

## INTERVENTION EFFECTS ON BEHAVIORAL TRAJECTORIES

### Can Universal SEL Programs Benefit Universally? Effects of the *Positive Action* Program on Multiple Trajectories of Social-Emotional and Misconduct Behaviors

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Robert Duncan<sup>a1</sup>, Isaac J. Washburn<sup>b</sup>, Kendra M. Lewis<sup>c</sup>, Niloofar Bavarian<sup>d</sup>, David L. DuBois<sup>e</sup>,  
Alan C. Acock<sup>a</sup>, Samuel Vuchinich<sup>a</sup>, Brian R. Flay<sup>a</sup>

<sup>a</sup>Oregon State University, <sup>b</sup>Oklahoma State University, <sup>c</sup>University of California, Agriculture and Natural Resources, <sup>d</sup>California State University, Long Beach, <sup>e</sup>University of Illinois at Chicago

#### Author Note

Robert Duncan, Human Development and Family Sciences, Oregon State University.  
Isaac J. Washburn, Human Development and Family Science, Oklahoma State University.  
Kendra M. Lewis, University of California, Agriculture and Natural Resources. Niloofar Bavarian, Health Science Department, California State University, Long Beach. David L. DuBois, Community Health Sciences, University of Illinois at Chicago. Alan Acock, Human Development and Family Sciences, Oregon State University. Samuel Vuchinich, Human Development and Family Sciences, Oregon State University. Brian Flay, Public Health, Oregon State University.

<sup>1</sup>Robert Duncan is now at the School of Education, University of California, Irvine.

Correspondence concerning this article should be addressed to Robert J. Duncan, University of California, Irvine, School of Education, 2066 Education, Irvine, CA 92697.

Contact: duncanrj@uci.edu

### Abstract

Behavioral trajectories during middle childhood are predictive of consequential outcomes later in life (e.g., substance abuse, violence). Social and emotional learning (SEL) programs are designed to promote trajectories that reflect both growth in positive behaviors and inhibited development of negative behaviors. The current study used growth mixture models to examine effects of the *Positive Action* program (PA) on behavioral trajectories of social-emotional and character development (SECD) and misconduct using data from a cluster-randomized trial that involved 14 schools and a sample of predominately low-income, urban youth followed from 3<sup>rd</sup> through 8<sup>th</sup> grade. For SECD, findings indicated that PA was similarly effective at improving trajectories within latent classes characterized as “High/declining” and “Low/stable”. Favorable program effects were likewise evident to a comparable degree for misconduct across observed latent classes that reflected “Low/rising” and “High/rising” trajectories. These findings suggest that PA and perhaps other school-based universal SEL programs have the potential to yield comparable benefits across subgroups of youth with differing trajectories of positive and negative behaviors, making them promising strategies for achieving the intended goal of school-wide improvements in student outcomes.

Keywords: *Positive Action*, social and emotional learning, behavioral trajectories, misconduct, growth mixture modeling

Can Universal SEL Programs Benefit Universally? Effects of the *Positive Action* Program on Multiple Trajectories of Social-Emotional and Misconduct Behaviors

Recent research has given increased attention to positive facets of child and adolescent development, including positive youth development (PYD) and social-emotional and character development (e.g., Durlak, Weissberg, Dymnicki, Taylor, & Schellinger, 2011; Flay & Allred, 2010; Lerner, Almerigi, Theokas, & Lerner, 2005). There has also been a growing drive to understand the development of youth from economically under-resourced families and neighborhoods (e.g., Farahmand, Grant, Polo, & Duffy, 2011). This focus is consistent with the well-documented increased susceptibility of youth in economically under-resourced contexts to less favorable outcomes, including problem behaviors and lower levels of personal skills and resources (Bradley & Corwyn, 2002). If prevention programs are to be successful, they need to be able to show contributions to favorable development across both a range of behaviors and in populations of youth facing higher risk. The present study addresses this need through the analysis of data from a multiyear evaluation of *Positive Action*, a social and emotional learning (SEL) program universally delivered at the school-level.

Theoretical perspectives posit that the promotion of youths' self-control and prosocial behaviors will be accompanied by diminished involvement in aggressive and delinquent behaviors (Durlak et al., 2011). For instance, the PYD framework focuses on fostering positive skills and assets for youth by applying a strengths-based approach to their development (Lerner et al., 2005). However, the existing literature also points to the potential for contextual norms and demands that youth may encounter in under-resourced and urban communities (e.g., decreased costs to engage in problem behavior, pressures to join gangs) to constrain the extent to which increases in social-emotional skills will be accompanied by co-occurring reductions in

behaviors such as aggression and delinquency (Farahmand et al., 2011). Moreover, SEL programs may differentially impact youth in these contexts who show differing behavioral trajectories. Thus, the degree and manner in which universal SEL programs impact different types of behaviors (e.g., aggression) across individuals in under-resourced communities who show different types of trajectories (e.g., more aggressive versus less aggressive) remains uncertain.

One analytic strategy for investigating differential SEL program effects on trajectories of positive and problem behaviors while controlling for potential confounders that affect only a single subpopulation is growth mixture modeling. Growth mixture models are used to identify subpopulations within an overall population whose trajectories follow a similar pattern, such that it is the combination of traditional latent growth curve modeling and latent class analysis (Muthén, 2004; Wang & Wang, 2012). This combination allows for empirical testing of multiple average trajectories within a sample and variance around each average trajectory, thus allowing for greater understanding of heterogeneity in the sample, including the impact of interventions on such variations (Brown et al., 2008; Liu, Hedeker, Segawa, & Flay, 2010). The current study examines the impact of the *Positive Action* program on multiple trajectories of social-emotional and character development (SECD) and misconduct within a predominantly low-income and minority, urban population.

### **Developmental Trajectories of Positive and Problem Behaviors**

Previous studies have found multiple trajectories of positive, or adaptive, behaviors and problem behaviors using mixture modeling approaches (for a selected review, see Table 1 available online). In general, studies have identified multiple classes of prosocial behavioral trajectories, often characterized by fairly stable, or declining, trajectories from middle childhood

to adolescence (Kokko, Tremblay, Lacourse, Nagin, & Vitaro, 2006; Lewin-Bizan et al., 2010; Nantel-Viver et al., 2009). The findings have been more varied for problem behavioral trajectories, but usually there consists a low stable trajectory class, a high stable trajectory class, and a relatively smaller percentage that increases or decreases more noticeably (Kokko et al., 2006; Lewin-Bizan et al., 2010; Schaeffer et al., 2006; Schaeffer, Petras, Ialongo, Poduska & Kellam, 2003). These studies provide evidence for the potential heterogeneity of behavioral trajectories existing within youth during this time period. However, the current study adds to this literature by examining the types of SECD and misconduct behavioral trajectories within a higher risk subpopulation of youth (i.e., predominantly low-income and minority). It is possible that because this subpopulation is more homogenous in terms of their contexts, fewer types of trajectories may be found.

