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Costs and benefits of cooperative learning as a universal school-based approach to adolescent substance use prevention

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Abstract

Substance use during early adolescence implies a greater likelihood of abuse and dependence in later adolescence or adulthood. In turn, substance abuse and dependence are linked to a variety of maladaptive long-term health-related outcomes that imply significant individual and societal costs. In this paper, we evaluated an approach to substance use prevention that relies on the vital role of peers, who comprise a key risk factor for adolescent substance use. This approach (i.e., cooperative learning, CL) focuses on interrupting the process of deviant peer clustering and providing at-risk youth with the opportunity to build social skills and cultivate friendships with low-risk youth. In addition to testing the efficacy of CL in reducing the number of students who become regular substance users, we also conducted a cost–benefit analysis. Using four waves of data from a cluster-randomized trial ($N = 15$ middle schools, 1890 students, 47.1% female, 75.2% White, 13.9% of students were receiving special education services), we found that significantly lower percentages of students in the intervention (CL) schools became regular users of tobacco, alcohol, and marijuana. We estimated that the reduction in substance use associated with the implementation of CL resulted in total lifetime benefits of between \$1027 and \$4621 per student (in 2019 dollars), or between \$8.79 and \$39.54 for each dollar invested in CL. Benefit/cost ratios would go up to \$22.54–\$101.39 per dollar invested with the continual implementation of CL, assuming retraining every 5 years. Implications and future research directions are discussed.

KEYWORDS

adolescence, cooperative learning, cost–benefit analysis, substance use

1 | INTRODUCTION

Substance use problems in adulthood often begin in adolescence, particularly early adolescence. Van Ryzin and Dishion (2014) hypothesized that substance use in early adolescence was particularly risky because it provided youth with an entry into a deviant social context that encouraged and reinforced substance use and related delinquent activity, contributing to increased risk of abuse and dependence later in development. Research supports the notion of early adolescence is a time of high risk, finding that substance use during this developmental period implies a greater likelihood of abuse and dependence in later adolescence or adulthood (Hingson & Zha, 2009; Pitkänen et al., 2005; Van Ryzin & Dishion, 2014). For example, alcohol use before age 14 or 15 has been linked to an elevated risk for later alcohol abuse and dependence (Dawson et al., 2008; Hingson et al., 2006); similar results have been found for early tobacco and marijuana use (Behrendt et al., 2009; Vega & Gil, 2005).

Substance abuse and dependence are linked to a variety of maladaptive long-term health-related outcomes such as cirrhosis of the liver, diabetes, and cancer (Goodchild et al., 2018; Rehm et al., 2009), as well as reduced work capacity and increased risk for injury and premature death (Marshall, 2014; World Health Organization, 2014). These outcomes imply significant individual and societal costs, including: (a) medical costs associated with the treatment of substance use disorders and other substance abuse-related diseases; (b) lost earnings due to substance abuse-related illness and premature mortality; and (c) indirect costs including property loss/damage (e.g., accidents, fires), costs of second-hand effects (e.g., fetal alcohol syndrome, second-hand smoke, the burden of victims, and caregivers), and other nonmedical costs such as crime, violence, child neglect, and the associated costs of policing, corrections, and incarcerations (Caulkins et al., 2014). These costs underline the necessity of developing effective universal substance use prevention programs that target early adolescence.

1.1 | Current approaches to prevention

Current school-based prevention programs deliver external curricula that aim to enhance adolescent knowledge of the dangers of substance use and/or enhance resistance skills. Research finds that these programs have some success in reducing adolescent substance use (Botvin et al., 1990; Rohrbach et al., 2010; Weser et al., 2020), but meta-analyses report that effect sizes are generally small or, in some cases, nonexistent (Carney & Myers, 2012; Hodder et al., 2017; MacArthur et al., 2016; Mason et al., 2015; Sandler et al., 2014). Other substance use prevention approaches attempt to target peer influence processes by involving peer leaders to spearhead prevention efforts (Black et al., 1998; Tobler et al., 2000), but the best methods for identifying, recruiting, and retaining peer leaders are not clear (Valente & Pumpuang, 2007). In addition, some studies have found that using peer leaders can have "iatrogenic" effects, where programs create an increase in substance use (Dishion & Dodge, 2005; Dodge et al., 2006; Valente et al., 2007).

