**A Qualitative Study of Motivation in Alaska Native Science & Engineering Program (ANSEP) Precollege Students**

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I am Unangax/Aleut or Alaska Native born and raised in Alaska. I come from a line of Unangax fishermen and spent much of my childhood in the Aleutians subsistence living. I am currently pursing my PhD in Engineering Education at Purdue University. My current dissertation title is: A Qualitative Study of Motivation in Alaska Native Science & Engineering Program (ANSEP) Precollege Students. Prior to starting at Purdue University, I was the Alaska Native Science & Engineering Program (ANSEP) Deputy Director and managed its Summer Bridge, Academies of Engineering, and University Success components. I earned a BS in Civil Engineering from University of Alaska Anchorage (UAA) in 2005 and a MS in Engineering Management from UAA in 2009. I have taught the Introduction to Engineering course at UAA 5 times. I have more than five years of construction and engineering professional experience in Alaska. I specialized in water and sewer projects in remote Alaskan villages. My responsibilities have included design assistance, technical report and permit writing, feasibility studies, and business plan preparations. Previous work includes conceptual design of water and sewer systems, surveying, construction, and field sampling of water, wastewater, and ground temperatures. Additional experience includes a broad range of environmental engineering activities in the oil and gas field in Prudhoe Bay.
A Qualitative Study of Motivation in Alaska Native Science & Engineering Program (ANSEP) Precollege Students

Introduction

The dramatic underrepresentation of Alaska Natives in science, technology, engineering and mathematics (STEM) degrees and professions calls for rigorous research in how students access these fields. Research has shown that students who complete advanced mathematics and science courses while in high school are more academically prepared to pursue and succeed in STEM degree programs and professions. There is limited research on what motivates precollege students to become more academically prepared before they graduate from high school. In Alaska, Alaska Native precollege students regularly underperform on required State of Alaska mathematics and science exams when compared to non-Alaska Native students. Research also suggests that different things may motivate Alaska Native students than racial majority students. Therefore, there is a need to better understand what motivates Alaska Native students to take and successfully complete advanced mathematics and science courses while in high school so that they are academically prepared to pursue and succeed in STEM degrees and professions.

The Alaska Native Science & Engineering Program (ANSEP) is a longitudinal STEM educational enrichment program that works with Alaskan students starting in middle school through doctoral degrees and further professional endeavors. Research suggests that Alaska Native students participating in ANSEP are completing STEM degrees at higher rates than before the program was available. ANSEP appears to be unique due to its longitudinal approach and the large numbers of Alaskan precollege, university, and graduate students it supports. ANSEP provides precollege students with opportunities to take advanced high school and college-level mathematics and science courses and complete STEM related projects. Students work and live together on campus during the program components. Student outcome data suggests that ANSEP has been successful at motivating precollege participants to successfully complete advanced high school and college-level mathematics and science courses prior to high school graduation.

This study aimed at answering the research question: “How do Alaska Native students participating in ANSEP describe the program’s role at motivating them to take advanced mathematics and science courses in high school?” In this study, twenty-two current ANSEP precollege participants and eleven former precollege participants who were pursuing STEM degrees participated in qualitative interviews. Preliminary findings suggest that ANSEP precollege academic coursework and social engagement components positively contributed to Alaska Native participant motivation to take and successfully complete advanced high school and college-level mathematics and science courses while in high school. Preliminary findings further suggest that ANSEP precollege components positively contributed to participant motivation to pursue STEM degrees and professions. Knowledge gained from this study may further support the use of longitudinal academic programs to increase STEM degree persistence and graduation.
Background

In Alaska, Alaska Natives make up 23.3% (31,049), the second largest percentage of students, after White students and are the largest minority group of students enrolled in pre-elementary through grade 12\textsuperscript{13}. During the 2012-2013 academic school year, the four-year cohort graduation rate was 57.1% (1,235) for Alaska Natives and American Indians, which was the lowest among all other race groups\textsuperscript{13}. During the 2012–2013 school year, Alaska Native students had the lowest performance compared to non-Alaska Natives students in mathematics and science as assessed by the Standards Based Assessments and High School Graduation Qualifying Examinations for grades four through twelve\textsuperscript{13}.