It is worth noting that growth mixture models have been critiqued for potentially identifying more latent trajectory classes in the data than truly exist (Bauer & Curran, 2003). Thus, a strong theoretical rationale for the different types of classes expected is needed, and acknowledgment that fit statistics for models are not proof of multiple latent classes of trajectories (Sterba & Bauer, 2010). However, growth mixture models are useful when there are theoretical expectations and statistical evidence for different classes of trajectories, and a focus is on understanding potential class-specific effects. Based on the evidence from mixture modeling studies of youth behavior, there is an expectation that youth will show multiple types of trajectories. Additionally, there is theory to suggest that children fall along at least two different trajectories of social-emotional behaviors and skills. Previous research finds youth are characterized by life-course persistent, adolescence-limited, or non-engagers of antisocial behaviors (Moffitt & Caspi, 2001). Therefore, this would suggest two classes of trajectories

from middle childhood to the beginning of adolescence. First, we would predict some youth to have relatively high levels of misconduct and low levels of SECD. In other words, this class would be consistent with the life-course persistent antisocial behavior group. Additionally, this class would be expected to be a relatively small percentage of the sample and more likely to be males. Second, we would predict the majority of youth to have relatively low levels of misconduct and higher levels of SECD. Specifically, this class would be consistent with the groups characterized as adolescent-limited or non-engagers of antisocial behavior. Although this argument would support two classes of behavioral trajectories, studies using mixture modeling typically find support for more than two classes during this age period. However, given the potential to over-extract latent trajectory classes (e.g., Bauer & Curran, 2003), expecting two classes of trajectories, but testing for more, is a conservative approach supported by both theory and previous mixture models. Nevertheless, the key research aim of focus is how a SEL intervention influences these potentially differing trajectories.

### **Intervention Effects on Trajectories of Positive and Problem Behaviors**

Growth mixture models have been used in order to gain a deeper understanding of the effectiveness of interventions on multiple behavioral trajectories (e.g., Liu et al., 2010; Muthén et al., 2002). Findings from these studies point toward greater effectiveness of interventions for youth who were engaged in higher levels or have steeper increases in problem behaviors, a pattern that is consistent with other intervention literature suggesting larger effects in higher risk populations (e.g., Gottfredson & Wilson, 2003). However, more research is needed to clarify the extent to which such differential effects generalize across a broader range of interventions and behaviors. It could be, for example, that SEL programs that focus on developing social and emotional skills among all students in schools (universally delivered) are more likely to have

broader, favorable effects on positive and problem behaviors for all children (Flay & Allred, 2010). Furthermore, behaviors that show some variation across most children and over time, such as SECD and misconduct, may be sensitive to detecting differential intervention effects. Thus, it is important to understand if SEL program effects extend to youth with differing behavioral trajectories. To summarize, as strength-based approaches to youth development become more of a focal point in applied research (Lerner et al., 2005), it is important to understand how SEL programs influence not only the overall levels of positive and problem behaviors (Durlak et al., 2011; Washburn et al., 2011), but also the subpopulation-specific underlying trajectories (e.g., Liu et al., 2010). The current study uses the *Positive Action* program to better understand how universally delivered SEL programs may impact subpopulation-specific underlying trajectories of positive and problem behaviors.

### **The *Positive Action* Program**

We use data from the Chicago trial of the *Positive Action* program, which followed children from 3<sup>rd</sup> through 8<sup>th</sup> grade. The *Positive Action* program has already been found to help mitigate the decline in prosocial behaviors in this sample and to enhance academic achievement and school involvement, while reducing disciplinary referrals, substance use, risky sexual behavior, and violence (see, e.g., Bavarian et al., 2013; Beets et al., 2009; Lewis et al., 2016; Li et al., 2011; Washburn et al., 2011). These evaluations have typically assessed an overall *Positive Action* program effect on children's behavior, or tested interactions through a variable-centered approach (e.g., program  $\times$  gender effects). With the application of growth mixture modeling (Brown et al., 2008; Muthén et al., 2002), a person-centered approach can answer questions not addressed in prior research on the program's effects, including the extent to which effects generalize across subpopulations of youth that are distinguished by distinct trajectories of

SECD and misconduct.

### **The Current Study**

Using growth mixture modeling as an analytic framework, two pairs of complementary research questions are addressed. *First, what are the underlying latent trajectory classes of SECD from middle childhood to early adolescence and what effect does Positive Action have on them? Second, what are the underlying latent trajectory classes of misconduct from middle childhood to early adolescence and what effect does Positive Action have on them?* Our hypotheses with regards to both SECD and misconduct trajectories are twofold. First, we anticipate multiple trajectories to be identified based on previous mixture model studies (e.g., Kokko et al., 2006). Specifically, we anticipate there will be at least two unique classes reflecting 1) youth with overall more misconduct and lower levels of SECD and 2) youth with overall less misconduct and higher levels of SECD during this age period (Moffitt & Caspi, 2001). Second, and for our primary research aims, we hypothesize that the *Positive Action* program will have the most favorable impact on classes of SECD and misconduct trajectories characterized by overall lower levels of SECD and overall higher levels of misconduct (Liu et al., 2010; Muthén et al., 2002). However, if the program similarly benefits everyone as intended, we would find similar program effects regardless of the underlying trajectory.

## **Method**

### **The Chicago Trial of the *Positive Action* Program**

The *Positive Action* program is grounded in theories of positive psychology, self-concept, and Self-esteem Enhancement Theory (DuBois, Flay, & Fagen, 2009; Flay & Allred, 2010). In line with those theoretical perspectives and PYD, the *Positive Action* program uses classroom-based curriculum focusing on the importance of the desire to feel good about oneself.

Additionally, it teaches students the necessary self-control and social skills for prosocial interactions with peers. The program is school-based, universally delivered, and consistent with other work detailing the positive effects of universal, school delivery for SEL programs (Durlak et al., 2011). A more detailed description of the study design and methods is available through the U.S. National Institutes of Health at <http://clinicaltrials.gov/show/NCT01025674> and in previous published work (e.g., Bavarian et al., 2013; Lewis et al., 2016).

