight the usefulness of considering the co-development of cooperative and competitive attitudes.

Key words: cooperation – competition – social interdependence theory

As adolescents shift to secondary school, there is an increase in public evaluation and concerns about social comparison (Eccles et al., 1993). At the same time, the secondary school transition period is a developmentally critical time for adolescents to attend to peer relationships and seek social belonging and acceptance (Wigfield et al., 2006). The environmental and developmental characteristics during this transition period shape certain ways of interacting with others. Social interdependence theory (Deutsch, 1949; Johnson & Johnson, 1989) suggests that individuals may work with others cooperatively or competitively and that the nature of social interaction influences a range of outcomes, including psychological (e.g., mental health) and academic (e.g., school achievement) outcomes.

Adolescents' behavioral patterns based on their preference for and value of cooperation or competition, namely *cooperative and competitive attitudes*, are key predictors of a variety of developmental and educational outcomes (Lee et al., 2020; Lee & Seo, 2022). However, considering that adolescence is a critical period during which adolescents experience a great deal of environmental and developmental changes (Eccles et al., 1993), it is very likely

that their cooperative and competitive attitudes change over time. This may lead to a change in the extent to which the two different attitudes influence educational outcomes across time, such that competitive attitudes in early adolescence may be detrimental to students' mental health (Roseth et al., 2008); however, competitive attitudes may have little impact in late adolescence as competition becomes a norm and relative evaluation is emphasized. Thus, we need to examine both the initial levels of cooperative and competitive attitudes during early adolescence and their development patterns over time to better understand how they contribute to the educational domain across all stages of adolescence.

However, most extant studies have used experimental or cross-sectional designs to identify the relative effects of cooperative and competitive situations on various outcomes (Johnson & Johnson, 2009; Roseth et al., 2008). This means that research is lacking on how adolescents' naturalistic cooperative and competitive attitudes develop in classroom contexts over time, and how these attitudes are associated with distal outcomes. Furthermore, given the significant associations between cooperative and competitive attitudes reported in prior research (Elliot et al., 2016), the development

of these attitudes over time may not be independent but may rather be interrelated. Therefore, we tested a parallel process model of adolescents' cooperative and competitive attitudes longitudinally, allowing us to examine the co-development of these attitudes and their associations with mental health and academic achievement.

Social Interdependence Theory

According to social interdependence theory (Deutsch, 1949; Johnson & Johnson, 1989), cooperation occurs when an individual's actions positively influence others' and own outcomes. However, competition is fostered when an individual's actions negatively influence others' outcomes. Although numerous studies have focused on the effects of cooperative and competitive *situations*, Deutsch theorized that individuals develop their own psychological orientations toward cooperation and competition over time (Coleman & Deutsch, 2015), which are defined as social interdependence *attitudes*. Given the dynamic nature of social relations in the classroom, adolescents' social interdependence attitudes, including cooperative and competitive attitudes, are likely to guide social interactions with others, affecting their psychological and achievement outcomes (Lee et al., 2020).

According to this theory, an individual who prefers and values cooperation (i.e., cooperative attitudes; Johnson & Norem-Hebeisen, 1979) tends to perceive others as informational sources with whom to collaborate to achieve shared goals (Nichols & Miller, 1994; Norem-Hebeisen & Johnson, 1981). The theory also posits that individuals who prefer and value competition (i.e., competitive attitudes) tend to perceive others as a potential threat to self-evaluation (Nichols & Miller, 1994; Norem-Hebeisen & Johnson, 1981). Importantly, the basic assumption of social interdependence theory is that cooperation occurs when one's success relates to others' success, whereas competition occurs when one's success relates to others' failure (Johnson & Johnson, 2009); hence, it may be that cooperative and competitive attitudes are opposite ends of a single dimension. However, Deutsch also suggests that "there are probably very few, if any, real-life situations which [. . .] are 'purely' cooperative or competitive. Most situations of everyday life involve a complex set of goals and sub-goals" (Deutsch, 1949, p. 132). That is, cooperative and competitive attitudes may be somewhat intertwined as life often presents people with complex, mixed-motive situations. This perspective provided

by social interdependence theory is important because it underpins the possibility that these two attitudes are shaped interrelatedly, not independently from each other.

Development of Cooperative and Competitive Attitudes

Research has documented that students' cooperative and competitive attitudes can change depending on classroom environment (Choi et al., 2011; Roseth et al., 2019), indicating that individuals' social interdependence attitudes are malleable rather than trait-like, static variables. For instance, third- to fifth-grade students who perceived a more frequent use of cooperative learning in their classroom experiences showed greater cooperative attitudes (Choi et al., 2011). Roseth et al. (2019) also found that college students' cooperative attitudes were higher in cooperative learning laboratories than in the control condition (business-as-usual laboratories). These findings indicate that social interdependence attitudes can develop over time or under certain situations, rather than being a stable and biological predisposition.

As adolescence is characterized by many changes in social developmental aspects (Eccles et al., 1993), social interdependence attitudes may also change during this period (Shwalb et al., 1995). For one, adolescence is a critical developmental period for social cognition—including the emergence of mature perspective taking, moral reasoning, and sensitivity to social status (Crone & Dahl, 2012; Damon et al., 2006)—so individuals' attitudes toward cooperation and competition may increase during adolescence. For another, the changes in the learning environment that adolescents face when going from primary to secondary schools, which emphasize individual work, may thwart the development of competitive and cooperative attitudes during adolescence.

Most extant empirical studies on cooperative and competitive attitudes have been conducted with a cross-sectional or experimental design by manipulating learning conditions, with a few exceptions (e.g., Choi et al., 2011; Shwalb et al., 1995). In one of the few studies examining whether adolescents' cooperative and competitive attitudes would change longitudinally (i.e., across 3 years) from junior high to high school, cooperative attitudes declined, whereas competitive attitudes increased over time in academic settings (Shwalb et al., 1995). Additionally, Choi et al. (2011) provided evidence that there are differences in the levels of social

interdependence attitudes depending on grade level, such that fifth graders showed greater competitive attitudes compared with third or fourth graders, whereas their cooperative attitudes were lower.

Notably, no prior research has examined the joint trajectories of cooperative and competitive attitudes. Based on the assumption that real-life situations often evoke complex, mixed-motive settings containing elements of both cooperation and competition (Deutsch, 1949, 2006), one may rationalize that the developmental pathways of cooperative and competitive attitudes interrelate in the real world and covary longitudinally. A longitudinal study showed that adolescents' competitive attitudes increased over time, whereas their cooperative attitudes decreased during the same period (Shwalb et al., 1995). However, these researchers examined the trajectories of the two attitudes separately, not how they interrelated over time. Therefore, examining the associations between the trajectories of these two attitudes in one model (i.e., a parallel process model) may allow us to reveal the patterns of development of social interdependence attitudes and whether these patterns indeed interrelate in reality. Such knowledge will provide insights that can advance theory on the developmental patterns of social interdependence attitudes.

