

Academic and Social-Emotional Learning in NASEF: Quantifying the Patterns in Qualitative Observations

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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

During year two (Y2) of our research on NASEF, our team went back and ran a second analysis the year one (Y1) data in order to quantify the qualitative patterns initially found in year one. The goal of the original Y1 research was to explore the existing and potential alignments between students' naturally occurring activities within the league and high school common core standards. In this secondary analysis, we interrogated these patterns by formally coding the data corpus for key learning indicators representing core goals of the program and then quantifying the codes.

Data Collection

The Y1 data set was originally collected in Spring 2018 from six schools in Orange County that were selected for maximum variation on key variables (such as income and ethnicity). This original data corpus consists of 20 hours of fieldnotes and focus group interviews with student & club members (n=39), teachers serving as general managers or GMs (n=11), near peers serving as virtual coaches (n=5), and parents (n=10). Focus groups followed a semi-structured protocol that covered: general impressions of the program, successes and frictions encountered, whether/how the league tied to school, and other social emotional learning topics. Example questions include:

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- Has playing in the league changed the way you think about the game? About school?
- Has playing on the team impacted the way you work with others?
- What is the best thing about the esports team?

For this secondary analysis, we focused on transcripts of all interviews with students and interviews with staff less talk that was not directly related to student activities (e.g., feedback on the league structure or leadership, discussions of scheduling). This subset corpora totalled 5870 turns of talk, the unit of analysis used here.

Data Analysis

First, we developed a coding scheme comprised of interconnected science, math, and english standards based on the work of Cheuk (2013) and recommended by the National Science Teachers Association (<https://www.nsta.org>) (Figure 1). We then supplemented this subset of academic standards with social-emotional learning standards based on CASEL (2019) to insure that our complete code set captured the breadth of student outcomes targeted by the NASEF mission.

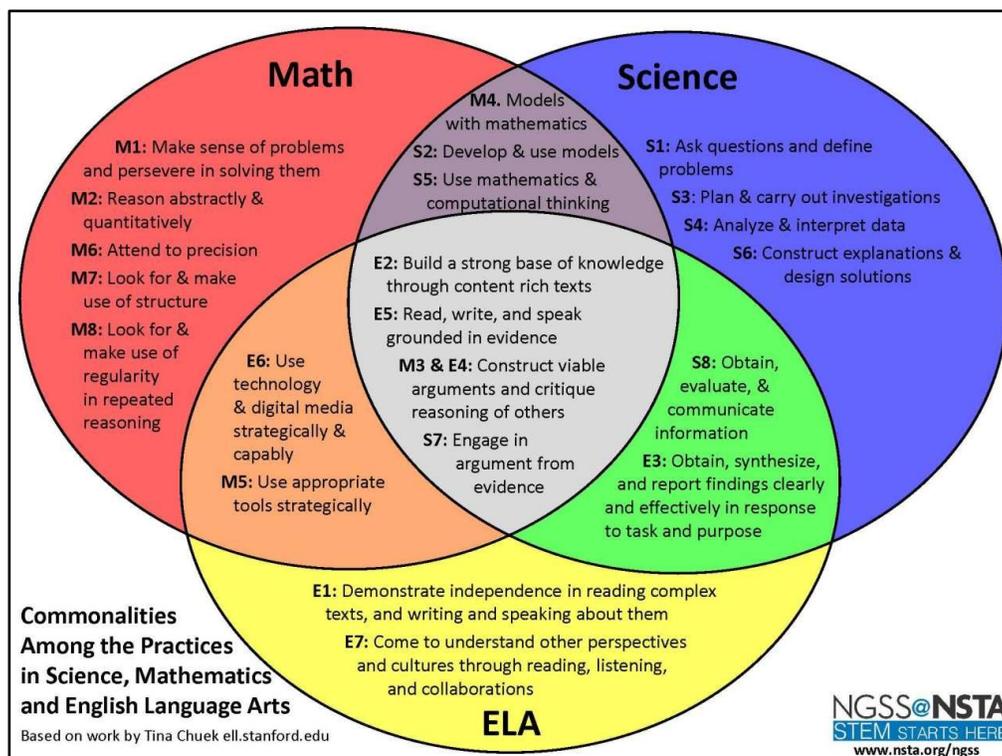


Figure 1. Selected academic content codes (Cheuk, 2013) used for analysis.

