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Yi-Lung Kuo

Jeff Allen

Alex Casillas

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Relationships between non-cognitive factors and course failure: A longitudinal perspective

Yi-Lung Kuo^{1*}, Jeff Allen², Alex Casillas²

¹ *Applied Psychology Program, Beijing Normal University-Hong Kong Baptist University United International College, Guangdong, China*

² *ACT, Inc., Iowa City, USA*

Abstract

This study investigated the relationships between non-cognitive factors and course failure for 9,308 7th – 9th graders. Student self-report measures of social and emotional learning (SEL) and biographical factors (ACT Engage Grades 6-9) were analyzed through multiple regression models with propensity score weighting techniques. The results showed that given a sample of 7th graders, the increase in academic discipline, optimism, and orderly conduct, as well as having higher parent/guardian’s educational degree and expected educational degree from family could reduce the likelihood of course failure. Further, students who reported failing a course in grade 7 demonstrated lower SEL factors in grade 8; similarly, students failing a course in grade 8 demonstrated lower SEL factors in grade 9. Finally, for 7th graders reporting a failed class within the last year, an increase in SEL factors was shown to prevent additional course failures in grades 8 and 9. Interventions helping students who have failed a class to develop their SEL skills and how SEL information can be used in early warning systems to help identify at-risk students are discussed.

Keywords: social and emotional learning, biographical factors, course failure

* Corresponding author: yilungkuo@uic.edu.hk

Relationships between Measures of Non-cognitive Factors and Course Failure

Introduction

Middle school is a key transition period for the development of effective behaviors that can facilitate later high school and postsecondary academic success (ACT, 2008). Surprisingly, statistics of national or state course failure rates in secondary school are rarely released to the public. One exception comes from Washington State, which based on its 2016 data, reported that 23% of Grade 9 students failed at least one core course in English, math, or science (State of Washington, 2017). Other research shows that course failure has a large impact on likelihood of graduation (Allensworth & Easton, 2007; Balfanz, Herzog, & Mac Iver, 2007), which has led to course failure being an important indicator in early warning systems for middle and high school dropout.

Casillas et al. (2012) suggested that psychosocial factors, (a.k.a. social and emotional learning—SEL—factors) are related to subsequent academic outcomes and course failure, which may later result in dropout. However, the study did not show which SEL factors have more predictive power than others in predicting course failure. The current study extends previous work by investigating the relationships between course failure, SEL, and biographical factors. The research questions include: (1) Which SEL and biographical factors are most predictive of failing a class? (2) Does failing a class predict subsequent changes in SEL factors? (3) Which SEL and background factors predict recovery from failing a class?

Method

Participants

A total of 9,308 students were included in the study based on two criteria: (1) students took an assessment of SEL factors (ACT Engage Grades 6-9) once per year while in grades 7, 8, and 9; and (2) students' responses in the assessment were not flagged due to item response problems (e.g., response inconsistency, missing data). Approximately half of the students reported being male (51%) and 61% of the students considered English as their primary language.

Measures

SEL factors. Consistent with earlier studies (Casillas et al., 2012; Kuo, Casillas, & Allen, 2019), SEL factors were measured by ACT Engage Grades 6-9, a self-reported assessment related to academic performance and persistence. The assessment includes 10 scales: Academic Discipline, Commitment to School, Optimism, Family Attitude toward Education Family Involvement, Relationships with School Personnel, School Safety Climate, Managing Feelings, Thinking before Acting and Orderly Conduct. Students were asked to respond to a series of 6-point Likert-type (1 = *Disagree a Lot* and 6 = *Agree a Lot*) and yes/no questions (Orderly Conduct) (1 = *Yes* and 0 = *No*). These scales show moderate to high internal reliabilities ($\alpha = .82 - .91$, $Mdn = .87$) based on a national sample of 180,424 students (ACT, 2016). Scale definitions, sample items and psychometric properties are presented in the Appendix (ACT, 2011, 2016).

Biographical factors. Biographical factors refer to age, gender, primary language spoken, the highest parent/guardian education, the highest expected educational degree from

family, and hours spent on watching TV, playing video games, and surfing the Internet for materials not related to schoolwork on a school day.

Course failure. Course failure was reported by students through their response to this question: “I have failed a class within the last year” (Yes was coded as 1 and No was coded as 0). *Recovery from course failure* refers to reporting a failed class within the last year as a 7th grader and no failed classes as an 8th grader *and* as a 9th grader. If this condition was met for students, it was coded as 1. If not (i.e., failed classes as an 8th grader and/or as a 9th grader), it was coded as 0.