The Associations Between Social Interdependence and Mental Health

The consistent findings of prior studies emphasize the crucial role of adolescents' mental health in predicting their successful adaptation to environments and completion of developmental tasks across ages (Masten & Curtis, 2000; Roeser et al., 1999). Social interdependence theory states that "working cooperatively with peers and valuing cooperation result in greater psychological health than do competing with peers" (Johnson & Johnson, 2009, p. 372). More specifically, cooperative attitudes encourage open and accurate communication with others, high feelings of safety and self-confidence, and high satisfaction from efforts to achieve (Johnson & Johnson, 2005; Norem-Hebeisen & Johnson, 1981), making it so that cooperative attitudes enhance one's mental health. Social interdependence theory also postulates that competitive attitudes—in contrast to cooperative attitudes—result in conditional acceptance, meaning that the approval of others and feelings of self-worth depend on others' evaluations of one's

performance (Norem-Hebeisen & Johnson, 1981; Tjosvold et al., 2006), making it so that competitive attitudes deteriorate one's mental health.

While limited empirical research has focused on the outcomes of social interdependence *attitudes* (e.g., cooperation attitudes), studies on the effects of interdependence *situations* (e.g., competition-promoting situations) have reported findings that are consistent with these theoretical claims (for review, see Johnson & Johnson, 2005; Johnson et al., 2014). In a review of prior literature on the effectiveness of cooperative attitudes, Johnson and Johnson (2005) suggested the following: a positive relation between cooperative attitudes and mental health (e.g., emotional maturity and the ability to deal with distress); and that there are empirical research which highlight the negative association between competitive attitudes and mental health, such that those with higher competitive attitudes are more likely to alienate themselves from others than their counterparts with lower competitive attitudes. In particular, self-esteem—a major mental health indicator—was promoted more by cooperative than competitive situations (Johnson & Johnson, 1989). Additionally, Van Ryzin and Roseth (2018) conducted an experimental study and found that students who received an intervention promoting cooperative learning showed less perceived stress and emotional problems (e.g., worry, unhappiness, and depression). Thus, cooperative attitudes may lead to better mental health among adolescents compared with competitive attitudes.

Importantly, most prior researchers have not accounted for time-related changes in cooperative and competitive attitudes; instead, these were assessed at a single time point or manipulated in experimental research. Therefore, the literature on the longitudinal associations of prosocial behaviors (i.e., one's tendency to help and cooperate with others) and performance-approach goals (i.e., aims of outperforming others), which reflect the key characteristics of cooperative and competitive attitudes, respectively, may help us understand—and potentially predict—how developmental changes in these attitudes lead to mental health-related outcomes.

Regarding prosocial behaviors, those with prior tendencies to help and cooperate with others tend to show higher levels of mental health at later time points (Davis et al., 2016; Haroz et al., 2013; Zuffianò et al., 2014). For example, the prosocial behaviors of adolescents at baseline showed a negative relation with their depressive symptoms 6–8 months and 1 year later (Davis et al., 2016), as well as with depression 6 months later (Haroz

et al., 2013). Furthermore, a 10-year longitudinal study showed that a developmental increase in prosocial behaviors (i.e., helping, taking care of others' needs, sharing, empathizing with others' feelings) was positively associated with an increase in self-esteem (Zuffianò et al., 2014). These positive relations between adolescents' prosocial behaviors and mental health over time suggest the existence of positive associations between the initial level and change rate of cooperative attitudes and mental health.

Performance-approach goals have shown mixed associations with mental health (Scherrer et al., 2020; Zhou et al., 2020). For instance, performance-approach goals in sixth grade were positively related to positive emotions toward mathematics in eighth grade (Scherrer et al., 2020). A 3-year longitudinal study showed that adolescents' performance-approach goals in seventh grade did not significantly predict their self-esteem in eighth grade nor their subjective well-being in ninth grade (Zhou et al., 2020), contrasting the aforementioned results. Given the inconclusive patterns of performance-approach goals and the lack of empirical research on how changes in competitive attitudes predict mental health-related outcomes, we based our hypothesis regarding the association between competitive attitudes and mental health mainly on social interdependence theory.

The Associations Between Social Interdependence and Academic Achievement

Academic achievement is considered a key indicator of educational outcomes; for example, it strongly predicts students' post-graduation success, including in future jobs, educational careers (i.e., achieving high educational levels), above and beyond cognitive abilities and intelligence (Zuffianò et al., 2013). As academic achievement and mental health are two crucial aspects of adolescents' adjustment (Roeser et al., 1999; Zuffianò et al., 2013), including both variables in our analytical model may enable our findings to provide a comprehensive picture of the role of social interdependence attitudes in adolescents' psychological and educational development.

Social interdependence theory suggests that cooperative attitudes increase group members' efforts to achieve mutual benefits and empower them to achieve goals that cannot be attained alone (Johnson et al., 2014). These attitudes also lead one to focus on self-improvement and task understanding without concerns about winning or outperforming others, positively predicting achievement (Roseth et al., 2008, 2019). Meta-analytic research findings provided consistent evidence that cooperative situations are more strongly and positively related to achievement than competitive situations ($g = .43$ in Johnson et al., 2014; $g = .46$ in Roseth et al., 2008). Although research framed on social interdependence theory has primarily focused on the comparisons of the impact of cooperative and competitive *situations*, social interdependence attitudes are expected to show similar relations, with cooperative and competitive attitudes predicting increased and decreased academic achievement, respectively (see Choi et al., 2011).

However, empirical research also reports that competitive attitudes are not always detrimental to adolescents' academic achievement (Lee & Seo, 2022; Murayama & Elliot, 2012). For instance, competitive attitudes can facilitate task performance and achievement (for review, see Aiello & Douthitt, 2001). In their review of social facilitation theory, Aiello and Douthitt (2001) demonstrated that individuals could show higher levels of performance in the presence of others than when they were alone because social presence leads individuals to focus on competence validation, thereby making them commit to their goals. Even social interdependence researchers suggest that competitive attitudes could promote higher achievement under certain circumstances, proposing the notion of "constructive competition" (Johnson & Johnson, 2005). For instance, when winning is relatively unimportant, every individual can win, and there are clear rules and criteria for winning in a competitive situation, these characteristics could lead individuals to gain higher achievement. These studies indicate the possibility of competitive attitudes positively predicting adolescents' academic achievement.

Of note, most researchers studying the association between adolescents' social interdependence attitudes and academic achievement have conducted cross-sectional studies, meaning that this relation remains to be analyzed through longitudinal designs. Prior longitudinal research on prosocial behaviors—which are closely related to cooperative attitudes—consistently support the idea that prior prosocial behaviors are positively associated with later academic achievement (Caprara et al., 2000; Carlo et al., 2018; Wentzel & Caldwell, 1997). While the evidence here suggests a positive association between the initial level of cooperative attitude and later academic achievement, there is much less evidence on how the rate

of change in cooperative attitude over time relates to academic achievement later on.

Moreover, the evidence on performance-approach goals—conceptually close to competitive attitudes (Scherrer et al., 2020; Shim et al., 2008)—remains inconclusive. Some researchers showed that, from sixth to seventh grades, performance-approach goal changes were positively associated with achievement changes (Shim et al., 2008). Others demonstrated that, from fifth to seventh grades, students' performance-approach goals trajectory was non-significantly associated with longitudinal achievements in math (Scherrer et al., 2020). This inconsistency in the directions of the association between changes in performance-approach goals and academic achievement further complexify our predictions, leading us to base our expectations regarding the association between competitive attitudes and achievement on social interdependence theory and social facilitation theory.

