ONLINE APPENDIX

EVER FAILED, TRY AGAIN, SUCCEED BETTER: RESULTS FROM A RANDOMIZED EDUCATIONAL INTERVENTION ON GRIT

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I APPENDIX A: SUPPLEMENTARY ANALYSES

Table A.1 Effect of Patience Treatment on Choice of Difficult Task

	Difficult Round 1	Difficult Round 2	Difficult Round 3	Difficult Round 4	Difficult Round 5	Difficult All	After Failure	Next Week
A: Sample 1								
Patience Treatment	-0.049	0.022	-0.004	-0.029	-0.005	-0.005	-0.029	-0.003
	(0.05)	(0.03)	(0.04)	(0.05)	(0.03)	(0.03)	(0.08)	(0.04)
Permutation p-value	0.318	0.601	0.929	0.559	0.890	0.868	0.848	0.944
Control Mean	0.68	0.53	0.42	0.42	0.39	0.23	0.40	0.44
N	903	904	906	905	905	896	246	887

Notes. Reported estimates are average marginal effects from logit regressions. Standard errors are clustered at the school level (unit of randomization) and reported in parentheses. * p < 0.10, ** p < 0.05, *** p < 0.01. The outcome variable in columns 1-5 is a dummy variable which equals one if the student chooses to do the difficult task in the respective round of the first visit, while the outcome variable in column 6 equals one if the student chooses the difficult task in all five rounds. The outcome variable in column 7 is a dummy variable which equals 1 if the student chooses to do the difficult task in the 2nd round of the first visit; estimates are obtained for students for whom the difficult task was imposed in round 1 and who failed to meet the target. The outcome variable in column 8 is a dummy which equals 1 if the student chooses to do the difficult task for the following week. Patience treatment is a dummy variable which equals 1 if the student was treated with the patience intervention. The analysis only uses individuals who were not exposed to the grit intervention. Controls include task ability, gender, the Raven score, baseline beliefs and test scores, and risk tolerance as well as a dummy variable for whether the student has some inconsistent data entries.

Table A.2 Effect of Patience Treatment on Success and Payoffs in the Second Visit

	Success		Payof	f	Total Payoff
	Imposed	All	Imposed	Not Imposed	All
A: Sample 1					
Patience Treatment	-0.025	-0.088	-0.112	-0.033	0.000
	(0.05)	(0.11)	(0.19)	(0.16)	(0.17)
Permuted p-value	0.672	0.512	0.654	0.822	1.000
Control Mean	0.46	1.77	1.81	1.67	2.92
N	554	922	554	368	825

Notes. Reported estimates in columns 1, 6 and 7 are average marginal effects from logit regressions. Estimates in columns 2-5 are obtained via Ordinary Least Squares regressions. Standard errors are clustered at the school level (unit of randomization) and reported in parentheses. * p < 0.10, *** p < 0.05, **** p < 0.01. The outcome variable in column 1 is a dummy which equals 1 if the student was successful in meeting the target. The outcome in columns 2-4 is the student's payoff in visit 2. The sample used in the analysis either contains all observations ("All"), the observations for whom the difficult game was imposed ("Imposed") or for whom it was not imposed ("Not Imposed"). The outcome variable in column 5 is the sum of the average payoff in visit 1 and the payoff in visit 2. Patience treatment is a dummy variable which equals 1 if the student is treated with the patience intervention. The analysis only uses individuals who were not exposed to the grit intervention. Controls include task ability, gender, the Raven score, baseline beliefs and test scores, and risk tolerance as well as a dummy variable for whether the student has some inconsistent data entries.

Table A.3 Effect of Patience Treatment on Test Scores

	Math Score Long-Run	Verbal Score Long-Run
Patience Treatment	-0.216 (0.14)	-0.131 (0.12)
Permutation p-value Control Mean N	0.130 -0.10 454	0.345 -0.05 454

Notes. Estimates are obtained via Ordinary Least Squares regressions. Standard errors are clustered at the school level (unit of randomization) and reported in parentheses. * p<0.10, ** p<0.05, *** p<0.01. The dependent variables are the students' math and verbal standardized test scores at follow-up. The long-run follow-up data for Sample 1 was collected 2.5 years after the intervention. Patience treatment is a dummy which equals 1 if the student is treated with the patience intervention. The analysis only uses individuals who were not exposed to the grit intervention. Controls include gender, the Raven score, class size, baseline beliefs and test scores.

Table A.4 Mean Comparisons of Pre-Treatment Variables for Follow-up Samples

		A: Sample	1		B: Sample 2	2
	Control Mean [SD]	Treatment Mean [SD]	Difference (p-value)	Control Mean [SD]	Treatment Mean [SD]	Difference (p-value)
Beliefs (survey)	0.05	-0.04	-0.09	-0.10	-0.00	0.10
	[0.93]	[0.99]	(0.48)	[0.99]	[0.93]	(0.28)
Grit (survey)	-0.01 [0.98]	0.01	0.02 (0.90)	0.00 [1.00]	-0.06 [1.02]	-0.07 (0.52)
Gender (Male=1)	0.51	0.51	-0.01	0.49	0.49	0.01
	[0.50]	[0.50]	(0.86)	[0.50]	[0.50]	(0.85)
Age	10.03	10.04	0.01	9.46	9.48	0.02
	[0.42]	[0.46]	(0.73)	[0.56]	[0.47]	(0.71)
Raven	-0.05	-0.06	-0.00	-0.01	-0.18	-0.17
	[1.04]	[1.01]	(1.00)	[0.98]	[1.00]	(0.23)
Risk Tolerance	2.72	2.48	-0.24	2.13	2.27	0.14
	[1.50]	[1.51]	(0.17)	[1.49]	[1.65]	(0.57)
Wealth	2.78	2.74	-0.04	2.47	2.63	0.16
	[0.91]	[0.99]	(0.80)	[1.08]	[0.87]	(0.33)
Success in School	3.35	3.32	-0.03	3.34	3.23	-0.10
	[1.04]	[1.08]	(0.73)	[1.09]	[1.17]	(0.48)
Class Size	37.86	43.05	5.19	35.39	40.68	5.29*
	[9.29]	[9.60]	(0.20)	[5.32]	[8.24]	(0.09)
Math Test Score	0.03	-0.03	-0.05	-0.02	-0.03	-0.01
	[0.92]	[1.04]	(0.75)	[1.02]	[0.96]	(0.92)
Verbal Test Score	0.10	-0.02	-0.12	0.06	-0.18	-0.24**
	[0.88]	[1.03]	(0.58)	[0.96]	[1.04]	(0.04)
Task Ability	4.73	4.70	-0.03	3.55	3.93	0.38
	[2.47]	[2.36]	(0.90)	[2.22]	[2.06]	(0.12)
N	454	586		432	349	