Data Analyses

Since the SEL scales include different item numbers in different formats, the aggregated scale scores (i.e., sum of item scores for each scale) were linearly transformed on a 10-60 scale. According to the recommendations of Aiken and West (1991), the SEL scores and biographical factors (e.g., highest expected educational degree from family, hours spent watching TV, playing video games, and surfing the Internet) were transformed to z-scores for the regression analyses in the present study.

Multiple logistic regression models were constructed to address research questions 1 and 3. Separate models were fit for each of the 10 measures of SEL. For research question 1, the dependent variable is whether students reported failing a class within the last year as a 7th grader, while the independent variables include gender, primary language spoken, age, the SEL measure from grade 7, and biographical factors. For research question 3, the dependent variable is *recovery from course failure*. The models for research question 3 were only fit for students who reporting failing a class in grade 7, and the independent variables are the same variables described in research question 1 and grade 7 course failure propensity score propensity score (described below). The SEL measure and factors such as hours spent on watching TV, playing video games, and surfing the Internet are the means from grades 8 and 9.

Intercorrelations between SEL and biographical factors for research questions 1 and 3 are presented in Table 1 and Table 2 to examine multicollinearity. The range of correlation coefficients for Table 1 is between -.39 and .68 and for Table 2 is between -.28 and .73.

Research question 2 was addressed by two sets of multiple regression analyses when students were at grade 7 and grade 8, respectively. Each set includes a separate multiple linear regression model for each of the 10 SEL measures. Regarding the first set of analyses, the dependent variable is the SEL measure from grade 8 (e.g., Academic Discipline in grade 8) and independent variables include the SEL measure from grade 7 (e.g., Academic Discipline in grade 7), grade 7 course failure propensity score, and course failure reported in grade 7. Similarly, the dependent variable for the second set of analyses is the grade 9 SEL measure and independent variables include the grade 8 SEL measure, grade 8 course failure propensity score, and course failure reported in grade 8. Figure 1 summarizes the research questions and variables.

The propensity score is a conditional probability proposed by Rosenbaum and Rubin (1983) that “aggregates a number of characteristics that individually would be difficult to match among

those in the treatment and nontreatment groups” (Schneider, Carnoy, Kilpatrick, Schmidt, & Shavelson, 2005, p. 49). For research question 2, we are interested in the effect of failing a class on future measures of SEL factors. Because students who fail a class and students who do not fail a class are different on many baseline variables (e.g., biographical, and prior SEL measures), we used propensity scores to adjust for the baseline differences. Grade 7 course failure propensity score is the predicted probability of grade 7 course failure (derived from a logistic regression model), conditional on grade 7 SEL measures, biographic factors, and grades from the past two years.

Table 1. Intercorrelations for Scores on SEL and Biographical Factors for Research Question 1

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. Academic Discipline	-														
2. Commitment to School	.50	-													
3. Family Attitude toward Education	.49	.74	-												
4. Family Involvement	.59	.50	.62	-											
5. Managing Feelings	.62	.29	.30	.45	-										
6. Optimism	.58	.58	.56	.61	.44	-									
7. Orderly Conduct	.61	.28	.28	.37	.68	.36	-								
8. Relationships with School Personnel	.48	.35	.34	.55	.43	.51	.34	-							
9. School Safety Climate	.36	.28	.26	.37	.38	.41	.32	.55	-						
10. Thinking before Acting	.64	.32	.31	.47	.68	.51	.60	.43	.37	-					
11. Highest expected educational degree from family	.22	.31	.31	.22	.11	.22	.12	.11	.03	.13	-				
12. Hours spent watching TV	-.18	-.10	-.10	-.15	-.19	-.11	-.14	-.14	-.12	-.19	-.02 ^a	-			
13. Hours spent playing video games	-.21	-.17	-.15	-.19	-.23	-.15	-.20	-.16	-.12	-.18	-.07	.33	-		
14. Hours spent surfing the Internet	-.23	-.10	-.09	-.17	-.26	-.12	-.23	-.18	-.17	-.23	.01 ^a	.29	.25	-	
15. Reporting course failure as a 7 th grader	-.39	-.18	-.17	-.22	-.27	-.23	-.35	-.18	-.14	-.26	-.12	.07	.09	.09	-

Note. $n = 8,708$. ^a $p > .05$

Table 2. Intercorrelations for Scores on SEL and Biographical Factors for Research Question 3