THE PRESENT STUDY

In this study, we aimed to answer three research questions by utilizing a parallel process model examining the joint trajectories of adolescents' cooperative and competitive attitudes from sixth to ninth grades, along with how these trajectories were related to mental health and academic achievement in 10th grade. The first research question was how adolescents' cooperative and competitive attitudes changed from sixth to ninth grades. Based on the assumptions pertaining to the environmental changes during the secondary school transition (Eccles et al., 1993) and prior empirical studies (Choi et al., 2011; Shwalb et al., 1995), we hypothesized that cooperative attitudes would decrease, whereas competitive attitudes would increase over time.

The second research question was whether and to what extent the trajectories of cooperative and competitive attitudes covaried from sixth to ninth grades. Specifically, the hypothesis for this research question considered the theoretical coexistence of cooperative and competitive attitudes, meaning that they would covary across adolescence. Namely, their trajectories (i.e., intercepts and slopes) are associated with one another. However, due to the lack of prior empirical research examining the associations between the developmental patterns of cooperative and competitive attitudes, we did not make a direct hypothesis regarding the extent and direction of their associations and trajectories.

The third research question was how the trajectories of cooperative and competitive attitudes from sixth to ninth grades related to mental health and academic achievement in 10th grade. For mental health, based on prior empirical research, we hypothesized that cooperative attitudes would positively relate to mental health, whereas competitive attitudes would negatively relate to it (Johnson & Johnson, 2005). For academic achievement, we set two competing hypotheses based on the inconsistent research findings: (1) cooperative attitudes would more positively relate to achievement than competitive attitudes (Johnson et al., 2014; Roseth et al., 2008); or (2) cooperative and competitive attitudes would positively relate to achievement to a similar extent (Aiello & Douthitt, 2001; Johnson & Johnson, 2005).

Finally, we included gender, baseline achievement, and family income as covariates in the model, as prior research suggests that these demographic factors account for individual differences in social interdependence-related constructs (Van der Graaff et al., 2018) as well as developmental and educational outcomes (Matthews et al., 2009; Sirin, 2005).

METHOD

Sample

Data from the Korean Educational Longitudinal Study 2013 (KELS2013), a nationally representative longitudinal survey conducted in South Korea, were used. In 2013, a total of 7324 fifth grade students (50.5% female; $M_{age} \approx 11$ years) were selected through stratified cluster random sampling based on region (e.g., rural or urban), city size, and school type to ensure that the sample was representative of all fifth-grade students in South Korea, which was the target population in the dataset. These students were surveyed every year, and this annual survey continued until they graduated from high school for the first stage of data collection. Based on the availability of the focal variables (social interdependence attitudes, mental health, and academic achievement), the data in the second (sixth grade) to sixth (10th grade) waves were used, excluding the first and fourth waves where social interdependence attitudes were not assessed. The total number of sixth-grade students was 7105 (retention rate: 97%), and the retention rates in grades 7, 9, and 10 were 92%, 89%, and 85%, respectively (see Missing data analyses in the Appendix S1 and Table S1).

Measures

Adolescents' social interdependence attitudes, including cooperative and competitive attitudes, were measured in sixth, seventh, and ninth grades (not measured in fifth, eighth, and 10th grades). Self-reported mental health and academic performance scores on the national-level standardized test were collected in 10th grade. Covariates were included in the analysis. All items for social interdependence attitudes and mental health are presented in the Supplemental materials.

Social interdependence attitudes. Three items were used for cooperative attitudes (e.g., "I like helping my friends study better," αs = .86–.92). Three other items were used for competitive attitudes (e.g., "I try to get ahead of other students," αs = .79–.86). All items were answered on a 4-point Likert scale ranging from 1 (*not at all*) to 4 (*very much*). These items were similar to those often used in prior studies examining social interdependence attitudes, representing a liking for and value of social interdependence in educational settings (e.g., "I like to help other students," "I want to do better than other students," Lee et al., 2020; Roseth et al., 2019); they were originally developed by Johnson and Norem-Hebeisen (1979).

Confirmatory factor analysis of items for cooperative and competitive attitudes by each year was conducted to compare one-factor (all items for both attitudes were loaded onto the same factor with the reverse-coded scores on competitive attitude) and two-factor models (items for cooperative attitude were loaded onto one factor and those for competitive attitude were loaded onto the other factor, and these two factors were correlated with each other). The two-factor model for cooperative and competitive attitudes at each grade fit the data well (Table 1), whereas the one-factor model showed poor fit, CFI = 0.252 to 0.411, RMSEA = 0.352 to 0.364. Thus, we used a two-factor model for the main longitudinal growth curve model.

Mental health. Nine items were used to assess mental health in the past 1–2 weeks (α = .91). Some examples of items are: "I feel comfortable," and "I feel happy." Six of the nine items were negatively worded (e.g., "I feel anxious"), which were reverse coded prior to analysis. All items were answered using a 5-point Likert scale ranging from 1 (*not at all*) to 5 (*very much*). Similar items have been used to assess individuals' mental health in prior

TABLE 1
Confirmatory Factor Analysis (CFA) on Social Interdependence Attitudes

Model	χ^2(df)	CFI	ΔCFI	RMSEA [90% CI]
One-factor CFA[a]				
Grade 6	8021.15 (9)	0.411	–	0.352 [.345, .358]
Grade 7	8142.58 (9)	0.376	–	0.364 [.358, .371]
Grade 9	8172.41 (9)	0.252	–	0.355 [.348, .361]
Two-factor CFA				
Grade 6	118.96 (8)	0.991	–	0.044 [.037, .051]
Grade 7	154.26 (8)	0.987	–	0.052 [.045, .059]
Grade 9	273.69 (8)	0.977	–	0.072 [.064, .079]
Longitudinal CFA				
Configural	2084.06 (120)	0.960	–	0.048 [.046, .050]
Weak	2243.97 (128)	0.957	−.003	0.048 [.046, .050]
Strong	2445.97 (136)	0.953	−.004	0.049 [.047, .050]
Strict	2528.14 (148)	0.952	−.001	0.047 [.046, .049]

Note. CFI = comparative fit index; RMSEA = root-mean-square error of approximation.
All chi-square values were statistically significant, $p < .001$.
[a] To ensure the dimensionality of cooperative and competitive attitudes, one-factor models, in which all items for cooperative and competitive attitudes (but the scores on competitive attitude were reverse coded) were loaded onto the same factor, were compared to two-factor models, where the items for cooperative attitude were loaded onto one factor and those for competitive attitude were loaded onto the other factor. The two-factor models showed better fit indices than the one-factor models across grades, thus the two-factor models were used to test the longitudinal CFA models.

research (e.g., Clarke et al., 2011; e.g., "I've been feeling relaxed," and "I've been feeling cheerful").

Academic achievement. Participants' National United Achievement Test (NUAT) scores were collected through institutional records when they were in the 10th grade. In South Korea, the majority of 10th-grade students in high school take this standardized test to assess their current academic performance level. The purpose of this test is to provide students with the opportunity to practice for the College Scholastic Assessment Test (CSAT). It is also known that the number of test takers in the NUAT is parallel to that of the CSAT. Like the CSAT, the NUAT provides a nine-grade relative evaluation result (where Rank 1 is the best and Rank 9 is the worst) based on the standardized test scores.