Notes. Columns 1-2 and 4-5 display the means of the pre-treatment variables in the control and treatment groups for Samples 1 and 2, respectively. Standard deviations are displayed in brackets. Columns 3 and 6 show the estimated difference in means which is obtained from regressing the variable of interest on the treatment dummy. Standard errors are clustered at the school level (unit of randomization) and p-values are reported in parentheses. * p<0.10, ** p<0.05, *** p<0.01. The variables beliefs (about the malleability of skills) and grit are extracted factors from questionnaire items in the pre-treatment student survey. The Raven score is measured using a progressive Raven's matrices test (Raven et al., 2004). Task ability refers to the student's performance in the ability measuring round of the experiment. Risk tolerance is elicited using the incentivized Gneezy and Potters (1997) task. The student's wealth and success in school is based on reports by teachers (scale: 1-5). Students' math and verbal baseline test scores are normalized (mean 0, standard deviation 1). For Sample 1, these test scores refer to the grades given to the students by their teachers, while for Sample 2 they refer to the students' performance on the standardized tests we administer.

Table A.5 Associations in Control Group

		A: Saı	mple 1		B: Sample 2			
	Math	Math	Verbal	Verbal	Math	Math	Verbal	Verbal
	Score	Score	Score	Score	Score	Score	Score	Score
Raven Score	0.486***	0.497***	0.461***	0.470***	0.456***	0.452***	0.373***	0.356***
	(0.05)	(0.04)	(0.04)	(0.04)	(0.05)	(0.05)	(0.03)	(0.04)
Choose Difficult (All Rounds 1-5)	0.342*** (0.07)		0.167** (0.06)		0.193 (0.12)		0.205 (0.13)	
Choose Difficult (Second visit)		0.226*** (0.06)		0.140** (0.06)		0.313*** (0.08)		0.221*** (0.05)
R-squared	0.29	0.29	0.27	0.27	0.20	0.22	0.15	0.15
N	784	776	782	773	740	747	740	747

Notes. All estimates are obtained via Ordinary Least Squares regressions, controlling for Raven score and using observations from the control group only. Standard errors are clustered at the school level (unit of randomization) and are reported in parentheses. * p<0.10, ** p<0.05, *** p<0.01. The outcome variable is the student's math or verbal test score measured at baseline. The dummy variable "Choose Difficult (All Rounds 1-5)" equals 1 if the student chooses difficult in all 5 rounds of the first visit and zero otherwise. The dummy variable "Choose Difficult (Second visit)" equals 1 if the student chooses to do the difficult task for the second visit.

Table A.6 Treatment Effect on Choice of Difficult Task - Robustness I

	Difficult Round 1	Difficult Round 2	Difficult Round 3	Difficult Round 4	Difficult Round 5	Difficult All	After Failure	Next Week
A: Sample 1								
Treatment	0.108***	0.098***	0.129***	0.106***	0.097***	0.096***	0.151***	0.155***
	(0.03)	(0.04)	(0.03)	(0.03)	(0.03)	(0.03)	(0.05)	(0.04)
Permutation p-value	0.003	0.027	0.001	0.004	0.004	0.014	0.045	0.002
Control Mean	0.71	0.56	0.45	0.44	0.42	0.26	0.39	0.46
N	1716	1712	1714	1712	1715	1694	622	1686
B: Sample 2								
Treatment	0.096**	0.155***	0.157***	0.149***	0.136***	0.124***	0.149^{*}	0.188***
	(0.04)	(0.04)	(0.04)	(0.05)	(0.04)	(0.05)	(0.08)	(0.04)
Permutation p-value	0.048	0.002	0.003	0.012	0.004	0.015	0.118	0.000
Control Mean	0.71	0.52	0.36	0.32	0.27	0.17	0.49	0.41
N	1237	1234	1234	1233	1236	1219	578	1234

Notes. Reported estimates are average marginal effects from logit regressions. Standard errors are clustered at the school level (unit of randomization) and reported in parentheses. * p < 0.10, ** p < 0.05, *** p < 0.01. The outcome variable in columns 1-5 is a dummy variable which equals one if the student chooses to do the difficult task in the respective round of the first visit, while the outcome variable in column 6 equals one if the student chooses the difficult task in all five rounds. The outcome variable in column 7 is a dummy variable which equals 1 if the student chooses to do the difficult task in the 2nd round of the first visit; estimates are obtained for students for whom the difficult task was imposed in round 1 and who failed to meet the target. The outcome variable in column 8 is a dummy which equals 1 if the student chooses to do the difficult task for the following week. Treatment is a dummy variable which equals 1 if the student attends a school which has been treated with the grit intervention. The analysis is performed using only those students for whom we do not have inconsistent data entries. Controls include task ability, gender, the Raven score, baseline beliefs and test scores, and risk tolerance.

Table A.7 Treatment Effect on Success and Payoffs in the Second Visit - Robustness I

	Success		Payoff		Total Payoff	Maximizi	ng Choice
	Imposed	All	Imposed	Not Imposed	All	Visit 1	Visit 2
A: Sample 1							
Treatment	0.088***	0.315***	0.340**	0.261**	0.390***	0.012	0.078*
	(0.03)	(0.09)	(0.13)	(0.10)	(0.13)	(0.02)	(0.04)
Permuted p-value	0.005	0.004	0.010	0.043	0.005	0.584	0.087
Control Mean	0.47	1.83	1.88	1.77	3.15	0.64	0.55
N	1011	1806	1011	795	1556	1698	1567
B: Sample 2							
Treatment	0.101**	0.445***	0.399**	0.553***	0.558***	0.088***	0.093***
	(0.05)	(0.12)	(0.18)	(0.13)	(0.16)	(0.02)	(0.03)
Permuted p-value	0.062	0.004	0.060	0.010	0.010	0.001	0.011
Control Mean	0.46	1.73	1.85	1.55	2.66	0.46	0.51
N	828	1237	828	409	1139	1228	1156

Notes. Reported estimates in columns 1, 6 and 7 are average marginal effects from logit regressions. Estimates in columns 2-5 are obtained via Ordinary Least Squares regressions. Standard errors are clustered at the school level (unit of randomization) and reported in parentheses. * p < 0.10, ** p < 0.05, **** p < 0.01. The outcome variable in column 1 is a dummy which equals 1 if the student was successful in meeting the target. The outcome in columns 2-4 is the student's payoff in visit 2. The sample used in the analysis either contains all observations ("All"), the observations for whom the difficult game was imposed ("Imposed") or for whom it was not imposed ("Not Imposed"). The outcome variable in column 5 is the sum of the average payoff in visit 1 and the payoff in visit 2. the outcome variable in columns 6 and 7 is a dummy variable which indicates whether the student makes the payoff-maximizing choice in visit 1 and visit 2, respectively. Treatment is a dummy variable which equals 1 if the student attends a school which has been treated with the grit intervention. The analysis is performed using only those students for whom we do not have inconsistent data entries. Controls include task ability, gender, the Raven score, baseline beliefs and test scores, and risk tolerance.