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. Academic Discipline	-														
2. Commitment to School	.51	-													
3. Family Attitude toward Education	.46	.73	-												
4. Family Involvement	.56	.46	.64	-											
5. Managing Feelings	.57	.29	.30	.38	-										
6. Optimism	.54	.52	.50	.56	.36	-									
7. Orderly Conduct	.60	.32	.31	.34	.70	.29	-								
8. Relationships with School Personnel	.48	.35	.33	.56	.36	.50	.30	-							
9. School Safety Climate	.33	.22	.20	.35	.33	.39	.29	.53	-						
10. Thinking before Acting	.63	.30	.30	.38	.70	.43	.65	.34	.32	-					
11. Highest expected educational degree from family	.23	.35	.35	.24	.11	.22	.12	.13	.04 ^a	.13	-				
12. Hours spent watching TV	-.15	-.05	-.04 ^a	-.09	-.15	-.07	-.14	-.10	-.12	-.19	-.02 ^a	-			
13. Hours spent playing video games	-.16	-.15	-.07	-.11	-.11	-.09	-.15	-.11	-.07	-.10	-.07	.29	-		
14. Hours spent surfing the Internet	-.28	-.09	-.08	-.16	-.25	-.17	-.22	-.22	-.24	-.26	.03 ^a	.31	.15	-	
15. Recovery from course failure	.34	.17	.15	.20	.21	.20	.28	.17	.10	.23	.09	-.06	-.07	-.11	-

Note. $n = 1,814$. ^a $p > .05$

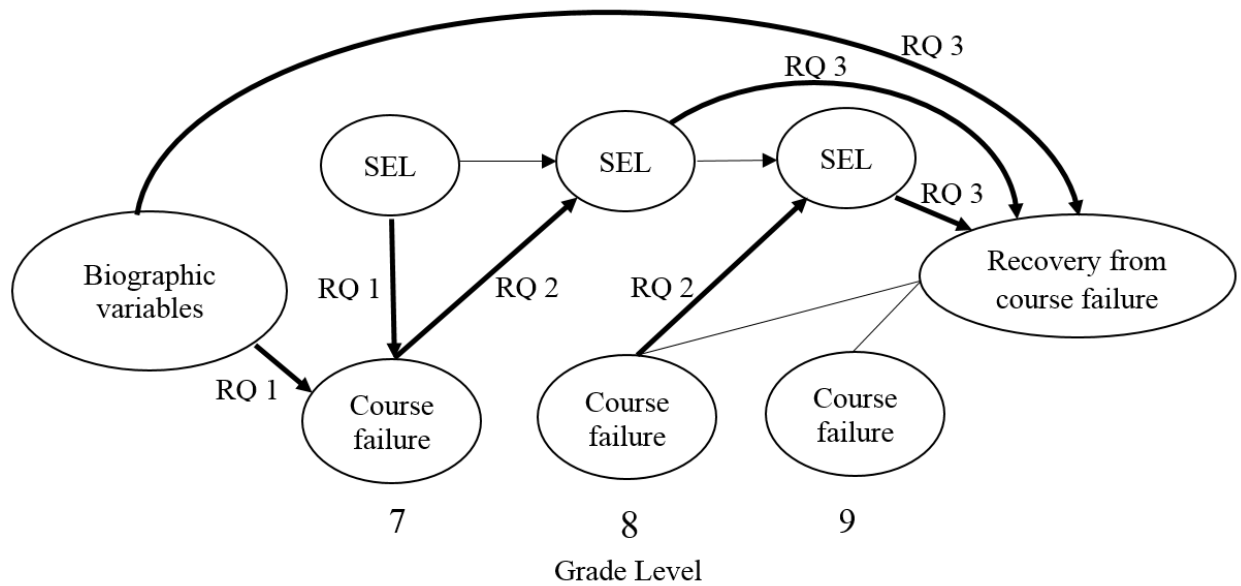


Figure 1. A path diagram representing the research questions and variables.

Results

Research Question 1: SEL and biographical factors in predicting course failure

In Table 3, the model shows that the odds of reporting class failure at the first wave of data (7th grade) decreases by 51%¹, 8%, and 37% for every standard deviation increase in Academic Discipline, Optimism and Orderly Conduct, respectively, even when controlling for other variables. Regarding biographical factors, the model shows that the odds of failing a class decrease by 16% and 8% for every standard deviation increase in the highest parent/guardian education and the highest expected educational degree.