Both manifest and latent content was coded. Given the nature of the data (focus group interviews), each code represents an indicator of the specific forms of learning that students, teacher GMs, and coaches reported (manifest content) or alluded to (latent content) in reference to the league.

Codes were non-exclusive; each turn of talk could be coded with more than one code. Four researchers independently coded a randomly selected subset of the data (n=110) to establish suitable interrater agreement (92.31%), and then the remaining corpus was partitioned and each researcher coded their portion of the remaining corpus independently.

Student Learning

Figure 1 below shows the overall profile of codes, grouped by domain: science (blue), mathematics (red), english language arts (yellow), and social emotional awareness (orange). Here, raw counts are used in order to highlight which of the specific standards emerged within student and staff descriptions of their NASEF activity during the first year of the program. Several key patterns emerge.

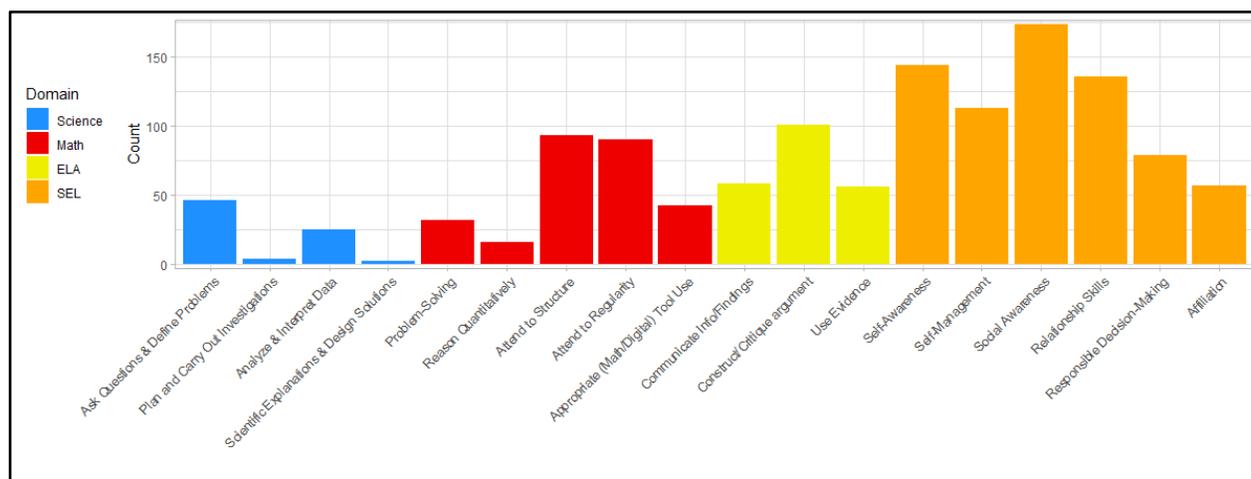


Figure 2. Student learning indicators (counts) across Y1 NASEF data.

Math and science. First, science and math do indeed appear to be a natural part of students’ NASEF activities, with notable emphasis on attending to structure and regularity (M7 and M8), appropriate tool use (M5), asking questions and defining problems (S1), and analyzing and interpreting data (S4). Mathematizing esports content seems more naturally aligned with competitive play, with both game and league structures providing a rich context for quantitative and analytical thinking. Particularly fruitful were activities in which students’ analyzed data available on their own performance (35% of such cases), the performance of their team (50%), or the performance of their opponent (17%). The following interview excerpt illustrates:

I’m a lot more careful when I do go into a game, even before the game even starts, like in champ[ion] select. I check to see how we can really make plays together as a team. If I’m last pick I’ll see – okay, so this person’s heavily on AD [attack damage] or this person I can really synergize well with... it’s just team composition is huge and just like small things in game...can mean the difference between losing a game or winning a game and just very small, incremental things that really heavily depend on

whether or not you're successful in *League of Legends*. (ANON-2018-05-07_student-focus-group, School 3, #55294-55543)

Scientific forms of reasoning, by way of contrast, appear more potential than actualized outcomes, with greater evidence of the first phases of scientific inquiry – asking questions, defining problems (S1), analyzing data made available via the game or league interface (S4) – than the latter half of the scientific process – carrying out investigations (S3), developing scientific explanations, and designing solutions (S6). Recall that, in our first year, NASEF offered small workshops on UCI campus to target key STEM standards but did not yet offer digital tool kits for GMs to use to enrich their club activities. It is worth investigation to see whether and how these additional materials in Y2 of the league might have amplified student science learning in particular.