1.2 | A new approach to substance use prevention

In this paper, we are testing a new approach to substance use prevention that relies on the vital role of peers, who comprise a key risk factor for adolescent substance use (Haynie & Osgood, 2005; Van Ryzin et al., 2012). Peer influence increases significantly beginning in early adolescence when the need for belonging and acceptance among peers becomes paramount (Steinberg & Morris, 2001). Unfortunately, some youth at this age are rejected by peers due to a lack of social skills and/or maladaptive social behavior. Rejected youth can self-aggregate and adopt antisocial behavioral norms (i.e., "deviant peer clustering"; Dishion et al., 1991). In these groups, delinquent behavior like substance use is reinforced through peer pressure, modeling, facilitation, and expressions of approval (i.e., "deviancy training"; Granic & Dishion, 2003; Van Ryzin & Dishion, 2013). Indeed, deviant peer clustering has been identified as a consistent risk factor for substance use throughout adolescence and into early adulthood (Van Ryzin et al., 2012). Early adolescents are particularly vulnerable to this sort of peer influence (Kelly et al., 2012; Steinberg & Monahan, 2007), again highlighting early adolescence as a key period of risk for negative long-term substance-related outcomes and a key window of opportunity for prevention efforts.

Our approach focuses on interrupting this process of deviant peer clustering and providing at-risk youth with the opportunity to build social skills and cultivate friendships with low-risk youth. Such friendships can confer a degree of protection (Ennett et al., 2006) by providing a context in which prosocial behavior, rather than antisocial behavior, can be supported and reinforced (Gest et al., 2011).

To promote the development of social skills and strengthen social relationships among a wide range of youth, we have implemented *cooperative learning* (CL), a small-group instructional technique that can be applied to any subject at any grade level. CL establishes a positive social context that reduces biases and prejudices among students who belong to different social groups (Pettigrew, 1998; Pettigrew & Tropp, 2008) and promotes the development of positive peer relationships (Roseth et al., 2008). CL calls for a series of design dimensions (see Johnson et al., 2008) for learning activities that, when implemented correctly, provide opportunities for social interaction where positive behavior is explicitly scaffolded and recognized. Thus, instead of competing with or ignoring one another, students in CL groups are more likely to promote the success of one another through instrumental and emotional support; these positive social interactions, in turn, encourage greater social acceptance and more positive relationships among students, in addition to promoting academic motivation and achievement (Johnson & Johnson, 1989, 2005; Roseth et al., 2008).

By creating positive social interactions among youth with different levels of risk and belonging to different social groups, and by fostering a social context where prosocial (rather than antisocial) behavior is explicitly rewarded by teachers and peers, CL can reduce deviant peer clustering among at-risk youth and provide opportunities for them to develop positive social relationships with prosocial peers. Research from a recent cluster-randomized trial of CL found that students in intervention schools reported significantly lower rates of substance use compared to students in control schools (*Effect Size* = 0.58–0.60; Van Ryzin & Roseth, 2018a), and later analysis found that these effects were mediated by deviant peer processes (Van Ryzin & Roseth, 2019).

1.3 | Current study

In this study, we wished to evaluate both the efficacy and the costs and benefits of CL as a universal school-based substance use prevention program. Initially, we quantified the number of students who avoided regular use of tobacco, alcohol, and marijuana in middle school and, as a consequence, faced a lower risk of later substance abuse, dependence, and related negative outcomes. Using these data, we evaluated whether there was a significant difference between the intervention and control schools in the number of youth who avoided regular substance use (each substance was evaluated independently). If a significant difference existed, we then calculated the benefits implied by this reduction in substance use risk, as well as the costs for CL as it was implemented in our study.

2 | METHODS

2.1 | Sample

The sample was derived from a small‐scale randomized trial of CL in 15 middle schools in the Pacific Northwest. Schools were matched based upon demographics (i.e., size, ethnicity, free/reduced lunch percentage) and randomized to condition (i.e., intervention vs. waitlist control). We were concerned about the likelihood of losing schools assigned as controls, so we randomized an extra school to this condition (i.e., eight control vs. seven in the intervention condition).

