



# What Works for Whom? Evaluating Patterns and Mechanisms of Change Among Bullies, Victims, and Bully-Victims Participating in a School-Based Prevention Program

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## Abstract

The effectiveness and program mechanisms of a whole-school anti-bullying program that builds on the socio-ecological framework were investigated by applying person-oriented methods of data analyses. A longitudinal cluster randomized control study was utilized comprising 1377 adolescents (48.5% girls,  $M_{age} = 11.7$ ) who participated in a 1-year whole school anti-bullying program that was implemented in 13 schools and 665 adolescents (45.2% girls,  $M_{age} = 11.6$ ) who attended 5 control schools. Student reports were collected at pre- and post-test within a 1-year interval. Applying latent profile analyses (LPA), students who were actively involved in bullying as perpetrators (e.g., bullies), who were the target of bullying (e.g., victims), who were both (e.g., bully-victims), and who were not involved either as perpetrators or victims (e.g., uninvolved) were identified. Latent transition analyses (LTA) investigated transition patterns between bully, victim, bully-victim, and uninvolved subgroups in the control and intervention group before and after the 1-year program implementation. Program effectiveness (e.g., a higher transition probability in the intervention compared to the control group) were found for victims and bully-victims. It was explored whether changes in program mechanisms were differently related to changes in these subgroup memberships in the intervention group. Victims transiting to the uninvolved sub-group increased in help-seeking and anti-bullying norms, while bully-victims transiting to the uninvolved sub-group increased help-seeking, perceived teacher intervention, and anti-bullying norms. It can be concluded that this program works differently for different sub-groups of students and that different mechanisms of change drive changes in different sub-groups of students.

**Keywords** Whole school anti-bullying program · Person-oriented methods of data analyses · Latent profile analysis · Latent transition analysis

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Three decades of research on bullying—a subcategory of aggressive behavior—characterized by hostile intent, imbalance of power, and repetition (Olweus, 1993; Roland, 1989) has identified various mechanisms for the prevention of bullying and victimization (e.g., Kljakovic & Hunt, 2016). Meta-analyses showed that whole school multi-level prevention programs that integrate a socio-ecological perspective on development (Swearer & Espelage, 2004) are on average successful to reduce rates of bullying and victimization (e.g., Farrington et al., 2017; Gaffney et al., 2019, 2021). Whole school multi-level prevention programs often use Bronfenbrenner's socio-ecological model as the overarching theoretical framework (Bronfenbrenner, 1979), but usually also integrate other theoretical ideas to structure their complex interventions that are carried out on different systemic levels (Strohmeier et al., 2012b). Importantly, interventions are often designed to target the needs of distinct sub-groups. Depending on their

varying involvement in bullying and victimization students are usually divided into bullies, victims, bully-victims, and uninvolved (e.g., Zych et al., 2020). Therefore, it is important to find out whether students identified as bullies, victims, or bully-victims change equally to the group of uninvolved after they participated in a whole school multi-level prevention program and more so compared to students in a control group. Such knowledge is important to develop socio-ecological prevention programs further and to tailor their interventions even better to the needs of these different sub-groups. Furthermore, longitudinal mediation was only rarely demonstrated for whole-school multi-level prevention programs when applying variable-oriented approaches of data analyses (Kärnä et al., 2010; Leadbeater et al., 2016). Therefore, to date, many program mechanisms have not been empirically detected for several effective anti-bullying programs and thus, it is unknown why these programs are effective (e.g., Gaffney et al., 2019, 2021). Considering that several programs assume that different mechanisms might work differently for different sub-groups of students, person-oriented approaches of data analyses are ideally suited to investigate these assumptions. To the best of our knowledge, however, this has not been done yet. To fill this gap, the present study investigates whether hypothesized program mechanisms (like, e.g., the increase of help-seeking in the intervention compared to the control group) work differently for students depending on their changes of bullying roles over time (e.g., for victims who get uninvolved after the intervention versus for stable bullies). To the best of our knowledge, no study to date investigated this type of question within a whole school prevention program applying person-oriented methods of analysis.

### Capturing the Heterogeneity of Youth Involved in Bullying

Although there is a discussion to deconstruct the typical bullying roles (Demaray et al., 2021), many studies still differentiate three major roles (Zych et al., 2020). A perpetrator of bullying is referred to as “bully,” the target of bullying as “victim” and a person who is both perpetrating and targeted as “bully-victim,” while students who are not involved in bullying are labeled “uninvolved”. There is ample evidence that adolescents belonging to these three sub-groups differ regarding several personal characteristics such as gender and age (Kljakovic & Hunt, 2016) as well as their behavior in bullying situations (Salmivalli, 2010). More boys than girls are in the group of bullies (e.g., Graham et al., 2006). This gender gap even increases over the course of adolescence when bullying rates are usually declining (e.g., Pellegrini & Long, 2002; Zych et al., 2020), but the relative number of male bullies is increasing (Currie et al., 2012; Inchley et al., 2016). For bullies, the main motivation for their behavior is to gain power

over weaker peers and to sustain a high-status position in their peer group (Salmivalli, 2010). Thus, the bullying behavior is rewarding for the bullies that make it difficult to change (Reijntjes et al., 2013). There are no clear gender patterns in the group of victims (Graham et al., 2006). Victimization rates are highest among early adolescents aged 11–13 years and then decreasing (Currie et al., 2012; Inchley et al., 2016). Victimized adolescents tend to blame themselves for being victimized (Graham et al., 2006) and are reluctant to tell their troubles to teachers as they are afraid of getting even more victimized (e.g., Oliver & Candappa, 2007). A high percentage of bully-victims are male (e.g., Graham et al., 2006) with decreasing numbers from grade 5 to 9 (Solberg & Olweus, 2003). Bully-victims are high on reactive aggression because they tend to interpret ambiguous situations as hostile attacks and react aggressively due to their limited social skills (Pouwels et al., 2016). Finally, consistently more girls than boys are in the group of uninvolved students and this group is rising with increasing age (e.g., Solberg & Olweus, 2003).

### The Viennese Social Competence (ViSC) Program

The Viennese Social Competence (ViSC) program was designed as a whole-school bullying prevention program for secondary schools as a part of the Austrian national strategy plan called “Together Against Violence” (Spiel & Strohmeier, 2011, 2012; Strohmeier & Spiel, 2019). The ViSC program aims to reduce bullying and victimization and to increase social and intercultural competences among students (Strohmeier et al., 2012b). Based on a socioecological theoretical perspective and a whole-school approach (Swearer & Espelage, 2004), the ViSC program aims to change the school and class environment as well as the behavior of the students including bullies, victims, bully-victims, and uninvolved. The interventions on different systemic levels are based on several theories including social learning theory (Bandura, 1973), social information processing theory (Crick & Dodge, 1996), moral development (Malti et al., 2009), and bullying as a group phenomenon (Salmivalli, 2010). The program defines the prevention of aggressive behavior and victimization as a whole school task and comprises measures on the school, class, and individual levels. On the school level, the program aims to promote the shared responsibility of teachers for bullying prevention which implies that as many teachers as possible have worked out a common understanding of bullying, agreed on procedures for how to tackle acute bullying cases, and implement preventive measures in their classes (Schultes et al., 2014). On the class level, teachers implement a manualized 13-unit class project. Students are trained on

a broad range of social-emotional competences including recognizing their own and others' emotions, effectively coping with negative emotions, feeling responsible when a peer was bullied, and learning effective strategies on how to deal with bullying (e.g., telling the incident to a teacher). These skills are taught by using a variety of methods such as role-playing, interactive games, small group work, or whole class discussions. On the individual level, teachers are trained to recognize and differentiate bullies, victims, and bully-victims and to conduct different structured conversations with them to stop ongoing bullying cases (Roland & Vaaland, 2006).

