

Full Length Research Paper

Grit, growth mindset and participation in competitive policy debate: Evidence from the Chicago Debate League

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Non-cognitive skills (NCS) contribute to variation in how students respond to challenges inside the classroom and beyond. Competitive policy debate is a co-curricular activity that both encourages cooperative learning and is hypothesized to promote NCS. The goal of this pilot was to examine the relationship between debate participation and change in four NCS among high school students over the course of an academic year. Two surveys (Fall and Spring) were administered during the 2017/18 academic year to students who participated in the Chicago Debate League (n=102). Surveys assessed demographic factors, characteristics of debate participation, and four indicators of NCS each measured using established scales: Growth mindset, grit, mood, and civic engagement. Paired t-tests were used to quantify change in NCS over time. Linear regression was used to assess the relationship between characteristics of debate participation and change in NCS. In the Fall, median length of debate participation was 6.2 months. Average age was 16, most (82%) participants were non-White and 52% were female. Over the academic year, growth mindset increased ($\Delta=0.29$ (95% Confidence Interval (CI): 0.10, 0.48) while grit declined ($\Delta= -0.17$, 95% CI: -0.34, -0.01). Civic engagement and mood were unchanged. Duration of participation was associated with increased change in grit ($\beta=0.04$, $p\leq 0.01$), but was unrelated to the other NCS. Motivation for joining debate did not explain variation in any NCS. Debate participation is associated with improvement in some NCS. Findings have implications for scalable interventions to promote NCS in the context of cooperative learning.

Key words: Cooperative learning, grit, growth mindset, motivation, urban debate.

INTRODUCTION

Empirical research increasingly demonstrates that variation in educational achievement, particularly in the context of social disadvantage, is not fully, or even primarily, explained by intrinsic cognitive ability. Instead, high achieving individuals are distinguished by their “non-

cognitive skills” (NCS): beliefs, attitudes, and motivation toward learning that help them persevere and grow from challenges (Guez et al., 2018; Kornilova et al., 2009; Blackwell et al., 2007; Culin et al., 2014; Duckworth et al., 2007; Johnson et al., 2017; MacNamara and Collins, 2010;

Stokas, 2015). Supported by evidence from neuroscience that the human brain remains malleable well into adulthood (Fuchs and Gould, 2000), NCS encompass beliefs that human capacities for learning are fluid and extend across lifespan. These constructs have caught the attention of education researchers, policymakers and practitioners alike as potential modifiable determinants of student achievement.

One core NCS is the construct of “growth mindset.” As articulated by psychologist Carol Dweck, who coined the term, growth mindset captures a belief that intelligence evolves from experience and develops throughout life; it stands in contrast to the conceptualization that intelligence is a fixed trait (Dweck and Leggett, 1988; Blackwell et al., 2007; Dweck, 2008). In the context of educational achievement, learners with a growth mindset believe that their cognitive capacities change in response to adequate effort and training, which helps cultivate motivation for learning, approach-oriented coping with setbacks, and a willingness to follow through on long-term goals. In research, surveys that aim to measure this construct ask students to rate their level of agreement with statements such as “*I am not good at math*” and “*I can be successful in learning mathematics, even if I have had trouble with it in the past*” as an indicator of fixed and growth mindset, respectively. More broadly, people with a growth mindset tend to seek out challenges and develop a sense of self-efficacy and robust ability for emotional regulation in response to hardships (Dweck et al., 2014; Jamieson et al., 2018; Yeager et al., 2016).

Another core NCS construct is “grit,” which describes the tendency to persevere and sustain long-term motivation toward a goal (Duckworth et al., 2007). This concept seeks to capture the notion of a trade-off between short-term challenges for long-term achievements. For example, high grit predicts retention of cadets following intense summer training sessions at West Point (Blackwell et al., 2007; Duckworth et al., 2007; Kelly et al., 2014). Some research indicates that, compared to IQ, grit is a stronger predictor of grade point average (GPA) among undergraduate students at elite institutions; however, IQ is a stronger predictor of performance on college entrance exams (e.g., SAT, ACT) relative to grit (Blackwell et al., 2007). This difference is thought to reflect the notion that grit influences cumulative effort over long periods of time (e.g., GPA over many semesters), rather than ability to perform at a single evaluation (e.g., taking the SAT). Additional studies of undergraduate students have extended this notion by showing that grit is associated with a range of outcomes indicative of long-term commitment: higher academic achievement, self-regulated learning, and

overall satisfaction (Bowman et al., 2015; Hodge et al., 2018; Wolters and Hussain, 2015). While grit has utility as a NCS, this concept has come under notable criticism for focusing on individual responsibility versus the context of learning, which de-emphasizes the role of structural inequalities in educational opportunities and achievement (Kirchgasler, 2018).

For education researchers and practitioners, growth mindset and grit are conceptualized as modifiable determinants of achievement (Brady et al., 2017; Damgaard and Nielsen, 2018; Wilson and Buttrick, 2016). These NCS represent strategies that can be developed through practice and sustained effort, akin to muscular strength that can grow from training, but also atrophy from lack of use. This notion is especially important in the context of disadvantage (Spitzer and Aronson, 2015); racial/ethnic minorities, students with disabilities, and individuals from low socioeconomic backgrounds are more likely to endorse beliefs consistent with a fixed mindset, which may contribute to lower achievement for these groups (Good et al., 2003; Jury et al., 2017; Martin, 2013; Master and Meltzoff, 2016; Scherr et al., 2017).