Our sample included $N = 1890$ students who participated in the project during the 2016–2017 or 2017–2018 school years. All students were in seventh grade during the first year of the project and in eighth grade during the second year. Any student who participated in at least one wave of data collection was included in the sample. The sample was 47.1% female ($N = 890$) and 75.2% White ($N = 1421$). Other racial/ethnic groups included Hispanic/Latino (13.2%, $N = 249$), multiracial (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 the school are provided in Table 1, and 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.

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

School	Intervention	*N*	% Female	% White	% Special Ed	% FRPL[a]
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

Note: One school did not provide special education status.

Abbreviation: n/a, not applicable.

[a]State records.

TABLE 2 New enrollment data (number of students) by wave and intervention condition

Wave	New enrollment		Lost to follow-up[a]	
	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

[a]Students do not appear in any subsequent waves.

2.2 | Procedure

Training in CL for teachers at intervention schools began in the fall of 2016 and continued through the 2016–2017 school year, consisting of three half-day in-person sessions, periodic check-ins via videoconference, and access to resources (e.g., newsletters). The three in-person training sessions per school were conducted in (1) late September and early October, (2) late October through early December, and (3) late January through late March. We also conducted a 1-day administrator training during the summer of 2017, and a half-day follow-up teacher training in the second year. Due to the geographic dispersal of the schools, each school received training according to its own schedule for professional development. Training sessions were conducted by D. W. Johnson and R. T. Johnson and utilized *Cooperation in the Classroom, 8th edition* by Johnson et al. (2008); each staff member received a copy of the book. The Johnson et al. (2008) approach to CL emphasizes the structuring of positive interdependence and individual accountability, as well as explicit coaching in collaborative social skills, a high degree of interpersonal interaction, and guided post-lesson processing of group performance. CL is viewed as a conceptual framework within which teachers can apply the basic concepts to design their own group-based activities using existing curricula.

The teacher training was experiential as well as informational, with teachers actively involved in their own learning through the use of CL techniques to deliver the training. In this way, teachers developed not only an understanding of the key design dimensions of CL but also experienced these lessons from the student perspective, which enabled them to develop an appreciation for the active, student-centered, yet structured nature of CL, and how this contributes to positive social and academic outcomes simultaneously (Roseth et al., 2008).

As part of the training, teachers were asked to bring existing curricular materials, which they adapted to be delivered using CL. For example, a 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 a jigsaw, the lesson material is divided into two to four independent topics, and each student in a jigsaw group is responsible for learning one topic in the company of other students who are assigned the same topic. Subsequently, students teach what they know to other students in a jigsaw group. As each student in a jigsaw group presents their topic, students in the jigsaw group are exposed to all the lesson material. Other lesson examples include peer tutoring and group-based activities or projects where each student in the group has an explicit role or task to complete that contributes to group success.

2.3 | Measures

Student data collection was conducted in September/October and March/April of the 2016–2017 and 2017–2018 school years (four waves in total, about 6 months apart) using online surveys (i.e., Qualtrics; https://www.qualtrics.com/). To assess the fidelity of implementation, we also conducted teacher observations. We implemented a passive consent process for students and an active consent for teachers. All procedures were approved by the relevant Institutional Review Board.

2.3.1 | Substance use

Students reported their use of tobacco, alcohol, and marijuana in the last month using the following scale: *no use* = 1, *occasionally (1–3 times)* = 2, *fairly often (4–6 times)* = 3, *regularly (7–9 times)* = 4, and *all the time (10+ times)* = 5. At each time point, we converted these data into a dichotomous indicator of whether the student reported *none* (0) or *some* (1) use of tobacco, alcohol, and marijuana, with *some* use comprising any value other than *no use*. We also evaluated these data longitudinally and classified each student as reporting *none* (0) or *some* (1) use of tobacco, alcohol, and marijuana during the entirety of the project; a student was classified as *none* if they reported *No use* at each time point, and otherwise were classified as reporting *some* use at some point during the project.

2.3.2 | Intervention fidelity

Research staff blind to intervention assignment observed teaching practices in both intervention and control schools. Using an established observation protocol to capture the existence of key aspects of CL in a lesson (e.g., positive interdependence; Krol et al., 2008; Veenman et al., 2002), observers were trained to 100% reliability using simulated data before they conducted observations in actual classrooms. Observations were conducted once in the late fall/early winter and again in the spring of the first year. Teachers were not informed in advance of the presence of observers, ensuring unbiased observations. Where possible (i.e., in smaller schools), observers visited every classroom in the school during their visit, which lasted a single day; when this was not possible (i.e., in larger schools), classrooms were selected at random. Observers remained in a classroom for an entire class period.