English Language Arts. Communication and argumentation were also core parts of students' naturally occurring activities within NASEF. Students engaged in both expository and persuasive oral and written texts as a natural part of their preparation for competitive play. In more than half of such arguments presented, students used evidence as a means to support their claims. Communication skills were improved not only from the face-to-face club interactions but also from the in-game interactions as well. The following interview with a teacher GM illustrates:

I don't have any of my team as students but I did notice that their levels of communication did improve as the coaching sessions went on and in terms of their game playing and their skills, definitely there was a huge improvement... I think they're becoming more thoughtful in what they're saying, in what they need to say and what they need not to say. (ANON-2018-04-16_GM-focus-group, School 3, #537787-38703)

Social Emotional Learning. Perhaps our most surprising finding, however, is the striking emphasis on social emotional learning gains across the interviews. Both students and staff spoke at length about the ways in which the league was transformative in terms of both self-awareness and self-management, on the one hand, and social-awareness and relationships skills, on the other. Students repeatedly told stories about transformation in their understanding and skills of emotional regulation, social acumen and sensitivity, and the ability to regulate what many refer to as "tilt" – strong emotional responses during gameplay that degrades decision-making and teamwork. For example, as one student commented:

I get tilted very easily, and whenever I play with them, I would start getting upset, and they would start joking, and it would take me *off tilt*, and then I would sit down and focus and be like, okay, I know what I've been doing wrong. I know how to improve it for the next games. So...I haven't been getting as tilted as often, because I basically have gotten better to where if someone does do really horrible, I don't care. I just focus on myself playing. (2018-05-08SFG, V3,#18731-19243)

These strong patterns of increased social and emotional well-being are remarkable given the broader context of esports and internet communication more generally, suggesting the strong potential of youth esports to combat toxicity online. Students also repeatedly remarked on the role the program had in increasing their own affiliation with school itself. By acknowledging students' interests and making a space for their accomplishments this domain as school, students came to feel more

meaningfully connected to both the institution of schooling and the adults participating in it. As another student commented:

I was really excited to hear about it [NASEF] too because I have been playing this game since 2012...I thought, yeah, this is something I want to do. This is what I've always wanted in school. I've always avoided actual sports and everything because I hated the crowd. This is where I felt like I could truly fit in. (2018-05-08SFG, V3 #10482-10903)

This pattern of increased affiliation also extended to parents who acknowledged their efforts in this new sport.

Equity

Such student gains are impressive, but are they equitable? In order to interrogate whether NASEF Y1 outcomes were the same for students in low versus high income schools, we compared outcomes for students in high income schools to outcomes for students in low income schools. First, we categorized the six schools from which data were gathered by income based on their percentage of free/reduced lunch, with schools with less than 40% free/reduced lunch categorized as “high income” and those with 40% or higher categorized as “low income” following Title 1 definitions (US Department of Education, 2018). Next, we tagged students interviewed by the income level of their school, pooled across school income level, and compared the overall percentage of indicators in student talk from high income schools to student talk from low income schools. Figure 3 below shows the percentage of talk coded by our learning indicators for each school income level. Here, we shift to percentages of coded talk rather than raw counts to control for any differences in verbosity between the two income groups. Note that, for all indicators, low income schools outperform high income schools.

