



# A Longitudinal Process Model Evaluating the Effects of Cooperative Learning on Victimization, Stress, Mental Health, and Academic Engagement in Middle School

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## Abstract

Mental health is a significant concern among young people, particularly during the COVID-19 pandemic. Notably, mental health problems can significantly reduce student performance in school, including both engagement and achievement. Both mental health problems and reduced student performance often arise due to *peer victimization*, which can include teasing, racial- or gender-based discrimination, and/or physical assault. Stress has been proposed as one mechanism through which victimization influences mental health, and stress can also interfere with academic performance at school, including engagement and achievement. To date, however, no research has evaluated longitudinal associations between victimization and stress, and how these longitudinal patterns may impact adolescent behavior and mental health. In this study, we used data from a 2-year cluster randomized trial of cooperative learning to evaluate an etiological process model that includes (1) longitudinal reciprocal effects between victimization and stress, and (2) the effects of both victimization and stress on student mental health and academic engagement. We hypothesized that victimization and stress would have significant reciprocal effects, and that both would predict greater mental health problems and lower academic engagement. We further hypothesized that cooperative learning would have significant effects on all constructs. We found partial support for this model, whereby stress predicted greater victimization, but victimization did not predict increased stress. While both factors were linked to student outcomes, stress was a more powerful predictor. We also found significant salutary effects of cooperative learning on all constructs. The implications of these results for student behavioral and mental health are discussed.

**Keywords** Victimization · Stress · Engagement · Mental health · Cooperative learning · Middle school

## Introduction

Adolescent mental health is a significant concern worldwide, with anywhere from 13 to 20% of youth suffering a disabling mental illness (Belfer, 2008; Polanczyk et al., 2015). Unfortunately, the enforced social isolation resulting from school closures during the coronavirus pandemic has exacerbated this problem. A recent review of 63 studies involving 51,576 students found that social isolation resulting from the

pandemic was linked to higher levels of stress, fear, loneliness, anxiety, and depression among adolescents (Loades et al., 2020). Research also suggests that the pandemic has created higher rates of suicide ideation (Hill et al., 2021). In addition, adolescents are likely to experience high rates of depression even after the enforced isolation ends, and this risk is likely to increase the longer students are isolated (Loades et al., 2020).

While mental health problems are uncommon in childhood and early adolescence, they increase markedly in the mid-to-late teens; specifically, the prevalence of depression is only 2.8% in children under the age of 13, but this doubles to 5.6% by age 18 (Costello et al., 2006). In addition, the incidence of major depression peaks between the ages of 15 and 18 (Hankin et al., 1998). Mental health problems of this nature can significantly reduce student performance in school, including both engagement and achievement (Madjar et al., 2021; Olivier et al., 2020; Weidman et al., 2015), and

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reductions in academic engagement in adolescence can foreshadow school dropout (Archambault et al., 2009; Wang & Fredricks, 2014). Furthermore, experiencing mental health problems in adolescence creates significant risk for more serious mental illness in adulthood (Aronen et al., 1999; Fergusson et al., 2005).

### Victimization as a Key Antecedent

Both mental health problems and reduced student performance often arise as a consequence of negative social experiences in school, such as peer victimization, which can include malicious teasing, threats of harm, stalking, racial- or gender-based discrimination, and/or physical or sexual assault. Peer victimization has been linked to a variety of negative behavioral and emotional outcomes for adolescents, including higher levels of mental health problems, drug use, and delinquency, and lower levels of self-esteem, school attendance, and academic achievement (Barchia & Bussey, 2010; Moore et al., 2017; Nishina et al., 2005; Polanin et al., 2021; Rueger et al., 2011; Storch et al., 2005; Sullivan et al., 2006; Thijs & Verkuyten, 2008).

Negative peer experiences such as victimization are particularly impactful for early adolescents (Rubin et al., 2006) due to social and biological changes occurring during these years. Socially, peers become increasingly important as a source of belonging and support during adolescence as youth begin to separate from families and develop affiliative and romantic relationships (Steinberg & Morris, 2001). Biologically, adolescents are increasingly sensitive to social reward (Fareri et al., 2008; Spear, 2000) and changes in reactivity to certain neurotransmitters contributes to adolescents being more sensitive to perceived threats in the social realm (Barkley-Levenson & Galvan, 2017; Dreyfuss et al., 2014). Increased relevance of peers and heightened sensitivity to social feedback and negative experiences are compounded by limited coping skills, as adolescents are less able to self-regulate due to the relative immaturity of the prefrontal cortex (Casey et al., 2000). Taken together, early adolescence is a time of particular sensitivity to peer victimization, increasing the likelihood of more intense and enduring behavioral and mental health consequences.