2.4 | Analysis plan

As described above, we initially classified students as reporting either *none* or *some* substance use at each time point and across the entire project. We then conducted χ^2 analyses to evaluate whether there were systematic differences in the relative size of these groups in intervention and control schools. We conducted analyses separately for each time point and for each substance (tobacco, alcohol, and marijuana), as well as a comprehensive analysis for each substance across all four-time points using the comprehensive measure of use described above (i.e., whether the student reported any use at any time point). Given the number of tests, we set the threshold of statistical significance to be $p = 0.001$.

3 | RESULTS

Descriptive data and correlations for all variables are presented in Table 3. Substance use at each time point was highly correlated, as expected given prior research (Mason et al., 2020). Use of all substances increased over time, as seen by the increase in variable means.

We first compared tobacco use in the intervention schools (i.e., CL) and control (i.e., business-as-usual) schools in terms of the number of students reporting *some* versus *none*. We found that group differences were not significant at baseline (Fall of seventh grade), but became significant starting in the Spring of seventh grade and continued to be significant thereafter (see Table 4, tobacco use). The percentage of students reporting tobacco use

TABLE 3 Correlations and descriptive data (dichotomized variables)

Variable	1	2	3	4	5	6	7	8	9	10	11	12
1. Tobacco use (W1)	—											
2. Tobacco use (W2)	0.31***	—										
3. Tobacco use (W3)	0.23***	0.20***	—									
4. Tobacco use (W4)	0.11***	0.15***	0.32***	—								
5. Alcohol use (W1)	0.54***	0.26***	0.16***	0.13***	—							
6. Alcohol use (W2)	0.25***	0.70***	0.21***	0.18***	0.32***	—						
7. Alcohol use (W3)	0.19***	0.18***	0.73***	0.29***	0.17***	0.28***	—					
8. Alcohol use (W4)	0.04	0.14***	0.26***	0.69***	0.10**	0.20***	0.33***	—				
9. Marijuana use (W1)	0.54***	0.32***	0.20***	0.17***	0.50***	0.31***	0.19***	0.14***	—			
10. Marijuana use (W2)	0.28***	0.74***	0.22***	0.21***	0.29***	0.66***	0.19***	0.18***	0.45***	—		
11. Marijuana use (W3)	0.22***	0.19***	0.74***	0.29***	0.19***	0.22***	0.69***	0.29***	0.28***	0.29***	—	
12. Marijuana use (W4)	0.16***	0.19***	0.29***	0.71***	0.13***	0.20***	0.28***	0.70***	0.22***	0.30***	0.38***	—
N	1453	1534	1569	1481	1453	1534	1569	1481	1453	1534	1570	1480
M	0.03	0.07	0.13	0.16	0.04	0.10	0.16	0.21	0.04	0.10	0.15	0.19
SD	0.17	0.26	0.33	0.37	0.20	0.30	0.37	0.41	0.20	0.29	0.35	0.39

**$p < 0.01$.

***$p < 0.001$.

TABLE 4 χ^2 results by wave and overall

Wave	Tobacco	Alcohol	Marijuana
1	χ^2 (1) = 0.91, ns	χ^2 (1) = 3.26, ns	χ^2 (1) = 0.96, ns
2	χ^2 (1) = 22.53, $p < 0.001$	χ^2 (1) = 24.86, $p < 0.001$	χ^2 (1) = 17.91, $p < 0.001$
3	χ^2 (1) = 52.34, $p < 0.001$	χ^2 (1) = 35.19, $p < 0.001$	χ^2 (1) = 44.13, $p < 0.001$
4	χ^2 (1) = 45.56, $p < 0.001$	χ^2 (1) = 34.93, $p < 0.001$	χ^2 (1) = 47.42, $p < 0.001$
Overall	χ^2 (1) = 88.94, $p < 0.001$	χ^2 (1) = 66.07, $p < 0.001$	χ^2 (1) = 71.20, $p < 0.001$

Abbreviation: ns, not significant.