Table A.8 Treatment Effect on Choice of Difficult Task - OLS

	Difficult Round 1	Difficult Round 2	Difficult Round 3	Difficult Round 4	Difficult Round 5	Difficult All	After Failure	Next Week
A: Sample 1								
Treatment	0.103***	0.088**	0.126***	0.107***	0.087***	0.085***	0.146**	0.136***
	(0.03)	(0.04)	(0.03)	(0.03)	(0.03)	(0.03)	(0.05)	(0.04)
Permutation p-value	0.002	0.035	0.002	0.009	0.003	0.012	0.051	0.000
Control Mean	0.67	0.54	0.43	0.42	0.40	0.24	0.40	0.45
N	1889	1884	1885	1882	1886	1862	642	1858
B: Sample 2								
Treatment	0.097**	0.160***	0.162***	0.163***	0.135***	0.125**	0.152^{*}	0.184***
	(0.04)	(0.04)	(0.04)	(0.05)	(0.04)	(0.05)	(0.08)	(0.04)
Permutation p-value	0.027	0.002	0.004	0.005	0.005	0.011	0.103	0.003
Control Mean	0.67	0.51	0.35	0.30	0.26	0.16	0.50	0.41
N	1354	1351	1351	1350	1354	1335	585	1349

Notes. Reported estimates are obtained via Ordinary Least Squares regressions. Standard errors are clustered at the school level (unit of randomization) and reported in parentheses. * p < 0.10, ** p < 0.05, *** p < 0.01. The outcome variable in columns 1-5 is a dummy variable which equals one if the student chooses to do the difficult task in the respective round of the first visit, while the outcome variable in column 6 equals one if the student chooses the difficult task in all five rounds. The outcome variable in column 7 is a dummy variable which equals 1 if the student chooses to do the difficult task in the 2nd round of the first visit; estimates are obtained for students for whom the difficult task was imposed in round 1 and who failed to meet the target. The outcome variable in column 8 is a dummy which equals 1 if the student chooses to do the difficult task for the following week. Treatment is a dummy variable which equals 1 if the student attends a school which has been treated with the grit intervention. Controls include task ability, gender, the Raven score, baseline beliefs and test scores, and risk tolerance as well as a dummy variable for whether the student has some inconsistent data entries.

Table A.9 Treatment Effect on Success and Payoffs in the Second Visit - OLS

	Success		Payoff		Total Payoff	Maximizi	ng Choice
	Imposed	All	Imposed	Not Imposed	All	Visit 1	Visit 2
A: Sample 1							
Treatment	0.081**	0.297***	0.323**	0.245**	0.359***	0.017	0.079^{*}
	(0.03)	(0.09)	(0.13)	(0.10)	(0.13)	(0.02)	(0.04)
Permuted p-value	0.025	0.004	0.026	0.058	0.002	0.492	0.071
Control Mean	0.47	1.82	1.87	1.75	3.10	0.62	0.55
N	1101	1969	1101	868	1710	1868	1567
B: Sample 2							
Treatment	0.102**	0.450***	0.399**	0.576***	0.552***	0.065**	0.083**
	(0.04)	(0.12)	(0.17)	(0.11)	(0.15)	(0.02)	(0.03)
Permuted p-value	0.041	0.008	0.049	0.012	0.009	0.013	0.012
Control Mean	0.45	1.70	1.81	1.55	2.61	0.47	0.50
N	878	1350	878	472	1248	1344	1266

Notes. Reported estimates are obtained via Ordinary Least Squares regressions. Standard errors are clustered at the school level (unit of randomization) and reported in parentheses. * p < 0.10, ** p < 0.05, *** p < 0.01. The outcome variable in column 1 is a dummy which equals 1 if the student was successful in meeting the target. The outcome in columns 2-4 is the student's payoff in visit 2. The sample used in the analysis either contains all observations ("All"), the observations for whom the difficult game was imposed ("Imposed") or for whom it was not imposed ("Not Imposed"). The outcome variable in column 5 is the sum of the average payoff in visit 1 and the payoff in visit 2. the outcome variable in columns 6 and 7 is a dummy variable which indicates whether the student makes the payoff-maximizing choice in visit 1 and visit 2, respectively. Treatment is a dummy variable which equals 1 if the student attends a school which has been treated with the grit intervention. Controls include task ability, gender, the Raven score, baseline beliefs and test scores, and risk tolerance as well as a dummy variable for whether the student has some inconsistent data entries.

Table A.10 Treatment Effect on Choice of Difficult Task - No Controls

	Difficult Round 1	Difficult Round 2	Difficult Round 3	Difficult Round 4	Difficult Round 5	Difficult All	After Failure	Next Week
A: Sample 1								
Treatment	0.091***	0.081**	0.118***	0.101***	0.078**	0.079**	0.146***	0.129***
	(0.03)	(0.04)	(0.03)	(0.04)	(0.04)	(0.04)	(0.05)	(0.05)
Controls	No	No	No	No	No	No	No	No
Permutation p-value	0.018	0.053	0.004	0.015	0.038	0.029	0.043	0.008
Control Mean	0.67	0.54	0.43	0.42	0.40	0.24	0.40	0.45
N	1889	1884	1885	1882	1886	1862	642	1858
B: Sample 2								
Treatment	0.139***	0.180***	0.178***	0.176***	0.142***	0.137***	0.166**	0.185***
	(0.03)	(0.04)	(0.04)	(0.05)	(0.04)	(0.05)	(0.08)	(0.04)
Controls	No	No	No	No	No	No	No	No
Permutation p-value	0.002	0.003	0.005	0.004	0.008	0.006	0.074	0.001
Control Mean	0.67	0.51	0.35	0.30	0.26	0.16	0.50	0.41
N	1354	1351	1351	1350	1354	1335	585	1349