### The Role of Stress

The key role of victimization in adolescent behavioral and mental health suggests that it is vitally important to identify factors that sustain victimization and help explain the link between victimization and the elaboration of mental health problems and academic disengagement. One candidate mediator that has received some attention to date is the role of stress. Stress has been proposed as one mechanism through which victimization

influences mental health outcomes (Arseneault, 2018; Turner et al., 2013; Van Ryzin et al., 2020b). Previous research finds that stress creates significant risk for mental health problems, including anxiety, depression, and low self-esteem (Greenberger et al., 2000; Hankin et al., 2015; Moksnes et al., 2010; Rudolph, 2002; Wenz-Gross et al., 1997), which have all been implicated as both consequences of and risk factors for victimization. Stress can also interfere with academic performance at school, including engagement and achievement (Kaplan et al., 2005; Raufelder et al., 2014; Van Ryzin et al., 2020b). To date, however, no research has evaluated longitudinal associations between victimization and stress, and how these longitudinal patterns may impact adolescent behavior and mental health.

### Theoretical Framework

Researchers have hypothesized a transactional framework for stress and peer relationship processes that is based upon the notion that youth select and contribute to their environments in ways that maintain their individual circumstances over time (Lerner, 1978). It has been hypothesized that: (1) stressful peer experiences impact youth behavior, and (2) youth behavior contributes to greater likelihood of stressful experiences (Caldwell et al., 2004). According to this view, not only do victimization and related negative peer experiences create significant stress for early adolescents, but stress, in turn, can cause adolescents to exhibit certain behavior (e.g., internalizing or externalizing behavior) that may render them vulnerable to further victimization. Specifically, stress in adolescents can overwhelm developing neurocircuitry associated with coping and decision-making, leaving youth more apt to either withdraw socially or act out aggressively (Eiland & Romeo, 2013; Galvan & Rahdar, 2013; Suldo & Huebner, 2004). These negative internalizing and externalizing behaviors are key antecedents of victimization (Bowker et al., 2012; Paul & Cillessen, 2003).

Although this hypothesis is provocative, we are aware of no research that has evaluated the ability of stress to directly predict victimization. In addition, we are aware of no research that has explored the combined effects of both victimization and stress on student mental health and academic engagement, although extensive research has evaluated each predictor independently, finding negative effects for both victimization and stress on adolescent mental health (Arseneault, 2018; Barchia & Bussey, 2010; Moore et al., 2017; Rueger et al., 2011; Storch et al., 2005; Turner et al., 2013) and academic outcomes (Kaplan et al., 2005; Nishina et al., 2005; Raufelder et al., 2014; Rueger et al., 2011; Thijs & Verkuyten, 2008).

### Current Study

In this study, we used data from a 2-year (4 waves of data) cluster randomized trial of cooperative learning (CL) in middle schools to evaluate an etiological process model that includes two components: (1) an evaluation of reciprocal effects between victimization and stress over time, and (2) a comparison of the relative effects of both victimization and stress on student mental health and academic engagement. Given sex differences in adolescent mental health problems (Alloy et al., 2016), our study also evaluated sex as a moderator of these relationships. Finally, we added to this model an evaluation of the effects of CL on all key constructs, including victimization, stress, mental health, and academic engagement. In so doing, we wished to evaluate not only whether a reciprocal relationship exists among victimization and stress (which could imply a “vicious cycle”), but also to determine whether CL can impact this relationship and leverage the reciprocal nature of this relationship for positive ends (i.e., create a “virtuous cycle”). Finally, we wished to evaluate whether victimization and stress exert equal (or unequal) effects on student mental health and academic engagement over time, findings which could inform school-based prevention efforts that currently focus more strongly on the former than the latter (Yeager et al., 2015).

To evaluate this etiological process model, we employed cross-lagged latent difference score modeling, which decomposes change over time into a series of segments representing the amount of change from one measurement wave to the next. Difference scores are then used in an autoregressive

cross-lag framework to assess the degree in which one variable influences change in the other over time (McArdle, 2009). These difference scores are latent constructs that represent the amount of change between adjacent waves, which enable us to obtain accurate assessments of the influence of one variable (e.g., victimization) on the net change in another variable (e.g., stress) while controlling for the influence of baseline levels (McArdle, 2009). We provide an example model in Fig. 1 where we estimate change between waves (e.g., wave 1 to wave 2) in stress and victimization and evaluate how each influences subsequent change in the other. This model also evaluates the impact of change in the two constructs over time (via the intercept and slope terms, which closely resemble similar terms in growth modeling) on change in mental health problems and academic engagement from wave 1 to wave 4 (our model also evaluated the effects of CL on all model constructs, but this is not shown in Fig. 1 to enhance clarity).

### Cooperative Learning

Cooperative learning (CL) is an instructional pedagogy that puts students into small groups under specific conditions that foster improved social relationships while also enhancing academic achievement (Roseth et al., 2008). CL groups are designed around the purposeful implementation of several key design features to ensure that the collaboration among students is successful (Johnson et al., 2013). First, a CL lesson must create conditions of *positive interdependence*, in which individual goal attainment also

