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Müller, C., Hofmann, V., Fleischli, J. & Studer, F. (2016). Effects of classroom composition on the development of antisocial behavior in lower secondary school. *Journal of Research on Adolescence*, 26, 345-359.

<https://doi.org/10.1111/jora.12195>

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Effects of Classroom Composition on Early Adolescents' Antisocial Behavior Development

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Abstract

Early adolescence is a critical period during which classroom composition may affect behavioral development. This study investigated whether classmates' levels of aggression and delinquency influenced individual behavior during the first year of secondary school. At this point, students had just transitioned to a new classroom peer environment. A short-term longitudinal design with four measurement points distributed across the school year was applied. Data were collected from the anonymous self-reports of 825 7th graders.

Longitudinal negative binomial multilevel analyses revealed that classmates' antisocial behavior influenced pupils' behavioral development (other peer influences were controlled).

Furthermore, classroom behavioral heterogeneity did not moderate this effect.

Human behavior development is influenced by the various environments in which individuals have different social experiences (Bornstein, 2012). In an attempt to explain adolescent antisocial behaviors like aggression and delinquency, a number of researchers throughout history have investigated these contextual factors, especially in regards to peer influence (e.g., Sutherland, 1939). Most of these studies found that spending time with deviant friends is one of the best predictors of adolescent antisocial behavior (Dishion & Tipsord, 2011; Warr, 2002). However, peer influence processes such as imitation and social reinforcement operate not only among self-chosen friends but also among involuntarily created peer groups, such as groups of classmates (Juvonen & Galván, 2008). Hence, the assignment to a particular classroom where high or low levels of behavioral problems are exhibited among the classmates could influence early adolescent development. The current study examined such classroom composition effects regarding the development of aggression and delinquency in the first year of secondary school.

Effects of Classroom Composition on Individual Behavioral Development

In recent years, a number of studies have investigated the effects of classroom composition on individual antisocial behavior (e.g., Barth, Dunlap, Dane, Lochman, & Wells, 2004; Henry, Guerra, Huesmann, Tolan, VanAcker, & Eron, 2000; Kellam, Ling, Merisca, Brown, & Ialongo, 1998; Kuppens, Grietens, Onghena, Michiels, & Subramanian, 2008; LeBlanc, Swisher, Vitaro, & Tremblay, 2008; Mercer, McMillen, & DeRosier, 2009; Thomas, Bierman, & CPRG, 2006; Thomas, Bierman, Powers, & CPRG, 2011). Generally, these studies focused on aggressive and disruptive behavior among kindergarten and primary school children and suggested that individual development is influenced by the classmates' behavioral characteristics (but see Henry et al., 2000). For example, Thomas and colleagues (2006; 2011) showed that exposure to classrooms with high levels of aggressive behavior was

associated with an increase in individual aggression. This corresponds to previous findings at the schoolhouse level, which showed that students who witness aggression among their school peers exhibit themselves more aggressive behavior (Boxer, Edwards-Leeper, Goldstein, Musher-Eizenman, & Dubow, 2003).

Less is known about classmates' influences on delinquency. Such behavior is less frequent and visible at school than aggressive or disruptive behavior, and it might especially be observed during extracurricular activities with the classmates. The few existing results concerning this issue are not conclusive. While a recent cross-sectional study by Araos, Cea, Fernández, and Valenzuela (2014) in Chile indicated that the level of marijuana use in class was related to the individual rates of consumption among 7th graders, different results emerged from a study by Bosse, Gerritsen, and Klein (2010). Based on their dataset of 194 7th graders, these authors found little evidence of compositional effects but stressed the preliminary nature of their findings due to the small sample size and the incomplete information available on class composition.

Classroom Composition Effects in Early Adolescence

The studies by Araos et al. (2014) and Bosse and colleagues (2010) are also very interesting in that they relate to what we consider the main research gap. Most existing studies investigated the effects of class composition among children but not among adolescents. This is rather astonishing, as early adolescence (from approximately age 11 to 14) is a crucial developmental period for peer influence and experimentation with deviant behaviors (e.g., Jang, 1999; Tang & Orwin, 2005). Besides the cognitive, physical, and sexual maturation that is occurring, students at this age experience increasing autonomy, which often goes along with changes in parent-child relationships. While the peers do not

simply replace the parents' influence, they become central figures in the process of establishing adolescent identity (Warr, 2002, p. 23ff.).

The classroom, as a place to meet peers and build social networks for extracurricular activities (Kiesner, Poulin, & Nicotra, 2003) thus plays an important role in early adolescents' daily lives. In view of this, the change from primary to secondary school classrooms may be a critical event in the development process, as the students' peer environment is considerably changed (Howe & Richards, 2011). The characteristics of this new social ecological context can vary greatly depending on the individual classroom assignment; for example, lower academic track classrooms are often characterized by more antisocial behaviors among students than are higher (Junger-Tas, Sketee, & Moll, 2010). It is thus important to understand how much classroom composition contributes to early adolescents' behavioral development during their first year in secondary school.

Evidence concerning this issue is scarce, as most studies on early adolescence examined the impact of cliques or best friends (e.g., Berndt & Keefe, 1995; Espelage, Holt, & Henkel, 2003). Some relevant information is provided by the two studies described above (Araos et al., 2014; Bosse et al., 2010) and an analysis by the authors indicating that there are significant class composition effects on 7th graders' school problem behaviors (a paper written in German; *Anonymous Authors, submitted*). Problem behaviors at school, as explored in this study, were narrowly defined as students' norm violations in their interactions with their classroom teachers (e.g., not being attentive, standing up in class, not completing homework, etc.). These findings should be extended by further research into classroom composition effects on the more general categories of early adolescents' aggressive and delinquent behaviors.

Issues Regarding the Operationalization of Classroom Composition

When conducting studies in this field, it is important to discuss exactly how classroom composition should be defined (see also Yudron, Jones, & Raver, submitted). Usually, class composition, as viewed from the perspective of behavioral problems, is understood as the mean level of specific behaviors present among the students in a classroom. According to the conceptualization of Cialdini, Kallgren, and Reno (1990), this classroom mean can be considered a descriptive norm that indicates a central tendency of behavior in a group (the norm of what “is”; see also Henry et al., 2000). Defined in this way, it is distinguishable from other concepts such as injunctive norms, which relate to the beliefs about the acceptability of certain behaviors (the norm of what “ought to be”; Cialdini et al., 1990). Descriptive norms can be predictors of individual behavior as they inform a person about what others typically do and, by this, provide decisional shortcuts (Cialdini et al., 1990). Further, as descriptive norms represent concrete behaviors, they provide the opportunity for imitation and may indicate which behavior is accepted among the classmates and will, as a result, be socially reinforced (Bandura, 1977; Cialdini et al., 1990; Dishion & Tipsord, 2011).

In earlier research, the classroom mean of students’ problem behaviors was either deducted from individual students’ values of teacher’s reports (e.g., Kellam et al., 1998) or students’ self-reports (e.g., Araos et al., 2014). In this study, anonymous self-reports were preferred since they represent the classroom composition from the point of view of the actors embedded in the context (Bornstein, 2012, p. 18; Bronfenbrenner, 1979, p. 22ff; Yudron et al., submitted). This approach may be especially useful in terms of the measurement of aggression and delinquency, which often occur outside teachers’ viewing capabilities. However, self-reports also raise problems, as they can be confounded with students’ views of their peers’ behaviors (Henry, Kobus, & Schoeny, 2011). For this reason, the operationalization of class composition in this research was based solely on classroom-

aggregated students' reports of their own behavior and did not include students' reports of their peers' behaviors. In accordance with Marsh and colleagues (2012), we consider class compositional effects as statistically evident when the effect of the aggregated students' behavior at t1 significantly predicts an individual student's behavior in the future, controlling for his/her behavior at t1.