### **Participants**

The current study included a total of 1,130 youth in 14 schools, with schools randomized within matched pairs into either treatment (school received *Positive Action*) or control (business as usual). Figure 1 shows the CONSORT flow diagram of how schools were selected for participation in the study and randomized to condition. The 1,130 youth represent the number of children in the study that had at least one observation on the SECD or misconduct scales. Overall, the sample was 53% female, and self-reported as 51% African-American, 28% Hispanic, and 20% other. Data were collected on students within the schools on eight occasions from 3<sup>rd</sup> to 8<sup>th</sup> grade, with the number of students at each wave and the length of time students remained in the study varying: fall of 3<sup>rd</sup> grade ( $n = 624$ ), spring of 3<sup>rd</sup> grade ( $n = 605$ ; 11% new to the study), fall of 4<sup>th</sup> grade ( $n = 464$ ), spring of 4<sup>th</sup> grade ( $n = 541$ ; 24% new), spring of 5<sup>th</sup> ( $n = 515$ ; 21% new), fall of 7<sup>th</sup> grade ( $n = 196$ ), spring of 7<sup>th</sup> grade ( $n = 359$ ; 46% new), and spring of 8<sup>th</sup> grade ( $n = 363$ ; 21% new). Children in the fall of 4<sup>th</sup> grade and 7<sup>th</sup> grade who were new to the study (no data from a previous wave) were recoded as missing due to uncertainty of whether they were previously in a *Positive Action* or control school, and then as joiners to the study at the subsequent spring follow-up. Given the treatment condition uncertainty, data were excluded for students who were only ever in the study at the fall of either the 4<sup>th</sup> or 7<sup>th</sup> grade.

**Behavioral Measures used in Growth Mixture Models**

All scales used in the current study were youth's self-report of the behavior. Measures of SECD and misconduct were collected at all eight time points and used to model the trajectories. We used self-reports for a few reasons. First, students reported on their behavior at school and at home, as well as interactions with parents, teachers, and peers, which was not true of parent or teacher reports. Second, the self-reports used the same instruments at each wave of the study providing consistency in measurement over the 6-year period. Third, it is consistent with previous research during this age period using self-reports (e.g., Lewin-Bizan et al., 2010; Moffitt & Caspi, 2001). Finally, the self-reports were collected more consistently and had less missing data than teacher or parent reports due to the study design. We discuss the potential limitations of using self-reports in the discussion.

**Social-Emotional and Character Development (SECD).** The 28-item Child Social-Emotional and Character Development scale was used to assess children's SECD behaviors (Ji, Flay, & DuBois, 2013). Items describe different SECD-related behaviors with students asked to rate their level of engagement in the behavior on a four-point Likert scale (i.e., "None of the time" [1], "Some of the time" [2], "Most of the time" [3], "All of the time" [4]). Some example items include "I treat my friends the way I like to be treated" and "I tell others the truth." In validation research using data from the first five time points of data from the current study, support was found for a second-order factor model that included first-order factors of prosocial behavior, honesty, self-development, self-control, respectful behavior at school, and respectful behavior at home, each of which had a high positive loading onto a single, higher-order "SECD" factor (Ji et al., 2013). Furthermore, this study found that the SECD scores were significantly associated with a range of related behavioral outcomes at 3<sup>rd</sup> grade (e.g., health behaviors) and

5<sup>th</sup> grade (e.g., substance use, violence), or both (e.g., self-esteem). Therefore, the present study used all of the items associated with the first-order factors (i.e., 28 items) and aligns with the second-order, “SECD” factor. The Cronbach’s alphas in the current sample for the 8 waves, respectively, were: .91, .93, .94, .95, .94, .95, .95, and .95.

**Misconduct.** Misconduct was assessed using a 12-item scale. Six items were adapted from the Aggression Scale and assessed aggression and bullying (Orpinas & Frankowski, 2001). Examples of these items include “I teased a kid at school” and “I pushed, shoved, or hit a kid from school”. The Aggression Scale has been validated in previous research, showing significant positive associations with teacher reports of children’s aggression (Orpinas & Frankowski, 2001). The remaining six items were adapted from the Frequency of Delinquent Behavior Scale and assessed delinquent and disruptive behavior (Elliott, Ageton, Huizinga, Knowles, & Canter, 1983). Example items include “I was sent home from school for bad behavior” and “I broke or ruined something on purpose that belonged to the school”. The self-reported Frequency of Delinquent Behavior Scale is commonly used and has been shown to provide valid estimates of youth delinquent behavior (Elliott et al., 1983). Given the age range of the current study, however, some items were dropped from both of the original scales that were inappropriate for 3<sup>rd</sup> graders, and all items were scaled to follow a 4-point Likert rating (i.e., “Never” [1], “Once or twice” [2], “A few times” [3], “Many Times” [4]). Combining aggressive and delinquent behaviors is consistent with previous research on teacher ratings of these behaviors (Schaeffer et al., 2006) and scales that combine aggressive and delinquency behaviors due to content overlap (e.g., Elliott et al., 1983). The Cronbach’s alphas in the current sample for the 8 waves, respectively, were: .86, .90, .91, .90, .90, .89, .90, and .87.

### **Analytic Plan**

Growth mixture models were run using *Mplus* Version 7 (Muthén & Muthén, 1998-2012) with a maximum likelihood estimator and robust standard errors. Clustering of participants by school ( $N = 14$ ) was accounted for in all models using the sandwich estimator in *Mplus* (Asparouhov, 2005). The latent growth curves were estimated using the eight time points from the fall of 3<sup>rd</sup> grade until the spring of 8<sup>th</sup> grade (for a conceptual model, see Figure 2 available online). The proper time scaling of these waves is identified to be as follows: fall of 3<sup>rd</sup> grade (intercept, time = 0), spring of 3<sup>rd</sup> grade (time = 0.58 years), fall of 4<sup>th</sup> grade (time = 1 year), spring of 4<sup>th</sup> grade (time = 1.58 years), fall of 5<sup>th</sup> grade (time = 2 years), spring of 5<sup>th</sup> grade (time = 2.58 years), fall of 7<sup>th</sup> grade (time = 4 years), spring of 7<sup>th</sup> grade (4.58 years), and spring of 8<sup>th</sup> grade (5.58 years). A gap in funding explains the gap in data collection at grade 6. Children transitioned into and out of the study on occasion, and therefore full information maximum likelihood estimators were used to handle the missing data rather than listwise deletion. That is, all children that had at least one observation on SECD or misconduct informed the model estimates. Full information maximum likelihood has been found to produce less biased estimates than listwise deletion (Acock, 2012). When gender was modeled on the latent classes, model constraints required listwise deletion for children who had missing gender data. However, this was a very small percentage of the observations (one to two cases per wave deleted on average) so it unlikely created any bias in our results.