Notes. Reported estimates are average marginal effects from logit regressions. Standard errors are clustered at the school level (unit of randomization) and reported in parentheses. * p < 0.10, ** p < 0.05, *** p < 0.01. The outcome variable in columns 1-5 is a dummy variable which equals one if the student chooses to do the difficult task in the respective round of the first visit, while the outcome variable in column 6 equals one if the student chooses the difficult task in all five rounds. The outcome variable in column 7 is a dummy variable which equals 1 if the student chooses to do the difficult task in the 2nd round of the first visit; estimates are obtained for students for whom the difficult task was imposed in round 1 and who failed to meet the target. The outcome variable in column 8 is a dummy which equals 1 if the student chooses to do the difficult task for the following week. Treatment is a dummy variable which equals 1 if the student attends a school which has been treated with the grit intervention.

Table A.11 Treatment Effect on Success and Payoffs in the Second Visit - No Controls

	Success		Payoff		Total Payoff	Maximizi	ng Choice
	Imposed	All	Imposed	Not Imposed	All	Visit 1	Visit 2
A: Sample 1							
Treatment	0.105***	0.250	0.417**	0.034	0.339	0.011	0.079^{*}
	(0.04)	(0.15)	(0.16)	(0.20)	(0.23)	(0.02)	(0.05)
Controls	No	No	No	No	No	No	No
Permuted p-value	0.006	0.105	0.007	0.908	0.144	0.642	0.106
Control Mean	0.47	1.82	1.87	1.75	3.10	0.62	0.55
N	1102	1970	1102	868	1710	1868	1567
B: Sample 2							
Treatment	0.111**	0.429***	0.441**	0.406**	0.552***	0.062***	0.092***
	(0.05)	(0.14)	(0.20)	(0.16)	(0.16)	(0.02)	(0.03)
Controls	No	No	No	No	No	No	No
Permuted p-value	0.080	0.014	0.086	0.066	0.010	0.033	0.008
Control Mean	0.45	1.70	1.81	1.55	2.61	0.47	0.50
N	878	1350	878	472	1248	1344	1266

Notes. Reported estimates in columns 1, 6 and 7 are average marginal effects from logit regressions. Estimates in columns 2-5 are obtained via Ordinary Least Squares regressions. Standard errors are clustered at the school level (unit of randomization) and reported in parentheses. * p < 0.10, *** p < 0.05, **** p < 0.01. The outcome variable in column 1 is a dummy which equals 1 if the student was successful in meeting the target. The outcome in columns 2-4 is the student's payoff in visit 2. The sample used in the analysis either contains all observations ("All"), the observations for whom the difficult game was imposed ("Imposed") or for whom it was not imposed ("Not Imposed"). The outcome variable in column 5 is the sum of the average payoff in visit 1 and the payoff in visit 2. the outcome variable in columns 6 and 7 is a dummy variable which indicates whether the student makes the payoff-maximizing choice in visit 1 and visit 2, respectively. Treatment is a dummy variable which equals 1 if the student attends a school which has been treated with the grit intervention.

Table A.12 Treatment Effect on Standardized Test Scores - Baseline Scores as Controls

	A: Sample 1		B: Sample 2			
	Math Score	Verbal Score	Math Score	Verbal Score	Math Score	Verbal Score
	Long-Run	Long-Run	Short-Run	Short-Run	Long-Run	Long-Run
Treatment	0.215**	0.021	0.203*	0.055	0.096	-0.048
	(0.09)	(0.10)	(0.10)	(0.05)	(0.07)	(0.07)
Math score (pre)	0.299***	0.337***	0.334***	0.356***	0.358***	0.337***
	(0.05)	(0.05)	(0.03)	(0.02)	(0.04)	(0.03)
Verbal score (pre)	0.169***	0.291***	0.284***	0.310***	0.265***	0.364***
	(0.04)	(0.06)	(0.03)	(0.03)	(0.04)	(0.02)
Permutation p-value	0.044	0.840	0.096	0.350	0.252	0.582
Control Mean	-0.09	0.02	-0.06	0.01	-0.02	0.06
N	1040	1036	1347	1350	781	778

Notes. Estimates are obtained via Ordinary Least Squares regressions. Standard errors are clustered at the school level (unit of randomization) and reported in parentheses. * p < 0.10, ** p < 0.05, *** p < 0.01. The dependent variables are the students' math and verbal standardized test scores at follow-up. The long-run follow-up data for Sample 1 was collected 2.5 years after the intervention. For Sample 2, the short-run and the long-run follow-up data were collected immediately after the implementation of the intervention and 1.5 years after the intervention, respectively. Treatment is a dummy variable which equals 1 if the student attends a school which has been treated with the grit intervention.

Table A.13 Original and Romano-Wolf p-values (Sample 1)

	(1) Original p-value	(2) Romano Wolf p-value
	Original p-value	Romano won p-value
I. Achievement Outcomes		
Math test score (long-run)	0.014	0.036
Verbal test score (long-run)	0.578	0.916
Math grade	0.570	0.916
Verbal grade	0.858	0.916
II. Survey and Experimental C	Outcomes	
Beliefs (survey)	0.000	0.000
Grit (survey)	0.000	0.000
Confidence	0.903	0.885
Difficult Round 1	0.000	0.000
Difficult Round 2	0.012	0.040
Difficult Round 3	0.000	0.000
Difficult Round 4	0.000	0.000
Difficult Round 5	0.001	0.000
Payoff Visit 1	0.583	0.805
Next Week	0.001	0.000
Payoff Visit 2	0.010	0.040

Notes. Math and verbal test score refer to the standardized math and verbal scores measured 2.5 years after the intervention. Math and verbal grade refer to the grades given by teachers. For the purpose of this analysis, we group our main outcome measures into two blocks, namely (i) achievement outcomes and (ii) survey and experimental outcomes.