Heterogeneity of Behavior as a Potential Moderator of Compositional Effects

The described operationalization of classroom composition is commonly used in research, but it has a marked limitation. It only relates to the mean behavior in the classroom and does not represent any kind of variance. However, classrooms may differ in terms of the heterogeneity of antisocial behavior within the class. For example, in one class the behavior of all students is very close to the classroom mean (small variance) while in another class students' levels of problem behaviors vary a lot (large variance). In an important work on this issue, Yudron et al. (submitted) showed that just a few students with high rates of problem behavior in a classroom with otherwise low levels of such behavior can considerably increase the variance in a classroom. Furthermore, they found that classrooms with higher mean scores for externalizing behaviors also had higher standard deviations ($r=.78$; $p<.001$; Yudron et al., submitted). In view of this, it would be useful to test whether an effect of class composition remains significant when controlling for the variance of antisocial behavior in a class. Further, the level of heterogeneity might moderate the effect of classroom composition, as experimental studies suggest that the more homogeneous a group's behavior, the more individuals will conform (e.g., Rule, 1964). Classrooms that are more behaviorally homogeneous may thus exhibit higher levels of peer pressure so that individual deviance from the prevailing descriptive norm is less accepted than it is in heterogeneous classrooms.

The Current Study

In order to investigate the effects of classroom composition and the moderating role of heterogeneity on early adolescents' aggression and delinquency, a short-term longitudinal study using four measurement points throughout a school year was conducted in the first-year classrooms of Swiss secondary schools. Some features of this study allowed us to avoid some of the methodological problems faced in earlier studies. Given that pupils had just transitioned from primary to secondary school at the beginning of the data collection period, measurement began when these students had just recently been assigned to a newly composed classroom. Further, in the local school systems, adolescents remained within their self-contained classes throughout almost all of their courses, so the classroom composition stayed the same across the entire school year. A common problem encountered in earlier studies was that compositional measures had to be based on the characteristics of only a segment of the students within a classroom (e.g., Bosse et al., 2010). Here, it was possible to collect data from nearly the entire student cohort from a specific region so that composition measures could be based on information from almost all of the students in a particular class.

Hypothesis 1 stated that the higher the level of antisocial behavior among classmates at the beginning of the school year (t_1), the more such behavior students would report across the next points of measurement (t_2 – t_4). *Hypothesis 2* predicted that a lower variance of the class mean of antisocial behaviors would increase the class composition effect on individual behavioral development. Several control variables were considered. These were related to an individual's antisocial behavior and included gender, socio-economic status, immigration background, parental support, impulsivity, school grades, academic track, and the perceived care of the teacher (Furlong, Morrison, & Jimerson, 2004). In order to specifically draw conclusions about classmate influences, we also included the data on the behaviors of the students' friends from outside the class as a control measure (e.g., Ingoldsby & Shaw, 2002).

Methods

Participants

The present research was part of a longitudinal study that assessed antisocial behavior development among students in Swiss lower secondary schools. The following analyses focused on Grade 7 students (age at t1: $M=13.12$, $SD=0.48$ years). Data were collected in the Swiss canton of Fribourg, where students transition to secondary school after Grade 6. The first measurement took place four weeks after the beginning of 7th grade, so the students already had a chance to get to know each other (the first day of the new school year, t1, was in the 34th calendar week of 2011; t2: November/December; t3: February/March; and t4: May/June). Students reported to have known, on average, 14.72% ($SD=11.56$) of their secondary school classmates from their primary classrooms. All 7th grade students ($N=825$) from 55 classrooms distributed across eight schools took part in the study and attended at least one of the four measurement sessions. Only schools from the German-speaking part of the canton participated (student populations between 185 and 414). As Fribourg is a rural region, only one school was located in a town (>10,000 inhabitants), while the others were located in villages. Between 21 and 43 students were missing at different time points, and these missing data were statistically accounted for using maximum likelihood estimation.

The local school system comprises three regular academic tracks (advanced: *Progymnasium*; general: *Sekundarschule*; basic: *Realschule*) and special educational classes for students with learning difficulties. Assignment to each of the different tracks is based on four criteria regarding students' performance in the 6th grade: school grades, teachers' recommendations, parents' recommendations, and a standardized achievement test. Students remained in their self-contained classrooms until Grade 9. One teacher was assigned responsibility for each class, but students were taught by other subject teachers as well.

Measurement Instruments

Dependent Variables.

Self-reported antisocial behavior. To assess individual levels of aggressive and delinquent behaviors, the German self-report scales of the “Fribourg Self- and Peer-Report Scales – Antisocial Behavior” (FSP-A; Mueller, 2013) were used at all four measurement points. Generally, anonymous self-reports are well-established as a means of measuring antisocial behavior from the perspective of adolescents (Thornberry & Krohn, 2000). In the FSP-A, students anonymously provide information as to how many days (0–14 days) in the last two weeks they have exhibited a specific behavior (not restricted to the school setting). The relatively short rating time period of 14 days allowed for repeated measurements to be conducted across the school year, and it also reduced the potential for memory bias. The FSP-A contains a 9-item aggression scale (Cronbach’s $\alpha=.84$), which measures the following behaviors: directly aggressive acts (e.g., hitting, pushing around, threatening, annoying, or insulting others) and indirectly aggressive acts (e.g., spreading rumors about others, playing someone off against someone else). In addition, this scale measures oppositional behavior (e.g., fierce arguments with others or feeling very angry). The delinquency scale (11 items; $\alpha=.89$) considers a broad spectrum of deviant behaviors like carrying a weapon, consuming alcohol or drugs, public vandalism, destroying others’ belongings, shaking somebody down, engaging in theft, or dodging the payment of fares.

The FSP-A self-reports were evaluated with 552 7th to 9th graders (Mueller, 2013). Factor analyses supported the theoretical structure (aggression vs. delinquency) of the scales. Further, the classroom-aggregated values of the self-reports (“How many days during the last 14 did you do that?”) correlated highly with the classroom-aggregated values of peer reports (“How many of your classmates did that at least once during the last 14 days?”; aggression: $r=.79$; $p<.001$; and delinquency: $r=.85$; $p<.001$). Moreover, self-report scale classroom means

were significantly correlated with teachers' perceptions of the global level of psychosocial difficulties observed in the classrooms (aggression: $r=.58$; $p<.001$; and delinquency: $r=.56$; $p<.001$). In accordance with the procedure described by Mueller (2013), the single-item values were added scale-wise to a global aggression and global delinquency score.

Independent Variables.

Classroom composition and heterogeneity regarding antisocial behaviors. The variable "Classroom Composition" was represented by the classroom means of students' self-reports on aggressive and delinquent behaviors in the FSP-A described above. Heterogeneity was indicated by the variances of these levels of aggressive and delinquent behaviors in each classroom. The variance did not relate to the diversity of the behavioral spectrum exhibited (e.g., hitting and arguing in one class vs. only arguing in another class) but to the variance of the means of the FSP-A-scales in a classroom (see also Yudron et al., submitted).

Time in weeks after t1. In order to predict students' antisocial behavior development over time, we included the number of weeks after the first measurement point as a variable.

Control Variables.

Immigration background. As a rough estimate of immigration background we collected participants' self-reported information as to whether they owned a foreign passport (possibly in addition to a Swiss passport).

Socio-economic status. We estimated this factor via the ISEI-classification system (International Socio-Economic Index of Occupational Status; Ganzeboom & Treiman, 1996), and counted the higher of the two parents' employment scores as the relevant measure.

Impulsivity. Data regarding this factor were collected using the German self-report "Impulsivity" scale of the "Inventory to Assess Impulsivity, Risk Tolerance, and Empathy in

9- to 14-Year-Olds” (Stadler, Janke, & Schmeck, 2004). The scale consisted of 16 items measuring different aspects of cognitive and motivational impulsivity.

Behavior of the three best friends from outside of class. To assess this measure, the participants reported across three items, how often (almost never, sometimes, almost always) these anonymous friends “annoy other people” (considered as aggression) and “do forbidden things” (considered as delinquency). From these ratings, the mean was calculated for each scale (aggression: $\alpha=.65$; delinquency: $\alpha=.71$).