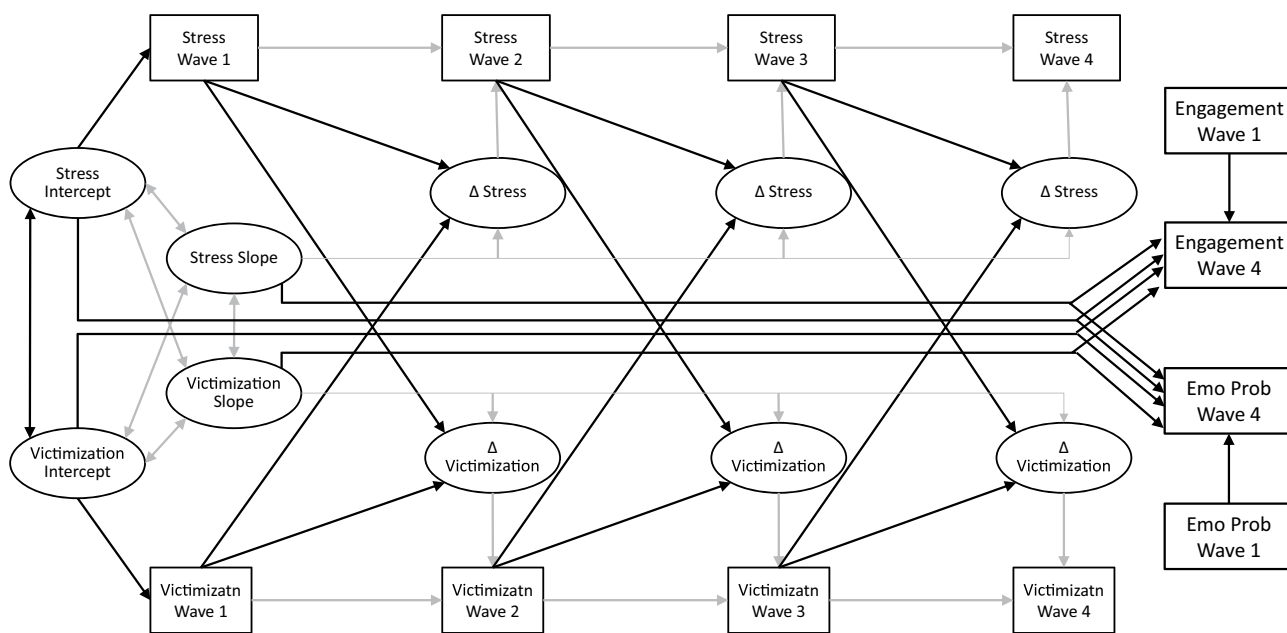


Fig. 1 Cross-lag difference score model

promotes the goal attainment of others (in contrast to more common educational situations, in which individual goal attention either has no impact, or has a negative impact, on the goal attainment of others). This is often attained by requiring a single finished product from a group (goal interdependence), or offering an incentive to the group if everyone achieves above a certain threshold on assessment (reward interdependence). The lesson may also specify that each member of the group do something specific for a lesson to be completed successfully, such as fulfill a unique role (role interdependence, e.g., tracking the group status, or taking notes on group discussions) or complete a unique task (task interdependence, e.g., each student has a different component of a project or presentation).

Second, CL activities must also implement *individual accountability* to ensure that students have a strong incentive to contribute to the success of the group (Johnson et al., 2013). Individual accountability can include an end-of-unit assessment to be taken individually (with the potential for group rewards as discussed above), or something as simple as a random oral quiz by the teacher as he or she supervises the group work during class time. When students know that they are going to be held individually accountable, they are more likely to engage and fulfill their role in their learning group (Johnson & Johnson, 1989).

Third, high-quality CL lessons must also include the explicit coaching of students in *collaborative social skills* (e.g., encouraging participation, checking for understanding, sharing ideas, asking for clarification), which includes scaffolding a specific skill, setting expectations and goals for group behavior, and monitoring by the teacher to identify and reward examples of such behavior. Finally, CL requires *extended interpersonal contact* and *guided processing of group performance* after the lesson is completed. The group discusses what they did well, sets targets for improvement in the future, and provides positive feedback to one another for behavior during the lesson that contributed to group success (Johnson et al., 2013).

When all of these features are present in a well-designed CL lesson, students are incentivized to promote the success of others through instrumental and emotional support; this promotive social interaction, and the successful attainment of group goals, creates a positive shared emotional experience among group members (Deutsch, 2012), which promotes more positive peer relations ( $ES=0.42-0.48$ ; Roseth et al., 2008) and peer support ( $ES=0.33$ ; Van Ryzin et al., 2020b) and reduces victimization ( $ES=-0.36$ ; Van Ryzin & Roseth, 2018a), and stress and mental health problems ( $ES=-0.24$  and  $-0.29$ , respectively; Van Ryzin et al., 2020b). Research also finds that CL can promote academic engagement ( $ES=0.35$ ; Van Ryzin et al., 2020b). In addition, the effects of CL on stress, mental health problems, and engagement were found to be mediated by peer relations (Van Ryzin et al., 2020b).

## Study Hypotheses

We hypothesized that victimization and stress would have reciprocal effects, with victimization creating greater levels of stress and stress making youth more vulnerable to victimization. We also hypothesized that both victimization and stress would predict greater levels of mental health problems and lower levels of academic engagement. This model suggests a positive feedback loop whereby, in the absence of any intervention, victimization and stress would contribute to one another and accelerate the negative impacts on student engagement and mental health (a “vicious cycle”).