### Evaluation Studies of the ViSC Program

In the last decade, the ViSC program was implemented in more than 100 Austrian schools, and it was possible to evaluate the program's effectiveness within a rather large longitudinal cluster randomized control trial (Bardach et al., 2022; Gradinger et al., 2015, 2016; Yanagida et al., 2019). Applying variable-oriented approaches of analyses, it was shown that cyberbullying and cyber victimization could be successfully reduced when controlling for traditional aggression and victimization immediately after program implementation (Gradinger et al., 2015). These effects were sustainable 6 months after the implementation controlling for individual (age, gender, internet use) and class level variables (school climate, ethnic diversity) (Gradinger et al., 2016). Applying a multiple-group bivariate latent change score model, it was found that there was a dynamic change of aggressive behavior and victimization indicating that the pretest levels and the change scores of aggressive behavior and victimization were associated and that higher levels of pretest values predicted more change (Yanagida et al., 2019). Directly after program implementation, a rather large effect size regarding the reduction of victimization was found (latent  $d=0.725$ ), while the reduction of aggressive behavior did not reach significance. However, 6 months after the program implementation both victimization and aggressive behavior decreased more in the intervention compared to the control group indicating a sleeper effect for aggressive behavior (Bardach et al., 2022). In addition to these four studies conducted in Austria, five independent quasi-experimental longitudinal studies have been conducted to evaluate the program effectiveness in Cyprus, Turkey, Romania, and Kosovo (Arënliu et al., 2020; Doğan et al., 2017, 2021; Solomontos-Kountouri et al., 2016; Trip et al., 2015). Applying variable-oriented methods of data analysis, these studies produced mixed results regarding program effectiveness that were most likely caused by the largely varying implementation models that had to be developed because of large structural differences between the national educational systems (for more details see Doğan et al., 2022; Strohmeier et al., 2021a).

### Program Effectiveness for Different Sub-Groups of Youth Involved in Bullying

Very few studies investigated the effectiveness of whole school programs on different sub-groups and person-oriented methods of data analysis have only rarely been applied. In some studies, groups were differentiated according to their initial level of aggression, and it was shown that students high on aggressive behavior benefited most from anti-violence prevention programs (e.g., Farrell et al., 2013). The KiVA program that has been large scale implemented in Finland was shown to be more effective for bully-victims compared to bullies and victims (Yang & Salmivalli, 2015), as well as for low and average popular bullies compared to highly popular bullies (Garandau et al., 2014). Moreover, the KiVA program was more effective for frequently victimized adolescents in changing their perceptions on the school climate as well as their levels of depression and self-esteem compared to occasionally or non-victimized youth (Juvonen et al., 2016). The Youth Matters (YM) program (Jenson et al., 2013) demonstrated that the transition from the involved bullying groups to the uninvolved group was significantly higher in the intervention compared to the control group. The most positive effect was found for victims. Thus, evidence supports the assumption that whole-school anti-bullying prevention programs have differential effects on sub-groups of in bullying-involved adolescents, although certainly more studies applying person-oriented methods of data analyses are needed. However, what has not been investigated yet is the question of whether program mechanisms that are assumed to drive these changes differ among different sub-groups of adolescents.

### Mechanisms of Change in Systemic Whole School Programs

Mechanisms of change in many bullying prevention programs including the ViSC program are increasing the levels of empathy with the victim, the feeling of responsibility to intervene, the help-seeking behavior, and anti-bullying norms. Although whole-school multi-level intervention programs (like the KiVA program) are effective to change empathy (Garandau et al., 2022; Kärnä et al., 2011; Limber et al., 2018), there is just one study that investigated whether the enhancement of empathy as mediator decreases bullying behavior, but yielded no significant effect (Saarento et al., 2015). Another important precursor to stop bullying is to feel responsible to intervene when witnessing such behavior (Craig et al., 2000). Students' responsibility to intervene was effective to reduce bullying and victimization on the class level (Kärnä et al., 2010), but also lead to decreases

in bullying and victimization on the individual level (Leadbeater et al., 2016). An effective intervention strategy to stop bullying is to tell another person about the incident. There is evidence that in classrooms where students report negative behaviors to their teachers, there is less bullying (Cortes & Kochenderfer-Ladd, 2014). However, many victims and bystanders do not tell their teachers about what is going on because they are afraid that teachers are not able to help and that the bullying would even get worse (Rigby & Bagshaw, 2003). Therefore, it is important that teachers are perceived as active to take measures against bullying by their students. Normative beliefs refer to the acceptability of aggressive behavior (Huesmann & Guerra, 1997) and are associated with aggressive behavior. Anti-bullying norms on individual and class levels are related to lower rates of bullying behavior (e.g., Saarento et al., 2015). Furthermore, norms might also relate to the motives for this behavior. To date, studies that differentiate between norms of proactive and reactive aggressive behavior in sub-groups of in bullying-involved students are lacking. Saarento et al. (2015) showed that anti-bullying attitudes, perceptions regarding peers' defending behavior, and teachers' attitudes toward bullying mediated the effectiveness of the KiVA program on the student level. Thus, to better understand why whole-school anti-bullying programs are effective among different sub-groups is necessary. To the best of our knowledge, such studies are lacking. Therefore, it is not known whether the change of program mechanisms is associated with transition patterns of sub-groups of students. Such knowledge is important, also because variable-oriented analyses using the whole sample were rather unsuccessful in demonstrating longitudinal mediation.

## The Present Study

Applying variable-oriented approaches of data analyses, the effectiveness of whole school socio-ecological anti-bullying programs has been extensively studied (Gaffney et al., 2019, 2021) and it has been found that these programs are *on average* effective in reducing bullying perpetration and bullying victimization. However, applying variable-oriented methods of data analyses, longitudinal mediation was only rarely demonstrated (Kärnä et al., 2010; Leadbeater et al., 2016). Therefore, program mechanisms are not known for many effective anti-bullying programs. Considering that several programs assume that different mechanisms might work differently for different sub-groups of students, person-oriented approaches of data analyses are ideally suited to investigate these assumptions. To the best of our knowledge, however, this has not been done yet. To fill this gap, the present study had three main goals. To begin with, different groups of adolescents involved in bullying and victimization were

identified. Secondly, to examine program effectiveness, the transition patterns of adolescents belonging to these sub-groups in the intervention versus the control group were compared over a period of 1-year. After demonstrating that program mechanisms were actually changed by the program as theorized, it was thirdly investigated whether these changes were differently associated with the transition patterns of different sub-groups in the intervention group. The following sets of hypotheses were investigated.

