Method

A total of 240 9th- and 10th-grade students from St. Anova School were randomly assigned to one of three treatment groups (coded as group) for the educational intervention program (control, NuKarma, and Discplinya). Within each treatment group, there were 80 females and males (biologically assigned sex at birth; coded as sex) and 20 9th- and 10th-grades (coded as grade). The school's Board of Trustees hypothesized that their current educational procedure is not enough to deal with the students' levels of loneliness, lack of social skills, and poorer school attendance and performance after the COVID-19 pandemic. The NuKarma intervention program is designed to teach students vital social skills through group sessions that promote belonging and activities that aim to nurture their empathy and social skills. The Discplinya program is designed to promote students' self-discipline through high expectations, strict deadlines, and required quasi-military training. The control group of students received the school's traditional education.

Materials and Procedures

At the beginning of the project, participants' Social Skills Index (SSI) was measured to capture their social skills (SSI1). In addition, General Intellectual Aptitude (GenApt) from their 8th grade was retrieved for the sake of the baseline of academic performance before the treatment. The treatment was run for one academic year. At the end of the academic year, participants' ability to control impulses, academic belonging, and SSI were collected to measure their social skill that relates to impulsiveness, sense of belonging in academic settings, and social skills, coded as JICS, BELONG_AC, SSI2, respectively. Once their grades were calculated, their GPA was collected to measure their academic performance. The number of days absent from school is obtained as a measure of attendance, but it is positively skewed (*Skewness* = 1.504); thus, it is modified by calculating the square root of the original values and saved as SkewFixed_attendance (*Skewness* = .230). In addition, descriptive statistics showed that there was misrecorded data in the grade and treatment groups (99 and 22, respectively). Those data points were labeled as missing values and excluded from the following analysis. For SSI, the new variable SSI_change was calculated to grasp the change in SSI scale by subtracting SSI that was measured after the intervention from SSI that was measured before. See Table 1 for descriptive statistics.

Results

To draw a big picture of the data, 3x2x2 mixed-model analysis of covariance was run for JICS, BELONG_AC, GPA, SkewFixed_attendance, SSI_change as dependent variables; group, sex, and grade of students as independent variables, controlling for GenApt. The result suggests that there are significant main effect of grade ($F_{(5, 219)}$ = 2.368, p = .041, *Eta squared* = .051), and significant interaction between group and grade ($F_{(10, 440)}$ = 2.800, p = .002, *Eta squared* = .060), sex and grade ($F_{(5, 219)}$ = 2.762, p = .019, *Eta squared* = .059). For other non-significant effects and statistics, see Table 2 and 3.

Post-hoc tests were run to 1) determine whether covariate mediates or moderates any dependent variables, and 2) determine the effect of each independent variable. To answer the first part, multiple regression analysis was performed between GenApt and JICS, BELONG_AC, GPA, SkewFixed_attendance, and SSI_change. The result indicates that the model that includes GPA explains almost 150% more variance in GenApt than the model that excludes only GPA, and therefore GPA is affected by GenApt (See Table 4). Correlation analysis was performed to determine whether GenApt moderates or mediates GPA, and there was no significant correlation between independent variables and GenApt (See Table 5). Thus GenApt moderates the relationship between independent variables and GPA. For the second part, the data was split based on group, sex, and grade. Then for each split data, one-way mixed model ANOVAs (for each dependent variable except SSI and GPA and IVs except what is splitting data), one-way mixed model ANCOVAs (for GPA as a dependent variable, independent variables excluding what is splitting data, controlling for GenApt), and one-way repeated-measure ANOVAs (SSI1 and SSI2 as within-subject dependent variable, IVs except what is splitting data) were run to determine the effect of each independent variable and interactions. Those analyses revealed that there are main effects of time on SSI1 and SSI2 (t = -16.320, p < .001, SD = 2.180, CI = [-2.585, -2.028]), sex on SSI1 and SSI2 ($F_{(1, 236)}$ = 10.251, p = .004, *Eta squared* = .035), sex on GPA when moderated by GenApt ($F_{(1, 235)}$ = 18.467, p < .001, *Eta squared* = .073), grade on BELONG_AC (t = -16.998, p < .001, CI = [-11.481, -9.096]), sex on BELONG_AC (t = -2.415, p < .016, CI = [-3.911, -.397]), sex on attendance (t = 12.169, p< .001, CI = [1.204, 1.670]), and group (control vs Group 2) on attendance (t = -2.997, p = .003, CI = [-.863, -.177]). Significant interactions were also found between grade and group (within treatment conditions) for SSI ($F_{(2,}$

$_{232)}$ = 10.539, p < .001, *Eta squared* = .083), and sex and grade for JICS ($F_{(1, 234)}$ = 4.613, p = .033, *Eta squared* = .019).