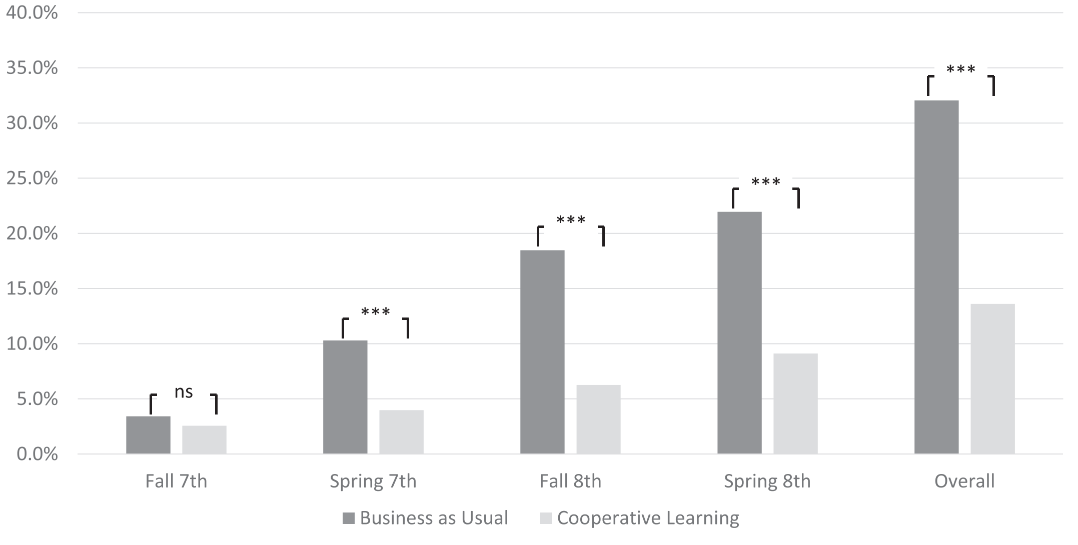

FIGURE 1 Percentage of students engaging in any tobacco use. ns, not significant.

climbed steadily over time in control schools but remained significantly lower in intervention schools (see Figure 1). The percentage of students reporting any tobacco use at any point during the course of the project was also significantly higher in control than in intervention schools (see Table 4 and Figure 1).

We then compared alcohol use in the intervention schools and control schools. As with tobacco use, we found that group differences were not significant at baseline (Fall of seventh grade), but became significant starting in the Spring of seventh grade and continued to be significant thereafter (see Table 4, alcohol use). The percentage of students reporting alcohol use climbed steadily over time in control schools but remained significantly lower in intervention schools (see Figure 2). The percentage of students reporting any alcohol use during the course of the project was also significantly higher in control than in intervention schools (see Table 4 and Figure 2).

Finally, we compared marijuana use in the intervention schools and control schools. As with tobacco and alcohol use, we found that group differences were not significant at baseline (Fall of seventh grade), but became significant starting in the Spring of seventh grade and continued to be significant thereafter (see Table 4, marijuana use). The percentage of students reporting marijuana use climbed steadily over time in control schools but remained significantly lower in intervention schools (see Figure 3). The percentage of students reporting any marijuana use during the course of the project was also significantly higher in control than in intervention schools (see Table 4 and Figure 3).