### Hypothesis I: Groups of Bullies and Victims

We expected to find at least four different groups of adolescents: uninvolved adolescents, bullies, victims, and bully-victims (e.g., Kochel et al., 2015). We expected that more girls than boys would be in the group of uninvolved students, and more boys than girls would be in the group of bullies and bully-victims (e.g., Graham et al., 2006).

### Hypothesis II: Effectiveness of the ViSC Program to Change Patterns of Groups of Bullies and Victims

We expected that adolescents classified as bullies, victims, and bully-victims who participated in the ViSC program would change to a higher rate to uninvolved adolescents compared to adolescents in the control schools. Although this question has never been investigated for the ViSC program, results from other whole-school anti-bullying prevention programs support this hypothesis (Garandau et al., 2014; Jenson et al., 2013; Juvonen et al., 2016; Yang & Salmivalli, 2015).

### Hypothesis III: Program Mechanisms to Reduce Bullying and Victimization

Assuming that there are sub-groups of students (e.g., bullies, victims, and bully-victims) and that different program mechanisms work differently for different sub-groups, it was examined whether changes in different program mechanisms are related with different transition patterns. Because no study to date ever investigated this question, it was not possible to formulate more specific hypotheses. Instead, these analyses are exploratory.

## Method

### Design and Procedure

All secondary schools located in the largest federal state in Austria (e.g., Vienna, the capital city), were invited to participate in the intervention program. In Austria, secondary schools comprise grades 5 to 8 when adolescents are 11 to

14 years old. Out of all 155 secondary schools, 34 schools applied for participation and 26 schools fulfilled the necessary requirements (e.g., they were willing to participate in the evaluation study). A cluster randomized controlled study design was applied, i.e., 13 schools were randomly assigned to the intervention group and five out of the 13 remaining schools agreed to serve as control schools. Thus, eight schools declined their participation after being selected as control schools; neither did they receive the program. The program was implemented during one school year in 13 intervention schools. To keep the data collection month constant, pre-test data were collected at the end of grades 5, 6, and 7, while post-test data were collected at the end of grades 6, 7, and 8. In Austria, the class compositions are quite constant in secondary schools. Thus, very few children left the classes after the pre-test data collection and very few newcomers entered the classes either at the beginning or during the grade 6 school year.

The study received initial ethical approval by the Ministry of Education in Austria. After the study was accepted by the local school council and the school principals, active parental consent was obtained. Because the participation in the longitudinal study was a requirement on the school level to be chosen for the cluster-randomized trial the parental consent was >90% in all 18 schools. In total, 71.1% of students were present at the day of data collection and participated in the study. Data were collected through an internet-based questionnaire, which was completed during one regular school hour in the school's computer lab under the supervision of two trained research assistants. Prior to data collection, students were assured that their answers would be kept confidential. To avoid any systematic order effect, items within scales were counterbalanced across participants.

## Participants

In sum, 2042 students (1377 in the intervention group, 665 in the control group) participated in at least one occasion of measurement and were included in the current study. At wave 1 (pre-test), the sample comprised 1639 students (47.6% girls) from 103 classrooms (50 fifth-grade classes, 51 sixth-grade classes, and 2 seventh-grade classes) with a mean age of 11.7 years ( $SD=0.9$ , Min = 10, Max = 15). Intervention and control group were compared on pre-test demographic characteristics (gender, age, immigrant status, and perceived family income) using three Pearson's chi-square tests, and a two-sample  $t$ -test. There was no statistically significant result indicating that the two groups were comparable (see Table 1).

## Program Implementation Fidelity

The quality of program implementation was carefully monitored in the intervention schools during the whole school year, and it was demonstrated that implementation fidelity

**Table 1** Demographic characteristics of the sample by intervention and control group at pre-test

| Variable                              | Intervention<br>( $n=1192$ ) | Control ( $n=447$ ) |
|---------------------------------------|------------------------------|---------------------|
| Gender (% female)                     | 48.5                         | 45.2                |
| Age in years, $M$ ( $SD$ )            | 11.7 (0.9)                   | 11.6 (0.8)          |
| Immigrant status (%)                  |                              |                     |
| Non-immigrant Austrians               | 46.1                         | 47.2                |
| Immigrants from the former Yugoslavia | 20.8                         | 18.6                |
| Immigrants from Turkey                | 13.7                         | 15.9                |
| Immigrants from other countries       | 19.4                         | 18.3                |
| Perceived family income (%)           |                              |                     |
| Less than others                      | 10.6                         | 6.1                 |
| Same like others                      | 70.5                         | 75.1                |
| More than others                      | 18.9                         | 18.8                |

and participant responsiveness are related with proximal program outcomes among teachers (Schultes et al., 2014). For instance, teachers' self-efficacy to stop aggressive behavior among students was significantly more enhanced in schools where the ViSC program had been implemented with high fidelity. Furthermore, only teachers with high participant responsiveness significantly changed their strategies when being asked to handle hypothetical bullying situations.

## Missing Data

In total, 20.69% of data were missing resulting from two main missing data patterns: students who participated at pre-test only ( $n=515$ ) and students who participated at post-test only ( $n=403$ ). The remaining 56 students had a general missing data pattern with missing value on single items. The mean percentage of missing values across the 53 variables ranged from 0.00 to 25.60%. A series of two-sample Wilcoxon tests and Bonferroni-Holm correction for multiple comparisons was conducted for attrition analysis. Results showed no differences between students who dropped out of the study (effect sizes ranged from  $r=0.01$  to  $r=0.08$ ) nor students who dropped in the study (effect sizes ranged from  $r=0.00$  to  $r=0.07$ ) after pre-test and students with complete data in any variable used in the present study. Multiple imputations (Rubin, 1987) under the missing at random (MAR) assumption were used to deal with missing data that incorporated not only variables used in the present study but also potential auxiliary variables into the missing data handling procedure (see Yanagida et al., 2019). In total, up to 373 main effects, 34,500 interaction terms, and 182 quadratic terms were considered in the imputation process. In addition, 34 scale cluster means and scale item cluster means were included

to account for the hierarchical data structure (Graham, 2009). Based on the fully conditional specification, an imputation model for each incomplete variable was specified. The imputation process involved a number of steps. First, the imputation model was specified by selecting variables based on minimal correlation criteria ( $r=0.15$  for main effects and  $r=0.25$  for interaction effects) resulting in up to 1000 predictor variables. Next, in order to reduce the number of predictor variables, a partial least square (PLS, Mevik & Wehrens, 2007) dimension reduction was conducted resulting in up to 30 component scores. Lastly, PLS component scores were used to predict missing values based on the predictive mean matching (PMM) algorithm (van Buuren, 2012) using Tukey's tricube weighting function (Harrell, 2006) for metric and ordered-categorical variables and polytomous logistic regression for nominal variables. This imputation process was carried out for each incomplete variable in the dataset completing one iteration. Graphical diagnostics using trace plots suggested that convergence was reached after 300 burn-in iterations. However, we took the conservative tack saving the first data set at the 501th iteration and saved additional data set every 50th iteration thereafter. At least 20 imputed data sets are recommended for most situations (Graham et al., 2007). In order to follow a conservative tack, we generated 50 imputed data sets. The imputation process was conducted separately for the intervention and control group and combined afterwards to preserve interactions between the grouping variable and other variables (Graham, 2009). Calculations were performed in R (R Core Team, 2014) using the mice package (van Buuren & Groothuis-Oudshoorn, 2011).