Interventions designed to foster growth mindset and grit have had moderate success at improving achievement among disadvantaged students in the US and elsewhere (Andersen and Nielsen, 2016; Aronson et al., 2002; Ballen et al., 2017; Claro et al., 2016; Conn, 2017; Goyer et al., 2017; Yeager et al., 2016). Despite these encouraging results, the question remains: how could a school system cultivate grit and growth mindset within educational settings and in a scalable manner? Many existing strategies take an explicitly individualistic approach that highlights the importance of NCS for personal achievement, while teaching students effective study skills and coping strategies (Blackwell et al., 2007; Wilkins, 2014). Other efforts have a more structural focus that target school culture as a whole. These efforts promote social and emotional learning by empowering teachers and school leaders, encouraging them to use growth-oriented vocabulary when working with their students’ failures and mistakes, and creating contextual opportunities that would challenge students to grow in safe environments (Bashant, 2014; Hoerr, 2013; Lou and Noels, 2016; Integrating Social, Emotional, and Academic Development, 2019). Such efforts are multifactorial and represent an essential step toward creating a substantial shift in redefining the purpose and value of public school education in the US.

One potential avenue for promoting NCS that has not received much attention is through *cooperative learning* (Ashman and Gillies, 2003; Johnson and Johnson, 2002). Cooperative learning reflects the notion that schooling

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naturally occurs within a social dimension via a dynamic interplay between individual accountability and group interdependence (Johnson, 2003). It offers a framework for tying NCS to educational achievement via joint problem-solving, providing and receiving peer instruction, and engaging in active learning (Laurian-Fitzgerald and Fitzgerald, 2016). Cooperative learning has been effectively implemented in different learning environments (e.g., K-12 and college) and with a wide range of groups (e.g., intellectually gifted students, racial/ethnic minority students, students with disabilities) (Capar and Tarim, 2015; Kyndt et al., 2013; Neber et al., 2001; Slavin, 1985, 1996; Stevens and Slavin, 1995; Xu and Wen, 2018). Additionally, it has been suggested that when implemented successfully, cooperative learning environments facilitate complete immersion in tasks, sometimes described as creative states of “flow” and high productivity (Nakamura and Csikszentmihalyi, 2002; Shernoff et al., 2014). A growing body of empirical studies indicates that students working toward a communal goal in a group (e.g., solving a complex task, recollecting information, or playing an interactive computer game) perform, on average, better than students working on those same tasks in pursuit of an individual goal (Boykin et al., 2004; Gemechu and Abebe, 2017; Ladley et al., 2015; Premo et al., 2018; Schultze et al., 2012). Cooperative learning environments (e.g., mixed or flipped classrooms), where students watch lectures beforehand and then apply that knowledge in the classroom via groupwork, accelerate learning and improve academic performance, especially among struggling students (Zamani, 2016). Overall, interventions that enhance both NCS and cooperation appear to be more effective in boosting achievement than those lacking a cooperative element (Foldnes, 2016; Kramarski and Mevarech, 2003; Slavin, 2014).

Building on research suggesting that NCS are important determinants of academic achievement, and the notion that cooperative learning modalities provide an effective way of engaging with these types of skills, this study explores whether an existing co-curricular activity, competitive policy debate, offers a scalable means to promote NCS in an urban school setting. In competitive policy debate, students work in teams of two and compete as a unit at afterschool and weekend tournaments: that is, the pair wins (or loses) together. Evidence from both qualitative and quantitative studies show that debate participation teaches both critical thinking cognitive skills and potentially NCS (Cridland-Hughes, 2012; Davis et al., 2016; Fine, 2010). Moreover, debate participation has been positively associated with positive achievement outcomes including likelihood of graduating high school, performance on college entrance exams, logical reasoning and literacy, and civic engagement and advocacy (Anderson and Mezuk, 2012; Mezuk, 2009; Mezuk et al., 2011; Mirra et al., 2016). Debate clubs are offered in middle and high

schools, including in lower-resource urban districts like Chicago Public Schools. Finally, there are efforts to support “debate across the curriculum,” being a central component of all subjects in school (Bellon, 2000; Merrell et al., 2017; Zorwick and Wade, 2016). If the hypothesized relationship between debate and NCS is supported, this co-curricular activity may thus provide a scalable way to promote these skills, including in lower-resource, urban school districts.

In this study, we investigated how competitive debate relates to NCS in a sample of students who participated in the Chicago Debate League (CDL). We hypothesized that over the course of a school year, active participation in debate would be positively correlated with three NCS—grit, growth mindset, and a greater tendency toward civic engagement. As a negative control, we examined mood, which we hypothesized would not be related to debate participation. We also hypothesized that motivation for joining the debate team would impact these relationships, such that students who joined the activity primarily for extrinsic reasons would experience more gains in NCS than those who joined for intrinsic reasons. We contextualize these findings within the broader discussion of promoting NCS and student achievement both within and outside the classroom.

MATERIALS AND METHODS

Participants and setting

Data collection took place over the 2017-2018 school year in Chicago Public Schools (CPS). During the study period, the CPS district served approximately 107,352 students in grades nine to twelve, of which 41,099 (38%) were African American, 50,688 (47%) were Hispanic or Latino students, 9,215 (8.6%) were non-Hispanic White, 4,262 (4%) were Asian, and 2,088 (2%) represented other minority backgrounds. Around 88,844 (83%) of all the CPS students in high school qualified for a free or reduced lunch (Chicago Public Schools, n.d.).

The CDL has worked in partnership with CPS to provide policy debate programming since 1997 (“About the CDL-Chicago Debates,” n.d.). Between 45-50 CPS middle and high schools usually participate in the CDL, which hosts five to six weekend tournaments (each consisting of maximum six rounds) during the academic year.

CDL coaches were informed of the study through information sessions held by the research team; students were informed about the study through posted flyers and by their coaches. Over the 2017/2018 school year, 2,742 CPS middle and high school students participated in the CDL, 102 of which were recruited into the current study. Data collection took place over the course of four debate tournaments (two in the Fall and two in the Spring semester) during which study participants completed brief (~20 min) self-administered surveys. These surveys were created in collaboration with staff from the National Association for Urban Debate Leagues (NAUDL), consistent with principles of community-engaged participatory research. The survey data was subsequently linked to archival records on debate participation (e.g., number of rounds debated, win-loss record) using an anonymous identifier code.