In addition, one-way mixed-model repeated measures ANOVA for group as an independent variable, SSI1 and SSI2 as within-subject dependent variables, and JICS, BELONG_AC, and SkewFixed_attendance as between-subject dependent variables; and one-way mixed-model ANCOVA was performed for group as an independent variable, GPA as a dependent variable controlling for GenApt to determine differences among groups on dependent variables mentioned above. The results respectively suggest that There are significant differences among groups for JICS ($F_{(2, 236)}$ = 5.188, p = .006, *Eta squared* = .042), BELONG_AC ($F_{(2, 236)}$ =5.947, p = .003, *Eta squared* = .048), and SkewFiexed_attendance ($F_{(2, 236)}$ = 4.415, p = .013, *Eta squared* = .036). Post hoc tests were run to determine which groups has significant differences. The result suggests that group 1 recorded significantly higher JICS than control group (p = .005, *SE* = .182), group 1 recorded significantly higher BELONG_AC than group 2 (p = .004, *SE* = 1.083) and control group (p = .027, *SE* = .1.079), and group 2 showed significantly higher SkewFiexed_attendance than control group (p = .010, *SE* = .182).

Discussion

The analyses insisted that multiple effect that should be considered when choosing intervention program. First, it revealed the grade of students affects their social skills, sense of belonging, academic achievement, and school attendance. Moreover, academic achievement is more related to students' general aptitude towards intellectual works. It insists the hypothesis that the school's Board of Trustees developed is partially moderated by a third variable. In addition, post hoc analysis revealed that students developed their social skill and sense of belonging over time; female students expressed higher degree of social skills, academic performance, sense of belonging, and more attendance compared to male.

Combining with another set of analyses, it was showen that Disciplinya program negatively changed students' attendance rate compared to the school's current style of education, increased social skills under NuKarma program compared to the school's original program, students on NuKarma program fostered more sense of belonging compared to those who were in Disciplinya program and original program, and higher degree of days of absence for Disciplinya compared to the original program. Taking all the considerations into account, the hypothesis is partially

supported. The NuKarma intervention program was effective to promote students' social skills compared to other programs, and NuKarma program made students to attend more classes compared to Discipline program. Despite there is few observed positive effects, NuKarma program is most likely to increase students' engagement. Further studies that includes more diverse subjects and more specific variables that students' measures engagement, mental health and social skills would be appropriate for follow-up studies.

Table 1

Descriptive Statistics of variables that were used to this analysis.

Descriptive Statistics

	N	Mean	Std. Deviation	Skewness
Treatment Group	240	1.00	0.817	0.008
Sex	239	0.50	0.501	0.000
Grade in School	240	9.50	0.501	-0.008
Social Skills Index (pretest)	240	10.40	5.750	0.199
General Intellectual aptitude assessed at end of Grade 8	240	123.00	9.499	0.298
Jenkins Impulse Control Scale (end of yr)	240	3.10	1.187	-0.172
Academic Belonging Scale (end of yr)	240	21.27	6.983	-0.021
# of days absent from school	240	4.89	4.980	1.504
SkewFixed_attendance	240	1.88	1.162	0.230
Social Skills Index (end of year retest)	240	12.70	6.320	0.232
End of Year Grade Point Avg	238	3.10	0.539	-0.336
Valid N (listwise)	238			

Table 2

3x2x2 mixed-model analysis of covariance to determine effects of treatment group, sex, students' grade and their interactions for the difference of pre- and post-treatment Social Skill Index score, ability to control impulse scale, academic belonging scale, days of absence, and GPA.

Multivariate Tests (a)

Effect		F	Hypothesis df	Error df	Sig.	Partial Eta Squared
group * GenApt	Pillai's Trace	1.437	10.000	446.000	0.161	0.031
group * grade	Pillai's Trace	2.830	10.000	446.000	0.002	0.060
group * sex	Pillai's Trace	1.662	10.000	446.000	0.087	0.036
group	Pillai's Trace	1.870	10.000	446.000	0.047	0.040
sex	Pillai's Trace	43.351	5.000	222.000	0.000	0.494
grade	Pillai's Trace	85.366	5.000	222.000	0.000	0.658
GenApt	Pillai's Trace	47.578	5.000	222.000	0.000	0.517

a. Design: Intercept + group * GenApt + group * grade + group * sex + group + sex + grade + GenApt

Table 3

3x2x2 mixed-model analysis of covariance for the difference of pre- and post-treatment Social Skill Index score, ability to control impulse scale, academic belonging scale, days of absence, and GPA, depend on treatment groups, grades, sex, and general intellectual aptitude at the end of 8th grade.