## Measures

Aggressive behavior and victimization were each measured with three scales, (1) bullying perpetration/victimization, (2) physical aggression/victimization, and (3) relational aggression/victimization. The construct validity of these scales has been demonstrated in a previous study applying a series of rigorous statistical tests (Yanagida et al., 2019).

### Bullying Perpetration and Bullying Victimization

Self-reported bullying and victimization were measured by validated items (Strohmeier, Gradinger et al., 2012a; Yanagida et al., 2016). The bullying as well as the victimization scale consists of a global item, and three specific items covering different forms of bullying. In the global item, students were asked "How often have you insulted or hurt other

students during the last 2 months?" and "How often have others insulted or hurt you in the last 2 months?" The three specific items were similar to the global ones, except that they described specific forms of bullying and victimization. Cronbach's  $\alpha$  coefficients were 0.82/0.83 (pre-test/post-test) for the bullying perpetration scale and 0.81/0.82 (pre-test/post-test) for the bullying victimization scale.

### Physical Aggression and Physical Victimization

The peer nomination measure developed by Crick and Grotpeter (1995) was modified into a self-report questionnaire and comprised three items, e.g., "How often have you hit one or more classmates during the last 2 months?" or "How often have you been hit by one or more classmates during the last 2 months?" Cronbach's  $\alpha$  coefficients were 0.79/0.79 (pre-test/post-test) for the physical aggression scale and 0.74/0.76 (pre-test/post-test) for the physical victimization scale.

### Relational Aggression and Relational Victimization

These five items were also adapted from the peer nomination measure originally developed by Crick and Grotpeter (1995), e.g., "Some kids leave other kids out on purpose when it's time to play or do an activity. How often have you done that during the last 2 months?" or "How often during the last 2 months have you been excluded from play or another activity by one or more classmates?" Cronbach's  $\alpha$  coefficients were 0.83/0.87 (pre-test/post-test) for the relational aggression scale and 0.82/0.81 (pre-test/post-test) for the relational victimization scale. Answers to these questions were given on a five-point response scale ranging from 0 (*not at all*), 1 (*once or twice*), 2 (*two or three times a month*), 3 (*once a week*), and 4 (*nearly every day*).

### Program Mediators

Empathy with the victim was measured with three slightly adapted items developed for the KIVA study (Kärnä et al., 2011); e.g. "I can understand how somebody feels who is insulted or hurt." Cronbach's  $\alpha$  coefficients were 0.79/0.77 (pre-test/post-test). Answers to these statements were given on a four-point response scale ranging from 0 (*strongly disagree*) to 3 (*strongly agree*). Imposing between group (intervention vs. control) and longitudinal invariance, results revealed a good model fit,  $\chi^2(28) = 57.96$ , CFI = 0.990, TLI = 0.989, RMSEA = 0.032, SRMR = 0.028.

Help-seeking ("When others are insulted or hurt I get help."), responsibility to intervene ("I feel responsible when somebody in my class is insulted or hurt."), and perceived teacher intervention ("When others are insulted or hurt, teachers help") were

measured with single items. The single-item measurement is certainly a sub-optimal measurement approach, even though these three items have some face validity. Answers to these three questions were given on a four-point response scale ranging from 0 (*not at all true*) to 3 (*very true*).

To measure anti-bullying norms, students evaluated the negativity of three different bullying motives (i.e., anger, instrumental, and fun) by asking them the following question: How do you rate the following behaviors? “To insult or hurt others because you are angry is ...,” “To insult or hurt others to get what you want is ...,” and “To insult or hurt others because it’s fun is ...” Although these items have some face validity, measuring them with single items is not optimal. Furthermore, students indicated how negative aggressive behavior is: “To say mean words is ...,” “To exclude other is ...,” and “Physical attacks are ...” These three items were averaged. Cronbach’s  $\alpha$  coefficients were 0.73/0.76 (pre-test/post-test). These three items were constructed for the ViSC study based on previous research (Fandrem et al., 2009; Little, et al., 2003). Answers to these six questions were given on a four-point response scale ranging from 0 (*not negative*) to 3 (*very negative*).

### Analytic Strategy

A finite mixture modeling approach (Masyn, 2013) was chosen to investigate the hypotheses of the present study. This approach assumes that the overall distribution of variables comprises a mixture of a finite number of component distributions

stemming from the heterogeneity of relationships between variables (Larsen & Hoff, 2006). That this assumption was met in the current dataset was demonstrated, because indeed different subgroups of students involved in bullying and victimization have been identified (see Tables 2 and 3). More specifically, two mixture models were applied, namely, (1) latent profile analysis (LPA) for identifying bully-victim groups with different patterns of involvement in bullying and victimization, and (2) latent transition analysis (LTA) to investigate the stability and change between the bully-victim groups across pre- and posttest (see Collins & Lanza, 2010).

### Examination of Hypothesis I

LPA was conducted for pre- and posttest separately to determine the number of latent bully-victim groups. The optimal number of latent profiles was determined by comparing several models using the Bayesian information criterion (BIC). Lower values of the BIC indicate a better model fit considering model complexity (i.e., number of estimated parameters). In addition, the different numbers of profiles were evaluated from a theoretical point of view. Moreover, the selected number of profiles needs to have an acceptable precision of classification, which is measured by the relative entropy value. Entropy values of 0.70 or higher indicate a good classification accuracy (Reinecke, 2006). Last, the same number of profiles are needed between pre- and posttest (i.e., measurement invariance) to investigate patterns of change of group memberships of bully-victims across time.