Alaska Natives are dramatically underrepresented in STEM degrees and professions\textsuperscript{1–6}. The McDowell Group\textsuperscript{23} report that barriers to success in higher education for Alaska Natives and American Indians include: “high cost of college, poor academic preparation, homesickness, cultural differences, and learning styles” (p. 33). Alaska Natives and American Indians are less likely than other races to pursue bachelor’s degrees\textsuperscript{24}. The 2000 U.S. Census showed that only 6% of Alaska Natives had completed four-year college degrees\textsuperscript{25}. In 2000, of those that graduated high school in 1992, only 15% of Alaska Natives and American Indians were likely to have received their bachelor’s degrees as compared to 24% of Hispanics, 31% of Blacks, 49% Whites, and 51% Asian/Pacific Islanders pursuing bachelor’s degrees\textsuperscript{24}.

It has been further argued students who complete advanced mathematics and science courses while in high school are more academically prepared to pursue and succeed in STEM degree programs and professions\textsuperscript{2,7–12}. Adelman\textsuperscript{8} explains that students at a minimum need to complete three and three-quarters worth of credits in mathematics in high school to successfully pursue a bachelor’s degree. Further, students need to complete two and half credits in science, with two of those having a laboratory portion\textsuperscript{8}. Adelman\textsuperscript{8} recommends as mathematics courses calculus, pre-calculus, or trigonometry, and the science courses he recommends includes a combination of biology, chemistry, and physics. These are the same courses ANSEP recommends high school students to complete\textsuperscript{19}. Adelman\textsuperscript{8} justified these recommendations by noting that 95% of the students who completed these courses in high school along with English, history or social studies, a foreign language, and computer science ended up receiving a bachelor’s degree. Additionally, success in STEM degrees are what will lead students to becoming STEM professionals\textsuperscript{7,20,26–31}.

Frehill et al.\textsuperscript{2} explains that underrepresented minority students are at further risk of being underprepared in mathematics than their non-underrepresented minority counterparts because often their teachers have low expectations for them in these courses and do not even encourage them to pursue these courses. The “4% problem” is a representation of this: only 4% of underrepresented minorities are prepared with the adequate mathematics and science preparation right out of high school to pursue engineering degrees\textsuperscript{2}. Because Alaska Natives are more likely to be underprepared\textsuperscript{2,32} and underrepresented in STEM\textsuperscript{1,2,5,6}, they are of particular interest. It becomes particularly important to understand what motivates those successful Alaska Native students to pursue the completion of advanced mathematics and science courses.
As evidenced by the number of students who complete the required courses in high school, pursue STEM degrees, and graduate with STEM degrees, ANSEP is successful at motivating Alaska Native students to consider STEM degrees, pursue STEM degrees, persist in STEM degrees, and pursue STEM careers upon graduation19–22. Because of this success, ANSEP Precollege component participants were the focus of this study. ANSEP is a longitudinal STEM educational enrichment program that works with Alaskan students starting in middle school through doctoral degrees and subsequent professional endeavors19–22. ANSEP targets the recruitment of Alaska Native students, but it does not discriminate, so all students are welcome to apply to attend ANSEP components19. ANSEP prepares Alaska Native precollege students for STEM bachelor degrees in high school through Precollege components: “Computer Assembly”, “Acceleration Academy”, and “Summer Bridge”.