The same sequence of steps were taken for modeling both SECD and misconduct behaviors. Analyses began by determining the types of trajectories youth were on for SECD and misconduct in the single class model. For the full sample and by condition status, we first estimated the behavioral trajectories with an intercept only model, and then added in a linear slope, and finally a quadratic slope. For the full sample and by condition, all models showed

improved statistical fit based on the BIC through the inclusion of a quadratic term. Additionally, the mean of the quadratic term was statistically significantly different from zero in the SECD and misconduct models for the full sample and in the control group sample, but not for the *Positive Action* sample. However, given our focus is on interpreting the program effect on trajectories, and the quadratic term makes this more challenging, we present the tables and figures for the model that only included the linear slope in text and provide the model information and figures that included the quadratic term as online supplemental materials. Conclusions are consistent across models and all output from models are fully available by request from the first author.

Next, we focused on determining the appropriate number of classes for trajectories of SECD and misconduct. As multiple latent trajectory classes were estimated, at times the residual variation around the intercept parameter estimate lost statistical significance. Therefore, it is noted in the table of results when intercept variance components were set to zero. However, this did not occur for the linear or quadratic slopes in any model. Following previous recommendations, substantive interpretability and theoretical justification was a primary concern for selecting the appropriate class solutions (Sterba & Bauer, 2010). However, the selection of the number of trajectory classes to retain was also informed by multiple indices of model fit: Adjusted-BIC (Sclove, 1987), Lo Mendell-Rubin Likelihood Ratio Test (Lo, Mendell, & Rubin, 2001), and Entropy (Ramaswamy, DeSarbo, Reibstein, & Robinson, 1993). The Bootstrap Log-likelihood Ratio test could not be used for analyses as *Mplus* cannot use this test with clustered data. For the first stage of determining the number of classes to retain, models were estimated with no covariates (i.e., unconditional) in order to ensure that trajectory classes were identified in a manner that was only influenced by SECD or misconduct (Brown et al., 2008).

To address our primary research aims regarding the effect of the *Positive Action* program

on the trajectories of SECD and misconduct, two covariates (treatment status and gender) were included. Treatment status was modeled as a predictor of both class membership and the trajectories (i.e., intercept and slope) within each class membership. The class membership should not depend on treatment status if the latent classes are true representations of possible underlying subpopulation trajectories (Brown et al., 2008). Modeling the effect of treatment status on class membership is a test of this condition, such that if treatment status influences class membership, then generalizability of classes beyond the study population is limited. Gender was modeled as a predictor of class membership to determine if it was related to the likelihood of a youth being in a given latent class. We did not model the effect of gender on latent trajectories in order to simplify the model and to focus on our primary question of how *Positive Action* influences the latent trajectories. Additionally, we did not look at race effects on class membership or trajectories because it was highly confounded by school placement and the overall sample was predominantly minority.

### Results

Overall, children declined in SECD and increased in misconduct over time in both *Positive Action* and control schools (see Table 2 available online). The SECD and misconduct scores did not significantly differ between children in the *Positive Action* and control schools at baseline (i.e., fall of 3<sup>rd</sup> grade). At baseline, children were on average between “always” and “most of the time” for their SECD responses and closest to “never” for their misconduct responses. At the end point in the study (i.e., spring of 8<sup>th</sup> grade), children on average responded “most of the time” for the SECD items and responded closest to “once or twice” for misconduct items. At the end point, children in the *Positive Action* schools had significantly higher scores on SECD,  $t(332) = -2.65, p = .009$ , and significantly lower scores on misconduct,  $t(333) = -3.00, p =$

.003.

**What are the underlying latent trajectory classes of SECD from middle childhood to early adolescence and what effect does *Positive Action* have on them?** We present fit statistics for the 1 – 4 class solutions for the SECD unconditional and conditional growth mixture models (see Table 3). The BIC continued to suggest improved fit through the 4-class solution, though we select the 2-class solution as preferred for theoretical and substantive reasons (Sterba & Bauer, 2010). First, it aligned with our expectations for two classes, showing a larger subpopulation with relatively higher levels of SECD and a smaller subpopulation with relatively lower levels of SECD. Second, the 3-class unconditional model had a class size as small as 43, and the 4-class solution had a class size as small as 6. Third, once running the conditional model, the 3-class solution had a class as small as 14, which was predicted by program status. These results suggest that despite the 3- and 4-class solutions having smaller BICs, they lacked substantive interpretability.

The 2-class solutions for the unconditional model, conditional model, and conditional model with the *Positive Action* effect constrained equal on slopes for both classes are shown in Figure 3. The 2-class solution finds a “High/declining” class (i.e., an intercept near the top of the SECD scale [3.75] that declines over time;  $n = 998$  for the unconditional model,  $n = 978$  for the conditional models), and a “Low/stable” class (i.e., an intercept closer to the middle of the scale [2.75] that remains stable over time;  $n = 120$  for the unconditional model,  $n = 129$  for the conditional models). When the *Positive Action* effect was not constrained to be equal on the linear slopes, we found an effect of  $b = .045$ ,  $p = .023$  for the “High/declining” class and  $b = .033$ ,  $p = .52$  for the “Low/stable” class. When the *Positive Action* effect was constrained to be equal on the linear slopes for both classes, we found an effect of  $b = .043$ ,  $p = .017$ . Across both

models, *Positive Action* was not associated with assignment to the latent classes; however, males were less likely to be in the “High/declining” class, Odds Ratio ( $OR$ ) = .29,  $p = .001$ . Due to the improved BIC for the 2-class conditional-constrained model compared to the 2-class conditional model, and relative similarity in the magnitude of the effect, we consider this as evidence that the *Positive Action* program is having a similarly beneficial effect for the two classes of children’s trajectories of SECD behaviors.

**What are the underlying latent trajectory classes of misconduct from middle childhood to early adolescence and what effect does *Positive Action* have on them?** As with the SECD models, we present fit statistics for the 1 – 4 class solutions for the misconduct unconditional and conditional growth mixture models (see Table 3). Similar to the SECD models, the BIC continued to suggest improved fit through the 4-class solution. However, with the misconduct models the Lo-Mendell-Rubin provided some evidence that the 2-class solution was preferred. Again, we focus on the 2-class solution for theoretical and substantive reasons. Similar to SECD, it showed a larger subpopulation with relatively lower levels of misconduct and a smaller subpopulation with relatively high levels of misconduct. Additionally, the 3-class unconditional model had a class size as small as 66, and the 4-class solution had a class size as small as 44. Once running the conditional model, the 3-class solution had a class as small as 34, which was predicted by program status. These results mirrored the substantive findings from the SECD models.