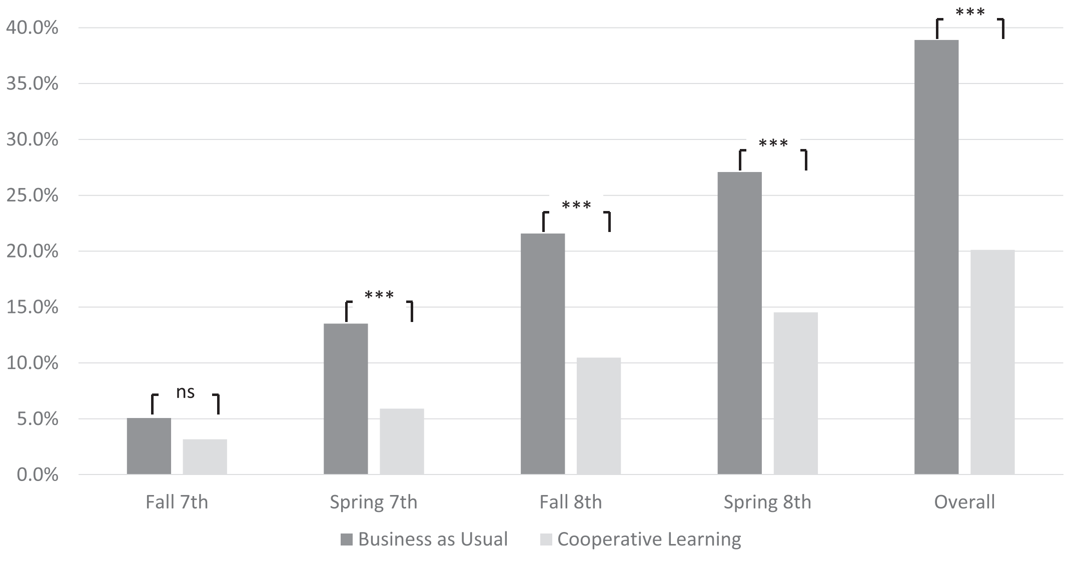

FIGURE 2 Percentage of students engaging in any alcohol use. ns, not significant.

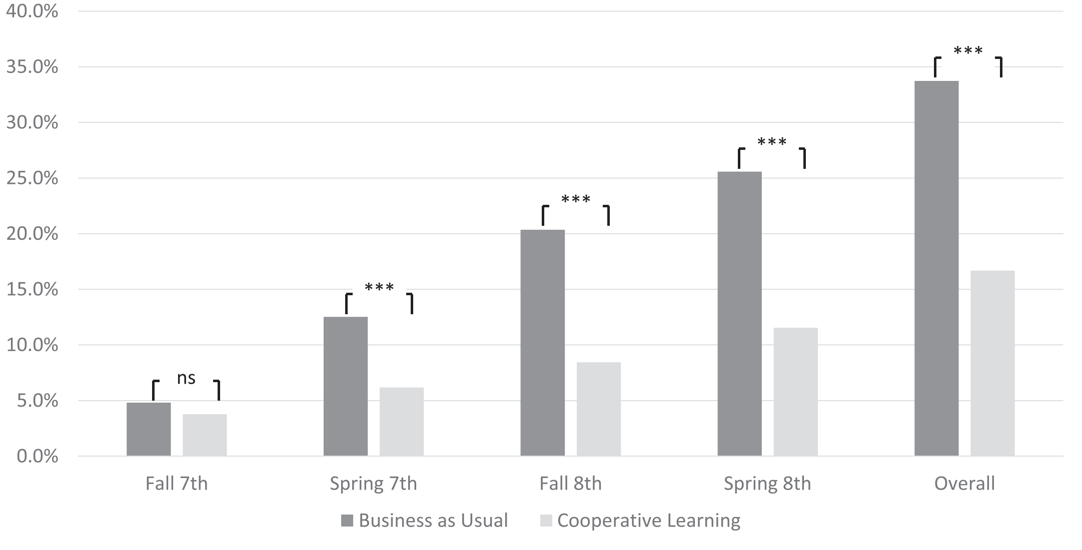

FIGURE 3 Percentage of students engaging in any marijuana use. ns, not significant.

Given these significant results, we then conducted cost–benefit analysis of CL for tobacco, alcohol, and marijuana use prevention. We calculated the costs of the implementation of CL using the ingredients method (Levin et al., 2017), including the costs associated with all resources required to implement CL above and beyond the resources used in control schools. These included costs related to teacher and administrator training (e.g., training material, trainer travel expenses, trainer and school staff time spent in training, and facility use for training sessions) as well as teacher preparation time for the creation of CL lessons. We estimated that the cost of implementing CL was $116.34 per student in 2019 dollars (see Table 5).

TABLE 5 List of cost items (resources needed above and beyond the business-as-usual resource use) and the associated quantities, prices, and total costs

	Items	Quantity	Unit costs	Total cost[a]
Teacher training	Manual	1 per teacher	$35	$4025
	Trainer fee	1 per session per school	$1000	$27,796
	Travel	1 per session per school	$1000	$27,796
	Teacher time	3.5 h/session × 4 sessions	$63.41/h[b]	$101,347
	Facility	900 sq ft school space for 14 h	$13.13/h[c]	$1277
Administrator training	Trainer fee	1 per school	$2000	$14,000
	Travel	1 per school	$1000	$7000
	Admin time	7 person-hours	$102.70/h[d]	$5032
	Facility	900 sq ft school space for 7 h	$13.13/h[c]	$643
Delivery	Prep time	0.75 person-hours/lesson × 12 lessons	$63.41/h[b]	$65,629
Total cost (1 year)				$254,546
Total cost per student[e]				$116.34
Total cost per year for 5-year implementation[f]				$99,699
Total cost per student per year[e,f]				$45.57

[a]Total costs were calculated for the seven middle schools in the study with 115 teachers in total. The costs associated with the teacher training in the second year are adjusted for inflation at a 3% rate.