With regard to the effects of CL, we hypothesized significant positive effects on all constructs in our model whereby CL would leverage the positive feedback loop between victimization and stress, bringing about positive change in student engagement and mental health (a “virtuous cycle”). We evaluated the effects of CL in this model by regressing both latent difference scores and outcomes (wave 4) on intervention condition (i.e., CL vs. business as usual).

## Method

### Sample

All aspects of this study were approved by the Institutional Review Board (IRB) at the Oregon Research Institute (ORI), and the study was performed in accordance with the ethical standards as laid down in the 1964 Declaration of Helsinki and its later amendments. The sample was derived from a small-scale cluster randomized trial of CL in 15 middle schools in the Pacific Northwest that volunteered for the study (registered on ClinicalTrials.gov; NCT03119415).

Schools were matched based upon size and demographics (i.e., free/reduced lunch percentage, race/ethnicity) and randomized to condition (i.e., intervention vs. waitlist control) with an online random number generator. We randomized an extra school to the control condition (i.e., 8 waitlist-control vs. 7 intervention schools) to account for the possibility that schools designated as controls may leave the study (all schools remained in the study).

Our sample included  $N=1890$  students who participated in the project during the 2016–2017 or 2017–2018 school years. Students were in 7th grade when they were initially enrolled in the project and we followed them into 8th grade during the second year. At each wave of data collection, we included all participants from previous waves (if they were still attending the same school) and enrolled a small number of new students who had not yet participated in the study; thus, at each time point, we experienced a degree of attrition (from students leaving the school) but also supplemented the sample by enrolling additional participants (we note that we

did not enroll new participants at the final wave of data collection). Any student who participated in at least one wave of data collection was included in the analytic sample, which was 47.1% female ( $N=890$ ) and 75.2% White ( $N=1421$ ). Other racial/ethnic groups included Hispanic/Latino (13.2%,  $N=249$ ), multi-racial (5.3%,  $N=100$ ), and American Indian/Alaska Native (3.1%,  $N=58$ ); our sample included less than 1% Asian, African-American, and Native Hawaiian/Pacific Islander. Overall, 13.9% ( $N=262$ ) were reported as having special education status, 78.6% ( $N=1486$ ) did not have special education status, and 7.5% ( $N=142$ ) were missing this designation. Student demographics by school are provided in Table 1, and student enrollment data by wave and condition are provided in Table 2. Free and reduced-price lunch status was not made available by the schools, although we added school-level figures (obtained from state records) to Table 1.

## Teacher Training

Training in CL for teachers in intervention schools began in the fall of the 2016–2017 school year and consisted of 3 half-day in-person sessions, periodic check-ins via video-conference, and access to resources (e.g., newsletters). The three in-person training sessions per school were conducted in (1) late September to early October, (2) late October to early December, and (3) late January to late March. Training sessions were conducted by D. W. and R. T. Johnson and utilized *Cooperation in the Classroom, 9th Edition* by Johnson et al. (2013); each staff member received a copy of the book. We also conducted a 1-day administrator training

**Table 2** Enrollment data (number of students) by wave and intervention condition

Wave	New enrollment		Lost to follow-up <sup>a</sup>	
	Intervention	Control	Intervention	Control
1	668	792	24	48
2	104	106	22	30
3	97	112	14	18
4	6	5	–	–
Total	875	1015	60	96

Data analysis (maximum likelihood) included all students. Data collection was conducted in September/October and March/April of the 2016–2017 and 2017–2018 school years (4 waves in total, about 6 months apart)

<sup>a</sup>Students do not appear in any subsequent waves

during the summer of 2017, and a half-day follow-up training for teachers in the following school year.

The teacher training was experiential as well as factual, with teachers actively involved in their own learning through the use of CL techniques as a central focus of the training. In other words, teachers did not receive lectures, but rather were placed in small groups to teach and learn from one another. Teachers were given foundational theory, an overview of the key design dimensions, and numerous examples, and each lesson was implemented using a form of CL. In this way, teachers developed not only an understanding of CL, but also experienced these lessons from the student perspective, developing an appreciation for the social nature of CL and the way in which it is active and student-centered as well

**Table 1** Intervention condition, sample size (number of students), sex, race/ethnicity, special education, and free/reduced price lunch data by school

School	Intervention	<i>N</i>	% female	% White	% Special Ed	% FRPL <sup>a</sup>
1	Yes	282	47.9	73.0	11.7	53
2	Yes	121	47.1	90.1	19.8	71
3	Yes	112	50.0	83.0	15.2	72
4	Yes	110	40.0	60.9	n/a	62
5	Yes	105	46.7	78.1	10.5	57
6	Yes	84	33.3	72.6	4.8	95
7	Yes	61	52.5	75.4	16.4	66
8	No	239	51.0	48.5	13.0	84
9	No	197	49.2	90.4	11.7	66
10	No	183	44.8	65.0	17.5	61
11	No	114	47.4	93.0	24.6	65
12	No	108	51.9	80.6	15.7	46
13	No	71	45.1	81.7	19.7	45
14	No	53	41.5	92.5	18.9	33
15	No	50	48.0	88.0	16.0	39

One school did not provide Special Ed status

FRPL free/reduced price lunch

<sup>a</sup>State records

as highly structured, and how this contributes to positive social and academic outcomes (Roseth et al., 2008).