Table 3. Relationship between Course Failure Experience, SEL and Biographical Factors

Variables	β	Standard Error	Odds Ratio
			Exp (β)
Intercept	-0.882***	0.069	0.414
Male	0.078	0.058	1.082
Language	0.054	0.054	1.056
Age	0.105***	0.026	1.110
Parent's Highest Educational Degree	-0.177***	0.028	0.838
Parent's Highest Educational Degree (unknown)	-0.002	0.087	0.998
Academic Discipline	-0.708***	0.042	0.493
Commitment to School	0.078	0.040	1.081

¹ $e^{(-0.708)} = 0.493$ which implies that the odds of failing a class increase by 49.3% for every standard deviation increase. In contrast, the odds of failing a class decrease by $1-49.3\% = 50.7\%$.

Family Attitude toward Education	0.045	0.041	1.046
Family Involvement	0.043	0.039	1.044
Managing Feelings	0.044	0.041	1.045
Optimism	-0.086*	0.037	0.918
Orderly Conduct	-0.461***	0.037	0.631
Relationships with School Personnel	-0.018	0.035	0.982
School Safety Climate	0.037	0.033	1.037
Thinking before Acting	0.083*	0.039	1.086
Highest expected educational degree from family	-0.080**	0.027	0.923
Hours spent watching TV	0.013	0.028	1.013
Hours spent playing video games	-0.016	0.030	0.984
Hours spent surfing the Internet ^a	-0.004	0.028	0.996

Note. n = 8,584. A multiple logistic regression model was constructed. Dependent variable refers to Grade 7 students who failed a class within the last year or not (Yes= 1; No = 0).

^a Surf the Internet for materials not related to schoolwork on a school day.

* $p < .05$ (two-tailed). ** $p < .01$ (two-tailed). *** $p < .001$ (two-tailed).

Research Question 2: Changes in SEL factors related to course failure

In Table 4, students who reported failing a course within the past year in grade 7 scored lower in Academic Discipline, Family Attitude, Family Involvement, Managing Feelings, Orderly Conduct, and Thinking before Acting in grade 8. Similarly, students who reported failing a course in grade 8 scored lower in Academic Discipline and Commitment in grade 9. Take Academic Discipline in grade 8 as an example. The results show that past course failure experiences reported in grade 7 are negatively related to Academic Discipline in grade 8 ($\beta = -0.082, p < .001$), after controlling for Academic Discipline in grade 7 and grade 7 course failure propensity score. Failing a course was related to a small decrease (0.082 SD units) in Academic Discipline in grade 8

Table 4. Prediction of Changes in SEL Factors

Period	SEL Factor	Variables	β	Standard Error
G7-G8 ^a	Academic Discipline	Intercept	0.312***	0.028
		Academic Discipline	0.482***	0.014
		Propensity Score	-0.820***	0.064
		Course Failure	-0.082***	0.020
	Commitment to School	Intercept	0.176***	0.021
		Commitment to School	0.485***	0.010
		Propensity Score	-0.481***	0.049
		Course Failure	-0.032	0.022
	Family Attitude toward Education	Intercept	0.201***	0.023
		Family Attitude	0.501***	0.010
		Propensity Score	-0.548***	0.048

	Course Failure	-0.045*	0.022
Family Involvement	Intercept	0.165***	0.021
	Family Involvement	0.566***	0.010
	Propensity Score	-0.420***	0.047
	Course Failure	-0.042*	0.021
Managing Feelings	Intercept	0.195***	0.027
	Managing Feelings	0.577***	0.010
	Propensity Score	-0.518***	0.048
	Course Failure	-0.067***	0.020
Optimism	Intercept	0.159***	0.022
	Optimism	0.517***	0.010
	Propensity Score	-0.417***	0.050
	Course Failure	-0.040	0.022
Orderly Conduct	Intercept	0.211***	0.025
	Orderly Conduct	0.556***	0.012
	Propensity Score	-0.527***	0.056
	Course Failure	-0.086***	0.020
Relationships with School Personnel	Intercept	0.159***	0.029
	Relationships with School Personnel	0.518***	0.010
	Propensity Score	-0.423***	0.048
	Course Failure	-0.015	0.022
School Safety Climate	Intercept	0.087*	0.039
	School Safety Climate	0.516***	0.010
	Propensity Score	-0.130**	0.046
	Course Failure	-0.002	0.022
Thinking before Acting	Intercept	0.254***	0.023
	Thinking before Acting	0.524***	0.010
	Propensity Score	-0.677***	0.050
	Course Failure	-0.069***	0.021
G8-G9 ^b Academic Discipline	Intercept	-0.112***	0.025
	Academic Discipline	0.536***	0.016
	Propensity Score	-0.122***	0.012
	Course Failure	-0.050*	0.023
Commitment to School	Intercept	-0.099***	0.026
	Commitment to School	0.486***	0.012
	Propensity Score	-0.106***	0.010
	Course Failure	-0.065*	0.026
Family Attitude toward Education	Intercept	-0.098***	0.024
	Family Attitude	0.518***	0.012