[b]$42.23 in wages + $21.18 in benefits. $42.23/h in wages corresponds to an annual wage of $60,810, which is the median annual middle school teacher salary in 2020 (Bureau of Labor Statistics, 2022a). Benefits represent 33.4% of total compensation in 2020 (Bureau of Labor Statistics, 2020). The annual wage was converted into an hourly rate assuming 1440 work hours per year.

[c]Following the approach outlined in Levin et al. (2017), we used the median construction costs of a middle school building in 2020 dollars uprated by 21% to include furniture, furnishing, fees, and site preparation and annualized over 30 years using the conventional 3% interest rate to obtain the cost per square foot per year. The estimated median construction cost of an average-sized middle school building (117,000 sqft) was from *CostOut*, the Center for Benefit–Cost Studies of Education Cost Tool Kit (Hollands et al., 2015). The annual use wa s assumed to be 1440 h per year, and the size of the space needed for training was assumed to be 900 sq ft.

[d]$68.40 in wages + $34.30 in benefits. $68.40/h in wages corresponds to an annual wage of $98,490, which is the median annual public school principal salary in 2020 (Bureau of Labor Statistics, 2022b). Benefits represent 33.4% of total compensation in 2020 (Bureau of Labor Statistics, 2020). The annual wage was converted into an hourly rate assuming 1440 work hours per year.

[e]Per-student costs were calculated by dividing the total costs by 2188, the total number of students in all participating schools.

[f]Per-year costs are calculated assuming a 5-year life for the program by adding the first-year costs to discounted delivery costs over the next 4 years with a conservative 3% discount rate.

We note that the costs associated with training were startup costs incurred only at the adoption of the program. We also note that schools can continue using CL for many years incurring only the costs associated with maintenance beyond the first year, which includes the cost of teachers' preparation time to create CL lessons and any additional training for new teachers who were not involved in the original training. With that in mind, we also calculated the per-year cost of CL implementation with a 5-year life by adding the startup training costs to discounted maintenance costs over the next 4 years and distributing these costs over 5 years. We used a conservative 3% discount rate, which is at the lower end of the range of discount rates traditionally used in cost analysis studies (3%–7%) and generates a relatively higher estimate of future costs. We estimated that the cost of implementing CL in this 5-year implementation scenario would be $45.57 per student per year.

We then estimated the potential benefits of CL in terms of cost savings associated with the prevention of substance use. We used the methods described in Caulkins et al. (2002), which provide a detailed outline of benefit calculations and estimates of key parameters to be used in benefit–cost evaluations of school-based substance use prevention programs. The social cost estimates included direct medical costs associated with substance-related diseases, lost earnings due to substance-related diseases, lost future earnings due to premature mortality, and crime costs for alcohol and other drugs. They did not include costs associated with lost earnings from impaired productivity due to alcohol and other substances, the costs of second-hand smoke, and nonmedical costs (e.g., fires) associated with smoking. The method we followed involved multiplying together factors including the average discounted amount of lifetime substance consumption, the percentage reduction in lifetime consumption associated with the implementation of CL, and the discounted social cost per unit of substance consumed. The predicted percentage reduction in lifetime consumption associated with CL combined the estimated effect sizes for CL in terms of percentage reduction in substance use in the short term (discussed above) with a predicted reduction in lifetime use. We included potential benefits associated with preventing alcohol, tobacco, and marijuana use using the parameters and the estimates of social costs provided in Caulkins et al. (2002) for each substance, but we did not include any potential benefits associated with prevented use of other illicit drugs (e.g., cocaine).

Using the worst- and best-case scenarios described in Caulkins et al. (2002), we estimated that the reduction in tobacco, alcohol, and marijuana use in middle school associated with the implementation of CL resulted in total lifetime benefits between $1027 and $4621 per student (in 2019 dollars). Using the cost figures provided above, this implies a benefit of between $8.79 and $39.54 for each dollar invested in CL. We note that the benefit/cost ratios would go up to $22.54–$101.39 per dollar invested with the continual implementation of CL, assuming retraining every 5 years.