As part of the training, teachers were asked to bring some of their existing curricular materials, which they adapted to be delivered using CL during the training. Thus, by the conclusion of the training, each teacher had several CL lessons, representing best practice, that they could use without further modification, and also significant experience in the process of adapting curriculum to CL. In a typical adaptation, an existing lecture and whole-class discussion on a certain topic could be reconfigured into a jigsaw lesson, where students teach and learn from one another in small groups. In such a scenario, the lesson material is divided into two to four independent subtopics, and each student in a jigsaw group is responsible for learning one subtopic in the company of other students who are assigned the same material. Subsequently, students teach what they know to other students in a jigsaw group. As each student in a jigsaw group presents their topic, students are exposed to all the lesson material.

## Measures

Student data collection was conducted in September/October and March/April of the 2016–2017 and 2017–2018 school years (4 waves in total, about 6 months apart) using online surveys (i.e., Qualtrics; <https://www.qualtrics.com/>). To shrink the overall number of items and reduce participant burden, existing data from other studies were used in an exploratory factor analysis (EFA) to select a subset of the highest-loading items from each scale below.

To assess fidelity of implementation, we also conducted teacher observations for intervention fidelity. Research staff blind to intervention assignment observed teaching practices in intervention and control schools. Using an established observation protocol for key aspects of CL (e.g., positive interdependence; Krol et al., 2008; Veenman et al., 2002), the authors trained observers to 100% reliability using simulated data before they conducted observations in actual classrooms, and conducted periodic checks during the project to ensure no rater drift. Observations were conducted once in the late fall/early winter and again in the spring of the first year. In smaller schools, raters visited all classrooms during their visit; in larger schools, classrooms were chosen at random. Observers remained in a classroom for an entire class period.

## Victimization

We used the Victimization subscale (3 items) from the University of Illinois Bully Scale (Espelage & Holt, 2001), which asked students to indicate the frequency over the last 30 days of the following: “Other students picked on me,”

“Other students called me names,” and “Other students made fun of me.” Students responded on a 5-point scale from 0 (*Never*) to 4 (*7 or more times*) and items were averaged to arrive at the subscale scores. Alpha reliability was 0.93 to 0.94 across the four waves of measurement.

## Perceived Stress

We used 4 of the 10 items from the Perceived Stress Scale (Cohen et al., 1983), including “In the last month, how often have you been upset because of something that happened unexpectedly?,” “In the last month, how often have you felt nervous and stressed?,” “In the last month, how often have you felt that things were going your way?,” and “In the last month, how often have you felt that you were on top of things?” (the last two being reverse scored). Students responded on a 5-point scale from 0 (*Never*) to 4 (*very often*), and items were averaged to arrive at the scale score. Alpha reliability was 0.59 at baseline, 0.63 at wave 2, 0.71 at wave 3, and 0.73 at wave 4. Confirmatory factor analysis (CFA) analyses indicated suboptimal fit according to standard criteria (see “[Analysis Plan](#)” below; Schumacker & Lomax, 2010) with acceptable loading for all items (>0.3) except for the reversed-scored items at waves 1 and 2, whose loadings were approximately 0.20.

## Mental Health Problems

We used 4 of the 5 items from the Emotional Problems subscale of the Strengths and Difficulties Questionnaire (Goodman et al., 1998), including “I worry a lot,” “I have many fears, I am easily scared,” “I am nervous in new situations,” and “I am often unhappy, depressed or tearful.” Students responded on a 3-point scale from 1 (*Not true*) to 3 (*Certainly true*), and items were averaged to arrive at the scale score. Alpha reliability was 0.71 at baseline (wave 1) and 0.81 at wave 4. Confirmatory factor analysis (CFA) analyses indicated adequate fit according to standard criteria (Schumacker & Lomax, 2010) with acceptable loading for all items (>0.3) at all waves.

## Academic Engagement

We used 4 of the 10 items from the Behavioral Engagement subscale of the Engagement vs. Disaffection with Learning Scale (Skinner & Belmont, 1993), including “I try hard to focus in class,” “In class, I work as hard as I can,” “I pay attention in class,” and “In class, I do just enough to get by” (reverse scored). Students responded on a 4-point scale from 1 (*Not at all true*) to 4 (*Very true*), and items were averaged to arrive at the scale score. Alpha reliability was 0.75 at baseline (wave 1) and 0.77 at wave 4. Confirmatory factor analysis (CFA) analyses indicated adequate fit according to

standard criteria (Schumacker & Lomax, 2010) with acceptable loading for all items (> 0.3) at all time points.

**Demographics**

Sex was collected from school records and coded male (0) and female (1).

**Analysis Plan**

We used structural equation modeling (SEM) to fit our cross-lag difference score model, which provides a number of advantages. For example, we can constrain all cross-lag coefficients in the model to be identical, which provides empirical tests of whether the degree of influence of one construct on another is identical to the degree of influence in the opposite direction. In addition, we conducted tests of moderation through a multiple-group comparison via a deviance test to explore whether effects hold for subgroups (e.g., boys vs. girls).