	Propensity Score	-0.095 ^{***}	0.009
	Course Failure	-0.034	0.025
Family Involvement	Intercept	-0.046 [*]	0.019
	Family Involvement	0.633 ^{***}	0.011
	Propensity Score	-0.059 ^{***}	0.009
	Course Failure	-0.035	0.023
Managing Feelings	Intercept	-0.084 ^{***}	0.022
	Managing Feelings	0.626 ^{***}	0.011
	Propensity Score	-0.088 ^{***}	0.009
	Course Failure	-0.035	0.022
Optimism	Intercept	-0.050 [*]	0.021
	Optimism	0.587 ^{***}	0.011
	Propensity Score	-0.057 ^{***}	0.009
	Course Failure	-0.030	0.025
Orderly Conduct	Intercept	-0.090 ^{***}	0.022
	Orderly Conduct	0.564 ^{***}	0.014
	Propensity Score	-0.091 ^{***}	0.011
	Course Failure	-0.037	0.023
Relationships with School Personnel	Intercept	-0.021	0.027
	Relationships with School Personnel	0.610 ^{***}	0.011
	Propensity Score	-0.050 ^{***}	0.009
	Course Failure	-0.018	0.024
School Safety Climate	Intercept	0.026	0.049
	School Safety Climate	0.574 ^{***}	0.011
	Propensity Score	-0.020 [*]	0.009
	Course Failure	-0.017	0.024
Thinking before Acting	Intercept	-0.075 ^{**}	0.021
	Thinking before Acting	0.62 ^{***}	0.011
	Propensity Score	-0.075 ^{***}	0.009
	Course Failure	-0.016	0.023

Note. n = 8,042 and n = 6,300 in predicting SEL skills in grade 8 and grade 9, respectively. ^a Dependent variables are measured in grade 8, while independent variables are measured in grade 7. ^b Dependent variables are measured in grade 9, while independent variables are measured in grade 8. Students reported course failure within the last year or not (Yes = 1; No = 0).

* $p < .05$ (two-tailed). ** $p < .01$ (two-tailed). *** $p < .001$ (two-tailed).

Research Question 3: SEL and biographical factors in predicting recovery from course failure

In Table 5, the model shows that, for 7th graders reporting a failed class within the last year, the odds of recovery from course failure (i.e., no failed classes as 8th graders and as 9th

graders) increase by 224%, 121% and 153% for every standard deviation increase in Academic Discipline, Optimism, and Orderly Conduct, respectively.

Table 5. Prediction of Recovery from Course Failure Experience

Variables	β	Standard Error	Odds Ratio Exp (β)
Intercept	-0.453*	0.194	0.636
Propensity Score	-0.835*	0.341	0.434
Male	-0.164	0.143	0.849
Language	0.04	0.130	1.041
Age	-0.008	0.062	0.992
Parent's Highest Educational Degree	0.106	0.068	1.112
Parent's Highest Educational Degree (unknown)	-0.124	0.249	0.883
Academic Discipline	0.808***	0.115	2.243
Commitment to School	-0.012	0.108	0.988
Family Attitude toward Education	-0.116	0.115	0.890
Family Involvement	0.002	0.098	1.002
Managing Feelings	-0.173	0.103	0.841
Optimism	0.188*	0.093	1.207
Orderly Conduct	0.424***	0.098	1.528
Relationships with School Personnel	0.041	0.092	1.042
School Safety Climate	-0.114	0.077	0.892
Thinking before Acting	-0.096	0.101	0.908
Highest expected educational degree from family	0.021	0.066	1.021
Hours spent watching TV	0.002	0.066	1.002
Hours spent playing video	0.002	0.071	1.002
Hours spent surfing the Internet	-0.106	0.070	0.899

Note. n = 1,785. A multiple logistic regression model was constructed. The participants in the analysis are students who failed a class in grade 7. Dependent variable refers to students who do not fail a class in grades 8 and 9 (Yes= 1; No = 0).