This project was approved by the Institutional Review Board at the University of Michigan and the CPS Research Review Board

(Project ID 1357). Written informed consent was obtained from the guardians of all students and for students aged ≥ 18 years old; written informed assent was obtained for students < 18 years old. Participants received a \$10 gift card to a local store for each survey (total possible compensation for completing Fall and Spring surveys: \$20).

Measures

The surveys assessed demographic and academic characteristics, including age, gender (female, male, non-binary, and prefer not to answer), race/ethnicity (White, Black, Asian, Hispanic or Latino, Mixed), grade level, enrollment in honors classes, and participation in other activities (that is, arts, sports, volunteer or community participation, academic clubs, working for pay, or caregiving for a family member). Debate experience, indicated by tournament participation records, was measured by both duration of debate participation (range 0 - 70 months) and number of rounds debated (range 1 - 185 rounds).

"Surveys also asked about student' motivation to join (Fall only) or remain on the debate team (Spring only)" the debate team. Reasons for joining were categorized as *extrinsic*, *intrinsic* or *both intrinsic/extrinsic motivation* by investigators. *Extrinsic motivation* was assigned if debaters indicated that their decision to join (or remain engaged with) the team was due to external factors (e.g., encouragement from friends, the debate coach, other teachers or principal, current or former members of the debate team, or family members). *Intrinsic motivation* was assigned if participants indicated that they joined (or remained engaged with) the team for personal reasons (e.g., to help with school, to learn argumentation, to get into college). Students who cited both external and personal motivation were assigned to the joint *intrinsic/extrinsic* group.

Outcomes

NCS were assessed using existing Social Emotional Learning (SEL) scales that had been modified for the study population (Panorama Education, n.d.). Each SEL scale used a 5-point Likert scale ranging from *strongly disagree* to *strongly agree*. Grit was assessed using the adapted SEL-Grit scale (6 items, Cronbach $\alpha=0.69$ (Fall) and $\alpha=0.66$ (Spring), which asked students to rate their agreement with each statement (e.g., *I get obsessed with a certain idea or project for a short time but later lose interest*). Growth mindset was assessed using the SEL-Growth mindset and SEL-Self-efficacy scales (6 items, $\alpha=0.82$ (Fall) and $\alpha=0.76$ (Spring)), which asked students to rate each statement (e.g., *I can learn all the material presented in my classes*). Civic engagement was assessed using the modified SEL-Social awareness scale (6 items, $\alpha=0.73$ (Fall) and $\alpha=0.69$ (Spring)), which asked students to rate their agreement with each statement (e.g., *I have a responsibility to be involved in community issues*). Finally, mood was assessed using the modified SEL-Emotion regulation scale (8 items, $\alpha=0.80$ (Fall) and $\alpha=0.85$ (Spring)), which asks respondents to rate their agreement with each statement as to how they have felt over the past two weeks (e.g., *I have felt worthless; I have felt stressed*).

Analysis

Descriptive statistics were used to characterize participants (e.g., age, gender, race/ethnicity, grade level, after school activities), their debate experience (e.g., duration of participation, number of rounds debated) and motivation for participating in debate (that is, extrinsic, intrinsic, or both extrinsic/intrinsic), and the four NCS measures at the Fall and Spring assessments. Non-parametric Spearman

coefficients were used to quantify the correlations between the four NCS measures at the Fall and Spring assessments.

Paired t-tests were used to assess overall change in the four NCS measures between the Fall and Spring semesters. A one-way analysis of variance (ANOVA) and Kruskal-Wallis non-parametric tests were used to compare the mean level of the outcomes across the three motivation groups. Next, linear regression models were fit to estimate the relationship between debate experience and each NCS measure. We conducted a sensitivity analysis to assess whether the relationship between debate experience and the NCS measures was linear using penalized splines (supplemental material). Based on smoothing plots, partial residual diagnostics, Akaike's Information Criterion, and adjusted R^2 , the indicators of debate experience were subsequently transformed to address non-linearity and improve model fit. However, none of these non-linear transformations changed the direction or significance of associations. Therefore, to ease interpretability and ensure comparability of results across models, we present outcomes from the untransformed analyses in the main paper, but illustrate the non-linear associations with supplemental analyses (Supplemental Table 1, Figures 1-2). To examine effect modification by motivation to join debate, we also included a cross-product between experience and motivation. All regression models were adjusted for age, gender, and race/ethnicity.

All statistical tests were two-tailed and statistical significance was set at $\alpha=0.05$. All analyses were conducted in R (v 3.4.3).

RESULTS

As shown in Table 1, 102 CDL debaters participated in the study. Average age was 16 years (Standard deviation (SD)=1.2) and approximately half were female. One-third were Hispanic/Latino, 19% were Black, and 18% were non-Hispanic White. Most (77%) were enrolled in an honors program. The most frequently reported reasons for joining the debate team were to learn argumentation (55%), to help get into college (47%), and because of a debate coach (43%). After categorizing these reasons, 13 (13%) participants indicated only extrinsic motives, 15 (15%) indicated only intrinsic motivations, and 58 (57%) indicated both intrinsic and extrinsic motivations ($n=16$ had missing data). Table 2 illustrates that the most commonly cited reasons for staying in debate at the Spring assessment were related to the influence of a coach (30%) or friends (22%), the enjoyment of learning new things (29%) or meeting other students at tournaments (20%), and the improvement in school performance (24%). These reasons for remaining engaged in the activity were not used in the regression analyses due to small cell sizes.