We fit our cross-lag difference score model using Mplus 7.4 (Muthén & Muthén, 1998–2012) and maximum likelihood (ML) estimation with robust standard errors, which can provide unbiased estimates in the presence of missing data and/or non-normal distributions (Enders & Bandalos, 2001). Mplus also enabled us to account for the nesting in the data and calculate appropriate standard errors; however, sample size limitations prevented us from including random effects in the model (i.e., the inclusion of random effects created instability and issues with convergence), so all effects were fixed. For each model, we provide standard measures

of fit, including the chi-square ( $\chi^2$ ), comparative fit index (CFI), nonnormed or Tucker-Lewis index (TLI), and root mean square error of approximation (RMSEA). CFI and TLI values greater than 0.90 and RMSEA values less than 0.05 indicate good fit (Schumacker & Lomax, 2010); similar criteria were applied for our CFA analyses (see above). We used all available data in each analysis as per standard practice with ML (Schafer & Graham, 2002).

**Results**

We provide descriptive data and correlations in Table 3. Female students generally did not report different levels of victimization but did report higher levels of stress ( $r=0.21$  to  $0.26$ ), engagement ( $r=0.12$  to  $0.13$ ), and mental health problems ( $r=0.29$  to  $0.33$ ) than male students. Students in intervention and control schools did not differ in terms of baseline levels of stress ( $B = -0.05, SE = 0.05, ns$ ), victimization ( $B = 0.01, SE = 0.10, ns$ ), or engagement ( $B = 0.01, SE = 0.07, ns$ ). The two groups were different, however, in terms of mental health problems at baseline ( $B = -0.07, SE = 0.03, p < 0.05$ ), with intervention schools being slightly lower ( $M = 1.75, SE = 0.51$ ) as compared to control schools ( $M = 1.82, SE = 0.55$ ). With regard to fidelity observations, analyses indicated no differences at baseline (i.e., wave 1;  $B = -0.01, SE = 0.02, ns$ ), but significantly higher levels of observed positive interdependence in intervention schools as compared to control schools at wave 2 ( $B = 0.04, SE = 0.02, p < 0.05, R^2 = 0.10$ ), with observations nested within schools.

**Table 3** Correlations and descriptive data

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Victimization (W1)	–												
2. Victimization (W2)	.60***	–											
3. Victimization (W3)	.47***	.54***	–										
4. Victimization (W4)	.39***	.47***	.52***	–									
5. Stress (W1)	.42***	.36***	.28***	.24***	–								
6. Stress (W2)	.29***	.44***	.31***	.29***	.58***	–							
7. Stress (W3)	.20***	.25***	.43***	.27***	.41***	.51***	–						
8. Stress (W4)	.17***	.21***	.28***	.40***	.35***	.40***	.53***	–					
9. Engagement (W1)	–.12***	–.05	–.10***	–.08*	–.18***	–.11***	–.11***	–.09**	–				
10. Engagement (W4)	–.11***	–.07*	–.14***	–.18***	–.15***	–.15***	–.28***	–.45***	.34***	–			
11. Emotional problems (W1)	.36***	.28**	.22***	.19***	.58***	.45***	.36***	.34***	.01	–.07*	–		
12. Emotional problems (W4)	.16***	.19***	.24***	.37***	.30***	.35***	.45***	.74***	–.01	–.29***	.40***	–	
13. Sex	–.01	.04	.07*	.04	.22***	.21***	.26***	.23***	.13***	.12***	.29***	.23***	–
<i>N</i>	1452	1532	1565	1471	1449	1531	1566	1472	1455	1490	1456	1481	1856
<i>M</i>	.99	1.03	.86	.91	1.97	2.05	12.03	2.03	3.38	2.96	1.79	1.82	.48
<i>SD</i>	1.23	1.26	1.12	1.15	.86	.89	.94	.98	.60	.71	.53	.62	–

Sex coded as female (1) and male (0)

\*  $p < .05$ ; \*\*  $p < .01$ ; \*\*\*  $p < .001$

We fit our cross-lag difference score model to the data and model fit was adequate,  $\chi^2(54) = 337.72, p < 0.001$ ; CFI = 0.97; TLI = 0.95; RMSEA = 0.053 (90% C.I.: 0.047–0.058). The results (presented in Fig. 2) indicated a unidirectional (i.e., one-way) relation between stress and victimization such that stress predicted increased victimization over time ( $\beta = 0.35, 0.42, 0.55$ ; all  $p < 0.001$ ), but victimization did not predict stress ( $\beta = -0.04, -0.04, -0.04$ ; all *ns*) once autoregressive effects were controlled. With regard to autoregressive effects, the results suggest that victimization was very stable over time ( $\beta = -0.72, -0.77, -0.88$ ; all  $p < 0.001$ ), with the negative coefficients implying that high victimization at one time point predicted lower levels of subsequent change. In contrast, stress was not stable ( $\beta = -0.16, -0.17, -0.19$ ; all  $p < 0.01$ ), with current levels of stress being only mildly predictive of subsequent change.