Parents’ support. Parental involvement in school activities and with school-related issues was assessed using a scale developed by Fuchs, Lamnek, Luedtke, and Baur (2009). It consisted of eight items, such as “My parents pay attention to me doing my homework,” or “My parents almost always go to parent-teacher conferences” ($\alpha=.79$).

School grades. The mean scores from students’ reports on their expected end-of-the-year-grades in the main subjects (German, French, and Mathematics) at t4 were used to assess this factor.

Perceived care of the teacher. Our exploration of this factor was based on the classroom-aggregated individual reports on the “Teacher Care” scale from the German “Landau Scales of Social Climate” (Saldern & Littig, 1987). Here, the respondents estimated, on an eight-item scale, the extent to which they perceived their classroom teacher as being supportive and solicitous. The subscale used was a slightly adapted version of Schwarzer and Jerusalem (1999), and it had an internal reliability of $\alpha=.84$.

Procedure

The local education government and the university worked together to inform students and parents about the study in a writing. This letter stressed that student anonymity was assured, since they never had to provide their names. Additionally, students’ individual

behavior reports would not be given to anyone outside the research team. Students and parents had the chance to decline participation at any time. The students filled in the questionnaires in their classroom. All instructions, including detailed explanations of the questionnaires, were provided by trained research assistants according to a manual. In order to have the participants answer the questionnaires as independently as possible from their peers, we set up mobile blinds (about 60 cm high) between them. Individual data were processed on the basis of codes that remained the same across the four measurement points. For this reason, even the research team could not determine the identity of participants.

Statistical Analyses

When considering the data characteristics, the dependent variables in this study (number of days a person exhibits aggressive or delinquent behavior) represented count data. Given that antisocial behavior is rather uncommon, a right-skewed distribution of the raw data and the residuals is typically found, with variances exceeding the means (“overdispersion”; e.g., Childs, Sullivan & Gullledge, 2011). This was also the case for the variables in this study (e.g., distribution of aggression at t1: skewness $\nu=3.95$; $M=0.46$; $SD=0.80$; delinquency at t1; $\nu=8.69$; $M=0.11$; $SD=0.38$; see Figure 1). Hence, we performed negative binomial models (extensions of Poisson) to take into account these data specificities (Hilbe, 2008a, p. 1). Moreover, the data’s multilevel structure had to be considered (Raudenbush & Bryk, 2002, pp. 3–4). Time in weeks after t1 (Level 1) was nested into individuals (Level 2), who were nested into classrooms (Level 3). Since only eight schools participated in this study, no fourth school level was included (Maas & Hox, 2005). We performed all negative binomial multilevel models with MLwiN 2.26.

Some peculiarities associated with these types of analyses should be mentioned. First, the Level 1 variance in the negative binomial models is not a freely estimated parameter but it

is fixed to 1. Therefore, neither the variance partition coefficient nor the explained variance by the predictors (R^2) can be calculated. The use of pseudo- R^2 was not considered to be an adequate alternative, as this parameter is not equivalent to R^2 (pseudo- R^2 represents a measure of model fit). Further, different pseudo- R^2 calculations lead to different results, and there is no clear indicator of when to use which calculation (e.g., Long, 1997, p. 102). The negative binomial model effects are thus typically interpreted in terms of incidence rate ratios (IRR), which represent the multiplicative dependent variable change for each one-unit predictor change (Hilbe, 2008b, pp. 6–9). As in negative binomial models, the coefficients are logarithmized, the IRR is defined as the inverse logarithm of the coefficients (exponential function).

First, preliminary analyses were conducted to explore the general development of antisocial behavior and the correlations between the variables of interest. Then, to answer Hypothesis 1, longitudinal negative binomial multilevel models were performed. Here, the initial class composition at t1 was used to predict the level of individual antisocial behavior at the subsequent points of measurement (t2, t3, and t4), controlling for individual behavior at t1. As class composition (t1) was measured before the dependent variable (t2, t3, t4), we were able to avoid reciprocal causation in these analyses (Singer & Willett, 2003, pp. 177–181). To test Hypothesis 2, we analyzed whether the class composition effect was moderated by the variance of the class's antisocial behavior. In all these analyses, the variable "Time in Weeks after t1" was included on Level 1 of the multi-level models. However, as the Level 1 variance is fixed in negative-binomial models, no random time effects could be estimated within individuals. By contrast, antisocial behavior intercepts and slopes were allowed to vary between individuals (Level 2) and classrooms (Level 3). Furthermore, we analyzed covariances between the intercepts and slopes on Levels 2 and 3.

Results

Preliminary Analyses

Table 1 presents the sample's demographic characteristics and the variables' descriptive statistics. Gender was nearly equally distributed, and the sample's mean socio-economic status was comparable to that of the overall Swiss population of students. About a fifth of the students had an immigration background (only foreign passport or both foreign and Swiss passport). Among these, 9.5% of the students reported to have only a Swiss passport, compared to 22.5% throughout the country (Federal Agency of Statistics, 2013). Together with the fact that Fribourg is a rural region of Switzerland, these participants' characteristics may be associated with lower levels of behavioral problems when compared to the rest of the country's young adolescents (e.g., Killias, Aebi, Sucia, Herrmann, & Dilitz, 2007; Lysterly & Skipper, 1981). However, in our view, this should not affect the validity of the results regarding class composition effects on students' behaviors.

Please insert Table 1 here

Figure 1 indicates the extremely right-skewed distribution of self-reported aggression and delinquency. To enhance understanding of our data, the scale means are presented in the figure. An individual value of 1 means that, on average, each of the eight aggressive (and the eleven delinquent) behaviors described in the scale were exhibited during one day of the past 14 based on student reports. As examples of single item incidences, students reported that they "verbally harassed or insulted others" during an average of 1.14 days ($SD=2.32$) and that they "dodged paying fares" on 0.25 days ($SD=0.99$) of the last 14 (for detailed item-specific descriptive statistics, see *Anonymous Authors*).

Please insert Figure 1 here

In order to analyze the general development of antisocial behavior across the 7th grade, negative binomial multilevel analyses were performed, and these predicted individual aggression and delinquency from t1 to t4 by “Time in Weeks after t1” (not including other predictor variables). In these analyses, aggression changes from the first to the fourth measurement points were not significant ($p=.13$; $IRR=1.003$; detailed data available upon request). The IRR of 1.003 indicates an estimated rise of 0.3% in aggressive behavior per week. Using dummy variables to compare the differences between measurement points, multilevel negative binomial models indicated that there was a significant increase from t1 to t2 ($p<.01$; $IRR=1.372$), a decrease from t2 to t3 ($p<.01$; $IRR=0.777$), and another increase from t3 to t4 ($p<.01$; $IRR=1.166$).

Please insert Figure 2 here

In contrast to aggression, there was a significant increase in delinquency across the four measurement points ($p<.01$; $IRR=1.021$). The IRR of the factor “Time in Weeks after t1” means that there was an increase of 2.1% per week in delinquent behavior occurrence. The comparisons between the different measurement points showed a significant increase from t1 to t2 ($p<.05$; $IRR=1.292$), no significant change from t2 to t3 ($p=.63$; $IRR=1.062$), and an increase from t3 to t4 ($p<.01$; $IRR=1.557$; see Figure 2).

Table 2 shows the correlations of classroom composition, heterogeneity, and individual antisocial behavior (Spearman’s rho was used to take into account the right-skewed distributions). The more antisocial behavior exhibited among all students from a classroom, the more individuals reported such behavior both at the start of the school year

and over time. The effect sizes of these correlations were small. Further, class composition was highly positively correlated with heterogeneity, indicating that classrooms in which more problem behavior was present also exhibited greater variation in the reported levels of these behaviors. For this reason, potential multicollinearity was explored, which may be an issue for the later presented analyses on Hypothesis 2. The partial correlations displayed in Table 2 showed that when controlling for class composition, the relation between heterogeneity and individual behavior partly lost its significance, while the correlations between composition and individual behavior all remained significant when controlling for heterogeneity. Class composition appeared thus to be related to individual behavior over and above what can be explained by heterogeneity. Furthermore, regressing individual aggressive and delinquent behavior on classroom composition and heterogeneity revealed multicollinearity tolerance values of 0.14 and 0.36, respectively, which is above the oft-cited critical value of 0.10 (lower values would indicate serious multicollinearity). It was thus decided that classroom composition and heterogeneity may be included as predictors in the models presented in Table 4 (see a detailed discussion of this topic in O'Brien, 2007).