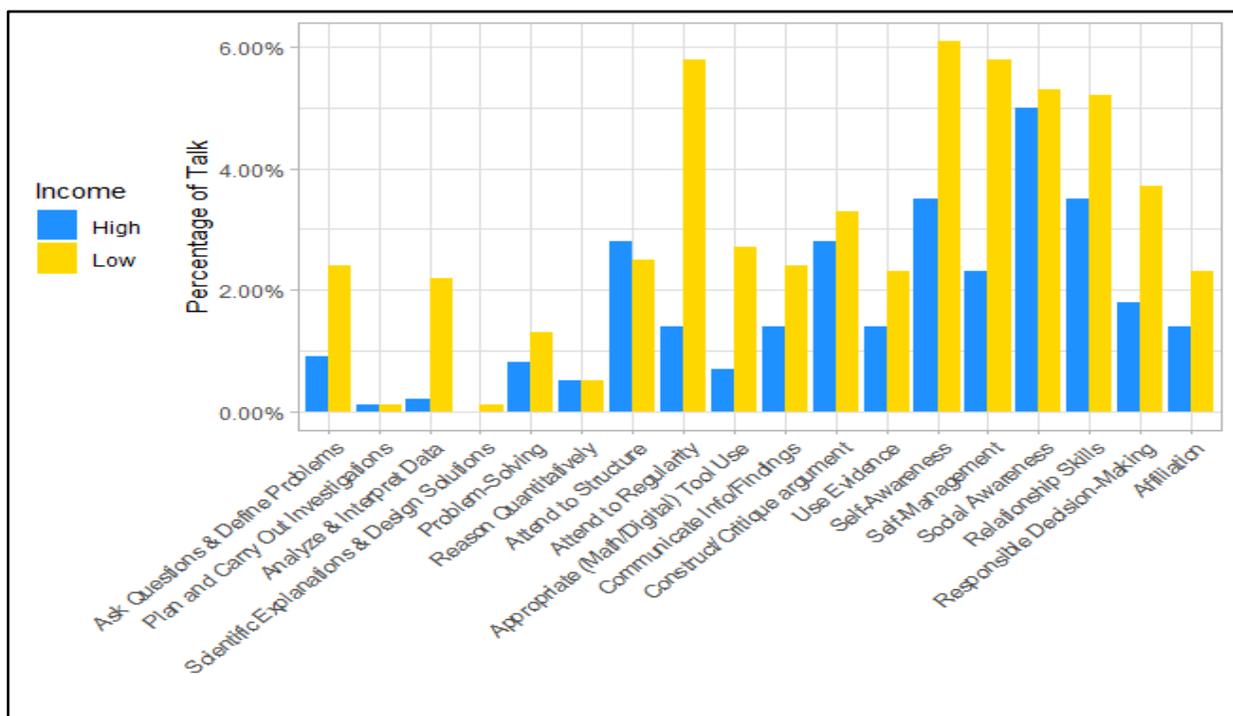


Figure 3. Student learning indicators (percentages) by school income.

In order to test whether these differences were significant, we then applied Boschloo’s (1970) Exact test (Calhoun, 2016) to each code, treating low income and high income as two groups. Note that while Pearson’s Chi or Fisher’s Exact are the standard choice for this analysis, Boschloo’s was selected because of our small expected cell counts and unfixed margins. Of the 18 total learning indicators across five target domains, six (6) were significant at $p < 0.10$ (Table 1 below).

Table 1. Significant differences in learning outcomes by school income.

Learning Indicator (Code)	p-value	Odds Ratio (OR)
Science: Analyze & Interpret Data	0	11.61
Math: Attend to Regularity	0.0009	2.5
Math: Appropriate (Math/Digital) Tool Use	0.0006	3.34
SEL: Self-Awareness	0.0062	1.82
SEL: Self-Management	0	3.2
SEL: Responsible Decision-Making	0.0003	2.76

We then calculated Odds Ratios (ORs) for high income versus low income school students to assess the difference in odds of each given learning indicator appearing in student talk as we shift from high versus income schools. Table 1 shows the change in odds (OR) for each learning indicator as one shifts from a high income school to a low income school. Here, ORs less than one represent a drop in odds and ORs greater than one represent an increase in odds. As Table 1 shows, low income schools were *more likely* to show learning gains as defined by the indicators targeted in this analysis.

Thus, *lower income students showed greater gains than our higher income students*, indicating that the NASEF league did indeed meet its goals in terms of serving the needs of lower income students in particular. The science standard of “Analyzing & Interpreting Data” evidences the greatest gain for low income students over high income students. 11.61 times more likely to appear in low income student descriptions of their experiences in the NASEF league than in high income students’ descriptions, followed by “Appropriate (Math/Digital) Tool Use” in Math and “Self-Management” in SEL which are both roughly three (3) times more likely to appear in low income student talk.