Table 3 shows the correlations between the four NCS measures in the Fall and Spring. Grit was significantly correlated with growth mindset [Fall $\rho=0.47$ ($p<0.0001$) and Spring $\rho=0.56$ ($p<0.0002$)]; civic engagement [Fall $\rho=0.32$ ($p=0.002$) and Spring $\rho=0.33$ ($p=0.03$)], but not mood [Fall $\rho=0.16$ ($p=0.14$) and Spring $\rho=0.23$ ($p=0.47$)]. Civic engagement was significantly correlated with growth mindset in the Fall ($\rho=0.34$, $p=0.001$), but not in the Spring ($\rho=0.23$, $p=0.16$). Mood was only correlated with growth mindset in the Fall ($\rho=0.28$, $p=0.01$). These results indicate good convergent and discriminant validity

Table 1. Characteristics of participants in the Chicago study of student success (n=102).

Demographic characteristic	N (%)
Age, mean (SD)	16 (1.2)
Female	53 (52.0)
Not reported	15 (14.7)
Race/ethnicity	
Hispanic/Latino	32 (31.4)
Black	19 (18.6)
White	18 (17.6)
Asian	6 (5.9)
Mixed race	11 (10.8)
Not reported	16 (15.7)
Current grade	
9 th	14 (13.7)
10 th	32 (31.4)
11 th	21 (20.6)
12 th	19 (18.6)
Not reported	16 (15.7)
AP/Honors	78 (76.5)
After school activities	
Performance or Fine Arts	36 (35.3)
Academic program or club	24 (23.5)
Community engagement/Volunteering	36 (35.3)
Sports	35 (34.3)
Paying job or caregiving	21 (20.6)
None reported	37 (36.3)

of these established scales with each other.

Table 4 shows the distribution of the four NCS measures overall and by motivation to join debate. Average change score for growth mindset was $\Delta=0.29$ (95% Confidence Interval (CI): 0.10, 0.48) from the Fall to Spring semesters. Civic engagement ($\Delta=-0.02$, 95% CI: -0.19, 0.15) and mood ($\Delta=0.04$, 95% CI: -0.12, 0.20) remained unchanged. Grit declined from the Fall to Spring assessments ($\Delta=-0.17$, 95% CI: -0.34, -0.01). As shown in Figure 1, this decline in grit was largely driven by the group with intrinsic motivation ($\beta_{\text{unadjusted}}=-0.17$ (SD=0.08), p-value=0.048). However, after adjusting for age, gender, and race/ethnicity, motivation to join debate did not significantly moderate grit or growth mindset. In the adjusted analysis, debaters with intrinsic motivation had higher initial (Fall) levels in civic engagement compared to those with extrinsic motivation ($\beta_{\text{adjusted}}=0.15$ (SD=0.06), p-value=0.01).

Table 5 summarizes the relationship between debate experience (that is, months of debate experience and number of rounds debated) and the four NCS measures in the Fall semester and their change over the school

year. After adjusting for age, gender and race/ethnicity, greater length of debate experience, as measured by months of participation, remained significantly associated with positive change score for grit ($\beta=0.08$ (SD=0.03); p-value=0.01, adjusted $R^2=0.10$), but not the other three NCS measures. The relationship between debate experience and change in grit from Fall to Spring was non-linear: grit declined over this time for those with less debate experience but increased for those with ≥ 10 months of participation (Supplemental Figures 2). Neither grit, growth mindset, civic engagement, nor mood were significantly associated with debate experience, measured as number of rounds debated, although all the associations were in the same direction.

DISCUSSION

This study examined how four NCS-growth mindset, grit, civic engagement, and mood-changed over the course of an academic year within a sample of high school debaters.

Overall, debaters reported a significant increase in

Table 2. Factors that influence decision to participate in debate

Factors influencing decision	Decision to join, N (%)	Decision to remain engaged, N (%)
Extrinsic motivation		
My friends	31 (30.4)	22 (21.6)
My family	20 (19.6)	11 (10.8)
Debate alumni	10 (9.8)	-
My debate coach	44 (43.1)	32 (30.4)
Principal or another teacher	12 (11.8)	-
Debaters on the team	31 (30.4)	14 (13.7)
Intrinsic motivation		
I thought it would help me get into college	48 (47.1)	24 (23.5)
I thought it would help with school	32 (31.4)	12 (11.8)
I thought it would make me better at argumentation	56 (54.9)	-
I enjoyed learning new things	-	30 (29.4)
I liked the topic	-	14 (13.7)
I enjoyed the competition	-	25 (24.5)
Going to tournaments and meeting students from other schools	-	20 (19.6)
Sample of write-in responses		
	15 (14.7)	4 (3.9)
	“Making friends and improving social skills”	“Distracts me from my issues.”
	“I love to argue against people/prove my point”	“I already spent money on it”
	“I want to become a lawyer so I could use it”	-
	“I needed to blow off some steam”	-
	“No specific reason, had nothing else to do”	-
	“I wanted to be a part of something great”	-

growth mindset, but a significant decline in grit, during this period. Attitudes toward civic engagement and mood did not significantly change over this period. Length of debate experience altered how grit changed over time: over the school year there was a decline in grit for students with limited debate experience, but an

increase in grit for those with at least 10 months of participation. Finally, motivation to join debate did not substantively relate to either initial levels of NCS or change over the school year. However, students indicating intrinsic motivation did report higher initial levels of civic engagement, consistent with the notion that debate attracts students who

want to engage in dialogue on social problems. Taken together these findings support the hypothesis that debate participation is positively associated with growth mindset, and to some degree grit, among urban high school students. While the present study was limited to students participating in the CDL, these findings can be

Table 3. Correlation between non-cognitive skills: Fall and spring semesters

Parameter	Grit		Civic engagement		Growth mindset	
	Fall	Spring	Fall	Spring	Fall	Spring
Grit	1	1				
Civic engagement	0.32*	0.33*	1	1		
Growth mindset	0.47**	0.56*	0.34*	0.23	1	1
Mood	0.16	0.23	0.06	0.16	0.28*	0.26

*p < 0.05, **p < 0.0001.