In line with this, the Korean Educational Longitudinal Study 2013 (KELS2013) provides nine-grade assessment scores, but only for three core subjects: Korean, mathematics, and English. These three subjects are considered the most important in assessing students' scholastic aptitude in Korea

(Lee & Seo, 2019). To utilize these scores as an academic achievement indicator, we reversed the average scores on the NUAT for the three subjects, so that higher values indicated higher academic achievement.

Covariates. Crucial covariates, such as gender (male = 0, female = 1), baseline achievement, and family background, which potentially influence adolescents' learning and academic performance, were included. For baseline achievement, the average scores on the standardized test on Korean, mathematics, and English in sixth grade were used. This test was developed and validated by the Korean Educational Development Institute, with strong evidence of reliability and predictive validity, as described in their official technical report.[1] The test scores were calculated based on vertical scaling, with a mean of 200 and a standard deviation of 40. Vertical scaling allows a comparison of the scores to those from other waves, which provides useful information (e.g., growth in individuals' academic ability) for longitudinal data. To utilize the scores in the analysis, a composite score was calculated based on the standardized scores of the three subjects (Korean, mathematics, and English). With regard to family background, the parent-reported average monthly income of the family was included (M = KRW 4,932,500; approximately $4205). The values for baseline achievement and family income were rescaled by dividing them by 10 for model convergence (Muthén, 2010).

Statistical Analysis

As a preliminary analysis, longitudinal confirmatory factor analyses were conducted to ensure measurement invariance over time for social interdependence attitudes (Vandenberg & Lance, 2000). Four consecutive models were tested to assess different levels of measurement invariance, including equivalent patterns of factor parameters (i.e., configural invariance), equivalent factor loadings (i.e., weak invariance), equivalent item intercepts (i.e., strong invariance), and equivalent residual variances (i.e., strict invariance).

As a primary analysis, a structural equation modeling framework was applied to test second-order latent growth curve models for social interdependence attitudes. Second-order growth models are effective in yielding less biased estimates by

accounting for measurement errors. First, a no-growth (intercept-only) model and an unconditional linear growth model were compared to determine the optimal trajectory of each cooperative and competitive attitude. Second, based on the selected unconditional models, parallel process models of cooperative and competitive attitudes were specified with two different outcomes (mental health and academic achievement). Three covariates (gender, baseline achievement, and family income) were also included as predictors of the two outcomes.

Across all preliminary and primary analyses, full information maximum likelihood (FIML) was used in conjunction with the robust maximum likelihood estimator in Mplus 8 to handle missing data (Enders, 2010). To address the nested structure of the data (i.e., students within schools), cluster-robust standard errors were adjusted. Model fit was determined using the comparative fit index (adequate if CFI ≥0.90; good if CFI ≥0.95) and root mean square error of approximation (adequate if RMSEA <0.08, good if RMSEA <0.06; Hu & Bentler, 1999). Given the large sample size, model comparisons were evaluated based on a change in CFI of less than or equal to 0.01 (Cheung & Rensvold, 2002).

RESULTS

Preliminary Analyses

The percentage of missing data ranged from 0% to 14.7% for the items, except for the NUAT score (academic achievement) for 10th grade (45.3%). Based on the Missing At Random pattern of our data, FIML was used (see Missing data analyses in the Appendix S1). Descriptive statistics showed that, on average, both cooperative and competitive attitudes decreased over time, and these two constructs were consistently positively correlated with each other (Table 2). Overall, academic achievement in 10th grade was more strongly related to competitive than cooperative attitudes, whereas mental health in 10th grade was more strongly related to cooperative than competitive attitudes.

Parallel Process Latent Growth Curve Models

Longitudinal measurement invariance was established with strict constraints using the two-factor model of social interdependence attitudes (Table 1). Accordingly, we used strict measurement invariance constraints for subsequent longitudinal growth curve models. For the unconditional

---

[1]https://www.kedi.re.kr/khome/main/research/selectPubForm.do?plNum0=9918

TABLE 2
Means, Standard Deviations, and Intercorrelations Among Study Variables

	1	2	3	4	5	6	7	8	9	10	11
1. Gender	–										
2. G6 Test score	.11***	–									
3. Family income	−.01	0.20*	–								
4. G6 Cooperation	0.01	0.07**	0.04***	–							
5. G7 Cooperation	−.04***	0.002	0.03	0.36***	–						
6. G9 Cooperation	−.09***	0.02	0.03**	0.24***	0.34***	–					
7. G6 Competition	−.09***	0.11**	0.07***	0.29***	0.11***	0.07***	–				
8. G7 Competition	−.07***	0.13***	0.08***	0.15***	0.26***	0.11**	0.42***	–			
9. G9 Competition	−.08***	0.10*	0.08***	0.09***	0.10*	0.27***	0.30***	0.39***	–		
10. G10 Mental health	−.19***	0.05**	0.01	0.10***	0.12**	0.15***	0.04**	0.03**	0.02		
11. G10 Achievement	0.04**	0.66**	0.20*	0.04	−.03	−.004	0.13***	0.16***	0.13***	0.08***	–
M	0.51	204.68	493.25	3.01	2.90	2.76	2.74	2.64	2.52	3.68	5.26
SD	0.50	32.75	458.87	0.70	0.71	0.72	0.77	0.76	0.76	0.82	1.85
N	7324	7196	6974	7105	6761	6479	7103	6760	6479	6257	4007

Note. G6 to G10 = grade 6 to grade 10. For gender, men were coded as 0 and women were coded as 1.
*$p < .05$; **$p < .01$; ***$p < .001$.

TABLE 3
Fit Statistics for Unconditional Growth Curve Models

Model	χ^2(df)	CFI	RMSEA
Cooperation			
Intercept-only	1930.66*** (44)	0.904	0.077
Linear	1328.09*** (41)	0.934	0.066
Competition			
Intercept-only	961.12*** (44)	0.963	0.054
Linear	606.42*** (41)	0.977	0.044

Note. CFI = comparative fit index; RMSEA = root-mean-square error of approximation.
***$p < .001$.

growth models, both the intercept-only and linear models showed acceptable fit indices (Table 3). However, the linear models showed better fit, with both intercepts and slopes that were significantly different from zero ($p < .001$); thus, linear models were chosen as the best-fitting models for both cooperative and competitive attitudes.

In the conditional growth model, mental health and academic achievement in 10th grade were added, along with gender, test scores in sixth grade, and family income as control variables (Figure 1). The fit indices revealed that the model represented the data well: χ^2 (237) = 4348.83, CFI = 0.926, RMSEA = 0.050 [90% CI: 0.049, 0.052]. Growth parameter estimates of cooperative and competitive attitudes (Table 4) were substantially similar to those in the final unconditional growth model, and the predicted trajectories are plotted in Figure 2.