The Role of Mentorship & Student Leadership

How are such student gains accomplished? In order to better understand the features of the NASEF program that contribute to its effect, we explored two possible mediating variables, both theoretically important justified by the Connected Learning Model (Ito, et al, xxxx): “Mentorship” of students from participating teacher GMs and virtual coaches and “Student Leadership” or opportunities that students were given to take on instigate, direct, and/or manage their own club or team activities in some way. The connected learning model (Ito et al, 2013) suggests both as potentially important causal variables for student outcomes. Based on this logic, we coded the entire corpus for the two target variables “Mentorship” and “Student Leadership” (interrater agreement, as discussed above, was 92.31%). We then followed the same methods described above, treating units coded with the mediating variable as one group and units without the code as the comparison group, applying Boschloo’s Exact test to the two groups for each learning indicator code, and then calculating the Odds Ratios (ORs) to determine the nature of the significant relationship.

For Mentorship, of the 18 total learning indicators across five target domains, seven (7) were significant at $p < 0.10$. Table 2 below shows the p-values for all significant code groups and the change in odds as one shifts from no mentorship to mentorship. All significant relationships are positive. Thus, we conclude that mentorship plays a significantly positive role in increasing the odds of all seven learning indicators.

Table 2. Significant associations between mentorship and learning outcomes.

Learning Indicator (Code)	p-value	Odds Ratio (OR)
Science: Ask Questions & Define Problems	0	4.60
Science: Analyze & Interpret Data	0.0731	2.34
Math: Problem-Solving	0.0334	2.43
ELA: Communicate Info/Findings	0.013	2.37
ELA: Use Evidence	0.0334	2.16
SEL: Social Awareness	0.0548	1.67
SEL: Responsible Decision-Making	0.0761	1.73

For student leadership, of the 18 total learning indicators across five target domains, four (4) were significant at $p < 0.10$. Table 3 below shows the p-values for all significant code groups and the change in odds as one shifts from no student leadership to student leadership. Three of four relationships are positive. Thus, we conclude that student leadership plays a significantly positive role in increasing the odds of problem solving, use of evidence and relationship skills.

Table 3. Significant associations between student leadership and learning outcomes.

Learning Indicator (Code)	P value	Odds Ratio (OR)
Math: Problem-Solving	0.0003	4.75
Math: Attend to Regularity	0.0117	0.2
ELA: Use Evidence	0.0583	2.06
SEL: Relationship Skills	0.0001	3.07

Discussion

Quantifying qualitative data allows one to test patterns in the data statistically as well as relationships among variables, although the strength and import of one's findings are still very much contingent on the quality of the data source, the relevance of the coding scheme applied, and the statistical procedures used. The coding scheme used herein represents a more detailed set of specific outcomes one might reasonably expect across the multiple target domains in which the NASEF program aspires to affect change. The patterns found as a result of this analysis are in keeping with our summative qualitative observations reported in August 2018, while providing a more detailed window into students' learning outcomes and a more systematic analysis of the strength of our program's impact and, potentially, its means.

In this analysis, both science and math emerge as a natural part of students' NASEF activities, with particular emphasis on mathematizing game and league data for what could be, with appropriate scaffolding, scientific investigation. Communication and argumentation also emerge as part of student's NASEF participation, with use of evidence (game data, for example) as a core part of their discursive work. Together, these content standards paint a picture in which NASEF fosters data-driven argumentation and exposition as a natural part of students' preparation for competitive play. Future activity designs might continue to support and cultivate this form of thinking and reasoning and explicitly tie it back to the respective academic domains in school.

These findings also highlight the crucial role that social emotional learning plays in student-reported outcomes. In interview after interview, both students and staff describe the ways in which the league fostered positive recognition and regulatory skills for both self and other. For many teens, NASEF provides the first, authentic, extended “in situ” mentorship experience they have had online on in games. The program’s positive effect on the social and emotional lives of its participants are evidenced in qualitative and quantitative findings alike.

The mentorship and opportunities for student leadership that NASEF provides appears to play a vital role in enabling these learning outcomes, and these learning outcomes appear to be strongest among those students who are typically the most underserved – students from the lowest income schools. In this way, NASEF does indeed enrich esports for students, particularly students of the most need.

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