Table 4. Initial level and change in non-cognitive skills by motivation to join the debate team

Non-cognitive skills	Overall	Motivation to join debate			ANOVA
		Intrinsic	Extrinsic	Both	
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	F, p-value
Fall					
Grit	2.5 (0.62)	2.5 (0.69)	2.2 (0.75)	2.6 (0.56)	2.0, 0.14
Growth mindset	3.0 (0.73)	3.0 (0.79)	2.8 (1.09)	3.1 (0.60)	0.9, 0.40
Civic engagement	2.7 (0.62)	2.7 (0.70)	2.5 (0.49)	2.8 (0.62)	1.4, 0.25
Mood	2.1 (0.72)	2.0 (0.75)	2.0 (0.90)	2.1 (0.69)	0.2, 0.84
Spring					
Grit	2.3 (0.64)	2.1 (0.45)	2.0 (1.14)	2.5 (0.54)	1.6, 0.22
Growth mindset	3.4 (0.54)	3.2 (0.73)	3.3 (0.48)	3.4 (0.52)	0.3, 0.75
Civic engagement	2.9 (0.59)	2.7 (0.33)	2.8 (0.67)	2.9 (0.61)	0.3, 0.75
Mood	2.0 (0.73)	2.0 (1.1)	1.8 (0.96)	2.1 (0.64)	0.2, 0.81
Change score					
Grit	-0.17 (0.53)*	-0.29 (0.51)	-0.10 (0.45)	-0.11 (0.50)	0.4, 0.69
Growth mindset	0.29 (0.58)*	0.10 (0.41)	0.12 (0.73)	0.35 (0.60)	0.6, 0.53
Civic engagement	-0.02 (0.55)	-0.12 (0.45)	0.13 (0.46)	-0.06 (0.57)	0.4, 0.71
Mood	0.04 (0.50)	-0.08 (0.23)	0.32 (0.70)	-0.003 (0.50)	1.0, 0.36
Characteristics of debate experience	Median (IQR)	Median (IQR)	Median (IQR)	Median (IQR)	Kruskal-Wallis χ^2 , df, p-value
Number of debate rounds (count)	29 (39.5)	19 (21.5)	57 (41.8)	30 (38.0)	60, 55, 0.31
Months of debate experience (months)	6.3 (14.9)	5.0 (5.3)	25.9 (21.7)	6.3 (25.8)	40, 39, 0.42

*P-value from paired t-test of change from fall to spring assessments, p<0.05.

contextualized in a broader discussion of NCS in educational settings. Prior studies of NCS among high school students have also reported mixed findings for change in grit and growth mindset over the course of an academic year (Donohoe et al., 2012). Other reports suggest that the relationship between mindset and grit is bi-directional (Ng and Ng, 2018) and mutually reinforcing (Bedford, 2017). In contrast to our expectations, students reporting intrinsically-motivated reasons for joining debate did not significantly differ, either initially or over time, in grit or growth mindset as compared to the students with more extrinsic reasons. Notably, the most

commonly cited extrinsic motivation to join the activity was the debate coach. This is supported by prior research that underscores the influence of role models and mentors in educational settings in general (Brown and Treviño, 2014; Orland-Barak, 2014; Stern et al., 2018) and within a context of cooperative learning activities like debate (Ferguson-Patrick, 2018; Gillies, 2016, 2014). This is also consistent with social interdependence theory, which emphasizes that positive outcomes from cooperative learning is a function of how mentors and team leaders structure learning goals and shape the nature of group interactions (Johnson, 2003;