Please insert Table 2 here

Hypothesis 1: The Effect of Class Composition on Antisocial Development

Table 3 presents the results of the negative binomial multilevel regression analyses predicting self-reported aggression and delinquency from t2 to t4 by class composition at t1, controlling for related variables. The results presented in the table refer to the composite specification of the multilevel model for change (see Singer & Willett, 2002, pp. 80–85). As is shown, there was a significant effect of class composition on individual aggressive and delinquent behavior. The higher the level of antisocial behavior among classmates at the

beginning of the school year, the more individual antisocial behavior was reported at the subsequent measurement points. Thus, Hypothesis 1 was supported.

Please insert Table 3 here

Interpreting the negative binomial model coefficients in detail requires more explanation. Classroom composition's effect on aggressive behavior had an *IRR* of 2.356, which indicates the multiplicative change of the dependent variable for each one-unit change in the predictor. Interpreted as a percentage, this means that a student will exhibit 135.6% more aggressive behavior across the school year when the mean value of aggressive behavior in his classroom at t1 increases by one unit. Concretely, this one-unit increase on the FSP-A scale means that the classroom mean for numbers of days with aggressive behavior over the past 14 days moves one day up. With an *IRR* of 7.836 and a resulting increase of 683.6% per one-unit change, the same interpretation applies to the effect of class composition on delinquent behavior. Considering the practical relevance of these effects, the right-skewed distribution and low levels of antisocial behavior in the sample must be kept in mind (e.g., the delinquency scale mean was 0.11 days for the past 14 days; see Figure 2). Hence, a one-unit increase in the predictor signifies a large difference in the classroom characteristics, thus resulting in greater percentage changes in individual behavior.

The effect of "Time in Weeks after t1" in Table 3 shows that there was a significant decrease in aggression from t2 to t4. The *IRR* of 0.991 means that, per week, aggressive behavior decreased 0.9% (calculated as 100% minus 99.1%). This result seems to contradict the preliminary analyses, where no effect of time was found on aggression. However, in the former calculations, all four measurement points of the individual's antisocial behaviors were considered, while in this model only the measures from t2 to t4 were included as dependent

variable. Delinquency, in contrast to aggression, increased significantly by a rate of 1.4% per week ($IRR=1.014$) between t2 and t4.

Regarding the control variables, higher rates of individual aggression at t1, more impulsivity and more aggressive behavior exhibited by one's friends from outside the class, and less parental support all went along with greater prospective aggression. More delinquency was predicted by higher rates of delinquency at t1, male gender, more impulsivity, less parental support, and no immigration background. The latter effect might be due to correlations with other control variables in the model. When only immigration background was included in the model, there was no more difference between students with and without an immigration background.

In addition to these fixed effects, variance components of the multi-level analyses provided additional information about within- and between-group effects (see the lower part of Table 3). The intercept variance was significant in regards to aggressive behavior between individuals. That is to say, students differed from each other in their aggression levels. The significant variance of the intercept between classes regarding aggressive behavior showed that classrooms differed from each other, too. Further, the slope of time varied significantly between individuals across both aggression and delinquency, indicating that students differed from each other in their behavioral development over time. Furthermore, the covariance of the intercept between individuals and change over time was significantly negative for aggression, meaning that participants who started with lower levels of aggression built up more aggression over the school year than did those who started with higher levels. The significant covariance of the intercept between classes and change over time showed the same effect on the classroom level. Classrooms with lower initial rates of aggression increased more in aggressive behavior than did classrooms with high rates.

Hypothesis 2: The Moderating Effect of Heterogeneity of Behavior in Class

Table 4 shows that the effects of class composition were not moderated by the heterogeneity of classroom behavioral problems. While the direction of the interaction was as expected (the more heterogeneous the class, the fewer the compositional effects), the effects were far from statistically significant (aggression: $p=.59$; delinquency: $p=.57$). Hypothesis 2 thus had to be refused. Interestingly, the effects of classroom composition remained significant when including heterogeneity in the models. Compared to the earlier presented analyses for Hypothesis 1, there were no changes regarding the significance of control variables or variance components, except that the immigration background effect on delinquency disappeared.

Please insert Table 4 here

Discussion

This study investigated how the level of antisocial behavior among classmates is associated with the individual adolescents' antisocial behavior development. Before we discuss this issue in more detail, it is interesting to note that delinquency in the first year of secondary school increased across the four measurements. This is in line with findings that, along with the personal and environmental changes that are characteristic of early adolescence, experimentation with delinquent acts is growing (e.g., Jang, 1999; Thornberry, 1987). By contrast, aggressive behavior did not significantly increase, and this finding was probably related to the large fluctuations in self-reports across the four time points. Behavioral problems increased from a lower level of deviancy at the beginning of the school year to a higher level in December. Then, deviant behavior decreased from December to March, but it again ascended toward the end of the school year. One possible explanation for

this pattern may be that the stress the students felt at school (e.g., studying for exams, worrying about grades, etc.) peaked at the ends of the terms, which may have been related to an increase in maladaptive behaviors (see also Morales & Guerra, 2006).

Effects of Classroom Composition on Antisocial Development

Regarding Hypothesis 1, it was found that the higher the classroom mean of antisocial behavior among lower secondary school students, the more such behavior was reported by an individual pupil later in the school year, after controlling for his initial behavior and other related factors. This finding adds to earlier research on classroom composition effects that mostly focused on children in kindergarten and primary school (e.g., Barth et al., 2004; Kellam et al., 1998; Mercer et al., 2009; Thomas et al., 2006; Thomas et al., 2011). Further, the study indicates that during early adolescence, the impact of the peer characteristics appears not to be restricted to self-selected friends and cliques (e.g., Berndt & Keefe, 1995; Espelage et al., 2003) but also to the institutionally imposed peer environment of the classroom, as represented in the here-investigated Swiss school system (see also Araos et al., 2014). Extending earlier research, the specificity of the classmates' influence could be more clearly defined by statistically controlling for the perceived level of problem behaviors among the friends from outside the classroom.

The underlying mechanisms of the classrooms' descriptive norms' effects on individual behavior are multifaceted (Cialdini et al., 1990); for example, the information about typical classmate behavior may have been interpreted by individual students as a reference to which behavior is considered popular in class. Further, the observation of other students' behaviors may have provided opportunities for social learning, such as imitation (Bandura, 1977). Regarding this point, it is especially interesting that class composition effects were found for both aggression and delinquency. This helps shed more light on the

processes involved, as delinquency, more than disruptive or aggressive behavior, often occurs outside of school. It is thus plausible that social networks formed in the classroom (Kiesner et al., 2003) lead to common activities between the classmates in leisure time, during which the majority of the negative peer influence occurred. Further research is needed to disentangle the influence of classroom composition from the effect of the composition of self-selected cliques that include both classmates and outside peers.

Moderating Effects of Classroom Heterogeneity

In Hypothesis 2, we predicted that the heterogeneity of antisocial behavior in class would moderate the classroom composition effect. This, however, was not the case, and the explanation of this result is multifaceted. First, conformity pressure may simply not be that important for regulating individual behavior in classrooms (as compared to, e.g., social modeling). At first glance, this would contradict Rule's (1964) findings on conformity pressure; however, the groups investigated in Rule's study consisted of five adults, while this investigation's mean class size was around 18 students. Hence, future research will need to examine whether group pressure is more prevalent within the smaller social networks among classmates but less in the classroom as a whole.