With regard to outcomes, the effect of stress slope on academic engagement ( $\beta = -0.55, p < 0.001$ ) was stronger than the effect of victimization slope on academic engagement ( $\beta = -0.08, ns$ ); a deviance test confirmed that this difference was highly significant,  $\chi^2(1) = 33.63, p < 0.001$ . The effect of stress slope on emotional problems ( $\beta = 0.84, p < 0.001$ ) was also stronger than the effect of victimization slope on emotional problems ( $\beta = 0.32, p < 0.001$ ), and again this difference was highly significant,  $\chi^2(1) = 27.01, p < 0.001$ .

The effect of CL on stress difference scores was significant over time ( $\beta = -0.41, -0.43, -0.46$ ; all  $p < 0.001$ ), as was the effect of CL on victimization difference scores ( $\beta = -0.13, -0.16, -0.19$ ; all  $p < 0.05$ ). A deviance test

indicated that CL had a stronger effect on stress than victimization,  $\chi^2(1) = 17.72, p < 0.001$ . CL also had significant direct effects on mental health ( $\beta = -0.21, p < 0.001$ ) and academic engagement ( $\beta = 0.26, p < 0.001$ ), controlling for baseline levels as well as the effects of victimization and stress.

### Discussion

In this paper, we evaluated a longitudinal process model representing a transactional framework for stress and peer relations where it is theorized that victimization experiences can create significant stress for early adolescents; stress, in turn, can cause adolescents to exhibit certain behavior (e.g., social withdrawal) that may render them vulnerable to further victimization. It was surprising, therefore, that victimization did not predict increased stress in our model. This could have been due to the overall low rates of victimization (see Table 3), or perhaps because, in general, other causes of stress are more potent or impactful in the day-to-day lives of youth. These sources of stress could include, for example, more typical/low intensity slights from peers that do not rise to the level of overt victimization, or concerns related to belonging or acceptance that are unrelated to victimization. Supporting this argument, previous research demonstrated that peer relatedness was a far stronger predictor of stress than victimization (Authors, under review); specifically, peer relatedness reduced stress by a larger amount than stress was

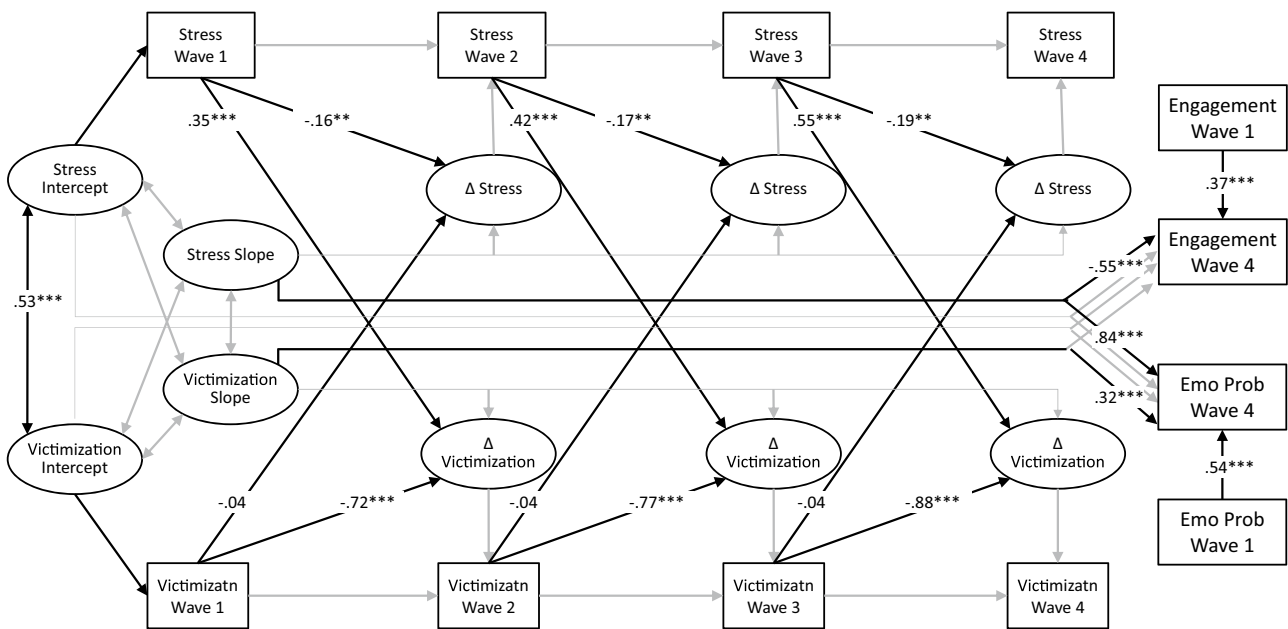


Fig. 2 Fitted model with standardized betas



elevated by victimization. Thus, a lack of peer relatedness could be seen as more harmful to students than overt victimization, which again was relatively rare in our sample.

The key role of stress was also apparent when examining longitudinal effects on key outcomes. Specifically, stress was a stronger predictor of both academic engagement and mental health problems when compared to victimization. This supports the notion that victimization may have been somewhat rare and/or relatively unimpactful as compared to other sources of stress, at least for most students. Indeed, chronically victimized students are estimated to be as little as 10% of the student population (Chester et al., 2015; Sheppard et al., 2019). Although this group of students is undeniably important and deserving of prevention efforts, our results demonstrate that the broader population of students suffers significant negative outcomes due to stress rather than victimization, and this stress seems to arise from mechanisms outside the bounds of overt victimization.