Table A.14 Original and Romano-Wolf p-values (Sample 2)

	(1)	(2)
	Original p-value	Romano Wolf p-value
I. Achievement Outcomes		
Math test score (short-run)	0.001	0.012
Verbal test (short-run)	0.034	0.116
Math test score (long-run)	0.004	0.028
Verbal test score (long-run)	0.697	0.924
Math grade	0.986	0.988
Verbal grade	0.967	0.924
II. Survey and Experimental C	Outcomes	
Beliefs (survey)	0.000	0.000
Grit (survey)	0.000	0.000
Confidence	0.324	0.271
Difficult Round 1	0.012	0.048
Difficult Round 2	0.000	0.008
Difficult Round 3	0.000	0.004
Difficult Round 4	0.001	0.008
Difficult Round 5	0.001	0.008
Payoff Visit 1	0.153	0.255
Next Week	0.000	0.004
Payoff Visit 2	0.000	0.008

Notes. Math and verbal test score (short-run) refer to the standardized math and verbal scores measured immediately after the implementation of the intervention, while math and verbal test score (long-run) refer to the standardized math and verbal scores measured 1.5 years after the intervention. Math and verbal grade refer to the grades given by teachers. For the purpose of this analysis, we group our main outcome measures into two blocks, namely (i) achievement outcomes and (ii) survey and experimental outcomes.

Table A.15 Power Calculations (Sample 1)

Variable	Mean	SD	ICC	MDE	In SD/%
Math grade	0.00	1.00	0.28*	0.33*	0.33 SD
Verbal grade	0.00	1.00	0.16*	0.22*	0.22 SD
Math score	0.00	1.00	0.06*	0.23*	0.23 SD
Verbal score	0.00	1.00	0.08*	0.23*	0.23 SD
Choose Difficult (Round 1)	0.76	0.42	0.05	0.10	13%
Choose Difficult (All Rounds 1-5)	0.28	0.45	0.03	0.09	33%
Choose Difficult (Second Visit)	0.52	0.50	0.05	0.11	22%
Total Payoff	3.29	2.55	0.04	0.57	17%

Notes. We calculate the smallest real effect sizes that we can detect at a 5% significance level with 80% power. We perform the calculation based on 15 treatment and 21 control clusters with approximately 71 students per cluster. This table displays the mean, standard deviation, intracluster correlation coefficient (ICC) and minimum detectable effect (MDE) sizes in levels and in SD/% for our main outcome variables: math and verbal grades given by teachers, math and verbal test scores as measured using standardized achievement tests, and experimental choices and outcomes, which comprise students' choice of difficult task in round 1, students' choice of difficult tasks in all five rounds of the first visit, students' choice of difficult task for the following week, and students' success in meeting the target in the second visit. Grades and achievement test scores are standardized to have a mean of zero and a standard deviation of one. (*) When calculating the ICC and MDE for grades and test scores, we take into account that we have baseline information on students' gender, baseline beliefs and test scores, student ability as measured by the Raven test and class size by first regressing the outcome variable on the baseline characteristics and performing the ICC and MDE calculations using the residuals from that regression.

Table A.16 Power Calculations (Sample 2)

Variable	Mean	SD	ICC	MDE	In SD/%
Math grade	0.00	1.00	0.094*	0.30*	0.30 SD
Verbal grade	0.00	1.00	0.139*	0.37*	0.37 SD
Math score	0.00	1.00	0.002*	0.13*	0.13 SD
Verbal score	0.00	1.00	0.008*	0.15*	0.15 SD
Choose Difficult (Round 1)	0.77	0.42	0.026	0.11	15%
Choose Difficult (All Rounds 1-5)	0.22	0.41	0.008	0.08	36%
Choose Difficult (Second Visit)	0.50	0.50	0.041	0.16	32%
Total Payoff	2.86	2.35	0.017	0.54	19%

Notes. We calculate the smallest real effect sizes that we can detect at a 5% significance level with 80% power. We perform the calculation based on 8 treatment and 8 control clusters with approximately 94 students per cluster. This table displays the mean, standard deviation, intracluster correlation coefficient (ICC) and minimum detectable effect (MDE) sizes in levels and in SD/% for our main outcome variables: math and verbal grades given by teachers, math and verbal test scores as measured using standardized achievement tests, and experimental choices and outcomes, which comprise students' choice of difficult task in round 1, students' choice of difficult tasks in all five rounds of the first visit, students' choice of difficult task for the following week, and students' success in meeting the target in the second visit. Grades and achievement test scores are standardized to have a mean of zero and a standard deviation of one. (*) When calculating the ICC and MDE for grades and test scores, we take into account that we have baseline information on students' gender, baseline beliefs and test scores, student ability as measured by the Raven test and class size by first regressing the outcome variable on the baseline characteristics and performing the ICC and MDE calculations using the residuals from that regression.

Table A.17 Treatment Effect on Post-Treatment Survey Measures

	A: Saı	nple 1	B: Sai	nple 2
	Grit	Beliefs	Grit	Beliefs
	(Survey)	(Survey)	(Survey)	(Survey)
Treatment	0.292***	0.346***	0.345***	0.331***
	(0.05)	(0.07)	(0.07)	(0.06)
Permutation p-value	0.000	0.000	0.004	0.004
Control Mean	-0.17	-0.19	-0.12	-0.12
N	1747	1840	1159	1294

Notes. Estimates are obtained via Ordinary Least Squares regressions. Standard errors are clustered at the school level (unit of randomization) and reported in parentheses. * p<0.10, ** p<0.05, *** p<0.01. The outcome variables are post-treatment grit and post-treatment beliefs about the malleability of skills elicited in the student survey. Treatment is a dummy variable which equals 1 if the student attends a school which has been treated with the grit intervention. Controls include gender, the Raven score, baseline beliefs and test scores, and risk tolerance.

II APPENDIX B: EXPERIMENTAL TASK INSTRUCTIONS

1st Visit

Hello everyone! Today we'll play a game. In this game, you'll do a task and make some decisions. Based on your performance and your decisions, you will earn gifts [show gift basket]. There are no right or wrong decisions. Everyone can choose what they want! But, there's an important rule: Not to comment at all on how the game is going, what you chose, whether you were successful... Keeping your choices a secret is important. And you should not ask others what they are choosing, because everyone is different and everyone can make their own choices. OK? We will now introduce our game [draw the following grid on the board].