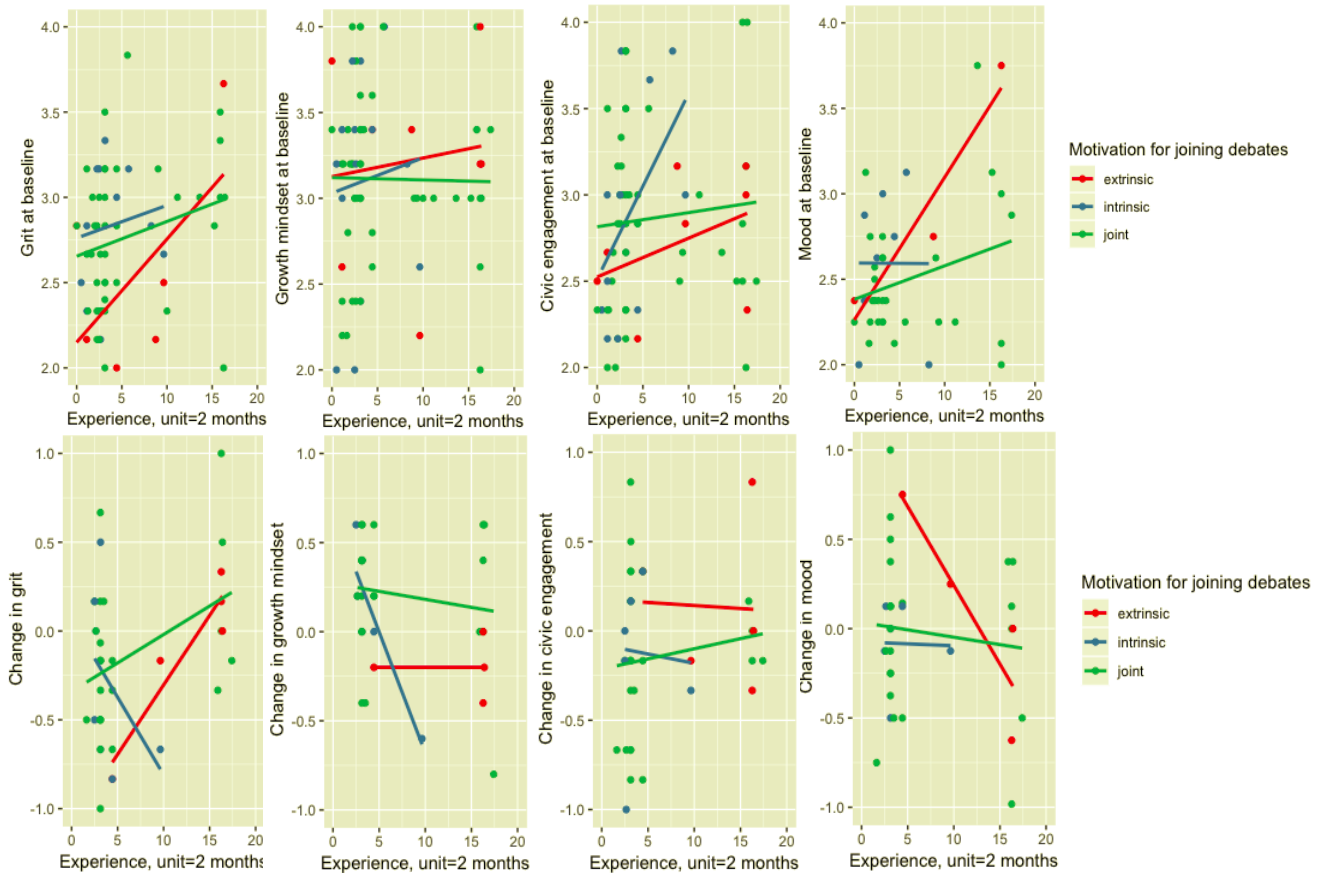


Figure 1. Association between duration of debate participation (in months) and the four non-cognitive skills (NCS): grit, growth mindset, civic engagement, and mood. The top panels show initial (fall/baseline) levels in these four NCS measures. The bottom panels show change from the fall to spring assessments, stratified by reason for joining the debate team.

Table 5. Relationship between debate experience and non-cognitive skills

Parameter	Grit	Growth Mindset	Civic Engagement	Mood
Debate experience (unit=2 months)				
Fall	β (95% CI)	β (95% CI)	β (95% CI)	β (95% CI)
Model 1	0.010 (-0.022; 0.042)	0.011 (-0.24; 0.046)	0.017 (-0.016; 0.050)	0.030 (-0.010; 0.069)
Model 2	0.008 (-0.028; 0.045)	0.021 (-0.021; 0.062)	0.004 (-0.035; 0.043)	0.028 (-0.016; 0.071)
Change score				
Model 1a	0.068 (0.020; 0.115)*	-0.046 (-0.104; 0.012)	0.029 (-0.025; 0.083)	-0.013 (-0.064; 0.037)
Model 2a	0.080 (0.019; 0.141)*	-0.044 (-0.115; 0.027)	0.014 (-0.048; 0.075)	-0.032 (-0.097; 0.033)
Number of debate rounds (unit=2 rounds)				
Fall	β (95% CI)	β (95% CI)	β (95% CI)	β (95% CI)
Model 1	0.001 (-0.006; 0.009)	0.004 (-0.004; 0.013)	0.005 (-0.003; 0.013)	-0.001 (-0.010; 0.009)
Model 2	0.003 (-0.005; 0.012)	0.005 (-0.004; 0.014)	0.002 (-0.007; 0.011)	-0.003 (-0.013; 0.007)
Change score				
Model 1a	0.004 (-0.005; 0.013)	-0.008 (-0.019; 0.002)	0.004 (-0.005; 0.014)	0.000 (-0.009; 0.009)
Model 2a	0.004 (-0.007; 0.015)	-0.004 (-0.016; 0.008)	0.004 (-0.007; 0.014)	-0.001 (-0.012; 0.010)

Model 1 and 1a: Unadjusted. Model 2 and 2a: Adjusted for age, gender, and race/ethnicity. *p < 0.05 (Linear regression).

Johnson and Johnson, 2002).

Debate is an inherently social activity, where students are part of large teams, and each student is paired with a partner for competition. Such debate structure promotes individual accountability, while maintaining a sense of group interdependence through peer feedback and pursuit of a common goal, which is a key to a successful cooperative learning (Johnson and Johnson, 2009; Tran, 2013). In this way, debate features a learning environment that differs from most existing interventions designed to cultivate NCS, which tend to be centered on the individual. Commonly-used individual-centered interventions range from workshops and online programs, to educational resources for teachers and parents (Bettinger et al., 2018; Burgoyne et al., 2018; Burnette et al., 2018; Cheng et al., 2017; Seaton, 2018; Singer-Freeman and Bastone, 2017). Unlike these individual-centered interventions, small group activities such as policy debate reorient participants toward assuming individual responsibility for common goal in the context of active collaboration and shared decision-making (Postmes et al., 2005). Such an orientation provides a foundation for testing and refining individual abilities with interactive peer feedback and performance evaluation (Huber and Lewis, 2010; Mercier and Landemore, 2012). Scholars working in communication studies and political science emphasize that debate facilitates political awareness and improves public argumentation (Davis et al., 2016; Hogan et al., 2016; Zorwick and Wade, 2016). The present findings extend this work to show that debate, as a cooperative learning activity, offers a potential platform for positive social reinforcement and fostering of NCS.