The ANSEP Computer Assembly is an extra-curricular component for high school students and includes having students build desktop computers; the post-component educational requirements for the students in this component are to complete chemistry, physics, and trigonometry or pre-calculus before graduating from high school19. These students can complete these courses either in their high schools, with ANSEP as part of the “Acceleration Academy” component, through attending University of Alaska either during the school year as an extension of the “Acceleration Academy” component, or on their own. The Computer Assembly components vary in size from ten to twenty participants19. There have been over 1,200 students who have participated in this component since its initiation in 200319. Of the students who have completed this component and graduated from high school, more than 60% have completed all three courses, while about 80% have completed at least two of the three required courses19.

The ANSEP Acceleration Academy component is a five to six week summer program for high school students19. Acceleration Academy components vary in size from forty to seventy participants. The educational requirement for these students includes completion of two courses for dual high school and college credit19. One of the courses must be a mathematics course, while the other can be a science, engineering, or English course. About 190 students have participated in this component since 2010; 95% of the students who participated have advanced one grade level in mathematics, science, or engineering, while 79% of the participants have completed the college level mathematics courses and 85% of the participants have completed the college level science courses19,21,22.

The ANSEP Summer Bridge component is a ten week summer experience for recently graduated high school students who are planning to pursue STEM degrees19. Summer Bridge students completes a college level mathematics course and a paid internship within an external engineering or science organization19. Summer Bridge components vary in size from 20 to 30 participants. Between 1998 and 2013, there has been 250 participants of which 95% have continued on to engineering or science 4-year degree programs after participation in the ANSEP Summer Bridge component19,21,22.

These three ANSEP components focus on high school students and therefore were selected for this study. The design of all of these ANSEP Precollege components is to help challenge high schools to prepare themselves for STEM bachelor degree programs19. During each of these components, ANSEP provides STEM inspirational experiences to try to encourage them to
consider STEM degrees and careers\textsuperscript{19}. For example, STEM professionals often speak or present their careers to the students.

There are many lenses to consider for understanding why Alaska Native students prepare themselves for STEM degrees and persistence in STEM degrees. I used motivation as my theoretical lens because it is linked to student success and persistence in STEM degrees\textsuperscript{30,33–39}. Students’ self-efficacy in mathematics and science is also related to student success and persistence in STEM degrees\textsuperscript{10,20,35,37,40–42}.

**Methods**

*Self-Determination Theory*

I used Ryan and Deci’s self-determination theory of motivation as the theoretical framework for my study. Self-determination theory takes into consideration intrinsic and extrinsic motivations\textsuperscript{43–46}. ANSEP makes public the extrinsic motives they provide to their high school students, such as scholarships, to motivate them to complete advanced mathematics and science courses\textsuperscript{19}. Due to ANSEP’s high levels of success at motivating high school students to take advanced mathematics and science course\textsuperscript{19,21,22}, ANSEP is also expected to be intrinsically motivating its students that participate. This study attempted to decipher whether Alaska Native ANSEP Precollege students are being intrinsically or extrinsically motivated to take advanced mathematics and science courses.

In their use of self-determination theory, Ryan and Deci\textsuperscript{43–46} focus on the elements of autonomy, competence, and relatedness in terms of what people need in order to be motivated, either intrinsically or extrinsically. *Autonomy* refers to as an internal perceived locus of causality\textsuperscript{43,44} or the sense of using self-direction to guide action\textsuperscript{47}. *Competence* refers to a persons’ perception or belief that they can do something or reach a certain goal and often positive feedback from others helps these feelings grow\textsuperscript{44}. *Relatedness* is a person’s internal feeling that provides “a sense of belongingness and connectedness to the persons, group, or culture disseminating a goal”\textsuperscript{43}.

Because of ANSEP’s success at motivating high school students to take advanced mathematics and science courses\textsuperscript{19,21,22}, it is possible that ANSEP has somewhat unintentionally incorporated the elements of autonomy, competence, and relatedness into their Precollege components. This study also attempted to determine if Alaska Native ANSEP high school students are gaining a sense of autonomy, competence, or relatedness to motivate them to take advanced mathematics and science courses.