However, this study's data characteristics provide a second explanation. The aggression and delinquency scale values were generally low considering the potential spectrum of 0 to 14 days (see Figures 1 and 2), so a few higher values of problem behavior in a classroom may have inflated the variances (Yudron et al., submitted). This implies that the majority of individuals in a classroom appeared rather similar in respect to their lower levels of antisocial behaviors (see also Figure 1). Thus, the variance may have been not a sufficiently good indicator of group conformity in this sample. At the same time, in our view it would not have made sense to delete outlying student responses from the analyses, as these

pupils were an essential part of the social ecological classroom context. While this issue may be less pronounced in studies on context effects regarding more normally distributed variables such as school achievement (Groehlich, Scharenberg & Bos, 2009), more research on how to more adequately represent behavioral conformity in groups with strongly skewed data distributions is warranted.

In spite of these issues, the effects of class composition remained significant when including the highly correlated classroom variances into the models, and this is an important result. Class composition may not be very strongly (see the small effect sizes of the correlations) related to students' behavior; nevertheless, these effects were still robust. This finding is further supported by the fact that classroom composition effects were significant when controlling for academic tracking, which is known to be a main organizational feature leading to different behavioral classroom compositions (e.g., Van Houtte & Stevens, 2008). Further, important predictors on the individual level, such as gender or impulsivity, were no substitute for classmates' influence.

Implications of the Findings

The specific classroom environment investigated in this Swiss study clearly represented an institutionally imposed peer context that remained stable over time. While the same applies to many lower secondary school systems (e.g., Araos et al., 2014; Groehlich et al., 2009; Van Houtte & Stevens, 2008), in other countries such as the US, classroom assignments often allow for more decisional range on the part of the students or parents. Further, students may not remain in a self-contained classroom but may change more often due to the departmental organization of schools. In such systems, influencing processes between classmates can be expected to be similar, but the effect of one specific class composition (e.g., the Math classroom) is probably smaller, as there are still other classrooms

to attend. It can be anticipated that school-level student characteristics gain an important additional influence here (see e.g., Henry, Farrell, Schoeny, Tolan, & Dymnicki, 2011). The presented findings thus permit conclusions on how peer contexts from one end of the continuum between imposed/self-contained and self-selected/flexible classroom peer environments affect individual behavior.

In view of this, our results may encourage school administrators to consider classroom assignments not as a purely organizational procedure; rather, they can play a significant role in early adolescent development. Nevertheless, drawing conclusions on how to ideally assign students to classrooms remains difficult, as the effects of class composition can always be considered from two sides. Students with lower levels of problem behavior may exhibit increases in such behavior, as influenced by a high proportion of more deviant students; conversely, other students' higher rates of antisocial behavior may decrease when they are in classes with more prosocial classmates (see also Boxer, Guerra, Huesmann, & Morales, 2005). In this light, the successful inclusion of adolescents with higher rates of antisocial behavior in classrooms may not only require individualized interventions for these pupils but could also signify a need for help at the classroom level in order to keep the prevailing classroom descriptive norms on a low level of antisocial behavior (e.g., implementing class-wide prevention programs).

Limitations and Future Perspectives

The strengths of this study, in our view, lie in its short-term longitudinal research design and its focus on newly composed, self-contained lower secondary classrooms. Further, negative binomial multilevel analyses and the use of several control variables may have allowed for conservative statistical estimations. However, a limitation in this study results from the fact that only self-reported behaviors could be analyzed. Although the inclusion of

participants' views within a peer context is crucial to understanding their overall behavioral development and we avoided the confounding influences of self- and peer-reports, our study would have benefited by comparing it with a second perspective. While the findings correspond to earlier research using teacher reports (e.g., Kellam et al., 1998), perceptions of behavioral problems often vary between different parties (Pakaslahti & Keltikangas-Järvinen, 2000). It is thus important to replicate this study using other measurement instruments. Another critical point is that, in spite of the newly composed 7th grade classrooms, some students already knew each other from being in the same primary classes, so the earlier influences of these classmates cannot be completely ruled out.

Generally, studies like this lack experimental variation, so conclusions on whether, for example, a more self-selected or more institutionally imposed classroom assignment would be more beneficial for the behavioral development cannot be made here. Future studies would do well to focus on this issue as, to date, there is a substantial lack of investigation into the detailed processes involved in classroom assignments and their consequences for behavioral classroom composition. Another promising research direction would be an examination of the long-term effects of classroom composition during adolescence and the factors that moderate the impact of the classmates on individual behavior. This line of research may help to better understand how individual adolescent development is influenced by the interaction of the characteristics of institutions, peer environments and personal factors.

References

- Araos, C., Cea, M., Fernández, M. & Valenzuela, E. (2014). The role of school context on marijuana use in Chile. A Classroom-level analysis. *Deviant Behavior*, 35, 412-431.
- Bandura, A. (1977). *Social learning theory*. Morristown: General Learning Press.

- Barth, J. M., Dunlap, S. T., Dane, H., Lochman, J. E. & Wells, K. C. (2004). Classroom environment influences on aggression, peer relations, and academic focus. *Journal of School Psychology, 42*, 115-133.
- Berndt, T. J. & Keefe, K. (1995). Friends' influence on adolescents' adjustment to school. *Child Development, 66*, 1312 – 1329.
- Bosse, T., Gerritsen, C. & Klein, M. C. A. (2010). Predicting the development of juvenile delinquency by simulation. In N. García-Pedrajas, F. Herrera, C. Fyfe, J.M. Benítez & M. Ali (Eds.), *Proceedings of the 23rd International Conference on Industrial, Engineering & Other Applications of Applied Intelligent Systems, Part II Vol. 6097* (pp. 565-574). Berlin: Springer.
- Boxer, P., Guerra, N. G., Huesmann, L. R. & Morales, J. (2005). Proximal peer-level effects of a small-group selected prevention on aggression in elementary school children: An investigation of the peer contagion hypothesis. *Journal of Abnormal Child Psychology, 33*, 325-338.
- Bornstein, M. H. (2012). Proximal to distal environments in child development. Theoretical, structural, methodological, and empirical considerations. In L. C. Mayes & M. Lewis (Eds.), *The Cambridge handbook of environment in human development* (pp. 15-34). Cambridge: Cambridge University Press.
- Boxer, P., Edwards-Leeper, L. Goldstein, S. E., Musher-Eizenman, D. & Dubow, E. F. (2003). Exposure to “low-level” aggression in school: Associations with aggressive behavior, future expectations, and perceived safety. *Violence and Victims, 18*, 691-705.
- Bronfenbrenner, U. (1979). *The ecology of human development: Experiments by nature and design*. Cambridge, MA: Harvard University Press.
- Childs, K. K., Sullivan, C. J. & Gullede, L. M. (2011). Delinquent behavior across adolescence: Investigating the shift in salience of key criminological predictors. *Deviant*

- Behavior*, 32, 64-100.
- Cialdini, R. B., Kallgren, C. A. & Reno, R. R. (1990). A focus theory of normative conduct. *Advances in Experimental Social Psychology*, 24, 201-234.
- Dishion, T. & Tipsord, J. M. (2011). Peer contagion in child and adolescent social and emotional development. *Annual Review of Psychiatry*, 62, 189–214.
- Dodge, K. A. & Sherrill, M. R. (2006). Deviant peer group effects in youth mental health interventions. In K. A. Dodge, T. J. Dishion & J. E. Lansford (Eds.), *Deviant peer influences in programs for youth* (pp. 98-140). New York: Guilford.
- Espelage, D. L., Holt, M. K. & Henkel, R. R. (2003). Examination of peer-group contextual effects on aggression during early adolescence. *Child Development*, 74, 205-220.
- Federal Agency of Statistics (2013). Migration and integration (*Migration und Integration*). Retrieved July 6 2013 from <http://www.pxweb.bfs.admin.ch>
- Fuchs, M., Lamnek, S., Luedtke, J. & Baur, N. (2009). Violence in schools. 1994 – 1999 – 2004 (*Gewalt an Schulen. 1994 – 1999 – 2004*). Wiesbaden: VS.
- Ganzeboom, H. B. G. & Treiman, D. J. (1996). Internationally comparable measures of occupational status for the 1988 International Standard Classification of Occupation. *Social Science Research*, 25, 201-239.
- Groehlich, C., Scharenberg, K. & Bos, W. (2009). Does classroom heterogeneity in secondary schools affect student achievement? *Journal of Educational Research Online*, 1, 86-105.
- Henry, D., Guerra, N., Huesmann, R., Tolan, P., VanAcker, R. & Eron, L. (2000). Normative influences on aggression in urban elementary school classrooms. *American Journal of Community Psychology*, 28, 59-81.
- Henry, D., Kobus, K. & Schoeny, E. S. (2011). Accuracy and bias in adolescents' perceptions of friends' substance use. *Psychology of Addictive Behaviors*, 25, 80-89.