* $p < .05$ (two-tailed). *** $p < .001$ (two-tailed).

Discussion

This longitudinal study shows that several SEL and biographical factors are associated with course failure, and that course failure is associated with later negative changes in SEL factors during secondary school. However, the results also show that, by developing some of these factors after the initial course failure, it is likely that students could prevent subsequent academic difficulties, such as additional course failures, and/or avoid the drop that happens after course failure.

Research shows that a foundational level of knowledge and SEL skills are required for student success in secondary school (e.g., Casillas et al., 2012; Kuo et al., 2019). To improve

SEL skills, effective interventions that integrate SEL knowledge and skills into existing curriculum are suggested. Studies on the efficacy of behavioral skill intervention should make use of SAFE programming. SAFE stand for Sequenced (programs with a connected and coordinated set of activities), Active (active forms of learning), Focused (programs having components to develop personal or social skills), and Explicit (programs targeting specific skills) (Durlak, Weissberg, Dymnicki, Taylor, & Schellinger, 2011). Recently, a more compact intervention framework emphasizing positive behavioral interventions and supports has been suggested to develop student behavioral skills (Bradshaw, Bottiani, Osher, & Sugai, 2014).

In addition to existing early warning flags (e.g., low attendance rate, poor academic achievement, and suspensions) that allow educators to focus on students at risk of dropping out (Balfanz et al., 2007), the learnings from this study suggest that educators should also be using measures of SEL skills in early warning systems. These skills can help to identify students who may be at risk of failing courses and assist them *before* they experience negative academic outcomes, which can lead to further increasing the gap between high- and low-achieving students.

Among the limitations of the study is that course failure was reported by students, and was limited to a single binary response. By not examining both number and types of courses, we may be less likely to detect differential effects. Another possible limitation is that when 7th graders responded to the item: “I have failed a class within the last year”, they may consider their grades in either grade 6 or grade 7 depending on their testing time. That is, if they took the assessment in the spring semester of 7th grade, they may consider their grades in the fall semester of 7th grade or in the spring semester of 6th grade.

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Appendix
ACT Engage Scales, Definitions, and Sample Items

Scale	Definition	Sample items	# of items	α -scale
Academic Discipline	Degree to which a student is hardworking and conscientious as evidenced by the amount of effort invested into completing schoolwork.	1. I turn in my assignments on time. 2. I'm usually prepared for class.	11	.91
Commitment to School	Commitment to stay in high school and obtain a diploma.	1. I am committed to graduating from high school. 2. A high school diploma is important for getting ahead in life.	10	.85
Optimism	Having a hopeful outlook about the future in spite of difficulties or challenges.	1. I am confident that everything will turn out all right. 2. I look for the bright side of things.	10	.88
Family Attitude toward Education	Positive family attitude regarding the value of education.	1. My family supports my efforts in school. 2. Education is important to my family.	10	.84
Family Involvement	Family involvement in a student's school life and activities.	1. My family tries hard to be involved in my school life. 2. I talk to my family about school accomplishments.	9	.87
Relationships with School Personnel	The extent to which students relate to school personnel as part of their connection to school.	1. Adults at my school understand point of view. 2. If I was in trouble, adults at my school would be there to help.	12	.89
School Safety Climate	School qualities related to student's perception of security at school.	1. I feel safe at school. 2. Students at my school don't get in trouble with the law.	11	.81

Managing Feelings	Tendency to manage duration and intensity of negative feelings, and to find appropriate ways to express these feelings.	<ol style="list-style-type: none"> 1. I would walk away if someone wanted to fight me. 2. I fight back when someone makes me mad (reverse-keyed). 	12	.89
Orderly Conduct	Tendency to behave appropriately in class and avoid disciplinary action.	<ol style="list-style-type: none"> 1. I joke around or make fun of others during class. 2. I have been sent to the principal's office for misbehaving (reverse-keyed). 	9	.80
Thinking before Acting	Tendency to think about the consequences of one's actions before acting.	<ol style="list-style-type: none"> 1. I think about what might happen before I act. 2. I think about what I say before I say it. 	12	.86

Note. Adapted from "ACT ENGAGE Grades 6-9 User's Guide," by ACT, 2011. Copyright 2011 by ACT. The internal reliabilities of each scale reported from "Development and validation of ACT Engage," by ACT, 2016.