The unconditional model, conditional model, and conditional model with the *Positive Action* effect constrained equal on the slopes for both classes are shown in Figure 4. The 2-class solution finds a “Low/rising” class (i.e., an intercept near the bottom of the scale [1.25] that increases slowly over time;  $n = 934$  for the unconditional model,  $n = 907$  for the conditional

models), and a “High/rising” class (i.e., an intercept near the middle of the scale [2.25] that increases slowly over time;  $n = 183$  for the unconditional model,  $n = 192$  for the conditional models). When the *Positive Action* effect was not constrained to be equal on the linear slopes, *Positive Action* had an effect of  $b = -.046$ ,  $p = .000$  for the “Low/rising” class and  $b = -.068$ ,  $p = .049$  for the “High/rising” class. When the *Positive Action* effect was constrained to be equal on the linear slopes for both classes, *Positive Action* had an effect of  $b = -.049$ ,  $p = .000$ . Across both models, condition was not associated with class membership, but males were less likely to be in the “Low/rising” class,  $OR = .35$ ,  $p < .001$ . As with the SECD model conclusions, we consider this as evidence that the *Positive Action* program is similarly beneficial for the two classes of misconduct trajectories.

**Growth mixture models that included a quadratic term.** For both SECD and misconduct, the trajectories were modeled as only having linear slopes in order to obtain interpretable program effects (i.e., the effect of *Positive Action* on SECD and misconduct for each year). However, both trajectories had significant quadratic terms, with significant random variation. Therefore, the model fit statistics and the modeled program effects on trajectories that included the quadratic terms were also examined (see Table 4 available online). In general, the findings supported a two-class solution for both behaviors, consistent with the results above. For the SECD models that included a quadratic term, the unconditional model, conditional model, and conditional model with the *Positive Action* effect constrained equal on the linear and quadratic slopes for both classes closely mirrored the linear slope only model reported above (see Figure 5 available online). This was also true for misconduct models that included a quadratic term, with the one exception that the *Positive Action* program appeared to have a larger effect on the “High/stable” misconduct trajectory class (see Figure 6 available online). However, the BIC

for the misconduct models that included the quadratic term supported the conclusion that the *Positive Action* program effect was similar across classes.

### **Discussion**

The current study extends previous research on the effectiveness of universal SEL programs by applying a growth mixture modeling framework to understand the effects of the *Positive Action* program on multiple SECD and misconduct trajectories. First, the study finds evidence for two latent classes of trajectories for both SECD and misconduct from grades 3 to 8. Second, students in the *Positive Action* schools having improved trajectories. Notably, the program appeared similarly beneficial for trajectories regardless of class membership. This finding is somewhat unexpected when considered in relation to previous studies that have found larger effects for preventive interventions for youth in higher risk classes (Liu et al., 2010; Muthén et al., 2002). Yet, it is exactly what a well-designed universal program should achieve – it should help everybody (Flay & Allred, 2010).

#### **The Impact of *Positive Action* on SECD and Misconduct Trajectories**

Consistent with previous research, there was statistical evidence for multiple underlying trajectories on both positive and problem behaviors in this population (e.g., Kokko et al., 2006; Lewin-Bizan et al., 2010; Schaeffer et al., 2006). However, given critiques that fit statistics (e.g., BIC) could suggest more classes than truly exists (Bauer & Curran, 2003), we made our class selection primarily based on theoretical and substantive rationale (Sterba & Bauer, 2010). Our theoretical expectation was a larger class of youth with relatively higher levels of SECD and lower levels of misconduct and a smaller class with relatively lower levels of SECD and higher levels of misconduct (Moffitt & Caspi, 2001). This expectation was supported based on the 2-class solutions for both SECD and misconduct. Furthermore, the 3- and 4-class model solutions

lost substantive interpretability, with very small class sizes and classes in the conditional models that were predicted by the program assignment, thus not likely reflecting underlying subpopulations (Brown et al., 2008). Ultimately, our motive for identifying latent classes of trajectories was to understand how a SEL program affected the differing trajectories.

Our findings suggest that the *Positive Action* program similarly improved children's trajectories of SECD and misconduct regardless of class membership. These findings differ from previous intervention studies that found effects to be more pronounced for the relatively higher risk class (Liu et al., 2010; Muthén et al., 2002). Part of the reason for these findings is potentially due to measuring behaviors (i.e., SECD, misconduct) that have wider variability across a range of youth. That is, it might be impossible to find program effects on risky behaviors (e.g., substance use or violence) in lower risk groups because they might never engage in them. It is also worth noting that we did observe slightly larger program effects on trajectories within the "High/rising" misconduct class (i.e., in both the linear and quadratic models); thus it is possible there are differential program effects but the study was underpowered to detect them.

The current findings are in alignment with previous reviews on the impact of SEL programs that have concluded that such programs are broadly beneficial to youth's development in areas related to both social-emotional skills (e.g., self-control) and misconduct (e.g., aggressive or delinquent behavior; Durlak et al., 2011). We find support for the universal effects of this program by applying a growth mixture modeling framework to identify multiple latent classes of behavioral trajectories. One potential critique based on our two-class selection is that there may be only a single trajectory with random variation around it (Bauer & Curran, 2003). Fortunately, if this were the case, then our conclusions regarding the program effects being broadly beneficial for children regardless of their types of trajectories would be the same.

Additionally, although interactions between program effects and baseline risk factors might have provided comparable conclusions (e.g., initial high levels of misconduct), only a subset of the data would have been available with baseline factors due to the study design (students leaving and entering the schools over the 5-year period).

### **Limitations**

Several limitations of this study should be noted. First, the study used self-reported measures of SECD and misconduct and thus findings are susceptible to associated sources of potential bias (e.g., social desirability). However, the measures were previously validated, were age appropriate from 3<sup>rd</sup> through 8<sup>th</sup> grade, were able to capture a range of behaviors, and included interactions with parents, teachers, and peers. These strengths notwithstanding, integration of more objective assessments (e.g., disciplinary referrals) and use of multi-informant data (e.g., parent ratings) clearly would be useful additions to self-report measures in future research. Second, we only had 14 schools and therefore any accounting of clustering allowing for level two effects will lead to potentially inaccurate estimates of the standard error (including the sandwich estimator used in this paper). Although more schools in the study would have provided more accurate estimates of the standard error due to non-independence of data, practical limitations due to funding prevented this from being possible. Third, there was some evidence of improved model fit through the four-class solution. Although substantive interpretation supports our selection of the two-class solution, future work should continue to try to determine which fit statistics and procedures provide the most appropriate information for class selection with mixture modeling (i.e., Kreuter & Muthén, 2008; Sterba & Bauer, 2010).