Adolescents reported moderately high cooperative attitudes (95% CI [3.06, 3.10]) and moderate competitive attitudes (95% CI [2.78, 2.83]) in sixth grade, and both attitudes significantly declined over time (cooperative: 95% CI [−0.10, −0.09]; competitive: 95% CI [−0.06, −0.05]), with a slightly steeper slope of cooperative attitudes. Each attitude showed that the intercept was negatively related to the corresponding slope to a similar extent (cooperative: 95% CI [−0.04, −0.03]; competitive: 95% CI [−0.03, −0.02]), meaning that adolescents with higher initial levels of cooperative or competitive attitudes showed steeper declines in the corresponding attitudes. The intercept of cooperative attitudes was positively related to that of competitive attitudes (95% CI [0.11, 0.13]), and the same occurred for the slopes (i.e., they were positively related; 95% CI [0.02, 0.02]). This indicates that adolescents with higher cooperative attitudes in sixth grade tended to have higher competitive attitudes in sixth grade, and adolescents with faster decreases in cooperative attitudes tended to show faster decreases in competitive attitudes as well. Finally, the results revealed that adolescents with higher cooperative attitudes in sixth grade tended to show faster declines in competitive attitudes (95% CI [−0.03, −0.02]), and those with higher competitive attitudes in sixth grade also tended to show faster declines in cooperative attitudes (95% CI [−0.04, −0.03]).

All estimated unstandardized and standardized coefficients, including those of the covariates, are presented in Table 5. The intercept of cooperative
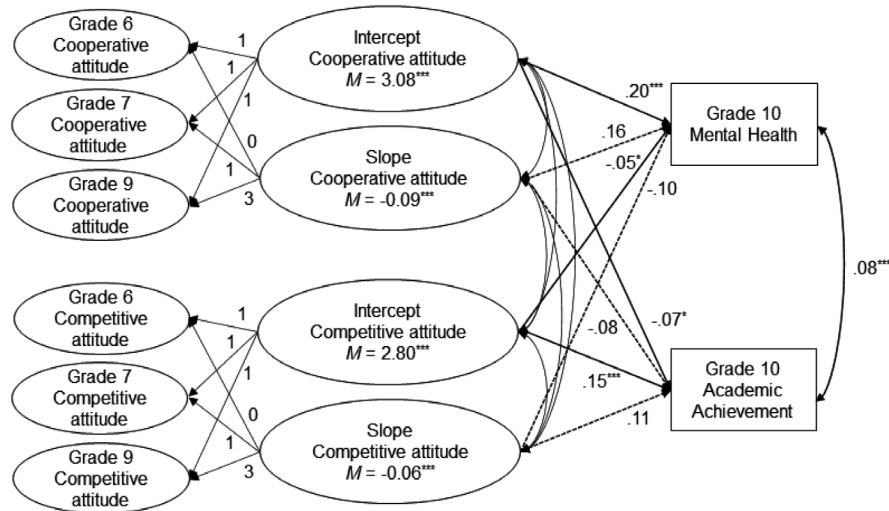
FIGURE 1 Standardized path coefficients for second-order linear growth model. *Note.* Dotted lines indicate statistically not significant paths. Three covariates (predicting mental health and academic achievement) were included but not pictured. *$p < .05$, ***$p < .001$.

TABLE 4
Unstandardized Growth Parameter Estimates and Their Correlations in the Conditional Growth Curve Model

| | | | | | Covariances | | |
	Mean	SE	Variance	SE	1	2	3
1. Cooperation Intercept	3.08***	0.01	0.24***	0.01	–		
2. Competition Intercept	2.80***	0.01	0.19***	0.01	0.12***	–	
3. Cooperation Slope	−0.09***	.01	.04***	.004	−.03***	−.03***	–
4. Competition Slope	−0.06***	0.004	0.02***	0.002	−.03***	−.02***	.02***

Note. The estimates for the unconditional and conditional growth curve models were remained substantially similar.
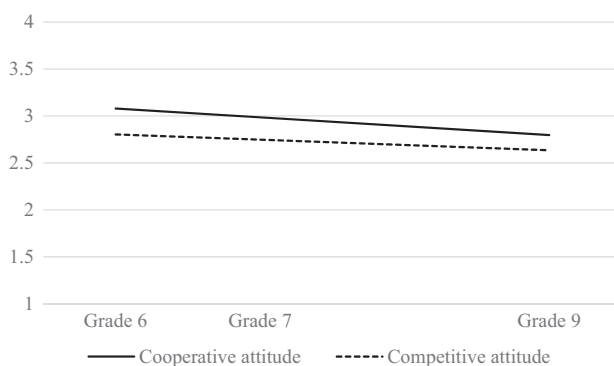***$p < .001$.

FIGURE 2 Estimated trajectories of cooperative and competitive attitudes. *Note.* These two trajectories were estimated from the parallel process latent growth model with two outcomes (mental health and academic achievement), controlling for covariates. The estimated trajectories for the unconditional and conditional growth models remained similar to each other. Cooperative attitudes decreased more quickly than competitive attitudes from grades 6 to 9.

attitudes was positively related to mental health (95% CI [0.23, 0.45]), but that of competitive attitudes showed the opposite relation (95% CI [−0.20, −0.003]). The intercept of cooperative attitudes was negatively related to academic achievement in 10th grade (95% CI [−0.51, −0.07]), whereas that of competitive attitudes showed the opposite relation (95% CI [0.44, 0.90]; see Figure 1). The slopes of both cooperative and competitive attitudes were not significantly related to either mental health or academic achievement.

For covariates, male students reported higher mental health than female students (95% CI [−0.35, −0.26]), and students with higher baseline achievement showed greater mental health (95% CI [0.01, 0.02]) and academic achievement (95% CI [0.38, 0.42]). Lastly, those with higher family income showed higher academic achievement (95% CI [0.002, 0.004]).

TABLE 5
Parameters for Predictors and Covariates of Conditional Growth Curve Models

Predictor	Mental Health			Academic Achievement		
	b	SE	β	b	SE	β
Cooperation Intercept	0.34***	0.06	0.20***	−0.29*	0.11	−.07*
Competition Intercept	−0.10*	0.05	−.05*	0.67***	0.12	0.15***
Cooperation Slope	0.68†	0.36	0.16*	−0.82	0.64	−.08
Competition Slope	−0.61	.52	−.10	1.54	0.98	0.11
Covariates						
Gender	−0.31***	0.02	−.19***	−0.07	0.05	−.02
Grade 6 test score	0.02***	0.003	0.07***	0.40***	0.01	0.68***
Family Income	<0.001	<.001	−.004	0.003***	0.001	0.07***

Note. R^2 for mental health = .08 ($p < .001$); R^2 for academic achievement = .50 ($p < .001$). For gender, men were coded as 0 and women were coded as 1.
†*$p < .10$, **$p < .05$, ***$p < .001$.

DISCUSSION

Adolescents' cooperative and competitive attitudes are essential for various outcomes, including achievement efforts, social relationships, and psychological health (Johnson & Johnson, 2009). Building on prior research that has primarily focused on the effects of cooperative and competitive *situations* on student outcomes, we investigated the time-related changes in cooperative and competitive *attitudes* in naturalistic school environments; furthermore, we examined how these changes are associated with adolescents' mental health and academic achievement using nationally representative longitudinal data of South Korean students.

Joint Development of Cooperative and Competitive Attitudes

The results indicated that adolescents' social interdependence attitudes changed from sixth to ninth grades. Prior research based on social interdependence theory has largely focused on how manipulated cooperative versus competitive situations (e.g., purposeful instruction) change individuals' perceptions of cooperation and competition as well as their achievement-related outcomes (for meta-analytic review, see Roseth et al., 2008). At the same time, researchers have seldom examined the changes in adolescents' cooperative and competitive attitudes in nonintervention learning environments. Therefore, this finding on time-related changes is an important contribution to our understanding of the development of adolescents' social interdependence attitudes.