- Henry, D., Farrell, A. D., Schoeny, M. E., Tolan, P. H. & Dymnicki, A. B. (2011). Influence of school-level variables on aggression and associated attitudes of middle school students. *Journal of School Psychology, 49*, 481-503.
- Hilbe, J. M. (2008a). *Negative binomial regression*. Cambridge: University Press.
- Hilbe, J. M. (2008b). *Brief overview on interpreting count model risk ratios. An addendum to Negative binomial regression*. Cambridge: University Press.
- Howe, A. & Richards, V. (Eds.) (2011). *Bridging the transition from primary to secondary school*. Milton Park: Routledge.
- Ingoldsby, E. M. & Shaw, D. S. (2002). Neighborhood contextual factors and early-starting antisocial pathways. *Clinical Child and Family Psychology Review, 5*, 21-55.
- Jang, S. J. (1999). Age-varying effects of family, school, and peers on delinquency: A multilevel modeling test of interactional theory. *Criminology, 37*, 643-686.
- Junger-Tas, J, Steketee, M., & Moll, M. (2010). The Netherlands. In J. Junger-Tas, I. H., Marshall, D. Enzmann, M. Killias, M. Steketee, & B. Gruszczynska (Eds.), *Juvenile delinquency in Europe and beyond* (pp. 15-28). New York: Springer.
- Juvonen, J. & Galván, A. (2008). Peer influence in involuntary social groups. Lessons from research on bullying. In: M. J. Prinstein & K. A. Dodge (Eds.), *Understanding peer influence in children and adolescents* (pp.225-244). New York: Guilford.
- Kellam, S. G., Ling, X., Merisca, R., Brown, C. H. & Ialongo, N. (1998). The effect of the level of aggression in the first grade classroom on the course of malleability of aggressive behavior into middle school. *Development and Psychopathology, 10*, 165-185.
- Kiesner, J., Poulin, F. & Nicotra, E. (2003). Peer relations across contexts. Individual-network homophily and network inclusion in and after school. *Child Development, 74*, 1328-1343.

- Killias, M., Aebi, M., Lucia, S., Herrmann, L. & Dilitz, C. (2007). *Self-reported juvenile delinquency in Switzerland in 2006: Overview and explanations*. Lausanne: Institute of Criminology and Criminal Law.
- Kuppens, S., Grietens, H., Onghena, P., Michiels, D. & Subramanian, S. V. (2008). Individual and classroom variables associated with relational aggression in elementary-school aged children: A multilevel analysis. *Journal of School Psychology, 46*, 639–660.
- LeBlanc, L., Swisher, R., Vitaro, F. & Tremblay, R. E. (2008). High school social climate and antisocial behavior: A 10 year longitudinal and multilevel study. *Journal of Research on Adolescence, 18*, 395-419.
- Long, J. S. (1997). *Regression models for categorical and limited dependent variables*. Thousand Oaks: SAGE.
- Lyerly, R. & Skipper, J. K. (1981). Differential rates of rural-urban delinquency: A social control approach. *Criminology, 19*, 385-399.
- Maas, C. J. M., & Hox, J. J. (2005). Sufficient sample sizes for multilevel modeling. *Methodology, 1*, 86-92.
- Marsh, H. W., Lüdtke, O., Nagengast, B., Trautwein, U., Moring, A. J. S., Abduljabbar, A. S. et al. (2012). Classroom Climate and Contextual Effects: Conceptual and Methodological Issues in the Evaluation of Group-Level Effects. *Educational Psychologist, 47*, 106-124.
- Mercer, S. H., McMillen, J. S. & DeRosier, M. E. (2009). Predicting change in children's aggression and victimization using classroom-level descriptive norms of aggression and pro-social behavior. *Journal of School Psychology, 47*, 267-289.
- Morales, J. R. & Guerra, N. G. (2006). Effects of multiple context and cumulative stress on urban children's adjustment in elementary schools. *Child Development, 77*, 907-923.

- Mueller, C. (2013). Assessing antisocial behaviour and attitudes in longitudinal research – Development and evaluation of the “Fribourg Self- and Peer-Report Scales – Antisocial Behavior. *Heilpädagogische Forschung*, 39, 2-13.
- O’Brien, R. M. (2007). A caution regarding rules of thumb for variance inflation factors. *Quality & Quantity*, 41, 673-690.
- Pakaslahti, L. & Keltikangas-Järvinen, L. (2000). Comparison of peer, teacher and self-assessments on adolescent direct and indirect aggression. *Educational Psychology*, 20, 177-190.
- Raudenbush, S. & Bryk, A. (2002). *Hierarchical linear models: Applications and data analysis methods*. Thousand Oaks: Sage.
- Rule, B. G. (1964). Group effects of deviant behavior. *Psychological Reports*, 15, 611-614.
- Saldern, M. & Littig, K. E. (1987). Landau scales to assess the social climate (*Landauer Skalen zum Sozialklima*). Weinheim: Beltz.
- Schwarzer, R. & Jerusalem, M. (Eds.) (1999). Scales to assess teachers’ and students’ characteristics. (*Skalen zur Erfassung von Lehrer- und Schülermerkmalen*). Retrieved July 7 2013 from www.psyc.de/skalendoku.pdf
- Singer, J. D. & Willett, J. B. (2003). *Applied longitudinal data analysis. Modeling change and event occurrence*. New York: Oxford University Press.
- Stadler, C., Janke, W. & Schmeck, K. (2004). Inventory to assess impulsivity, risk tolerance and empathy in 9 to 14 years old children (*Inventar zur Erfassung von Impulsivität, Risikoverhalten und Empathie bei 9- bis 14- jährigen Kindern*). Göttingen: Hogrefe.
- Sutherland, E. (1939). *Principles of criminology*. Lippincott: Philadelphia.
- Tang, Z. & Orwin, R. G. (2009). Marijuana initiation among American youth and its risks as dynamic processes: Prospective findings from a national longitudinal study. *Substance Use and Misuse*, 44, 195-211.

- Thomas, D. E., Bierman, K. L., Powers, C. J. & The Conduct Problems Prevention Research Group (2011). The influence of classroom aggression and classroom climate on aggressive-disruptive behavior. *Child Development, 82*, 751-757.
- Thomas, D. E., Bierman, K. L. & The Conduct Problems Prevention Research Group (2006). The impact of classroom aggression on the development of aggressive behavior problems in children. *Development and Psychopathology, 18*, 471-487.
- Thornberry, T. P. (1987). Towards an interactional theory of delinquency. *Criminology, 25*, 863-892.
- Thornberry, T. P. & Krohn, M. D. (2000). The self-report method for measuring delinquency and crime. *Criminal Justice, 4*, 33-83.
- Van Houtte, M. & Stevens, P. A. J. (2008). Sense of futility: The missing link between track position and self-reported school misconduct. *Youth & Society, 40*, 245-264.
- Warr, M. (2002). *Companions in crime. The social aspects of criminal conduct*. Cambridge: Cambridge University Press.
- Yudron, M., Jones, S. M. & Raver, C. C. (*submitted*). Implications of different methods for specifying classroom composition of externalizing behavior and its relationship to social emotional outcomes.