Tests of Between-Subjects Effects

Source		Type III Sum of Squares	df	F	Sig.	Partial Eta Squared
group	Jenkins Impulse Control Scale (end of yr)	0.906	2	0.494	0.611	0.004
	Academic Belonging Scale (end of yr)	7.235	2	0.238	0.788	0.002
	End of Year Grade Point Avg	0.302	2	0.822	0.441	0.007
	SkewFixed_attendance	6.387	2	4.813	0.009	0.041
	Observed change of social skills index.	14.940	2	2.163	0.117	0.019
sex	Jenkins Impulse Control Scale (end of yr)	10.898	1	11.899	0.001	0.050
	Academic Belonging Scale (end of yr)	272.171	1	17.913	0.000	0.073
	End of Year Grade Point Avg	3.311	1	18.017	0.000	0.074
	SkewFixed_attendance	117.256	1	176.711	0.000	0.439
	Observed change of social skills index.	34.879	1	10.100	0.002	0.043
grade	Jenkins Impulse Control Scale (end of yr)	5.944	1	6.490	0.012	0.028
	Academic Belonging Scale (end of yr)	6308.531	1	415.192	0.000	0.648
	End of Year Grade Point Avg	0.465	1	2.531	0.113	0.011
	SkewFixed_attendance	0.729	1	1.099	0.296	0.005
	Observed change of social skills index.	7.068	1	2.047	0.154	0.009
GenApt	Jenkins Impulse Control Scale (end of yr)	83.303	1	90.954	0.000	0.287
	Academic Belonging Scale (end of yr)	657.751	1	43.289	0.000	0.161
	End of Year Grade Point Avg	21.090	1	114.780	0.000	0.337
	SkewFixed_attendance	25.503	1	38.434	0.000	0.145
	Observed change of social skills index.	51.844	1	15.012	0.000	0.062
Error	Jenkins Impulse Control Scale (end of yr)	206.988	226			
	Academic Belonging Scale (end of yr)	3433.900	226			
	End of Year Grade Point Avg	41.526	226			
	SkewFixed_attendance	149.962	226			
	Observed change of social skills index.	780.469	226			

Table 4

Regression analysis between general intellectual aptitude at the end of 8th grade and ability to control impulse scale, academic belonging scale, days of absence, and GPA, respectively.

Model Summary

Model	R	R Square	Estimate	Change Statistics				
				R Square Change	F Change	df1	df2	Sig. F Change
1	.301 (a)	0.091	9.091	0.091	23.516	1	236	0.000
2	.519 (b)	0.270	8.165	0.179	57.565	1	235	0.000
3	.527 (c)	0.278	8.134	0.009	2.807	1	234	0.095
4	.648 (d)	0.419	7.311	0.141	56.620	1	233	0.000

a. Predictors: (Constant), SkewFixed_attendance

b. Predictors: (Constant), SkewFixed_attendance, Jenkins Impulse Control Scale (end of yr)

c. Predictors: (Constant), SkewFixed_attendance, Jenkins Impulse Control Scale (end of yr), Academic Belonging Scale (end of yr)

d. Predictors: (Constant), SkewFixed_attendance, Jenkins Impulse Control Scale (end of yr), Academic Belonging Scale (end of yr), End of Year Grade Point Avg

Table 5

Partial Correlation between general intellectual aptitude at the end of 8th grade and treatment group, sex, students' grade.

Correlations

Control Variables			Treatment Group	Sex	Grade in School
General Intellectual aptitude assessed at end of Grade 8	Treatment Group	Correlation	1.000		
		Significance (2-tailed)			
		df	0		
	Sex	Correlation	0.002	1.000	
		Significance (2-tailed)	0.975		
		df	235	0	
	Grade in School	Correlation	0.000	-0.009	1.000
		Significance (2-tailed)	0.995	0.894	
		df	235	235	0

I have adhered to the Honor Code for this assignment. - *Satoru Uchida*