The results revealed that, on average, adolescents' cooperative attitudes started at a higher level

than their competitive attitudes in sixth grade, but the decreasing rate of cooperative attitudes over 4 years was slightly faster than that of competitive attitudes. This suggests that adolescents' cooperative attitudes might be more prone to decline than their competitive attitudes during the secondary school transition period. Although the magnitude of the changes in cooperative and competitive attitudes was relatively small, it is noteworthy that both attitudes declined with time (see Figure 2), contrary to our hypothesis that cooperative attitudes would decrease and competitive attitudes increase. One possible explanation for the decrease in both attitudes is related to the general decline in motivation for school during adolescence (Chouinard & Roy, 2008). Extant literature on motivation development generally shows age-related decreases in adolescents' perceived task value and in the degree to which they value achievement and effort in academic settings (Wigfield & Cambria, 2010). Thus, adolescents whose motivation drops rapidly over the school years may lose their interest in learning (Wigfield & Cambria, 2010), inevitably lessening their preferences or values for cooperation and competition with others in school. This means that the increasing emphasis on social comparison, competitiveness, and evaluation during the secondary school transition (Eccles et al., 1993) may, on average, lead students to a lack of motivation rather than to an increase in motivation for competition (competitive attitudes) or cooperation (cooperative attitudes). However, future research should test this assumption, as there is no direct evidence of this claim in the present study.

Our parallel process modeling also revealed positive associations between the initial levels of the two attitudes and their change rates. Specifically,

those with a higher level of cooperative attitudes in sixth grade also tended to show a higher level of competitive attitudes in the same grade; and a more rapidly decreasing pattern of cooperative attitudes was related to a more rapidly decreasing pattern of competitive attitudes. Further, higher levels of both attitudes in sixth grade were associated with a faster decrease in these attitudes, regardless of the type of social interdependence attitudes.

These results suggest that the development of different types of social interdependence attitudes may not necessarily have opposite directions, despite their conceptual opposition according to social interdependence theory. Instead, our results concur with Deutsch's (1949) emphases that these two attitudes are not mutually exclusive and can change over time in the same direction. For example, individuals who hold a high value for working with others as a team may also like to compare themselves to and outperform others; that is, they may generally have a more positive attitude toward working in the presence of others. In contrast, it is possible that individuals who place a low value on cooperating with others may also place a low value on competing with others; namely, they may gradually come to avoid working on a given task in the presence of others and give preference for working individually, without any interpersonal interactions. Future research should examine whether the decline in both cooperative and competitive attitudes means an increase in individualistic attitudes (i.e., valuing working alone; Elliot et al., 2016).

Together, the current findings indicate that students' social interdependence attitudes are not simply either cooperative or competitive; rather, they may be multidimensional constructs because their positive relation exists in reality. This knowledge contributes to a better calibration of the two different attitudes in social interdependence theory.

How the Development of Cooperative and Competitive Attitudes Relates to Mental Health and Academic Achievement

The association with mental health was supported by our findings, in that the initial level of cooperative attitude was positively related to mental health, whereas the initial level of competitive attitude was negatively related to mental health. These results are in line with the expectations of social interdependence theory (Johnson & Johnson, 1989, 2005). Cooperative attitudes reflect more open communication with others and a greater sense of belonging, which allows a sense of security (Norem-Hebeisen & Johnson, 1981; Ross et al., 2003) that may contribute to one's mental health. In contrast, competitive attitudes reflect less trustful communication and conditional acceptance that rely on norm-based evaluation (Norem-Hebeisen & Johnson, 1981; Tjosvold et al., 2006), which may deteriorate one's mental health. The findings highlight the importance of supporting adolescents' cooperative attitudes and decreasing their competitive attitudes for their mental health.

For academic achievement, our second competing hypothesis was supported; competitive attitudes appeared to play a positive role in relation to achievement. In line with our findings, social facilitation theory (for review, see Aiello & Douthitt, 2001) suggests that performance is improved when working alongside others because this condition may increase the desire to validate one's competence. Furthermore, Tjosvold et al.'s (2006) study showed the positive effects of constructive competition on achievement outcomes, results that are also consistent with the current findings.

In contrast, unexpectedly, academic achievement showed a negative association with cooperative attitudes. These results were contrary to social interdependence theory (Johnson & Johnson, 1989), which presumes that cooperative attitudes reflect a greater feeling of self-confidence that allows one to focus on self-improvement, whereas competitive attitudes reflect concerns about social comparisons that lead one to focus less on task understanding. One explanation may be that the NUAT, like the CSAT, is a high-stakes test that induces relative evaluation, which may be positively related to competitive attitudes but negatively related to cooperative attitudes. Moreover, research has shown that individuals from East Asian countries have a greater tendency to consider competition as a source of self-improvement compared with those from Western countries (King et al., 2012); this may have influenced the current results. Examining other types of academic achievement is a subject for future research.

Interestingly, the slopes of cooperative and competitive attitudes were not associated with mental health nor with academic achievement. That is, adolescents' early social interdependence attitudes may be more critical for their adjustment than their later attitudes. These findings suggest the significance of early intervention targeting adolescents' social interdependence attitudes to promote mental health and academic achievement. Of note, although the sizes of the coefficients of the slopes

were not small (bs = −0.82 to 1.54), they were non-significantly associated with mental health and academic achievement. One possible reason for this could be the large standard errors of the slope coefficients (0.36 to 0.98; Table 5), which indicate relatively large variations in the associations of the slopes with mental health and academic achievement. For instance, some individuals with slower decreases in competitive attitudes could still show greater mental health than those with faster decreases. Additionally, some individuals with slower decreases in cooperative attitudes could still show greater academic achievement than those with faster decreases. Perhaps there are potential moderators that explain the associations between the slopes of social interdependence attitudes and mental health/academic achievement. Alternatively, applying a person-oriented analytical approach (e.g., growth mixture modeling) could help clarify these possibly complicated associations; specifically, such approaches may enable researchers to separate groups by the developmental pattern of cooperative and competitive attitudes and examine how different groups associate with mental health and academic achievement. Investigating other possible moderators or utilizing a person-oriented analytic model may be interesting topics for future research.

Practically speaking, it may be advisable to cultivate cooperative and alleviate competitive attitudes if adolescents are vulnerable to deteriorating mental health (e.g., adolescents with high depressive symptoms or anxiety). However, if adolescents display high levels of subjective well-being in a supportive environment, cultivating a constructive competitive attitude may help them reach their full potential and attain high levels of academic achievement. Together, the findings of this research show the crucial importance of striking the right balance between nurturing cooperative and constructive competitive attitudes, and that related interventions should be tailored based on individuals' needs.

Finally, it is noteworthy that the results cannot be interpreted within the scope of causal relations among the constructs. For example, it is possible that a potential confounding variable (e.g., parenting style and neighborhood contexts) influence social interdependence attitudes, mental health, and academic achievement. We suggest for future researchers to utilize experimental designs (e.g., field interventions to change adolescents' social interdependence attitudes) to give support for causal inferences. Furthermore, because the study sample comprised only Korean secondary school students, who have generally been exposed to highly competitive learning environments as well as collectivistic cultures (both common in Asian societies), we also suggest that future researchers explore the generalizability of the findings to other cultures.