Fourth, we focused primarily on the model with only a linear trend although both behaviors had significant quadratic terms. However, it is more difficult to quantify the program

effect when modeled on a quadratic. Although the models generally yielded consistent findings, the 2-class conditional misconduct model showed a relatively larger effect on the “High/stable” class than when it was constrained to be the same across classes. A final limitation that merits note is related to the data. The number of observations at all eight waves was limited because of student mobility (i.e., there were relatively high levels of transition in and out of the study over the five years). Although this is common with these kinds of studies (i.e., longitudinal, school-based), more rigorous follow-up of participants might have reduced potential biases related to missing data. Despite these limitations, the present study makes a unique contribution to the literature and has important implications for prevention research.

### **Implications and Conclusions**

By using a growth mixture modeling approach, the current study was better able to understand for whom and to what degree the *Positive Action* program improved behavioral trajectories. The program shows evidence of having benefited children’s trajectories of SECD and misconduct from 3<sup>rd</sup> through 8<sup>th</sup> grade similarly across two latent classes of trajectories for each type of behavior. Thus, evidence suggests that children from higher risk backgrounds (i.e., low-income, urban, minority status) can benefit from the holistic nature of this SEL program, which does not simply target or benefit the children in these contexts with the most behavioral problems or the lowest levels of social and emotional skills. These findings are in line with arguments for the effectiveness of SEL programs for improving youths’ positive and problem behaviors and their importance within the educational system (Durlak et al., 2011). They also add to the existing knowledge base by providing evidence that school-based SEL programs when designed and delivered universally can foster improved behavioral trajectories for different subgroups of children in a manner that is consistent with a key aim of such interventions.

## INTERVENTION EFFECTS ON BEHAVIORAL TRAJECTORIES

### **Compliance with Ethical Standards**

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**Disclosure of potential conflicts of interest:** The research described herein was conducted using the program, the training, and technical support of Positive Action, Inc. in which Brian R. Flay's spouse holds a significant financial interest. Conflict of interest issues were reported to the relevant institutions and appropriately managed following the institutional guidelines.

**Ethical approval:** "All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards."

**Informed consent:** "Informed consent was obtained from all individual participants included in the study."

## References

- Acock, A. C. (2012). What to do about missing values. In H. Cooper, P. M. Camic, D. L. Long, A. T. Panter, D. Rindskopf & K. J. Sher (Eds.), *Data analysis and research publication. APA handbook of research methods in psychology* (Vol. 3, pp. 27-50). Washington, DC: American Psychological Association.
- Asparouhov, T. (2005). Sampling weights in latent variable modeling. *Structural Equation Modeling, 12*, 411-434. doi: 10.1207/s15328007sem1203\_4
- Bauer, D. J., & Curran, P. J. (2003). Distributional assumptions of growth mixture models: implications for overextraction of latent trajectory classes. *Psychological methods, 8*(3), 338. doi: 10.1037/1082-989X.8.3.338
- Bavarian, N., Lewis, K. M., DuBois, D. L., Acock, A., Vuchinich, S., Silverthorn, N., . . . Flay, B. R. (2013). Using social-emotional and character development to improve academic outcomes: A matched-pair, cluster-randomized controlled trial in low-income, urban schools. *Journal of School Health, 83*, 771-779. doi: 10.1111/josh.12093
- Beets, M. W., Flay, B. R., Vuchinich, S., Snyder, F. J., Acock, A., Li, K. K., . . . Durlak, J. (2009). Use of a social and character development program to prevent substance use, violent behaviors, and sexual activity among elementary-school students in Hawaii. *American Journal of Public Health, 99*, 1438-1445. doi: 10.2105/ajph.2008.142919
- Bradley, R. H., & Corwyn, R. F. (2002). Socioeconomic status and child development. *Annual Review of Psychology, 53*, 371-399. doi: 10.1146/annurev.psych.53.100901.135233
- Brown, C. H., Wang, W., Kellam, S. G., Muthén, B. O., Petras, H., Toyinbo, P., . . . Chamberlain, P. (2008). Methods for testing theory and evaluating impact in randomized field trials: Intent-to-treat analyses for integrating the perspectives of person, place, and time.

*Drug and Alcohol Dependence*, 95, S74-S104. doi: 10.1016/j.drugalcdep.2007.11.013

DuBois, D. L., Flay, B. R., & Fagen, M. C. (2009). Self-esteem enhancement theory: Promoting health across the lifespan. In R. J. DiClements, R. A. Cosby, & M. Kegler (Eds.) *Emerging theories in health promotion practice and research* (pp. 97-130). San Francisco, CA: Jossey-Bass

Durlak, J. A., Weissberg, R. P., Dymnicki, A. B., Taylor, R. D., & Schellinger, K. B. (2011). The impact of enhancing students' social and emotional learning: A meta-analysis of school-based universal interventions. *Child Development*, 82, 405-432. doi: 10.1111/j.1467-8624.2010.01564.x

Elliott, D. S., Ageton, S. S., Huizinga, D., Knowles, B. A., & Canter, R. J. (1983). *The prevalence and incidence of delinquent behavior: 1976-1980 (National Youth Survey Report No. 26)*. Boulder, CO: Behavioral Research Institute.

Farahmand, F. K., Grant, K. E., Polo, A. J., & Duffy, S. N. (2011). School-based mental health and behavioral programs for low-income, urban youth: A systematic and meta-analytic review. *Clinical Psychology: Science and Practice*, 18, 372-390. doi: 10.1111/j.1468-2850.2011.01265.x

Flay, B. R., & Allred, C. G. (2010). The Positive Action program: Improving academics, behavior, and character by teaching comprehensive skills for successful learning and living. In T. Lovat, R. Toomey, & N. Clement (Eds.), *International research handbook on values education and student wellbeing* (pp. 471-501). Springer Netherlands. doi: 10.1007/978-90-481-8675-4\_28

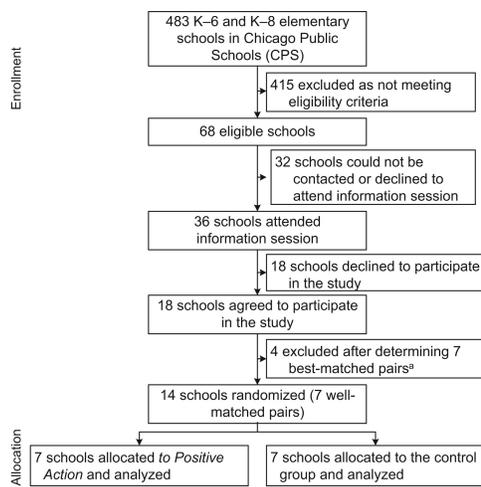
Gottfredson, D. C., & Wilson, D. B. (2003). Characteristics of effective school-based substance abuse prevention. *Prevention Science*, 4, 27-38. doi: 10.1023/A:1021782710278