**Table 2** Latent profiles of victimization and aggression: LPA models for 3–5 latent class solutions at pre-test

| Latent class solution       | <i>n</i> (%)  | Overt aggression | Relational aggression | Bullying perpetration | Overt victimization | Relational victimization | Bullying victimization | BIC       | Entropy |
|-----------------------------|---------------|------------------|-----------------------|-----------------------|---------------------|--------------------------|------------------------|-----------|---------|
| <i>Three latent classes</i> |               |                  |                       |                       |                     |                          |                        | 15,046.12 | 0.97    |
| Uninvolved                  | 1596 (78.17%) | 0.35             | 0.34                  | 0.22                  | 0.45                | 0.22                     | 0.34                   |           |         |
| Bully-victims               | 184 (9.01%)   | 2.22             | 2.40                  | 1.95                  | 1.86                | 1.49                     | 1.55                   |           |         |
| Victims                     | 262 (12.82%)  | 0.73             | 0.71                  | 0.47                  | 1.96                | 1.46                     | 1.59                   |           |         |
| <i>Four latent classes</i>  |               |                  |                       |                       |                     |                          |                        | 13,305.59 | 0.97    |
| Uninvolved                  | 1549 (75.84%) | 0.33             | 0.32                  | 0.21                  | 0.45                | 0.21                     | 0.33                   |           |         |
| Victims                     | 249 (12.18%)  | 0.66             | 0.62                  | 0.41                  | 2.00                | 1.47                     | 1.63                   |           |         |
| Bullies                     | 131 (6.42%)   | 1.65             | 1.90                  | 1.40                  | 0.84                | 0.60                     | 0.69                   |           |         |
| Bully-victims               | 114 (5.56%)   | 2.37             | 2.49                  | 2.08                  | 2.49                | 2.05                     | 2.09                   |           |         |
| <i>Five latent classes</i>  |               |                  |                       |                       |                     |                          |                        | 12,119.70 | 0.95    |
| Uninvolved                  | 1355 (66.3%)  | 0.31             | 0.30                  | 0.19                  | 0.35                | 0.15                     | 0.25                   |           |         |
| Bullies                     | 108 (5.28%)   | 1.83             | 2.11                  | 1.61                  | 0.85                | 0.61                     | 0.70                   |           |         |
| Bully-victims               | 103 (5.04%)   | 2.39             | 2.50                  | 2.09                  | 2.57                | 2.11                     | 2.16                   |           |         |
| Moderate victim             | 344 (16.87%)  | 0.57             | 0.56                  | 0.36                  | 1.21                | 0.79                     | 0.96                   |           |         |
| Severe victims              | 132 (6.47%)   | 0.72             | 0.69                  | 0.46                  | 2.47                | 1.87                     | 2.02                   |           |         |

The Lo-Mendell-Rubin test (LMR) and the bootstrapped likelihood ratio test (BLRT) for testing the number of latent classes is not available for multiply imputed data sets

**Table 3** Latent profiles for different forms of victimization and aggression: LPA models for 3–5 latent class solutions at post-test

| Latent class solution       | <i>n</i> (%)  | Overt aggression | Relational aggression | Bullying perpetration | Overt victimization | Relational victimization | Bullying victimization | BIC       | Entropy |
|-----------------------------|---------------|------------------|-----------------------|-----------------------|---------------------|--------------------------|------------------------|-----------|---------|
| <i>Three latent classes</i> |               |                  |                       |                       |                     |                          |                        | 15,664.00 | 0.98    |
| Uninvolved                  | 1681 (82.30%) | 0.37             | 0.39                  | 0.24                  | 0.39                | 0.14                     | 0.31                   |           |         |
| Victims                     | 164 (8.04%)   | 0.72             | 0.70                  | 0.47                  | 2.02                | 1.48                     | 1.65                   |           |         |
| Bully-victims               | 197 (9.66%)   | 2.18             | 2.53                  | 2.13                  | 1.45                | 1.05                     | 1.20                   |           |         |
| <i>Four latent classes</i>  |               |                  |                       |                       |                     |                          |                        | 13,478.79 | 0.98    |
| Uninvolved                  | 1632 (79.90%) | 0.35             | 0.37                  | 0.23                  | 0.37                | 0.13                     | 0.30                   |           |         |
| Bullies                     | 135 (6.60%)   | 1.87             | 2.30                  | 1.89                  | 0.65                | 0.36                     | 0.52                   |           |         |
| Victims                     | 188 (9.19%)   | 0.63             | 0.65                  | 0.45                  | 1.89                | 1.35                     | 1.54                   |           |         |
| Bully-victims               | 88 (4.31%)    | 2.50             | 2.62                  | 2.17                  | 2.52                | 1.98                     | 2.08                   |           |         |
| <i>Five latent classes</i>  |               |                  |                       |                       |                     |                          |                        | 12,429.24 | 0.98    |
| Uninvolved                  | 1546 (75.73%) | 0.34             | 0.36                  | 0.23                  | 0.33                | 0.11                     | 0.27                   |           |         |
| Bullies                     | 120 (5.89%)   | 1.91             | 2.36                  | 1.94                  | 0.57                | 0.30                     | 0.47                   |           |         |
| Moderate victim             | 224 (10.97%)  | 0.67             | 0.66                  | 0.46                  | 1.36                | 0.87                     | 1.08                   |           |         |
| Bully-victims               | 89 (4.37%)    | 2.49             | 2.65                  | 2.20                  | 2.46                | 1.91                     | 2.02                   |           |         |
| Severe victim               | 62 (3.04%)    | 0.68             | 0.62                  | 0.40                  | 2.67                | 2.06                     | 2.19                   |           |         |

The Lo-Mendell-Rubin test (LMR) and the bootstrapped likelihood ratio test (BLRT) for testing the number of latent classes is not available for multiply imputed data sets

## Examination of Hypothesis II

Multiple group LTA comparing intervention and control group and comparing intervention and control group within girls and boys was conducted to investigate group membership at pre- and posttest and transition probabilities between pre- and posttest. Transition probability refers to the probability of moving from one subgroup at pre-test to another subgroup at post-test. Hence, the effectiveness of the ViSC program on bully-victim groups was evaluated by statistically comparing transition probabilities between the intervention and control group. That is, the difference in transition probabilities for each stability and transition pattern was tested for statistical significance. Membership in the transition groups of each observation were extracted for subsequent analyses. Note that high entropy (e.g., > 0.80) is needed for an accurate assignment of observations into latent profiles (Clark & Muthén, 2009).

## Examination of Hypothesis III

A multiple-group structural equation modeling approach for analyzing differences in means (see Green & Thompson, 2012) was used to investigate intervention effects on hypothesized program mechanisms. More specifically, mean change (*post-test* minus *pre-test*) was estimated for the intervention and control group separately to further estimate the difference in mean change between the intervention and control group (*intervention group* minus *control group*).

Change scores for each hypothesized mechanism of change variable were extracted for subsequent analyses. Secondly, each stability and transition group across pre- and posttest was tested for mean difference from 0 in the change scores of the hypothesized mechanism of change variable to investigate relations between different transition groups and the hypothesized mechanism of change variable. This analysis was conducted in the intervention group only because we were interested in the differential program effectiveness depending on the hypothesized mechanism of change variables. All models were estimated in Mplus 7.4 (Muthén & Muthén, 1998–2012) using maximum likelihood estimation with robust standard errors (MLR).

## Results

### Hypothesis I: Groups of Bullies and Victims

Latent profile analysis (LPA) with three to five profiles was conducted for pre- and post-test separately to determine the number of latent profiles (see Tables 2 and 3). Since the BIC was inconclusive with the lowest BIC for the model with five profiles, the number of extracted profiles in the LPA was increased. The BIC, however, kept decreasing even after 10 extracted profiles at pre- and post-test. On the other hand, the elbow plot (see Masyn, 2013) indicated that after four profiles additional profiles do not add much more information.