Table 1
Descriptive Statistics: Sociodemographic Characteristics and Key Variables

| | Mean (SD) | % | Range |
|---|---------------|------|-------------|
| Boys | - | 52.5 | - |
| Socio-economic Status ^a | 49.22 (16.05) | - | 20.00–85.00 |
| Foreign Nationality ^b | - | 9.5 | - |
| Immigration Background ^c | - | 21.8 | - |
| Impulsivity | 0.41 (0.22) | - | 0.00–1.00 |
| Outside-of-Class Friends' Aggression | 0.51 (0.47) | - | 0.00–2.00 |
| Outside-of-Class Friends' Delinquency | 0.40 (0.46) | - | 0.00–2.00 |
| School Grades | 5.00 (0.37) | - | 3.17–6.00 |
| Parental Support | 2.47 (0.44) | - | 0.00–3.00 |
| Classroom Composition Aggression (Classroom Mean at t1) | 0.47 (0.21) | - | 0.12–1.36 |
| Classroom Composition Delinquency (Classroom Mean at t1) | 0.10 (0.00) | - | 0.01–0.90 |
| Classroom Size (Number of Students) | 17.58 (3.57) | - | 8–24 |
| High Academic Track | - | 28.7 | - |
| Middle Academic Track | - | 41.7 | - |
| Low Academic Track | - | 23.6 | - |
| Special Educational Track | - | 5.9 | - |
| Teacher's Support (Aggregated in Classroom) | 2.03 (0.29) | - | 1.15–2.52 |
| Individual Aggression at t1 | 0.46 (0.80) | - | 0.00–9.13 |
| Individual Delinquency at t1 | 0.11 (0.38) | - | 0.00–6.09 |

^aInternational Socio-Economic Index (ISEI); ^bowns only a foreign passport; ^cowns a foreign passport (possibly in addition to a Swiss passport)

Table 2

Spearman's Bivariate and Partial Correlations Between Class Composition (Mean Behavior in Class), Heterogeneity (Variance of Behavior in Class) and Individual Behavior

| | t1 Individual Aggression | t2 Individual Aggression | t3 Individual Aggression | t4 Individual Aggression | t1 Class Composition Aggression |
|----------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|----------------------------------|
| t1 Class Composition Aggression | .22** (.17**) ^a | .19** (.13**) ^a | .19** (.13**) ^a | .18** (.082*) ^a | - |
| t1 Heterogeneity Aggression | .13** (-.02) ^b | .16** (-.02) ^b | .14** (-.05) ^b | .17** (.03) ^b | .86** |
| | t1 Individual Delinquency | t2 Individual Delinquency | t3 Individual Delinquency | t4 Individual Delinquency | t1 Class Composition Delinquency |
| t1 Class Composition Delinquency | .22** (.22**) ^a | .18** (.13**) ^a | .17** (.10**) ^a | .17** (.13**) ^a | - |
| t1 Heterogeneity Delinquency | .15** (-.07*) ^b | .17** (-.06) ^b | .18** (-.06) ^b | .16** (-.09*) ^b | .91** |

* $p < .05$; ** $p < .01$

^aVariance in class partialled out

^bMean in class partialled out

Table 3
Negative-Binomial Three-Level Regression Analyses Predicting Individual Aggression and Delinquency by Class Composition

| | Aggression | | Delinquency | |
|--|------------------|-------|------------------|-------|
| | Log-B (SE) | IRR | Log-B (SE) | IRR |
| Intercept | 0.904 (0.898) | 2.469 | 0.666 (1.528) | 1.946 |
| <i>Level 1: Time</i> | | | | |
| Time in Weeks after t1 | -0.009* (0.004) | 0.991 | 0.014* (0.007) | 1.014 |
| <i>Level 2: Individual</i> | | | | |
| Individual Aggression at t1 | 0.455** (0.063) | 1.576 | | |
| Individual Delinquency at t1 | | | 1.459** (0.213) | 4.302 |
| Gender (Girl) | 0.066 (0.090) | 1.068 | 0.529** (0.165) | 1.697 |
| Immigration Background (No Immigration) | -0.156 (0.115) | 0.856 | -0.418* (0.211) | 0.658 |
| Socio-economic Status | 0.002 (0.003) | 1.002 | 0.006 (0.005) | 1.006 |
| Impulsivity | 1.954** (0.221) | 7.057 | 2.109** (0.395) | 8.240 |
| Outside-of-Class Friends' Aggression | 0.567** (0.100) | 1.763 | | |
| Outside-of-Class Friends' Delinquency | | | 0.343 (0.182) | 1.409 |
| Parental Support | -0.322** (0.109) | 0.725 | -0.944** (0.195) | 0.389 |
| School Grades | 0.040 (0.133) | 1.041 | -0.050 (0.238) | 0.951 |
| <i>Level 3: Classroom</i> | | | | |
| Class Composition Regarding Aggression | 0.857** (0.285) | 2.356 | | |
| Class Composition Regarding Delinquency | | | 2.059* (0.878) | 7.838 |
| High Academic Track (Low Track) | 0.024 (0.170) | 1.024 | -0.354 (0.303) | 0.702 |
| Middle Academic Track (Low Track) | 0.097 (0.142) | 1.102 | -0.017 (0.247) | 0.983 |
| Special Educational Track (Low Track) | 0.005 (0.254) | 1.005 | 0.148 (0.430) | 1.160 |
| Teacher's Support Aggregated in Class | 0.258 (0.197) | 1.294 | -0.128 (0.326) | 0.880 |
| <i>Variance Components</i> | | | | |
| Variance Intercept Between Individuals | 1.199** (0.248) | 3.317 | 0.000 (0.000) | 1.000 |
| Variance Slope of Time Between Individuals | 0.001** (0.000) | 1.001 | 0.005** (0.001) | 1.005 |
| Covariance Intercept/Slope of Time Between Individuals | -0.024* (0.009) | 0.976 | 0.000 (0.000) | 1.000 |
| Variance Intercept Between Classes | 0.353** (0.130) | 1.423 | 0.199 (0.224) | 1.220 |
| Variance Slope of Time Between Classes | 0.000 (0.000) | 1.000 | 0.000 (0.000) | 1.000 |
| Covariance Intercept/Slope of Time Between Classes | -0.012* (0.005) | 0.988 | -0.006 (0.009) | 0.994 |

Enclosed in parenthesis: Reference category.

* $p < .05$; ** $p < .01$; Significance test results based on unrounded results.

Table 4

Negative-Binomial Three-Level Regression Analyses Predicting Individual Aggression and Delinquency by Class Composition with the Heterogeneity of Behavior in the Classroom as a Moderator