- Ji, P., Flay, B. R., & DuBois, D. L. (2013). Social-emotional and character development scale: Development and initial validation with urban elementary school students. *Journal of Research in Character Education, 9*, 121-147.
- Kreuter, F., & Muthén, B. (2008). Analyzing criminal trajectory profiles: Bridging multilevel and group-based approaches using growth mixture modeling. *Journal of Quantitative Criminology, 24*, 1-31. doi: 10.1007/s10940-007-9036-0
- Kokko, K., Tremblay, R. E., Lacourse, E., Nagin, D. S., & Vitaro, F. (2006). Trajectories of prosocial behavior and physical aggression in middle childhood: Links to adolescent school dropout and physical violence. *Journal of Research on Adolescence, 16*, 403-428. doi: 10.1111/j.1532-7795.2006.00500.x
- Lerner, R. M., Almerigi, J. B., Theokas, C., & Lerner, J. V. (2005). Positive youth development. *Journal of Early Adolescence, 25*, 1-144. doi: 10.1177/0272431604273211
- Lewin-Bizan, S., Lynch, A. D., Fay, K., Schmid, K., McPherran, C., Lerner, J. V., & Lerner, R. M. (2010). Trajectories of positive and negative behaviors from early-to middle-adolescence. *Journal of Youth and Adolescence, 39*, 751-763. doi: 10.1007/s10964-010-9532-7
- Lewis, K. M., Vuchinich, S., Ji, P., DuBois, D. L., Acock, A., Bavarian, N., ... & Flay, B. R. (2016). Effects of the positive action program on indicators of positive youth development among urban youth. *Applied Developmental Science, 20*(1), 16-28. doi:10.1080/10888691.2015.1039123
- Li, K.-K., Washburn, I., DuBois, D. L., Vuchinich, S., Ji, P., Brechling, V., . . . Flay, B. R. (2011). Effects of the Positive Action programme on problem behaviors in elementary school students: A matched-pair, randomized control trial in Chicago. *Psychology & Health, 26*, 187-204. doi: 10.1080/08870446.2011.531574

- Liu, L. C., Hedeker, D., Segawa, E., & Flay, B. R. (2010). Evaluation of longitudinal intervention effects: An example of latent growth mixture models for ordinal drug-use outcomes. *Journal of Drug Issues, 40*, 27-43. doi: 10.1177/002204261004000103
- Lo, Y., Mendell, N. R., & Rubin, D. B. (2001). Testing the number of components in a normal mixture. *Biometrika, 88*, 767-778. doi: 10.1093/biomet/88.3.767
- Moffitt, T. E., & Caspi, A. (2001). Childhood predictors differentiate life-course persistent and adolescence-limited antisocial pathways among males and females. *Development and Psychopathology, 13*, 355-375.
- Muthén, B. (2004). Latent variable analysis: Growth mixture modeling and related techniques for longitudinal data. In D. Kaplan (Ed.), *Handbook of quantitative methodology for the social sciences* (pp. 345-368). Newbury Park, CA: Sage Publications.
- Muthén, B., Brown, C. H., Masyn, K., Jo, B., Khoo, S. T., Yang, C. C., . . . Liao, J. (2002). General growth mixture modeling for randomized preventive interventions. *Biostatistics, 3*, 459-475. doi: 10.1093/biostatistics/3.4.459
- Muthén, L. K., & Muthén, B. O. (1998-2012). *Mplus user's guide* (7th ed.). Los Angeles, CA: Muthén & Muthén.
- Nantel-Vivier, A., Kokko, K., Caprara, G. V., Pastorelli, C., Gerbino, M. G., Paciello, M., . . . Tremblay, R. E. (2009). Prosocial development from childhood to adolescence: a multi informant perspective with Canadian and Italian longitudinal studies. *Journal of Child Psychology and Psychiatry, 50*, 590-598. doi: 10.1111/j.1469-7610.2008.02039.x
- Orpinas, P., & Frankowski, R. (2001). The Aggression Scale: A self-report measure of aggressive behavior for young adolescents. *Journal of Early Adolescence, 21*, 50-67. doi: 10.1177/0272431601021001003

- Ramaswamy, V., DeSarbo, W. S., Reibstein, D. J., & Robinson, W. T. (1993). An empirical pooling approach for estimating marketing mix elasticities with PIMS data. *Marketing Science, 12*, 103-124. doi: 10.1287/mksc.12.1.103
- Schaeffer, C. M., Petras, H., Ialongo, N., Masyn, K. E., Hubbard, S. Poduska, J., & Kellam, S. (2006). A comparison of girls' and boys' aggressive-disruptive behavior trajectories across elementary school: Prediction to young adult antisocial outcomes. *Journal of Consulting and Clinical Psychology, 74*, 500 - 510. doi: 10.1037/0022-006X.74.3.500
- Schaeffer, C. M., Petras, H., Ialongo, N., Poduska, J., & Kellam, S. (2003). Modeling growth in boys' aggressive behavior across elementary school: links to later criminal involvement, conduct disorder, and antisocial personality disorder. *Developmental Psychology, 39*, 1020 - 1035. doi: 10.1037/0012-1649.39.6.1020
- Sclove, S. L. (1987). Application of model-selection criteria to some problems in multivariate analysis. *Psychometrika, 52*, 333-343. doi: 10.1007/BF02294360
- Sterba, S. K., & Bauer, D. J. (2010). Matching method with theory in person-oriented developmental psychopathology research. *Development and Psychopathology, 22*, 239-254. doi: 10.1017/S0954579410000015
- Wang, J., & Wang, X. (2012). *Structural equation modeling: Applications using Mplus*. West Sussex, United Kingdom: John Wiley & Sons Ltd.
- Washburn, I. J., Acock, A., Vuchinich, S., Snyder, F., Li, K.-K., Ji, P., . . . Flay, B. R. (2011). Effects of a social-emotional and character development program on the trajectory of behaviors associated with social-emotional and character development: Findings from three randomized trials. *Prevention Science, 12*, 314-323. doi: 10.1007/s11121-011-0230-9





*Figure 1.* CONSORT flow diagram for school selection and randomization in the randomized controlled trial. Figure first published in Lewis, K. M., Schure, M. B., Bavarian, N., DuBois, D. L., Day, J., Ji, P., ...Flay, B. F. (2013). Problem behavior and urban, low-income youth: A randomized controlled trial of Positive Action in Chicago. *American Journal of Preventive Medicine*, 6, 622-630. doi: 10.1016/j.amepre.2013.01.030

