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NASEF Students' Surveyed Beliefs & Attitudes

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NASEF

The North America Scholastic Esports Federation (NASEF) is a non-profit esports program for middle and high school students. What makes NASEF unique is its *enriched esports* model. NASEF uses student interest in esports as a context and means for learning, school affiliation, and social-emotional skills. The NASEF program accomplishes this through school-affiliated extracurricular clubs rather than just isolated competitive teams, engaging students not only in competitive play but also in esports-related intellectual and professional activities from shoutcasting to logo design, from expository writing to data analysis, from club leadership to team collaboration. The research detailed herein is part of the program's assessment and evaluation, funded by the Samueli Foundation to ensure that the program continues to make good on its stated mission and goals.

Study Goals & Design

To assess the impact of NASEF on the program's *student outcome goals*, we surveyed participants' beliefs and attitudes on the following 19 variables across five main constructs:

1. **STEM Attitudes & (Career) Knowledge** (in blue), including STEM Activity Participation, STEM Career Interest, STEM Career Knowledge, STEM Engagement, STEM Identity, and STEM Value;

2. **School Affiliation** (in green), including School Belonging, School Interest, School Value, and Effort in School;

3. **Social Skills & Relationships** (in red), including Communication, Cooperation, Relationships with Adults, and Relationships with Peers;

4. **Well-Being** (in purple), including Self-Regulation, Persistence, and Tilt Resilience; and

5. **21st Century Skills** (in orange), including Critical Thinking and Mastery Orientation.

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The survey was administered across both fall and spring league seasons using a trend study design with the same instrument administered to different samples of a single population at different points in time. A survey of General Managers (GMs) in the program was also administered during Fall and Spring league seasons to measure "extent of program" variables at each site implementation, such as size of club and team roster, number of student roles filled, and curricular materials and program toolkits used – variables that could be then tested as possible moderating variables to patterns in student outcomes found.

Sample

Our target sample was 350 students total but data collection was closed early as mandated by UCI in response to the pandemic, leaving us a sample of n=82 total (n=55 at time one, n=27 at time two). The Levene test for equality of variances supported homogeneity of variance across these two groups (α = 0.05), despite their differing sample sizes, allowing us to use two-sample t-tests to compare the means of each variable at time one and time two. Testing found *no significant differences between time one and time two on any measure* (α = 0.05).

Because the sample sizes were small and there were no differences detected between groups, we decided to *pool the data into a single sample* so as to describe students' beliefs and attitudes as a whole. We checked IP and email addresses to ensure there were no duplicate participants in the two groups and, finding none, pooled them. The overall demographic profile of the student sample is shown in Table 1 below. Only 2 staff members completed the General Managers (GMs) survey, so it was removed for analysis.

Table 1. Demographics of the sample.

Age	#	%	Gender		
13 years	1	1.2	Male	72	87.8
14 years	6	7.3	Female	7	8.5
15 years	23	28.0	Prefer not to answer	3	3.7
16 years	19	23.2	**Ethnicity**	**#**	**%**
17 years	24	29.3	African American/Black	1	1.2
18 years	6	7.3	American Indian, Native American, or Alaskan Native	1	1.2

Prefer not to answer	3	3.7	Asian/Asian American	30	36.6
Grade Year			Hispanic/Latino	10	12.2
9th	13	15.9	Middle Eastern/Arab	1	1.2
9th	13	15.9	Native Hawaiian/Pacific Islander	0	0.0
10th	24	29.3	Caucasian/White (Non-Hispanic)	20	24.4
11th	23	28.0	Multiethnic	17	20.7
12th	21	25.6	Other	1	1.2
Prefer not to answer	1	1.2	**Language other than English spoken at home**		
			Yes	30	36.6
			No	50	61.0
			Prefer not to answer	2	2.4

Survey Instrument

The student survey instrument used for this year's study was similar to the survey used previously (2019-2020) except that the questions were no longer retrospective and some variables were revised or removed based on last year's data and this year's instrument assessment. The current survey contains 105 items total including 54 items taken from the PEAR instrument (Partnerships in Education and Resilience, 2018). Responses to each item were collected on a 5-point Likert scale with 1 marked "strongly negative or disagree," 3 marked "neutral," and 5 marked "strongly positive or agree" except for those items taken from the PEAR instrument, which were on a Likert 4-point scale (with no middle or neutral response value assigned).