Findings should be interpreted in context of study strengths and limitations. This is a pilot study of a single site of a high school debate league, and thus these results may not be generalizable to non-urban school districts. This study was designed to explore the relationships between debate participation and NCS over a relatively brief period; these results are thus informative for refining hypotheses for future research, rather than testing hypotheses in their own right. As the sample was limited to students currently participating in debate we cannot determine if the lack of change in some of NCS over time reflects selection bias; future research should include comparison groups of students engaged in other types of co-curricular activities.

This study also has several strengths. To our knowledge, this is the first study to quantitatively assess and measure change in multiple indicators of NCS in an urban debate league. Exploring potential mediators of the relationship between debate participation and academic achievement can inform both afterschool debate programs like the CDL and efforts to integrate debate into education settings more generally (Glass and Westmont, 2014; Wang and Holcombe, 2010). The sample is notable for its diversity in terms of gender and race/ethnicity, which allows us to examine these relationships

for groups that are relatively understudied in NCS research.

Conclusion

Prior studies have shown that policy debate is a powerful tool for developing critical thinking, literacy and argumentation skills (Mitchell, 1998; Mirra et al., 2016). The findings of this study suggest that policy debate might also offer a viable platform for improving motivation and resilience among high school students. Policy debate is both accessible (that is, there are no “try-outs”) and multilevel (there are novice, junior varsity, and varsity divisions of competition). As compared to individual-based or teacher-oriented interventions for enhancing NCS, competitive debate creates an inherently interactive and rigorous learning environment that can be conceptualized as a form of cooperative learning that teaches students how to navigate social challenges in constructive and collaborative ways. Additionally, efforts like the CDL demonstrate that policy debate is scalable to large urban districts that serve students from a variety of socioeconomic backgrounds. A structured format such as policy debate should be considered as a potential tool for promoting NCS among student learners that could function alongside or in complement to current educational efforts focused on integrating social and emotional learning into all aspects of public school education (e.g., Integrating Social, Emotional, and Academic Development, 2019).

Taken together, these and other studies suggest that policy debate creates learning opportunities that are both accessible and challenging in a team-based social environment. These features make policy debate a fertile setting for promoting NCS like growth mindset and grit in a scalable manner. Future research should build on these findings to evaluate how debate participation supports student achievement and personal growth long-term.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests

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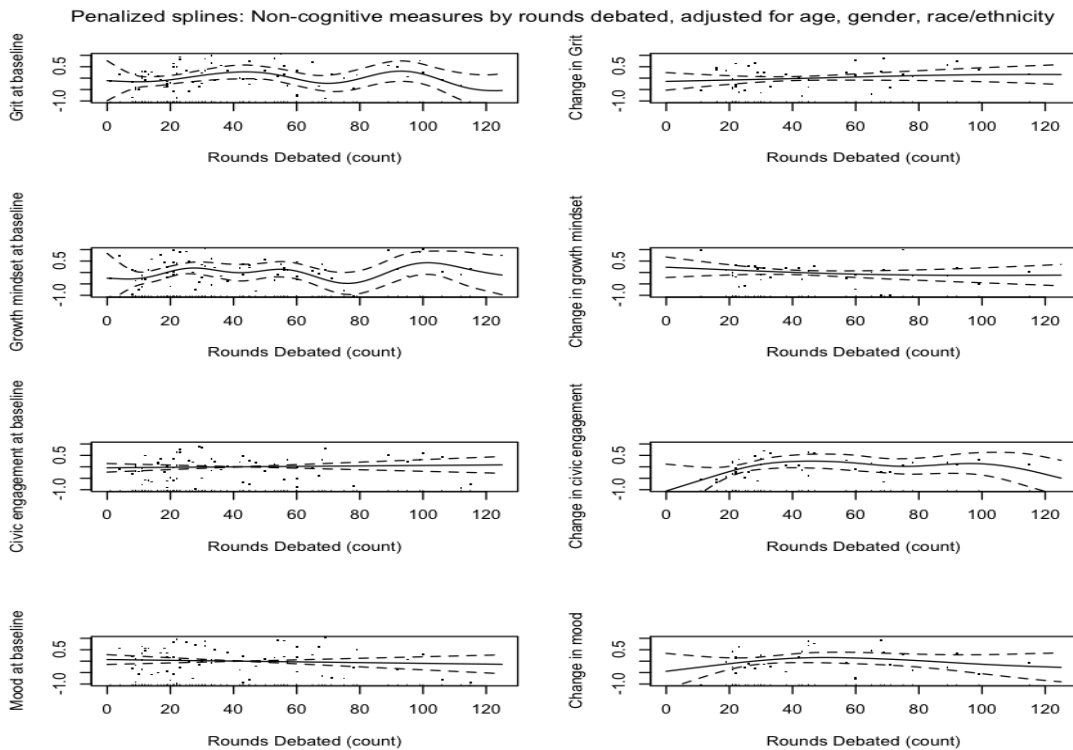
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Supplemental Material