Overall, these results call into question the narrow emphasis on reducing victimization in school-based prevention programs, particularly given the stability in victimization over time. Instead, these results (and those we have reported elsewhere) support the argument that schools may more profitably focus on reducing student stress by improving peer relations. Given that stress was a more powerful predictor of declining engagement and elevated mental health problems, reducing stress could be more impactful to student behavioral and mental health as compared to efforts to reduce the relatively rare phenomenon of victimization.

It should be noted that we are not the first to advocate for a broader focus on peer relations, as opposed to a narrow focus on victimization, in order to maximize the impact of school-based prevention efforts. For example, Dietrich and Cohen (2021) argued that bullying prevention for adolescents should focus more strongly on relationship-building efforts, and Newman et al. (2005) advocated for broad efforts to reduce social isolation rather than an exclusive focus on victimization. In addition, Wang et al. (2013), among others, have proposed enhancing “school climate” as an effective way to reduce bullying, where school climate often refers, at least in part, to the quality of social relationships in school. As with social relationships, school climate has also been linked to key outcomes such as student mental health (Aldridge & McChesney, 2018), emphasizing the congruence between these two areas if research.

To be clear, we do not advocate that schools ignore victimization; rather, reducing victimization can be one outcome of an overall strategy aimed at enhancing peer relations and reducing student stress. As noted above, enhancing peer relations has been found to reduce victimization and stress in previous research (Authors, under review; Van Ryzin et al., 2020b).

## Effects of Cooperative Learning

Our results demonstrate that CL may be uniquely positioned to address student behavioral and mental health in the manner proposed above. The results reported herein include significant salutary effects of CL on all constructs, including victimization, stress, mental health, and academic engagement. Interestingly, the effects of CL on stress in this study were much larger than the effects on victimization, potentially because CL has also been found to have significant positive effects on peer relations ( $\beta=0.46\text{--}0.51$ ;  $p<0.001$ ; Authors, under review). CL has also been found to reduce substance use ( $ES=0.58$  to  $0.60$ ; Van Ryzin & Roseth, 2018b) and promote prosocial behavior ( $ES=0.33$ ; Van Ryzin et al., 2020a) and academic achievement ( $ES=0.46$  to  $0.55$ ; Roseth et al., 2008). These results suggest that incorporating CL can have a wide range of positive effects. This contrasts with existing curriculum-based bullying prevention efforts that are adjunctive (i.e., outside the school curriculum), narrower in their effects, and detract from time spent on academic instruction.

## Future Research Directions

Future research should explore these links in further detail; in particular, future research should seek to replicate our unexpected finding that victimization failed to contribute to change student stress when autoregressive effects were considered. Future research should also verify the key role of stress, as compared to victimization, in predicting student behavioral and mental health. Finally, future research should compare and contrast the effects of CL as compared to existing school-based bullying prevention programs to explore not only differences in the magnitude of effects, but also in the mechanisms of effects.

## Limitations

A few study limitations warrant mention. First, it is based upon a relatively homogeneous sample of rural students that was about three-quarters White, which limits the external validity (generalizability) of the results. With a more diverse sample, it would be possible to evaluate whether CL can encourage greater diversification of social networks in terms of race/ethnicity, which could be very meaningful knowledge for the field. Second, all student measures were self-report, which limits internal validity. Future research should consider additional data sources, such as teachers and/or parents. Third, the reliability of our measure of perceived stress was low at two time points, but we note that this scale performed as it was theoretically expected to, thus reducing concerns about low reliability (i.e., the true signal was sufficient to overcome the noise in our analyses).

Fourth, our limited project budget did not allow for dual ratings of fidelity that would permit the calculation of interrater reliability, particularly given the far-flung nature of the schools in our sample; however, our raters achieved and maintained 100% reliability during the project, which was aided by the simple and straightforward nature of our observational protocol. Finally, the small number of schools in our sample (i.e., 15) limited the complexity of the models that we were able to fit to the data; specifically, we were unable to include random effects. Thus, some instances in which we failed to find significant results (e.g., the effect of victimization on stress) may be due to sample size and modeling limitations.

## Implications for Practice

In this study, we found partial support for a transactional model in which victimization and stress were hypothesized to exert reciprocal effects; specifically, we found that stress predicted greater victimization, but victimization did not predict increased stress. We also found that stress was a more powerful predictor of key outcomes. We hypothesize that other sources of stress besides victimization were more salient, at least to the students in this sample, and, in line with others (Dietrich & Cohen, 2021; Newman et al., 2005; Wang et al., 2013), we advocate that schools focus on improving peer relations as a means to reduce both stress and victimization, which should have salutary effects on student engagement and mental health. Our findings attest that CL is uniquely positioned to support such an effort. Given that it can be used in any subject throughout the school day and school year, and that it can promote positive academic, behavioral, and mental health outcomes simultaneously, these results argue for an increased emphasis on CL as a core instructional strategy, particularly given emerging technological supports for CL (PeerLearning.net).

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## Declarations

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

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