The relative entropy showed a very good overall precision of classification for the three (0.97 at pre-test and 0.98 at post-test), four (0.97 at pre-test and 0.98 at post-test), and five latent profiles (0.95 at pre-test and 0.98 at post-test) at pre- and post-test. In addition, the mean values of the different profiles were inspected to interpret them from a theoretical point of view. Based on all these considerations and since previous studies have shown that four bully-victim groups are sufficient to distinguish between different roles in bullying research (e.g., Kochel et al., 2015), the four-profile solution was used for further analyses. In the four-profile model, uninvolved adolescents (75.84% at pre-test and 79.90% at post-test), victims (12.18% at pre-test and 9.19% at post-test), bullies (6.42% at pre-test and 6.60% at post-test), and bully-victims (5.56% at pre-test and 4.31% at post-test) were identified at pre-test and post-test. The means of the latent profiles for pre-test are shown in Table 2 and for post-test in Table 3.

### Hypothesis II: Effectiveness of the ViSC Program

Multiple group LTA comparing intervention and control group and comparing intervention and control group on the four-profile solution was conducted to investigate group membership at pre- and post-test (see Table 4). In order to test the effectiveness of the ViSC program on bully-victim groups, transition probabilities were statistically compared between the intervention and control group (see Table 5).

### Latent Profile Membership in the Whole Sample

At pre-test, the distribution of bully-victim group membership across the four latent profiles was comparable between the intervention and control group with slightly more victims (15.69%) and less uninvolved (73.20%) in the intervention group than in the control group (10.23% and 80.05%). At post-test, the percentage of uninvolved increased (from 73.20 to 82.28%) while victims (from 15.69 to 6.83%) and bully-victims (5.95 to 3.92%) decreased in the intervention group. At the same time, the percentage of uninvolved decreased (from 80.05 to 74.59%) while victims (from 10.23 to 12.18%) and bully-victims (4.06 to 5.1%) increased in the

control group. As for bullies, the percentage increased in the intervention (from 5.16 to 6.97%) and control group (from 4.66 to 8.12%; see Table 4).

### Latent Profile Transition Probabilities in the Whole Sample

The probability for staying uninvolved between pre- and post-test was higher in the intervention group (.900) than in the control group (.824). Victims, on the other hand, had a lower probability for staying victims in the intervention group (.182) than in the control group (.403). There were no differences in the transition probabilities for bullies staying bullies and bully-victims staying bully-victims between pre- and post-test between the intervention and control group. Uninvolved had a lower probability for transitioning to victims (.038) or bully-victims (.015) in the intervention group than in the control group (.074 for transitioning to victims and .033 for transitioning to bully-victims). There were no differences in the transition probabilities for uninvolved transitioning to bullies between the intervention and control group. Moreover, the probability for victims transitioning to uninvolved was higher in the intervention group (.675) than in the control group (.448). Likewise, the probability for bully-victims transitioning to uninvolved was higher in the intervention group (.557) than in the control group (.318). There were no differences in the probabilities for bullies transitioning to uninvolved between the intervention and control group (see Table 5).

### Hypothesis III: Program Mechanisms

First, a multiple-group structural equation modeling approach was used to investigate latent mean differences between the intervention and control group. Secondly, these latent mean differences were tested whether they significantly deviate from 0 separately for different transition sub-groups participating in the intervention.

### Program Effects on Program Mechanisms

Multiple group models comparing intervention and control groups were estimated to investigate intervention effects on

**Table 4** Latent profile membership (%) for intervention and control group by wave

|             | Intervention group |            |       |        |              | Control group |            |       |        |              |
|-------------|--------------------|------------|-------|--------|--------------|---------------|------------|-------|--------|--------------|
|             | <i>n</i>           | Uninvolved | Bully | Victim | Bully-victim | <i>n</i>      | Uninvolved | Bully | Victim | Bully-victim |
| <i>Wave</i> |                    |            |       |        |              |               |            |       |        |              |
| Pre-test    | 1377               | 73.20%     | 5.16% | 15.69% | 5.95%        | 665           | 80.05%     | 4.66% | 10.23% | 4.06%        |
| Post-test   | 1377               | 82.28%     | 6.97% | 6.83%  | 3.92%        | 665           | 74.59%     | 8.12% | 12.18% | 5.11%        |

**Table 5** Transition probabilities in intervention and control group and difference in transition probabilities between intervention and control group

|                         | Intervention group (IG)<br>Post-test<br>( <i>n</i> = 1377) |             |             |              | Control Group (CG)<br>Post-test<br>( <i>n</i> = 665) |             |              |              | $\Delta$ Transition probability<br>IG-CG |       |        |              |              |  |
|-------------------------|--|-------------|-------------|--------------|--|-------------|--------------|--------------|--|-------|--------|--------------|--------------|--|
|                         | Uninvolved   |             | Victim      |              | Bully  |             | Bully-Victim |              | Uninvolved                               |       | Victim |              | Bully-Victim |  |
|                         | Uninvolved   | Bully       | Victim      | Bully-Victim | Uninvolved   | Bully       | Victim       | Bully-Victim | Uninvolved                               | Bully | Victim | Bully-Victim |              |  |
| Overall sample pre-test |  |             |             |              |  |             |              |              |  |       |        |              |              |  |
| Uninvolved              | <b>.900</b>  | <b>.047</b> | <b>.038</b> | <b>.015</b>  | <b>.824</b>  | <b>.069</b> | <b>.074</b>  | <b>.033</b>  | <b>.076</b>                              | -.022 | -.037  | -.017        |              |  |
| Bully                   | <b>.480</b>  | <b>.320</b> | <b>.092</b> | <b>.109</b>  | <b>.392</b>  | <b>.222</b> | <b>.195</b>  | <b>.192</b>  | .088                                     | .098  | -.103  | -.083        |              |  |
| Victim                  | <b>.675</b>  | <b>.051</b> | <b>.182</b> | <b>.092</b>  | <b>.448</b>  | <b>.059</b> | <b>.403</b>  | <b>.090</b>  | <b>.227</b>                              | -.008 | -.221  | .001         |              |  |
| Bully-victim            | <b>.557</b>  | <b>.197</b> | <b>.124</b> | <b>.122</b>  | <b>.318</b>  | <b>.255</b> | <b>.294</b>  | <b>.133</b>  | <b>.239</b>                              | -.059 | -.170  | -.011        |              |  |

Statistically significant results at  $\alpha = .05$  are boldface

hypothesized program mechanisms. There were differences in change between the intervention and control group across pre- and post-test for *help-seeking*, *perceived teacher intervention*, *evaluation of the anger motive*, and *evaluation of aggressive behaviors* (see Table 6). There was a stronger decrease in *help-seeking* ( $M = -0.27$ ,  $p < 0.001$ ) in the control group than in the intervention group ( $M = -0.07$ ,  $p = 0.190$ ). Likewise, there was a stronger decrease in *perceived teacher intervention* ( $M = -0.37$ ,  $p < 0.001$ ) in the control group than in the intervention group ( $M = -0.19$ ,  $p = 0.003$ ). Similarly, there was a stronger decrease in the *evaluation of aggressive behaviors* in the control group ( $M = -0.12$ ,  $p = 0.007$ ) than in the intervention group ( $M = -0.01$ ,  $p = 0.808$ ). For *evaluation of the anger motive*, there was a stronger increase in the intervention group ( $M = 0.12$ ,  $p = 0.005$ ) than in the control group ( $M = -0.06$ ,  $p = 0.352$ ).