Ryan and Deci\textsuperscript{45,46} explain that the self-determination theory of motivation is dichotomous in the types of continual change happening within people. The first type is that people themselves are “active, growth-oriented organisms” and because of this they tend to evolve, grow, overcome challenges, and utilize their past experiences to redevelop their own identities\textsuperscript{45,46}. The second type is a person’s’ social context, and this environment can either support or prevent a person’s personal growth and achievement\textsuperscript{45,46}. It is possible that ANSEP fosters a supportive environment for students that then fosters an increased intrinsic motivation. This study will attempt to determine what it is about its environment that fosters intrinsic motivation.
Study Participants

There were two types of participants for this study. Group 1 participants were high school graduates, former ANSEP Precollege component participants, and who were currently participating in ANSEP’s University Success component at one of the University of Alaska main campuses: University of Alaska Anchorage (UAA) and University of Alaska Fairbanks (UAF). Group 2 participants were current high school students and current ANSEP Precollege participants.

To recruit Group 1 students, I attended Group 1 weekly meetings hosted by ANSEP. I also emailed ANSEP Group 1 students information about the study and a flyer. I also posted study flyers in the ANSEP Building. Students emailed me to let me know they could participate. I then verified they met study requirements and then contacted them to set up a date and time. Study participants then met with me on the UAA campus where I recorded their interviews. In two cases, I could not meet face-to-face so met over the phone to conduct the interviews.

In October 2013, a pilot study was conducted which included five individual interviews with Group 1 participants. These participants consisted of two female Alaska Native participants, two male Alaska Native participants, and one female White participant who were all attending UAA. In the summer of 2014, five Group 1 participants were individually interviewed which included two female Alaska Native participants and three male Alaska Native participants who were all attending UAA. One of these participants also partook in the pilot study. Additionally, during this time, two Group 1 participants were individually interviewed which included two female Alaska Native participants who were attending UAF. In November 2014, six previously individually interviewed Group 1 participants partook in a group interview. This group interview consisted of one female Alaska Native participant from UAA, three male Alaska Native participants from UAA, and 2 female Alaska Native participants from UAF. Table 1 below summarizes Group 1 total, Alaska Native, and female participants.

Also during the summer of 2014, three group interviews with two ANSEP Group 2 participants was completed. To recruit Group 2 participants, ANSEP staff emailed a study information page and consent forms to both the parents and students. Because ANSEP had already accepted these participants to the ANSEP Precollege components, their responses to participating in this study did not affect their participation in ANSEP. Parents and students emailed back the consent forms to indicate they could participate in the study. I verified that prospective research participants submitted the proper forms. Group interviews with these students were set up through ANSEP Precollege staff.

ANSEP did not host a Computer Assembly during the summer of 2014 so I was not able to interview these specific students; however, I was able to include data about this specific component because all of the study participants participated in the Computer Assembly. Acceleration Academy participants partook in two of these three group interviews. The first of these group interviews consisted of two female Alaska Native participants, four male Alaska Native participants, one female non-Alaska Native participant, and two male non-Alaska Native participants. This first group consisted of 62.5% Alaska Native participants and 37.5% female participants. The second of these group interviews consisted of three female Alaska Native
participants, three male Alaska Native participants, one female non-Alaska Native participant, and one male non-Alaska Native participant. This second group consisted of 75% Alaska Native participants and 50% female participants. Summer Bridge participants partook in the third group interview. This third group interview consisted of five female Alaska Native participants and one male Alaska Native participant. This third group consisted of 100% Alaska Native participants and 83.3% female participants. Table 1 below summarizes Group 2 total, Alaska Native, and female participants.