Table 3

*Unconditional and Conditional Model Fit Statistics for SECD and Misconduct Growth Mixture Models*

<i>Model</i>	<i>SECD</i>			<i>Model</i>	<i>Misconduct</i>		
	<i>BIC ADJ</i>	<i>Entropy</i>	<i>LMR p-value</i>		<i>BIC ADJ</i>	<i>Entropy</i>	<i>LMR p-value</i>
				<u>Unconditional Models</u>			
1-Class	4726	–	–	1-Class	5336	–	–
2-Class	4614	.690	.129	2-Class <sup>a</sup>	5149	.772	.084
3-Class <sup>a</sup>	4557	.671	.114	3-Class <sup>a</sup>	5048	.743	.240
4-Class <sup>a</sup>	4536	.731	.313	4-Class <sup>a</sup>	5005	.728	.458
				<u>Conditional Models</u>			
1-Class	4689	–	–	1-Class	5324	–	–
2-Class	4568	.714	.250	2-Class <sup>a</sup>	5066	.773	.051
3-Class	4542	.796	.515	3-Class <sup>a</sup>	4953	.821	.246
4-Class <sup>a</sup>	4501	.734	.437	4-Class <sup>a</sup>	4904	.751	.634
2-Class-con.	4565	.713	.182	2-Class-con. <sup>a</sup>	5063	.774	.049

*Note.* “2-class-con.” had the *Positive Action* effect on slope for both classes constrained to be the same magnitude. *LMR p-value* is the Lo-Mendell Rubin adjusted p-value test.

<sup>a</sup> Intercept variance set to 0 due to non-significant residual variance.

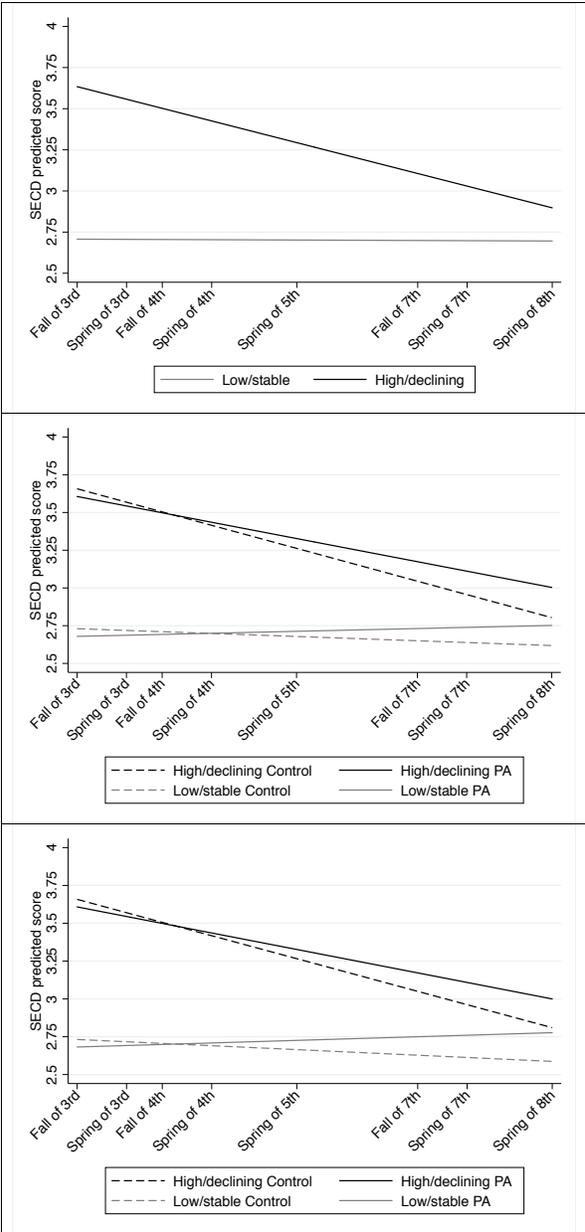


Figure 3. SECD trajectories for the 2-class unconditional (top), 2-class conditional (middle), and 2-class constrained (bottom) model solutions.

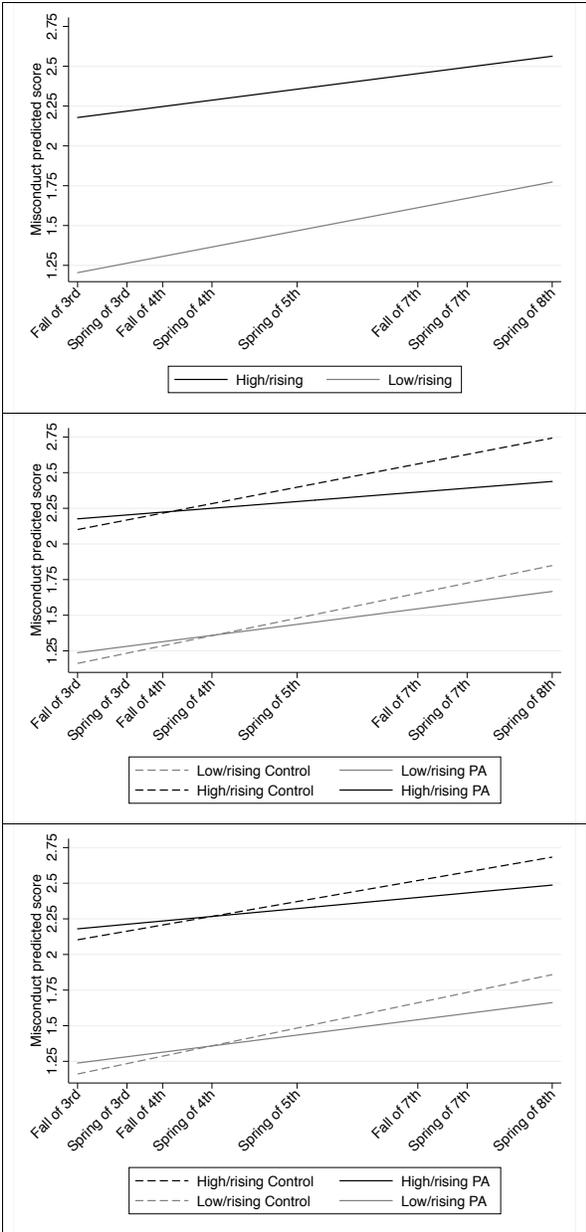


Figure 4. Misconduct trajectories for the 2-class unconditional (top), 2-class conditional (middle), and 2-class constrained (bottom) model solutions.