4 | DISCUSSION

We found that CL was able to significantly reduce the number of middle school students who were substance users in early adolescence, thus presumably reducing risk for the negative long-term outcomes associated with early use. We found significantly lower rates of use for all three substances (tobacco, alcohol, and marijuana) at every time point after the baseline measure, and found similar results when considering substance use across the entirety of the project (i.e., all four waves simulatenously).

We subsequently calculated the costs for implementing CL as well as the potential benefits implied by these significant group differences. Our estimates revealed that each dollar invested in CL generated between $8.79 and $39.54 in benefits associated with reductions in alcohol, tobacco, and marijuana use. We found that the cost savings in continual implementation with periodic retraining every 5 years would increase the return on investment substantially to $22.54–$101.39 per dollar invested. Overall, these results reinforce earlier findings that access to more positive, prosocial influences during CL lessons can reduce substance use risk (Van Ryzin & Roseth, 2018a, 2019), and further demonstrate that this reduction in risk implies significant cost savings.

These benefit–cost ratio estimates for CL are somewhat higher than the benefit–cost ratios estimated for other school-based substance use prevention programs. For example, Kuklinski et al. (2015) estimated $9.33 (in 2019 dollars) benefits in prevented delinquency and alcohol and tobacco use per dollar invested in the Communities that Care prevention system. Klappa et al. (2017) estimated a $15.25 per dollar (in 2019 dollars) benefit–cost ratio for preventing drug use associated with a Social-Emotional Learning intervention in Sweden. These discrepancies may be due to the flexible nature of CL, which can be implemented in any subject at any time during the school year, rather than being confined to a more proscribed implementation, as is the case for curriculum-based prevention programs. In short, CL may support higher dosage than other programs and thus realize greater benefits.

This study is limited in several key ways. First, it is based upon a relatively homogeneous sample that was about three-quarters White, which limits the generalizability of the results. Future research should explore similar research questions in more diverse urban populations. Second, all measures were self-report, which limits internal validity. Future research should consider additional data sources, such as teachers and/or parents. Finally, our cost–benefit analysis is intended for providing a crude estimate of the return on investment in CL implementation. We rely on the well-established and widely used methods in our cost–benefit analysis, and rely on rigorously calculated parameters in existing literature for our benefit estimates. However, these parameters do not reflect the latest trends in substance use prevalence in the U.S. It is possible that our benefit calculations over-estimate tobacco-related benefits and under-estimate marijuana-related benefits given the recent changes in the prevalence of these substances. Also, our benefit estimates do not include potential benefits associated with reductions in other substance use. In the continual implementation scenario, we assume the same effect size and same costs over a 5-year period. We acknowledge that there may be some fading of effectiveness within the 5-year period between trainings and cost reductions associated with efficiency gains resulting from learning by doing, and the net effect of these factors is not clear. Finally, we note that our benefit-cost ratio estimates are limited to the study sample and may not hold for larger-scale implementation of CL in which there would likely be economies of scale and reduced costs while there may be an offsetting degradation in effect sizes.

5 | CONCLUSION

These findings suggest that cooperative learning (CL) represents a highly cost-effective substance use prevention program, at least for middle schools. Future research should explore the effects of CL on substance use and other health-related behavior in high school populations.

Given that a variety of delinquent behaviors have been linked to deviant peer clustering (Dishion & Tipsord, 2011), CL may have wide-ranging positive effects, and in fact has been found to reduce bullying, victimization, stress, and mental health problems in previous research with middle school populations (Van Ryzin & Roseth, 2018b, 2021). Future research should incorporate these effects into cost–benefit analyses and explore effects at the high school level.

Due to its established ability to enhance academic achievement (Ginsburg-Block et al., 2006; Roseth et al., 2008) and the potential for very high dosage as discussed above, CL can be seen as having a significant advantage over existing middle-school prevention approaches. Combined with its flexibility and straightforward implementation via emerging tools such as PeerLearning.net (www.PeerLearning.net), our hope is that the results reported here can contribute to increased interest in CL as a means to support positive academic, social, and behavioral outcomes simultaneously.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

DATA AVAILABILITY STATEMENT

Research data are not shared.

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