Conclusion

This study is the first to apply parallel process modeling to longitudinally examine the dynamics of changes in social interdependence attitudes among adolescents. By doing so, it proved the usefulness of considering changes in both attitudes simultaneously and enhanced the understanding of this critical period of socio-cognitive development. We found that both cooperative and competitive attitudes declined over the course of 4 years, including the secondary school transition period. Furthermore, early adolescents' cooperative and competitive attitudes played unique roles in mental health and academic achievement, underscoring the importance of early interventions.

The results contribute to calibrating the social interdependence theory by providing empirical evidence for the development of naturalistic social interdependence attitudes and their longitudinal relations to mental health and academic achievement. We hope this study can inspire researchers and practitioners to consider the co-development and educational implications of adolescents' cooperative and competitive attitudes when supporting their social–emotional development.

CONFLICT OF INTEREST

We have no conflicts of interest to disclose.

REFERENCES

Aiello, J. R., & Douthitt, E. A. (2001). Social facilitation from Triplett to electronic performance monitoring. *Group Dynamics: Theory, Research, and Practice, 5*(3), 163–180. https://doi.org/10.1037/1089-2699.5.3.163

Caprara, G. V., Barbaranelli, C., Pastorelli, C., Bandura, A., & Zimbardo, P. G. (2000). Prosocial foundations of children's academic achievement. *Psychological Science, 11*(4), 302–306. https://doi.org/10.1111/1467-9280.00260

Carlo, G., White, R. M., Streit, C., Knight, G. P., & Zeiders, K. H. (2018). Longitudinal relations among parenting styles, prosocial behaviors, and academic outcomes in US Mexican adolescents. *Child Development, 89*(2), 577–592. https://doi.org/10.1111/cdev.12761

Cheung, G. W., & Rensvold, R. B. (2002). Evaluating goodness-of-fit indexes for testing measurement invariance. *Structural Equation Modeling: A Multidisciplinary Journal*, *9*(2), 233–255. https://doi.org/10.1207/S15328007SEM0902_5

Choi, J., Johnson, D. W., & Johnson, R. (2011). Relationships among cooperative learning experiences, social interdependence, children's aggression, victimization, and prosocial behaviors. *Journal of Applied Social Psychology*, *41*(4), 976–1003. https://doi.org/10.1111/j.1559-1816.2011.00744.x

Chouinard, R., & Roy, N. (2008). Changes in high-school students' competence beliefs, utility value and achievement goals in mathematics. *British Journal of Educational Psychology*, *78*(1), 31–50. https://doi.org/10.1348/000709907X197993

Clarke, A., Friede, T., Putz, R., Ashdown, J., Martin, S., Blake, A., Adi, Y., Parkinson, J., Flynn, P., Platt, S., & Stewart-Brown, S. (2011). Warwick-Edinburgh mental well-being scale (WEMWBS): Validated for teenage school students in England and Scotland. A mixed methods assessment. *BMC Public Health*, *11*(1), 1–9. https://doi.org/10.1186/1471-2458-11-487

Coleman, P. T., & Deutsch, M. (2015). Interdependence and psychological orientation. In P. T. Coleman & M. Deutsch (Eds.), *Morton Deutsch: A pioneer in developing peace psychology* (pp. 105–129). Springer.

Crone, E. A., & Dahl, R. E. (2012). Understanding adolescence as a period of social–affective engagement and goal flexibility. *Nature Reviews Neuroscience*, *13*(9), 636–650. https://doi.org/10.1038/nrn3313

Damon, W., Lerner, R. M., & Eisenberg, N. (2006). *Handbook of child psychology: Social, emotional, and personality development*. Wiley.

Davis, A. N., Carlo, G., Schwartz, S. J., Unger, J. B., Zamboanga, B. L., Lorenzo-Blanco, E. I., Cano, M. Á., Baezconde-Garbanati, L., Oshri, A., Streit, C., Martinez, M. M., Piña-Watson, B., Lizzi, K., & Soto, D. (2016). The longitudinal associations between discrimination, depressive symptoms, and prosocial behaviors in US Latino/a recent immigrant adolescents. *Journal of Youth and Adolescence*, *45*(3), 457–470. https://doi.org/10.1007/s10964-015-0394-x

Deutsch, M. (1949). A theory of co-operation and competition. *Human Relations*, *2*(2), 129–152. https://doi.org/10.1177/001872674900200204

Deutsch, M. (2006). Cooperation and competition. In M. Deutsch, P. T. Coleman & E. C. Marcus (Eds.), *The handbook of conflict resolution* (2nd ed., pp. 23–42). Jossey Bass.

Eccles, J. S., Midgley, C., Wigfield, A., Buchanan, C. M., Reuman, D., Flanagan, C., & Mac Iver, D. (1993). Development during adolescence: The impact of stage-environment fit on young adolescents' experiences in schools and in families. *American Psychologist*, *48*(2), 90–101. https://doi.org/10.1037/0003-066X.48.2.90

Elliot, A. J., Aldhobaiban, N., Kobeisy, A., Murayama, K., Gocłowska, M. A., Lichtenfeld, S., & Khayat, A. (2016). Linking social interdependence preferences to achievement goal adoption. *Learning and Individual Differences*, *50*, 291–295. https://doi.org/10.1016/j.lindif.2016.08.020

Enders, C. K. (2010). *Applied missing data analysis*. Guilford.

Haroz, E. E., Murray, L. K., Bolton, P., Betancourt, T., & Bass, J. K. (2013). Adolescent resilience in northern Uganda: The role of social support and prosocial behavior in reducing mental health problems. *Journal of Research on Adolescence*, *23*(1), 138–148. https://doi.org/10.1111/j.1532-7795.2012.00802.x

Hu, L. T., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal*, *6*(1), 1–55. https://doi.org/10.1080/10705519909540118

Johnson, D. W., & Johnson, R. T. (1989). *Cooperation and competition: Theory and research*. Interaction Book Company.

Johnson, D. W., & Johnson, R. T. (2005). New developments in social interdependence theory. *Genetic, Social, and General Psychology Monographs*, *131*(4), 285–358. https://doi.org/10.3200/MONO.131.4.285-358

Johnson, D. W., & Johnson, R. T. (2009). An educational psychology success story: Social interdependence theory and cooperative learning. *Educational Researcher*, *38*(5), 365–379. https://doi.org/10.3102/0013189X09339057

Johnson, D. W., Johnson, R. T., Roseth, C., & Shin, T. S. (2014). The relationship between motivation and achievement in interdependent situations. *Journal of Applied Social Psychology*, *44*(9), 622–633. https://doi.org/10.1111/jasp.12280

Johnson, D. W., & Norem-Hebeisen, A. A. (1979). A measure of cooperative, competitive, and individualistic attitudes. *The Journal of Social Psychology*, *109*(2), 253–261. https://doi.org/10.1080/00224545.1979.9924201

King, R. B., McInerney, D. M., & Watkins, D. A. (2012). Competitiveness is not that bad… at least in the east: Testing the hierarchical model of achievement motivation in the Asian setting. *International Journal of Intercultural Relations*, *36*(3), 446–457. https://doi.org/10.1016/j.ijintrel.2011.10.003

Lee, Y., Cho, E., & Roseth, C. J. (2020). Interpersonal predictors and outcomes of motivational profiles in middle school. *Learning and Individual Differences*, *81*, 101905. https://doi.org/10.1016/j.lindif.2020.101905