In order to construct the 19 variables listed above from the pool of 105 items, we checked each item for sufficient variability in responses, grouped them conceptually into subgroups

based on overall face validity, and then measured the internal consistency of each subgroup using Cronbach's alpha. Subgroups with α < 0.80 were reexamined to remove inconsistent items to improve internal consistency. Two (2) items total were thus removed, leaving a total of 103 items in the final data set, representing 19 variables total. Table 2 below lists all 19 variables, the number of contributing items, and the resulting Cronbach's coefficient (α) for each.

The resulting data set contains roughly two thirds (13) of the same variables as the study one year previously and one third (6) revised or new variables. Two (2) variables were renamed to better reflect what they actually measure: *Sense of Belonging* became *School Belonging*, and *Perseverance* became *Persistence.* Four (4) variables from the prior instrument were dissolved (*School Engagement, Emotional Regulation, Self-Management, Grit*) and their items merged into newly formed variables (*School Interest, Self-Regulation*) or other existing variables for better conceptual clarity. Five (5) entirely new items were constructed representing two (2) new variables (*Tilt Resilience, STEM Value*) that have emerged as part of NASEF's program goals over the intervening year.

Students' Beliefs & Attitudes

To standardize scores on the resulting set of new index variables, we inverted all negatively scaled questions and then summed students' responses across all items in the variable and divided by the highest number of response points possible, resulting in a single standardized index measure of each variable that ranged between zero and one. Students were thus scored on each of the 19 variables based on this calculation.