15	34	80
37	42	66
20	85	58

The game has 5 rounds [write R1, R2, R3, R4, R5 on the board]. You will earn gifts according to whether you are successful in these rounds or not. At the end of this class, we'll select one round randomly, by picking a number from a bag without looking inside. If you were successful in that round, you get gifts. For example, suppose I was unsuccessful in Round 1 and Round 2 but successful in 3, 4, and 5 [show by putting X and \sqrt{underneath R1...R5 on the board}]. Suppose Round 2 was selected. Do I get gifts? No, because I was not successful. Do I get gifts if Round 4 is selected? Yes, because I was successful in that round. This means, gifts don't accumulate. You only get the gift you earned in the selected round. So, you should not think "I got enough gifts from the previous rounds, so I don't need to take these rounds seriously". Any round can be selected, so take all rounds seriously. OK?

Now, the game we will play is a number search game [show grid on the board]. In this game, we try to find number pairs that add up to 100 within a number grid. Look at the grid on the board. Here, there are number pairs which sum to 100. For example: 15 and 85. Their total is 100 [mark 15 and 85 with \checkmark , and write 15+85=100 beneath the table on the board]. Are there any other pairs you can see? [Ask children, write on the board, mark the pairing numbers]. OK, so is there a number that matches with 37? No. This shows that not all numbers have a matching number to sum up to 100. Also, numbers do not repeat, there is only one of each number. So, when you find a pair, you can mark those two numbers off. OK?

Now, before we start our main 5 rounds, we will distribute a pre-game puzzle. Here, the goal is to find as many pairs summing up to 100 as you can, within 2 minutes. For each pair you find, you will get a small gift [distribute the pre-game puzzle sheets]. First, you'll write your name, last name and classroom on the front, and wait. Do not turn the page yet. Everyone will start at the same time. You will write the pairing numbers in the blanks underneath the table, and mark them off on the grid. OK? Everyone ready? Start! [Keep the time. Instruct children to turn the page immediately when time is up. Collect the sheets.]

OK, now we'll start our main 5-round game. We have two different types of games here. One is the 4-gift game. If you are successful in this one, you get 4 large gifts. If you fail, you get 0 gifts [write on the board: 4-gift game: $\sqrt{=4}$, X=0]. We also have a 1-gift game. Here, if you are successful, you get 1 large gift. If you fail, you get 0 gifts [write on the board: 1-gift game: $\sqrt{=1}$, X=0]. The target for success is the same in both games: Finding at least 3 pairs that sum up to 100 [write on the board: AT LEAST 3]. If you cannot find 3 pairs, you are unsuccessful. OK?

But what is the difference between the 4-gift and the 1-gift game? The target is the same in both: Finding at least 3 pairs adding up to 100, within 1.5 minutes. But, the 4-gift game is more difficult than the other, because the grid is larger. You are looking for the numbers within a bigger space [open one sample puzzle from the 4-gift booklet, one sample puzzle from the 1-gift booklet, and show]. See, the 1-gift grid is smaller. That is why the 1-gift game is easier than the 4-gift game. Both grids have the same number of pairs, but in one they are harder to find because the grid is larger. OK? So, every round, you are going to play either the 4-gift or the 1-gift game.

First, I will explain the rules for Round 1. You will first make the decision only for Round 1. For the other rounds, you will decide later. Now please think carefully: Would you like to play the 4-gift, more difficult game in Round 1, or the 1-gift, easier game? The choice you make will count with half-half chance. Either your own choice counts, or everyone will need to play the game written here [show a folded piece of paper]. OK? So think now: If the choice is up to you, what game would you like to play in Round 1? The 4-gift game or the 1-gift game? Think carefully because your choice may count! [Distribute 1st period choice sheets, collect.]

Now, we will give you both the 4-game booklet and the 1-game booklet. Look, in this booklet we have 5 rounds of the 4-gift game. In this one we have 5 rounds of the 1-gift game [show the booklets]. If you will play the 4-gift game in a round, you use that booklet in that round. If in another round you want to play the 1-gift game, you use the 1-gift booklet in that round. OK? [Distribute the booklets.] Now, please write your name on BOTH booklets, and wait. Do not open the booklets.

Now, let's have our draw. We have two folded pieces of paper here. One has "free choice" and one has "no free choice, 4-gift game" written on it. Now, let's see whether your choice will count or not. [Put pieces of paper in a bag and make a child draw one, record the outcome of the draw.]

• [If "No Choice" is drawn]: For the first round, everyone will need to start with the 4-gift game. In the other rounds, you will be free to make your own choices, OK? Now, everyone take the "4-gift" booklet in their hands and wait. Check and make sure that "4-gift booklet" is written on top. OK? Now, when we say so, you will open the 1st page of this booklet. "1st Round" will be written on the page. After 1.5 minutes when time is up, everyone will fold their arms and become a flower. If you finish earlier, you also wait quietly, OK? And remember, it is a very important rule of the game not to talk to your friends, not tell others how many pairs you found, and not comment on the game etc. OK? Also, there is a difference in the way you'll mark the matching numbers. You won't have to write them underneath the table but mark them with matching marks. Not to confuse two different pairs, you use different marks. For example, [show on the grid on the board] when 15 and 85 match, let's say we circle both. For 20 and 80, we can no longer use the circle because the pairs would get mixed up. We need to use something else. Let's say the check mark. You will see the signs you can use on your sheets [also write on the board]:

√ X O □ Δ ♡ +

Now, is everyone ready to open the 1st round page of the 4-gift booklet?

• [*If "Free Choice" is drawn*]: For the first round, you will play the game of your choice. In the other rounds, you will also be free to make your own choices. Now, please take the booklet corresponding to the game that you chose for the 1st round. If you want to play the 4-gift game, you take the 4-gift booklet in your hand. If you want to play the 1-gift game, you take the 1-gift booklet in your hand and wait. OK? When we say so, everyone will open the first page of the booklet they chose for the first round. You will see "1st round" written on the page. After 1.5 minutes when time is up, everyone will fold their arms and become a flower. If you finish earlier, you also wait quietly, OK? And remember, it is a very important rule of the game not to talk to your friends, not tell others how many pairs you found, and not comment on the game etc. OK? Also, there is a difference in the way you'll mark the matching numbers. You won't have to write them underneath the table but mark them with matching marks. Not to confuse two different pairs,

you use different marks. For example, [show on the grid on the board] when 15 and 85 match, let's say we circle both. For 20 and 80, we can no longer use the circle because the pairs would get mixed up. We need to use something else. Let's say the check mark. You will see the signs you can use on your sheets [also write on the board]:

$\sqrt{X0}$ \Box Δ \Box +

Now, is everyone ready to open the 1st round page of the booklet they chose?