Lee, Y., & Seo, E. (2019). Trajectories of implicit theories and their relations to scholastic aptitude: A mediational role of achievement goals. *Contemporary Educational Psychology*, *59*, 101800. https://doi.org/10.1016/j.cedpsych.2019.101800

Lee, Y., & Seo, E. (2022). Cooperative and competitive attitudes during adolescence and their social and academic outcomes. *Journal of Youth and Adolescence*, *51*, 792–804. https://doi.org/10.1007/s10964-022-01583-8

Matthews, J. S., Ponitz, C. C., & Morrison, F. J. (2009). Early gender differences in self-regulation and

academic achievement. *Journal of Educational Psychology*, *101*(3), 689–704. https://doi.org/10.1037/a0014240

Masten, A. S., & Curtis, W. J. (2000). Integrating competence and psychopathology: Pathways toward a comprehensive science of adaptation in development. *Development and Psychopathology*, *12*(3), 529–550. https://doi.org/10.1017/s095457940000314x

Murayama, K., & Elliot, A. J. (2012). The competition–performance relation: A meta-analytic review and test of the opposing processes model of competition and performance. *Psychological Bulletin*, *138*(6), 1035–1070. https://doi.org/10.1037/a0028324

Muthén, L. K. (2010). Indicators on different scales [online forum comment]. http://www.statmodel.com/discussion/messages/11/5266.html?1312503676

Nichols, J. D., & Miller, R. B. (1994). Cooperative learning and student motivation. *Contemporary Educational Psychology*, *19*(2), 167–178. https://doi.org/10.1006/ceps.1994.1015

Norem-Hebeisen, A. A., & Johnson, D. W. (1981). The relationship between cooperative, competitive, and individualistic attitudes and differentiated aspects of self-esteem. *Journal of Personality*, *49*(4), 415–426. https://doi.org/10.1111/j.1467-6494.1981.tb00223.x

Roeser, R. W., Eccles, J. S., & Freedman-Doan, C. (1999). Academic functioning and mental health in adolescence: Patterns, progressions, and routes from childhood. *Journal of Adolescent Research*, *14*(2), 135–174. https://doi.org/10.1177/0743558499142002

Roseth, C. J., Lee, Y., & Saltarelli, W. (2019). Reconsidering jigsaw social psychology: Longitudinal effects on social interdependence, sociocognitive conflict regulation, motivation, and achievement. *Journal of Educational Psychology*, *111*(1), 149–169. https://doi.org/10.1037/edu0000257

Roseth, C. J., Johnson, D. W., & Johnson, R. T. (2008). Promoting early adolescents' achievement and peer relationships: The effects of cooperative, competitive, and individualistic goal structures. *Psychological Bulletin*, *134*(2), 223–246. https://doi.org/10.1037/0033-2909.134.2.223

Ross, S. R., Rausch, M. K., & Canada, K. E. (2003). Competition and cooperation in the five-factor model: Individual differences in achievement orientation. *The Journal of Psychology*, *137*(4), 323–337. https://doi.org/10.1080/00223980309600617

Scherrer, V., Preckel, F., Schmidt, I., & Elliot, A. J. (2020). Development of achievement goals and their relation to academic interest and achievement in adolescence: A review of the literature and two longitudinal studies. *Developmental Psychology*, *56*(4), 795–814. https://doi.org/10.1037/dev0000898

Shim, S. S., Ryan, A. M., & Anderson, C. J. (2008). Achievement goals and achievement during early adolescence: Examining time-varying predictor and outcome variables in growth-curve analysis. *Journal of Educational Psychology*, *100*(3), 655–671. https://doi.org/10.1037/0022-0663.100.3.655

Shwalb, D. W., Shwalb, B. J., & Nakazawa, J. (1995). Competitive and cooperative attitudes: A longitudinal survey of Japanese adolescents. *The Journal of Early Adolescence*, *15*(1), 145–168. https://doi.org/10.1177/0272431695015001008

Sirin, S. R. (2005). Socioeconomic status and academic achievement: A meta-analytic review of research. *Review of Educational Research*, *75*(3), 417–453. https://doi.org/10.3102/00346543075003417

Tjosvold, D., Johnson, D. W., Johnson, R. T., & Sun, H. (2006). Competitive motives and strategies: Understanding constructive competition. *Group Dynamics: Theory, Research, and Practice*, *10*(2), 87–99. https://doi.org/10.1037/1089-2699.10.2.87

Vandenberg, R. J., & Lance, C. E. (2000). A review and synthesis of the measurement invariance literature: Suggestions, practices, and recommendations for organizational research. *Organizational Research Methods*, *3*(1), 4–70. https://doi.org/10.1177/109442810031002

Van der Graaff, J., Carlo, G., Crocetti, E., Koot, H. M., & Branje, S. (2018). Prosocial behavior in adolescence: Gender differences in development and links with empathy. *Journal of Youth and Adolescence*, *47*(5), 1086–1099. https://doi.org/10.1007/s10964-017-0786-1

Van Ryzin, M. J., & Roseth, C. J. (2018). Cooperative learning in middle school: A means to improve peer relations and reduce victimization, bullying, and related outcomes. *Journal of Educational Psychology*, *110*(8), 1192–1201. https://doi.org/10.1037/edu0000265

Wentzel, K. R., & Caldwell, K. (1997). Friendships, peer acceptance, and group membership: Relations to academic achievement in middle school. *Child Development*, *68*(6), 1198–1209. https://doi.org/10.1111/j.1467-8624.1997.tb01994.x

Wigfield, A., Byrnes, J. P., & Eccles, J. S. (2006). Development during early and middle adolescence. In P. A. Alexander & P. H. Winne (Eds.), *Handbook of educational psychology* (pp. 87–113). Lawrence Eribaum Associates Publishers.

Wigfield, A., & Cambria, J. (2010). Students' achievement values, goal orientations, and interest: Definitions, development, and relations to achievement outcomes. *Developmental Review*, *30*(1), 1–35. https://doi.org/10.1016/j.dr.2009.12.001

Zhou, J., Huebner, E. S., & Tian, L. (2020). Longitudinal associations and mechanisms between achievement goals and subjective well-being in school in Chinese adolescents. *School Mental Health*, *12*(2), 353–365. https://doi.org/10.1007/s12310-019-09356-8

Zuffianò, A., Alessandri, G., Gerbino, M., Kanacri, B. P. L., Di Giunta, L., Milioni, M., & Caprara, G. V. (2013). Academic achievement: The unique contribution of self-efficacy beliefs in self-regulated learning beyond intelligence, personality traits, and self-esteem. *Learning and Individual Differences*, *23*, 158–162. https://doi.org/10.1016/j.lindif.2012.07.010

Zuffianò, A., Alessandri, G., Kanacri, B. P. L., Pastorelli, C., Milioni, M., Ceravolo, R., Caprara, M. G., &

Caprara, G. V. (2014). The relation between prosociality and self-esteem from middle-adolescence to young adulthood. *Personality and Individual Differences, 63,* 24–29. https://doi.org/10.1016/j.paid.2014.01.041

Supporting Information

Additional supporting information may be found online in the Supporting Information section at the end of the article.

Appendix S1. Missing data analyses.
Table S1. Testing mean differences (*t*-test) in the focal variables and covariates between adolescents with completed data (coded as 1) and those with missing data (coded as 0).