### Change of Program Mechanisms in Different Patterns of Transition Groups

In order to investigate associations between different transition groups and the hypothesized program mechanism, group membership in the intervention was extracted for sub-groups whose transition patterns significantly differed between intervention and control group (i.e., stable uninvolved, victims and bully-victims transitioning to uninvolved). Each of these groups was tested for mean difference from 0 in the change score of the hypothesized mechanism of change variables (see Table 7). Results showed that stable uninvolved increased in the evaluation of the anger motive ( $\Delta M = 0.30$ ), evaluation of the instrumental motive ( $\Delta M = 0.43$ ), evaluation of the fun motive ( $\Delta M = 0.52$ ), and evaluation of aggressive behaviors ( $\Delta M = 0.22$ ). Victims transitioning to uninvolved increased in help-seeking ( $\Delta M = 0.70$ ), evaluation of the anger motive ( $\Delta M = 1.03$ ), and evaluation of aggressive behavior ( $\Delta M = 0.94$ ). Bully-victims transitioning to uninvolved increased help-seeking ( $\Delta M = 1.18$ ), perceived teacher intervention ( $\Delta M = 0.82$ ), evaluation of the anger motive ( $\Delta M = 1.33$ ), and evaluation of aggressive behaviors ( $\Delta M = 1.20$ ).

### Discussion

Extending many of the previous studies investigating the effectiveness of whole school prevention programs (e.g., Farrington et al., 2017; Gaffney et al., 2019, 2021), in the present study different sub-groups of in bullying involved adolescents (e.g., bullies, victims, and bully-victims) were identified applying person-oriented methods of data analyses. More specifically, it was examined whether the identified sub-groups profited equally from the participation in

**Table 6** Intervention effects on hypothesized program mechanisms

| Scales                                | Intervention group (IG) |      |           |      |                               | Control group (CG) |      |           |      |                               | ΔIG–CG<br>M (SE)   |
|---------------------------------------|-------------------------|------|-----------|------|-------------------------------|--------------------|------|-----------|------|-------------------------------|--------------------|
|                                       | Pre-test                |      | Post-test |      | ΔPost-test–pre-test<br>M (SE) | Pre-test           |      | Post-test |      | ΔPost-test–pre-test<br>M (SE) |                    |
|                                       | M                       | SD   | M         | SD   |                               | M                  | SD   | M         | SD   |                               |                    |
| Empathy with the Victim               | 2.23                    | 0.78 | 2.14      | 0.71 | <b>-0.09</b> (0.04)           | 2.25               | 0.69 | 2.13      | 0.77 | <b>-0.13</b> (0.05)           | 0.04 (0.06)        |
| Help-Seeking                          | 2.00                    | 1.11 | 1.93      | 1.10 | -0.07 (0.5)                   | 2.09               | 1.08 | 1.82      | 1.13 | <b>-0.27</b> (0.07)           | <b>0.21</b> (0.09) |
| Responsibility to intervene           | 1.24                    | 1.19 | 1.13      | 1.13 | <b>-0.11</b> (0.05)           | 1.23               | 1.21 | 1.08      | 1.17 | <b>-0.15</b> (0.07)           | 0.04 (0.09)        |
| Perceived teacher intervention        | 2.06                    | 1.06 | 1.87      | 1.09 | <b>-0.19</b> (0.06)           | 2.09               | 1.06 | 1.73      | 1.12 | <b>-0.37</b> (0.08)           | <b>0.18</b> (0.10) |
| Evaluation of the anger motive        | 1.99                    | 1.01 | 2.10      | 0.97 | <b>0.12</b> (0.04)            | 2.01               | 1.00 | 1.95      | 1.03 | -0.06 (0.06)                  | <b>0.17</b> (0.07) |
| Evaluation of the instrumental motive | 2.34                    | 1.03 | 2.42      | 0.93 | <b>0.08</b> (0.04)            | 2.32               | 1.02 | 2.35      | 1.00 | 0.02 (0.06)                   | 0.06 (0.08)        |
| Evaluation of the fun motive          | 2.33                    | 1.07 | 2.45      | 0.97 | <b>0.11</b> (0.04)            | 2.39               | 1.05 | 2.40      | 1.00 | 0.02 (0.06)                   | 0.10 (0.07)        |
| Evaluation of aggressive behaviors    | 2.19                    | 0.67 | 2.18      | 0.66 | -0.01 (0.04)                  | 2.23               | 0.67 | 2.11      | 0.69 | <b>-0.12</b> (0.05)           | <b>0.11</b> (0.06) |

Statistically significant results at  $\alpha = .05$  are boldface

a 1-year whole-school prevention program that was implemented in Austrian schools and whether the same or different program mechanisms were associated with the changes among different sub-groups. In line with the few previous studies applying person-oriented methods of data analyses (e.g., Garandeau et al., 2014; Jenson et al., 2013; Yang & Salmivalli, 2015), it was demonstrated that the program participation was not equally beneficial for all sub-groups. Victims and bully-victims, but not bullies changed to the uninvolved group after participating in the ViSC program. Extending previous studies, changes in the hypothesized mechanisms were differentially associated to the transition pattern of the subgroups.

**Program Effectiveness**

Like in many previous studies (e.g., Kochel et al., 2015; Zych et al., 2020), four groups of adolescents were identified

based on latent profile analysis (LPA), i.e., bullies, victims, bully-victims, and uninvolved adolescents. Although a five-class solution with two victim groups, i.e., moderate and severe victims, also showed high entropy, we decided to analyze the four-class solution for theoretical reasons. As expected, boys were overrepresented in the groups of bullies and bully-victims compared to girls (e.g., Currie et al., 2012; Inchley et al., 2016).

It was shown that the ViSC program was not equally effective for these four groups. There was a substantial decrease of victims in the intervention schools between pre-test (15.7%) and post-test (6.8%) indicating a drop of 56.7%, while the number of victims in the control group even slightly increased (from 10.2% at pre-test to 12.2% at post-test). The same pattern of results was found for bully-victims. In the intervention group, 6% of students were identified as bully-victims at pre-test and 3.9% at post-test indicating a drop of 35%, while in the control group the