OK, we start now! [Hold 90 seconds. When time is up]: Fold your arms please! Become a flower! Now we'll come and check everyone's sheets. [Experimenters go around and circle Succeeded/Failed depending on whether child was able to find 3 pairs or not.] Now, for the 2nd round, we have new grids, for both the 4-gift game and the 1-gift game. Everyone is free to choose which type of game they want. Either the 4-gift game or the 1-gift game. Now, think carefully again, would you like to do the 4-gift, more difficult game in the 2nd round, or the 1-gift, easier game? Take the booklet of your choice. And open the page that says 2nd round. Ready? Start! [Repeat this until 5 rounds are over.]

Now, we'll be playing this game again in a week. That day, you will play one of the games again (either the 4-gift or the 1-gift game), but only for 1 round. And there is an important point. If you want, you can get practice games to work on them [show practice booklet]. This booklet has examples and practice games for the 4-gift, more difficult game. Whoever wants, can take this practice booklet and work on it at home, before the game next week. OK? Now, we ask you: next week, would you like to play the 4-gift, more difficult game or the 1-gift, easier game?

An important point: You won't be able to change your choice next week! With 50-50 chance, either the choice you make now will count. Or, you will play the game written on this piece of paper [show a folded paper]. Now please think and make a choice carefully, because this choice you make can count and you may need to play the game you choose now, next week. OK? [Distribute choice sheets]. Don't forget, you can take practice booklets to take home. Did everyone make their decisions? [Collect choice sheets.] Now, let's see whether your choice will count, or this game written on this paper. [Put the "free choice", and "no choice, 4-gift game" papers in a bag, have a student draw one, record the outcome of the draw.]

• [*If "Free Choice" is drawn*]: "Free choice" was drawn, so next week, you will play the game you have chosen just now. If you chose the 4-gift game, you will play that. If you chose the 1-gift game, you will play that. OK? We will bring your booklets

accordingly. There will be no changing the game next week. Does everyone know what they will play next week? Good!

• [*If "No Choice" is drawn*]: "No choice" was drawn, so next week, everyone will play the game written on this paper [*unfold*], which is the 4-gift game. OK? Does everyone know which game they will play next week? There will be no changing the game next week. Everyone will need to play the 4-gift, more difficult game.

[Distribute the practice booklets to those who want one. Anyone who wants can take one.]

Now, it is time to get your gifts from today. Let's make the draw for which round of the 5 rounds today will count [make draw using pieces of paper labeled R1, R2, R3, R4, R5]. Please, everyone open the Xth round [whichever round was selected] on the booklet you chose for that round. Write your name on that page and keep that page open. [Collect the booklets.] Giving the gifts: Depending on whether the child was successful in the selected round and depending on the game that he/she played, he/she gets 4 or 1 gift or 0 gifts: Children who played the 4-gift game and were successful in that round, get 4 gifts. Children who played the 1-gift game and were successful in that round, get 1 gift. Children who were unsuccessful in the game they played get 0 gifts. In addition, give the gifts from the ability-measuring task: a small gift for every correct pair found.

2nd Visit

Hello! Remember that we played a number game with you last week. And we said we would play it again this week. Now let's remember what the rules of the number game were [write sample grid on board again, remind]:

15	34	80
37	42	66
20	85	58

Today we'll play a single round of the game. Remember that we had two types of games. One gave 4 gifts if you are successful, but was more difficult. The other gave 1 gift if you are successful, but was easier. In both, you needed to find at least 3 pairs to be successful [write on board: AT LEAST 3].

• [If this is a classroom in which "Free Choice" was drawn the previous week:] Remember that we asked you last time: "which game would you like to play next week?" And you made a choice. According to that choice you made last week, we will

either give you the 4-gift or the 1-gift game now. We need to wait until everyone gets their sheets, so do not turn the page, OK? [Distribute the 4-gift game to those who chose it and the 1-gift game to those who chose it. If there are children who were absent the previous week but there now, quietly ask which game he/she wants and give that.]

• [*If this is a classroom in which "No Choice" was drawn the previous week:*] Remember that last week, in your class the draw was such that everyone would play the 4-gift game. That's why we are now going to give everyone the 4-gift game, OK? We need to wait until everyone gets their sheets, so do not turn the page, OK? [*Distribute the 4-gift game to all.*]

Ready? Start! [Keep the time, mark success/failed. Collect sheets. Give children gifts depending on whether they were successful or not in the task.]

Figure B.1 Example of Easy Task

80	7
70	95
5	20
10	30
93	90

Figure B.2 Example of Difficult Task

17	86	23	12
71	42	27	38
51	62	83	30
77	59	46	67
81	58	29	54

III APPENDIX C: SUMMARY OF CURRICULUM

The grit curriculum consists of a range of topics to be covered in class during weekly project hours. Each week is dedicated to a specific topic, which is introduced by the teacher with the help of a pre-specified set of materials. The material is designed to initiate class discussions and activities, questions and homework. We recommend a minimum of 10 weeks to complete the curriculum. Based on the feedback we received from participating teachers, on average 12 weeks were necessary to complete the curriculum. Most teachers reported that they spent at least 2 hours/week on the project. In the following, we provide a summary of the material to be covered during each week together with the recommended follow-up activities.

Week 1: The Plasticity of the Brain

<u>Growth Mindset Video:</u> The material used for this lesson is a 4-minute video on the concept of the *growth mindset*. The focus of this week's lesson is the plasticity of the brain.

<u>Follow-up Activities:</u> Teachers initiate a class discussion based on questions we provide. Children are then asked to draw themselves while they struggle with an activity that they find very difficult and frustrating. They are asked to imagine their brain activities while they work on the task.

Activity for the Whole Semester: Every week the teacher selects a number of students to be the "students who exerted most effort during this week". The purpose of these announcements is to demonstrate how students make progress by putting in more effort. The announcements are followed by a class discussion on how valuable certain behaviors are. A round of applause is given to the selected students, after which the students' pictures are put on the board into a designated frame, and the students are provided with certificates.

Week 2: Growth Mindset Messages

<u>Growth Mindset Video:</u> Children watch the 4-minute video on the growth mindset one more time. The focus of the lesson is how children differ in their mindsets. The video shows two children who engage in a dialog, one with a growth mindset and one with a fixed mindset.

<u>Follow-up Activities:</u> Teachers initiate a class discussion based on questions we provide. In addition, students are given homework in which they are asked to reflect on their current mindset.