Figure 1 shows the mean response of NASEF students on all 19 variables grouped by color to indicate the five (5) broader constructs (listed above) that these variables together represent. Students participating in NASEF reported positively on 18 of 19 variables measured. Compared to Year 2 survey findings, we again see persistently high average ratings on *Critical Thinking, STEM Career Interest,* and *STEM Engagement,* although it is important to keep in mind that last year's survey reported *change* on each variable, not simply current beliefs and attitudes. This year, the highest reported index scores were for *STEM Value* (e.g. "I know STEM is good for me," 0.84), *STEM Career Interest* (e.g. "STEM is important for what I want to study later," 0.83), and *Critical Thinking* (e.g., "I think carefully before believing things people tell me," 0.83), followed closely by *STEM Engagement* (e.g., "I am interested in learning about STEM," 0.80), *Communication* (e.g., "I am truthful and open with sharing information with my peers," 0.80), and *Relationships with Peers* (e.g., "I have friends I can trust," 0.80). Other relatively high average scores were for *Effort in School* (e.g., How much effort do you put into your homework for your classes?" 0.76) and *School Value* (e.g., "How important is it to you to do well in your classes?" 0.76). Only one variable had a mean negative average score (i.e. below 0.5 or "neutral"): *STEM Activity Participation* (e.g., "I visit STEM websites," 0.46).
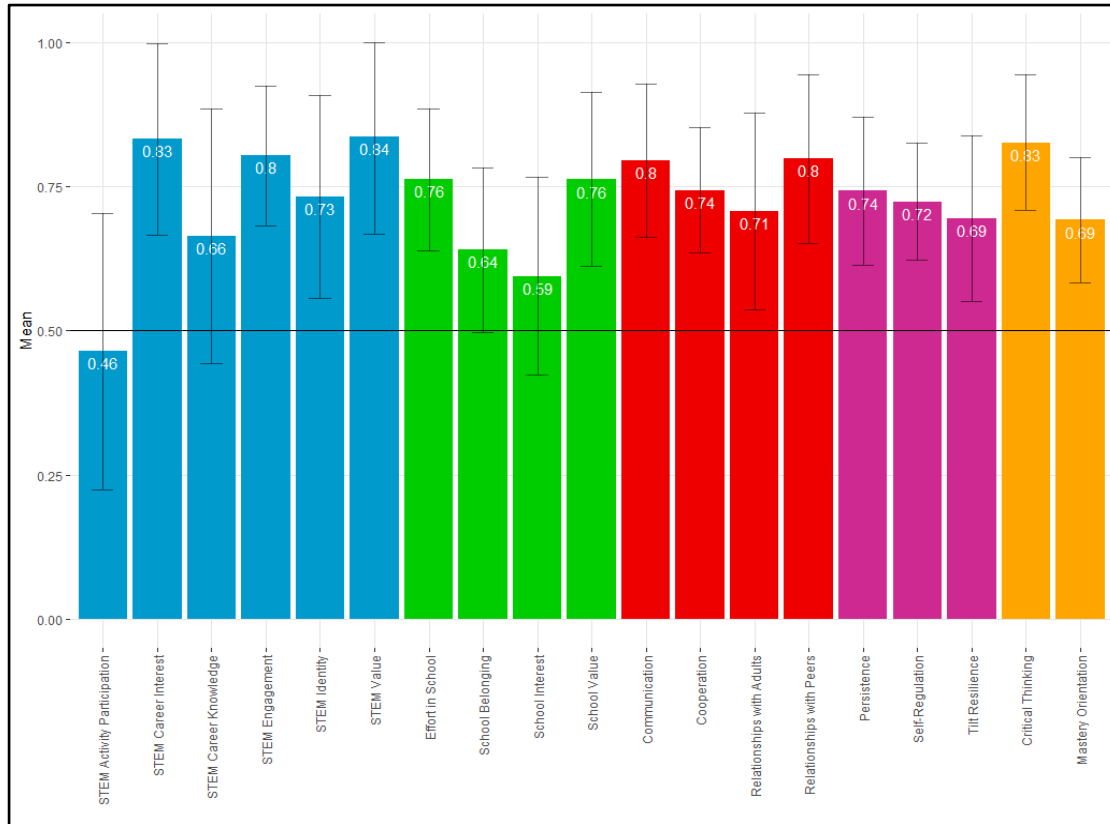
Figure 1. Means (and SD) of student responses on the 19 variables of interest.

We tested each variable to determine whether the mean score differed significantly from "neutral (an index score of 0.5) using one-tailed single sample t-tests. Eighteen (18) of 19 variables were statistically significant (*****), as shown in Table 2 below. The only variable that was not significant was the variable with a *negative* average score.

Table 2. All 19 variables of interest, their number of contributing items and internal reliability, measure of central tendency and dispersion, and whether they are significantly different from 0.50 or "neutral."

	Reliability		Descriptives		Single-Sample T-Test Results		
Variable	# items	Cronbach's α	Mean	SD	p-value	CI Lower Bound	sig.
STEM Activity Participation	5	0.80	0.46	0.24	0.907	0.42	

STEM Career Interest	4	0.99	0.83	0.17	<0.001	0.80	***
STEM Career Knowledge	4	0.95	0.66	0.22	<0.001	0.62	***
STEM Engagement	14	0.99	0.80	0.12	<0.001	0.78	***
STEM Identity	7	0.88	0.73	0.18	<0.001	0.70	***
STEM Value	3	0.99	0.84	0.17	<0.001	0.81	***
School Belonging	5	0.96	0.64	0.14	<0.001	0.61	***
School Interest	6	0.96	0.59	0.17	<0.001	0.56	***
School Value	3	0.81	0.76	0.15	<0.001	0.73	***
Effort in School	7	0.97	0.76	0.12	<0.001	0.74	***
Communication	6	0.98	0.80	0.13	<0.001	0.77	***
Cooperation	5	0.84	0.74	0.11	<0.001	0.72	***
Relationships with Adults	4	0.86	0.71	0.17	<0.001	0.68	***
Relationships with Peers	4	0.96	0.80	0.15	<0.001	0.77	***
Self-Regulation	7	0.95	0.72	0.10	<0.001	0.70	***
Persistence	5	0.97	0.74	0.13	<0.001	0.72	***
Tilt Resilience	2	0.97	0.69	0.14	<0.001	0.673	***