**Table 7** Change scores of hypothesized program mechanisms in stable uninvolved and transition groups of victims and bully-victims

|                                       | Intervention group<br>(n = 1377)  |                                    |  |
|---------------------------------------|-----------------------------------|------------------------------------|--|
|                                       | Stable<br>Uninvolved<br>(n = 908) | Victim<br>→ Uninvolved<br>(n = 33) | Bully-victim<br>→ Uninvolved<br>(n = 45) |
|                                       | ΔM (SE)                           | ΔM (SE)                            | ΔM (SE)                                  |
| Empathy with the victim               | 0.16 (0.11)                       | <b>0.51</b> (0.26)                 | <b>0.74</b> (0.27)                       |
| Help-seeking                          | 0.03 (0.14)                       | <b>0.70</b> (0.30)                 | <b>1.18</b> (0.29)                       |
| Responsibility to intervene           | -0.07 (0.14)                      | 0.20 (0.27)                        | 0.08 (0.28)                              |
| Perceived teacher intervention        | -0.00 (0.12)                      | 0.33 (0.29)                        | <b>0.82</b> (0.30)                       |
| Evaluation of the anger motive        | <b>0.30</b> (0.12)                | <b>1.03</b> (0.27)                 | <b>1.33</b> (0.25)                       |
| Evaluation of the instrumental motive | <b>0.43</b> (0.13)                | <b>1.08</b> (0.32)                 | <b>1.50</b> (0.26)                       |
| Evaluation of the fun motive          | <b>0.52</b> (0.13)                | <b>1.04</b> (0.37)                 | <b>1.68</b> (0.28)                       |
| Evaluation of aggressive behaviors    | <b>0.22</b> (0.11)                | <b>0.94</b> (0.26)                 | <b>1.20</b> (0.21)                       |

ΔM, change score post-test–pre-test, i.e., positive value indicates an increase and negative value a decrease; statistically significant results at  $\alpha = .05$  are boldface

number of bully-victims increased from 4.1% at pre-test to 5.1% at post-test. Thus, participation in the ViSC program was not able to change (proactive) bullies, a finding that has also been reported for the KiVA program (Garandeau et al., 2014). It is possible that the preventive measures that are implemented on school and class levels were not strong enough to change the behavior of proactive bullies, because teachers might still not be able to recognize their behavior and consequently did not consistently implement the suggested serious talks with them (Burger et al., 2015). Therefore, there might have been too few negative sanctions for them to change their behavior. Another explanation might be related to the ViSC program theory. Several measures that are implemented on the class level are based on social information processing theory (Crick & Dodge, 1996) and they have a strong focus on how to cope with anger and reactive aggression, which might be an effective strategy to change bully-victims but not proactive, power-driven bullies. Finally, there is a need for a better training of Austrian teachers that they are better able to implement these indicated measures properly (Strohmeier et al., 2021a). Overall, future implementations of whole school prevention programs should have a stronger focus on (proactive) bullies in order to also change their pattern of involvement.

### Program Mechanisms

Applying a variable-oriented perspective, program participation was able to prevent a stronger decline of help-seeking behavior, perception of teacher intervention, and negative evaluation of aggressive behavior in intervention classes compared to control classes. The program was successful in increasing the negative evaluation of reactive aggression, but there were no program effects on the evaluation of proactive aggression (i.e., the fun and instrumental motive). Although the negative evaluation of motives of fun and instrumental aggression increased significantly in intervention classes, differences of changes between intervention and control classes were not significant. Thus, together with the finding that the program was only successful in changing patterns of victims and bully-victims, the ViSC program appears to be especially effective in reducing reactive aggression. Unexpectedly, the ViSC program yielded neither an effect on empathy nor on the responsibility to intervene and these variables even declined in the intervention classes. Because also perceived teacher intervention was decreasing over time, although to a lesser extent in intervention classes compared to control classes, it is possible that teacher 's lower engagement in the intervention of bullying are related to less responsibility to intervene and less help-seeking behavior in students.

Applying a person-oriented perspective, hypothesized program mechanisms changed differently in stable uninvolved as

well as in bully-victims and victims who changed to the group of uninvolved after the program participation. The negative evaluation of the anger motive and of aggressive behavior increased in stable uninvolved adolescents, in victims, and bully-victims. These results are in line with previous studies where anti-bullying attitudes mediated the effectiveness of the KiVA program (Saarento et al., 2015). Additionally, in victims and bully-victims help-seeking behavior and only in bully-victims perceived teacher intervention was increasing. These findings underscore how important it is to apply person-oriented methods of data analyses because the hypothesized program mechanisms were increasing in stable uninvolved and transition groups (i.e., in those groups where the intervention was effective), while they were decreasing for the whole group.

### Limitations

Although the present study has a high methodological standard, several limitations should be mentioned. First, we relied on students' self-assessments only. When applying an intervention program large scale (as was the case in the present study), self-report measures are often chosen because they are easy to apply and are reliable, given that multiple items are used to measure a construct (Yanagida et al., 2016). The strengths and weaknesses of self-report measures in studies about aggressive behavior including bullying have already been discussed extensively in the literature (e.g., Solberg & Olweus, 2003). Likely, aggressive behavior is underestimated using self-reports, because perpetrators might not report the "true" frequency of their behavior but might underestimate it. Thus, self-report measures should be interpreted with caution. Second, the cluster-randomized study might be considered a disadvantage from an experimental point of view, because only self-selected volunteer schools were randomized, and not all of them were willing to serve in the control group. However, given the complexity and duration of the intervention, including a large amount of teacher trainings and class units delivered by volunteer teachers over a period of one school year, to implement an experimental approach was not feasible. Thirdly, several hypothesized program mechanisms (e.g., responsibility to intervene) were assessed with only one item that is a sub-optimal strategy from a methodological point of view. Considering measurement error, this weak measurement strategy might have worked against detecting program effectiveness and should be avoided in future studies.

### Conclusions

To the best of our knowledge, this is the first study that applied LTA to investigate the effectiveness of a whole-school anti-bullying intervention on changing patterns of in bullying involved and uninvolved adolescents. The large sample size allowed us

to investigate whether the hypothesized program mechanisms were differentially associated with different transition patterns of subgroups. This innovative approach has not been implemented in other evaluation studies of whole school programs before. It was demonstrated that hypothesized program mechanisms work differently in bullying-involved groups and that these effects might not have been identified when using a variable-oriented perspective and the whole sample.

### Data Transparency Statement

The same dataset has been used in four other papers that have already been published. In these studies, different research questions and different approaches for analysis have been used. This has also been outlined in the manuscript. These four papers are:

Bardach, L., Yanagida, T., Gradinger, P., & Strohmeier, D. (2022). Understanding for which students and classes a randomized controlled aggression prevention program works best: Testing individual student and class level moderators. *Journal of Youth and Adolescence*. <https://doi.org/10.1007/s10964-021-01553-6>

Gradinger, P., Yanagida, T., Strohmeier, D., & Spiel, C. (2015). Prevention of cyberbullying and cybervictimization: Evaluation of the ViSC social competence program. *Journal of School Violence*, 14 (1), 87–110. <https://doi.org/10.1080/15388220.2014.963231>

Gradinger, P., Yanagida, T., Strohmeier, D., & Spiel, C. (2016). Effectiveness and sustainability of the ViSC social competence program to prevent cyberbullying and cyber-victimization: Class and individual level moderators. *Aggressive Behavior*, 42, 181–193. <https://doi.org/10.1002/ab.21631>

Yanagida, T., Strohmeier, D. & Spiel, C. (2019) Dynamic change of aggressive behavior and victimization among adolescents: Effectiveness of the ViSC Program, *Journal of Clinical Child & Adolescent Psychology*, 48:sup1, S90-S104. <https://doi.org/10.1080/15374416.2016.1233498>

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**Data Availability** The data is available from the third author upon request.

### Declarations

**Competing Interests** The authors declare no competing interests.

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