Week 3-4: Failure and Praising

Reading a Letter: Students read a letter, which is written by a student to her parents. The student describes how she has been fascinated by the fact that famous scientists also experience failures on their way to success, and she asks her parents to understand that only because she sometimes fails on a test it doesn't mean that she is lacking the innate ability to perform better. She asks her parents to believe in her and support her when she is trying new things she is not good at from the start.

<u>Follow-up Activity (Week 3):</u> Teachers initiate a class discussion based on questions we provide. The children are then asked to write letters to their parents and teachers in which they explain how they would like to be praised/criticized.

<u>Follow-up Activity (Week 4):</u> Students are asked to form groups and to do research on a famous scientist, artist or athlete of their choice. They are asked to find out about this person's failures and frustrations. The students collect pictures and testimonies which they use to prepare a poster.

Week 5: Goals and Difficult Tasks

A Short Story on Mustafa - How to Deal with Difficult Tasks? In the fifth week, children read a short story about a boy who has been given a homework assignment that is challenging for him. The story describes which strategies the boy uses to tackle the challenging homework task.

<u>Follow-up Activity:</u> Students are asked to write down a goal they themselves want to achieve in one month's time. They are asked to write down the goal on a post-it, and put it on the classroom board together with their name. During the following weeks, students can put a star on the post-it whenever they accomplish something which brings them closer to achieving their main goal.

Weeks 6-7: Fear of Failure

A short story on Tugba - Who Likes Failing? Students read and discuss another short story. The story is about a girl who contemplates the meaning of the phrase 'Success consists of going from failure to failure without loss of enthusiasm'. In the story, the girl asks the 'Wise Bird' for advice. The girl and the Wise Bird engage in a conversation which centers around the idea that on the way to success people encounter numerous challenges and inevitably they fail many times before they succeed. The importance of not giving up is emphasized.

<u>Follow-up Activities:</u> In class, the teacher discusses these concepts on the basis of questions we provide and encourages students to think about their goals, what likely chal-

lenges they will encounter and how they are going to achieve them. In addition, the students are asked to write a letter to the Wise Bird in which they convey which goals they have.

<u>Follow-up Games:</u> In this game, the teacher draws a person on the board and asks students to imagine that this person has a goal (e.g. become a good football player). The teacher then draws a chronological chart, and complements it to include activities the child engages in to achieve this goal and challenges the student needs to overcome. <u>Homework:</u> Students find out about the dream of their close friend and they create a similar chronological chart for him/her.

Week 8-9: Fear of Mathematics

A Mini-Cartoon Story - Dancing with Numbers: Students are presented with a story about a boy who is afraid of math. In his dreams, there are numbers that want to engage and play with him but he is afraid. The next morning the boy is in school and observes how other children attempt to find solutions to math problems that the teacher poses in class, even if they do not know the right answer from the start. The boy observes how the students get encouraged to participate even if they do not know the right answer, which eventually encourages him to participate as well.

<u>Follow-up Activity:</u> Students are asked to complete the same math problems and raise their hands to give their solutions to the math problems. The teachers initiate a class discussion based on questions we provide.

Week 10: Developing a Classroom Culture and Announcing Learned Outcomes

In the tenth week, students engage in a consolidating activity. In particular, students form groups and they prepare a poster which is then displayed on the classroom board. Each group covers a different topic: 1) We dream big. We have plans. 2) We are not afraid of failure. 3) We do not give up. 4) We champion effort. 5) We love difficult tasks. Within each group, every student is expected to make a different contribution to the poster. Contributions ranged from making a painting, writing a short essay or choosing a slogan for the poster to writing poems or songs. We awarded a large trophy to the top 3 materials produced in class. The selection was made by a committee of volunteer teachers.

<u>Follow-up activity:</u> In all schools in which the project was carried out, the work was exhibited in the schools' corridors. This activity was carried out at the end of the semester, and it served the purpose to also inform the rest of the school about the project.

Examples of Classroom Activities

Figure C.1 Screenshot of animated video

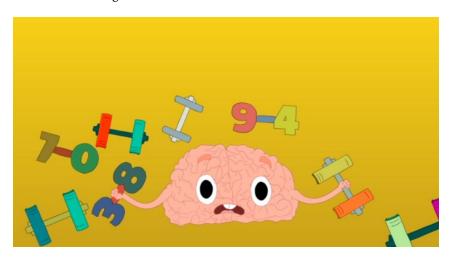
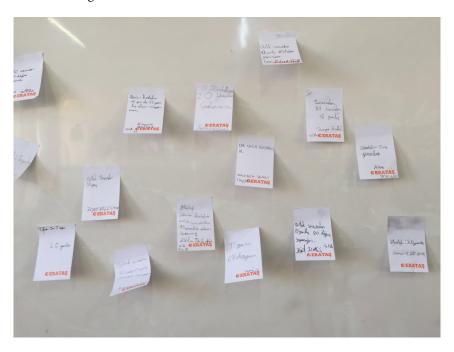


Figure C.2 Example of students' 1-month targets



BAŞARI BELGESİ

Sevgili Öğrencim:

Göstermiş olduğun üstün gayret ve başarılardan dolayı bu belgeyi almaya hak kazandın. Seni ve aileni kutlar başarılarının devamını dilerim..

Sınıf Öğretmeni

Figure C.3 Certificates students received for top posters

IV APPENDIX D: SURVEY QUESTIONS

Items Used for Constructing the Malleability Beliefs Measure

4-point item scale: completely agree, agree, disagree, completely disagree

- 1. Your intelligence is something very basic about you that you can't change very much.
- 2. Music or drawing talent can be learned by anyone.
- 3. No matter how intelligent you are, you can always change it quite a bit.
- 4. Truly smart people do not need to try hard.
- 5. If you're not good at a subject, working hard won't make you good at it.
- 6. If I study hard enough, I could be the most successful student in the class.

Items Used for Constructing the Survey-based Grit Measure

4-point item scale: completely agree, agree, disagree, completely disagree

- 1. I like schoolwork best which makes me think hard, even if I make a lot of mistakes.
- 2. Setbacks discourage me.
- 3. If I think I will lose in a game, I do not want to continue playing.
- 4. If I set a goal and see that it's harder than I thought I easily lose interest.
- 5. When I receive a bad result on a test I spend less time on this subject and focus on other subjects that I'm actually good at.
- 6. I work hard in tasks.
- 7. I prefer easy homework where I can easily answer all questions correctly.
- 8. If I'm having difficulty in a task, it is a waste of time to keep trying. I move on to things which I am better at doing.