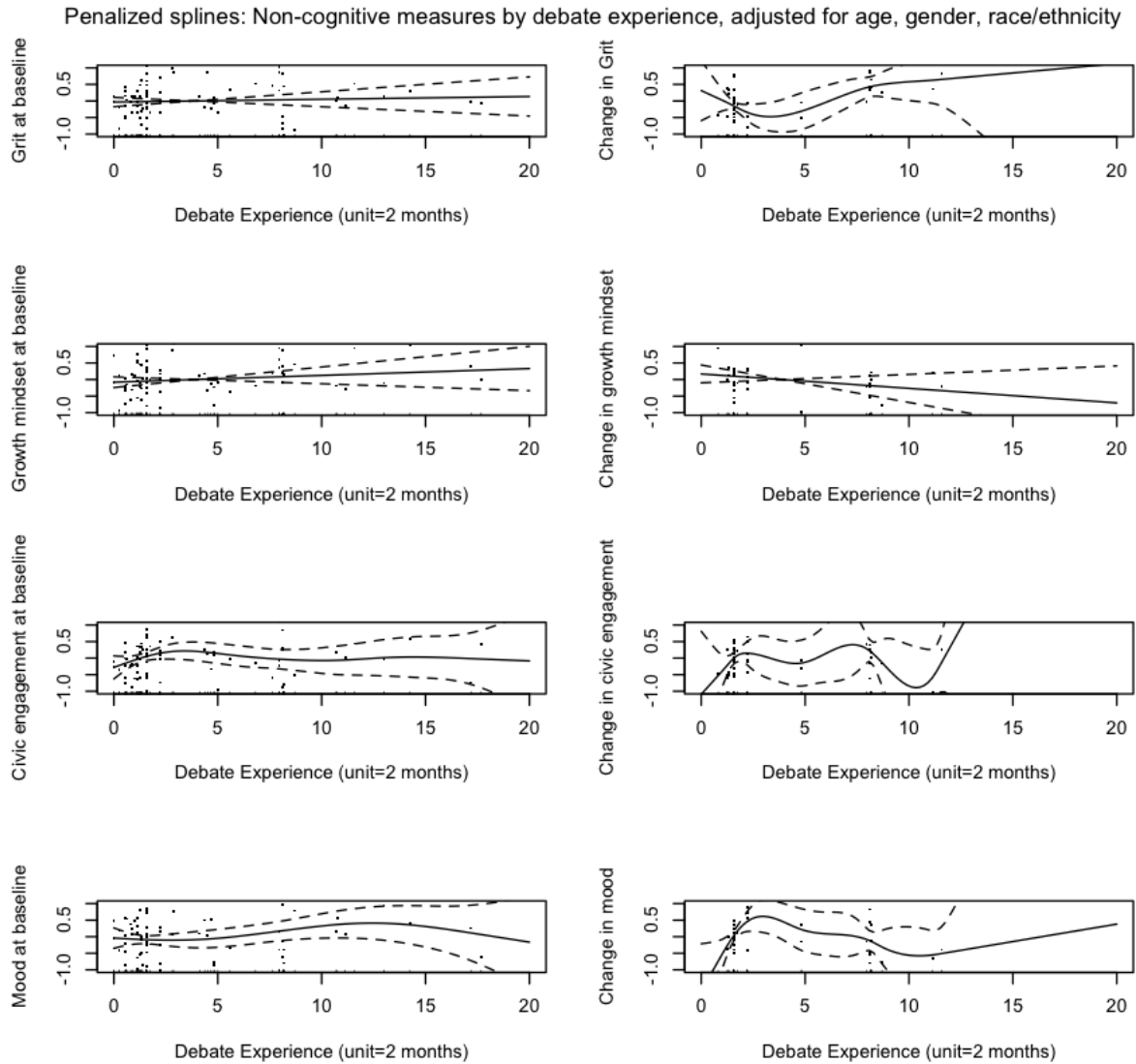
Table 1. Relationship between debate experience and non-cognitive measures

Parameter	Grit	Growth Mindset	Civic Engagement	Mood
Fall	Mean (95% CI)	Mean (95% CI)	Mean (95% CI)	Mean (95% CI)
Debate Experience (unit=2 months)				
Model 1	.005 (-.011; .021)	.006 (-.012; .023)	.009 (-.008; .025)	.015 (-.005; .035)
Model 2*	.004 (-.014; .022)	.010 (-.010; .031)	.011 (-.713; .732) †	.585 (-.643; 1.81) †
Change score				
Model 1a	.034 (.010; .058) **	-.023 (-.052; .006)	.015 (-.012; .042)	-.007 (-.032; .019)
Model 2a*	.040 (.009; .070) **	-.022 (-.057; .014)	.065 (-.098; .227) ‡	-.005 (-.012; .002) ±
Rounds debates (unit=2 rounds)				
Model 1	.001(-.006; .009)	.004 (-.004; .013)	.005 (-.003; .013)	-.001 (-.010; .009)
Model 2*	.110 (-.250; .470) †	.182 (-.194; .558) †	.002 (-.007; .011)	-.003 (-.013; .007)
Change score				
Model 1a	.004 (-.005; .013)	-.008 (-.019; .002)	.004 (-.005; .014)	.000 (-.009; .009)
Model 2a*	.004 (-.007; .015)	-.004 (-.016; .008)	.109 (-.075; .294) ‡	.045 (-.165; .255) ‡

*Adjusted for age, gender, and race/ethnicity. **p < .05. † According to smoothing plots, AIC and adjusted R² outcome is log-transformed; result is reported in % change in geometric mean. ‡ According to smoothing plots, AIC and adjusted R² predictor is log-transformed; result is reported in the original scale for outcome for the double increase in the round units (2 rounds x2). ± According to smoothing plots, AIC and adjusted R² predictor is fitted as a quadratic term. There is a positive increase in mood with a unit increase in debate experience, when students start debating. The positive effect of increased debate experience on mood tapers down after about 10 months of debating.



Supplemental Figure 1. Relationship between duration of debate experience (number of rounds debated) and non-cognitive skills: Initial levels and change from the fall to spring assessments. Association between debate experience (number of rounds debated) and four non-cognitive skills (NCS): grit, growth mindset, civic engagement, and mood. The left panels show initial (fall/baseline) levels in these NCS measures. The right panels show change in the NCS measures from the fall to spring assessments



Supplemental Figure 2. Relationship between duration of debate experience (months of participation) and non-cognitive skills: Initial levels and change from the fall to spring assessments. Association between duration of debate participation (months of participation) and four non-cognitive skills (NCS): grit, growth mindset, civic engagement, and mood. The left panels show initial (fall/baseline) levels in these NCS measures. The right panels show change in the NCS measures from the fall to spring assessments.