Critical Thinking	5	0.99	0.83	0.12	<0.001	0.80	***
Mastery Orientation	7	0.90	0.69	0.11	<0.001	0.67	***

Single Sample T-Test with H_o: Mean = 0.5 vs H_a: Mean ≠ 0.5. * = p<0.05, ** = p<0.01, *** = p<0.001

Group Differences

A subsequent research question was, do students' beliefs and attitudes vary by demographic group? To test whether there were any differences between demographic groups, we conducted a one-way multivariate analysis of variance (one-way MANOVA) on all 19 student variables. Five (5) demographic variables were tested for effects: age, grade level, gender, ethnicity, and whether a second language is spoken in the home. There was a statistically significant difference in students' beliefs and attitudes based on Gender, $F_{(19, 59)}$ = 2.82, p = 0.001; Wilk's Λ = 0.52, partial η2 = 0.48 and based on Grade Year, $F_{(57, 183)}$ = 1.90, p < 0.001; Wilk's Λ = 0.24, partial η2 = 0.37.

Table 3. Results of one-way MANOVA comparing students' beliefs and attitudes by demographic group

	df	F	p	sig.
Age	(19, 59)	1.51	0.116	
Gender (m/f only)	(19, 59)	2.82	0.001	**
Other Languages in the Home	(38, 122)	0.52	0.989	
Grade Year	(57, 183)	1.90	<0.001	***
Ethnicity	(133, 427)	1.11	0.214	

* = p<0.05, ** = p<0.01, *** = p<0.001

Differences by Gender

Follow-up testing using one-way analysis of variance (ANOVA) found significant differences between female and male students on five outcome variables: *STEM Career Interest* ($F_{(2, 78)}$ = 6.46, p = 0.003), *STEM Career Knowledge* ($F_{(2, 78)}$ = 3.50, p = 0.035), *STEM Identity* ($F_{(2, 78)}$ = 6.78, p = 0.002), *STEM Value* ($F_{(2, 78)}$ = 4.51, p = 0.014), and *School Belonging* ($F_{(2, 78)}$ = 5.54, p = 0.006). Table 4 presents the means scores on all four variables by gender group. Males report significantly greater *STEM Career Interest*, *STEM Identity*, and *School Belonging* than females. Females, on the other hand, report significantly greater *STEM Career Knowledge* and *STEM Value* than men (Table 4).

Thus, while female students in NASEF value STEM more and show greater career knowledge than males, males in NASEF show greater interest in and identity with STEM. Males in NASEF also report a greater sense of belonging at school overall. While interpreting this pattern, is worth noting, however, that the sample size for females is small.

Table 4. Mean (and standard deviation) of the 4 variables that differ significantly by gender groups.

	Female (n=7)	Male (n=72)
STEM Career Interest	0.75 (SD=0.17)	**0.85** (SD=0.15)
STEM Career Knowledge	**0.84** (SD=0.17)	0.65 (SD=0.22)
STEM Identity	0.68 (SD=0.09)	**0.75** (SD=0.17)
STEM Value	**0.87** (SD=0.12)	0.84 (SD=0.17)
School Belonging	0.57 (SD=0.11)	**0.65** (SD=0.14)

Differences by Grade Year

Follow-up testing using ANOVA also found significant differences between grade years in school for STEM Identity ($F_{(3,77)}$=6.75, p<0.001). As students in NASEF increase in grade years, their STEM identity also increases.

Table 5. Mean (and standard deviation) of STEM Identity by grade year.

	9th (n=13)	10th (n=24)	11th (n=23)	12th (n=21)

STEM Identity	0.61 (SD=0.10)	0.68 (SD=0.23)	0.76 (SD=0.11)	0.84 (SD=0.13)

References

Partnerships in Education and Resilience (2018). Common Instrument Suite. Retrieved September 16, 2019 from https://www.thepearinstitute.org/common-instrument-suite