| | Aggression | | Delinquency | |
|--|------------------|-------|------------------|--------|
| | Log-B (SE) | IRR | Log-B (SE) | IRR |
| Intercept | 1.049 (0.911) | 2.855 | -0.078 (1.593) | 0.925 |
| <i>Level 1: Time</i> | | | | |
| Time in Weeks after t1 | -0.009* (0.004) | 0.991 | 0.014* (0.007) | 1.014 |
| <i>Level 2: Individual</i> | | | | |
| Individual Aggression at t1 | 0.455** (0.064) | 1.576 | | |
| Individual Delinquency at t1 | | | 1.415** (0.224) | 4.116 |
| Gender (Girl) | 0.069 (0.090) | 1.071 | 0.535** (0.172) | 1.707 |
| Immigration Background (No Immigration) | -0.159 (0.116) | 0.852 | -0.327 (0.221) | 0.721 |
| Socio-economic Status | 0.002 (0.003) | 1.002 | 0.006 (0.006) | 1.006 |
| Impulsivity | 1.960** (0.222) | 7.099 | 2.151** (0.412) | 8.593 |
| Outside-of-Class Friends' Aggression | 0.564** (0.100) | 1.758 | | |
| Outside-of-Class Friends' Delinquency | | | 0.363 (0.190) | 1.438 |
| Parental Support | -0.324** (0.110) | 0.723 | -0.895** (0.205) | 0.409 |
| School Grades | 0.030 (0.134) | 1.030 | -0.133 (0.205) | 0.875 |
| <i>Level 3: Classroom</i> | | | | |
| Class Composition Regarding Aggression | 0.862 (0.496) | 2.368 | | |
| Class Composition Regarding Delinquency | | | 6.712** (2.405) | 822.21 |
| Heterogeneity of Aggression in the Classroom | 0.158 (0.381) | 1.171 | | |
| Heterogeneity of Delinquency in the Classroom | | | -0.752 (1.419) | 0.471 |
| Class Composition*Heterogeneity | -0.146 (0.273) | 0.864 | -0.924 (1.608) | 0.397 |
| High Academic Track (Low Track) | 0.015 (0.171) | 1.015 | -0.081 (0.325) | 0.922 |
| Middle Academic Track (Low Track) | 0.083 (0.144) | 1.087 | 0.049 (0.255) | 1.050 |
| Special Educational Track (Low Track) | 0.002 (0.257) | 1.002 | -0.036 (0.459) | 0.964 |
| Teacher's Support Aggregated in Class | 0.205 (0.201) | 1.228 | 0.137 (0.337) | 1.147 |
| <i>Variance components</i> | | | | |
| Variance Intercept Between Individuals | 1.205** (0.249) | 3.337 | 0.000 (0.000) | 1.000 |
| Variance Slope of Time Between Individuals | 0.001** (0.000) | 1.001 | 0.006** (0.001) | 1.006 |
| Covariance Intercept/Slope of Time Between Individuals | -0.023* (0.009) | 0.977 | 0.000 (0.000) | 1.000 |
| Variance Intercept Between Classes | 0.384** (0.137) | 1.468 | 0.113 (0.212) | 1.120 |
| Variance Slope of Time Between Classes | 0.000 (0.000) | 1.000 | 0.000 (0.000) | 1.000 |
| Covariance Intercept/Slope of Time Between Classes | -0.013** (0.005) | 0.987 | -0.003 (0.009) | 0.997 |

Enclosed in parentheses: Reference category.

* $p < .05$; ** $p < .01$; Significance test results based on unrounded results.

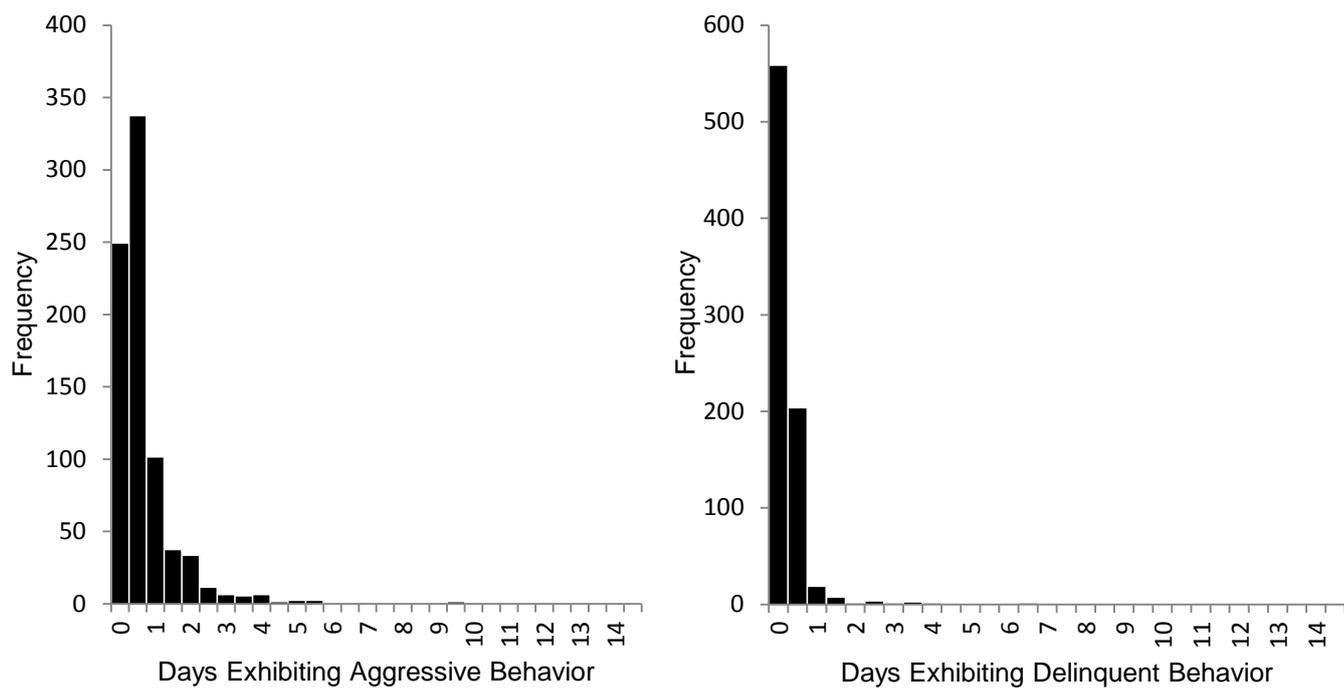


Figure 1. Incidence of self-reported aggressive and delinquent behavior over a 14-day period at the beginning of 7th grade (mean scale values of the FSP-A at t1).

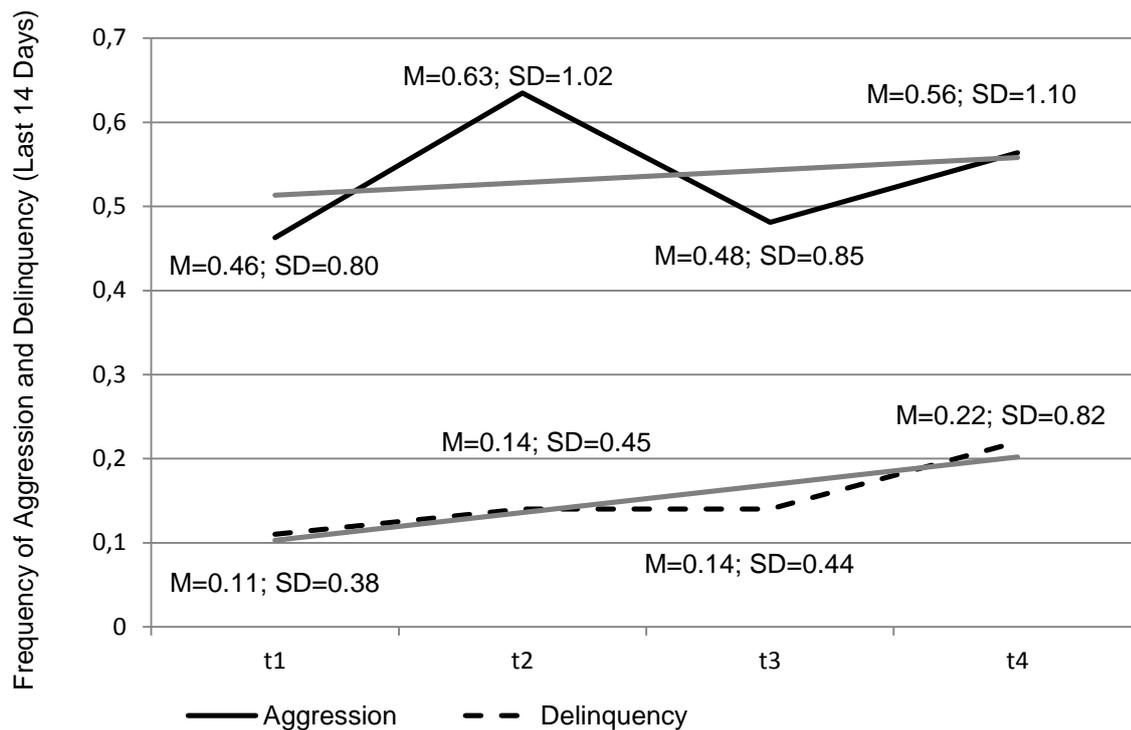


Figure 2. Development of self-reported aggression and delinquency across 7th grade (mean scale values of the FSP-A; maximum values would be 14 days).