To summarize, 11 Group 1 participants partook in individual interviews. In Group 1, 90.9% were Alaska Native, 54.5% were female, and 81.8% were attending UAA. Six previously individually interviewed Group 1 participants also partook in a group interview. In the Group 1 group interview, 100% were Alaska Native, 50% were female, and 66.7% were attending UAA. Twenty-two Group 2 participants partook in three separate group interviews. In Group 2, 77.2% were Alaska Native and 54.5% were female. Table 1 below summarizes all of the study participants by total, Alaska Native, and female participants.

Table 1. Summary of Study Participants

<table>
<thead>
<tr>
<th>Participants</th>
<th>Total Number of Participants</th>
<th>Number of Alaska Native</th>
<th>Percent Alaska Native</th>
<th>Number Female</th>
<th>Percent Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group 1 Pilot Study</td>
<td>4</td>
<td>3</td>
<td>80.0%</td>
<td>2</td>
<td>50%</td>
</tr>
<tr>
<td>Group 1</td>
<td>6</td>
<td>6</td>
<td>100.0%</td>
<td>3</td>
<td>50%</td>
</tr>
<tr>
<td>Group 1 Pilot Study and Group 1</td>
<td>1</td>
<td>1</td>
<td>100.0%</td>
<td>1</td>
<td>100%</td>
</tr>
<tr>
<td>Group 1 Summary</td>
<td>11</td>
<td>10</td>
<td>90.9%</td>
<td>6</td>
<td>54.5%</td>
</tr>
<tr>
<td>Group 2 Acceleration Academy</td>
<td>16</td>
<td>11</td>
<td>68.8%</td>
<td>7</td>
<td>43.8%</td>
</tr>
<tr>
<td>Group 2 Summer Bridge</td>
<td>6</td>
<td>6</td>
<td>100%</td>
<td>5</td>
<td>83.3%</td>
</tr>
<tr>
<td>Group 2 Summary</td>
<td>22</td>
<td>17</td>
<td>77.3%</td>
<td>12</td>
<td>54.5%</td>
</tr>
<tr>
<td>Total Summary</td>
<td>33</td>
<td>27</td>
<td>81.8%</td>
<td>18</td>
<td>54.5%</td>
</tr>
</tbody>
</table>

Interview Schedules

I generated my interview schedules to answer my research question using the self-determination theory of motivation. As a refresher, my research question is: How do Alaska Native students participating in ANSEP describe ANSEP’s role regarding their choice to take advanced mathematics and science courses in high school? The first interview schedule asked Group 1 participants individual interview questions, the second interview schedule asked Group 1
participants group interview questions, and the third interview schedule asked Group 2 participants group interview questions.

To orient each of the participants to begin thinking about motivation, in each of the interview schedules, I first asked them to define the term “motivation”. I then asked participants to describe internal and external driving forces towards succeeding in school. This was so that, when I asked further questions about motivation, participants could provide both internal and external motivating factors. This was also to bring the self-determination theory of motivation into the interviews.

In each of the interview schedules, I asked participants what they think most motivated them to take mathematics and science courses in high school. This gave them the opportunity to say what first came to mind and not just focus on ANSEP. Participants that responded initially that ANSEP helped motivate them, thereby verifying my assumption that their participation in ANSEP Precollege was contributing to their motivation to take more advanced mathematics and science course. If the participants did not mention ANSEP to start with, then I asked them if they thought ANSEP motivated them to take mathematics and science courses while they were in high school.

I then focused on each of the interview schedules on asking about specific areas of ANSEP that could have possibly been motivating them. For the Computer Assembly, I asked questions about the computers they build. For the Acceleration Academy, I asked questions about the college courses they took with ANSEP and the teachers that teach those courses. For the Summer Bridge, I asked questions about the college math course they took with ANSEP and about their internships. For all of the ANSEP Precollege components, I asked about ANSEP scholarships, staff, peers, presentations or presenters, and community. I also asked about things that ANSEP focused on like informing students about STEM jobs and careers, introducing students to the UAA campus, and Alaska Native cultural activities. I also asked students about when they knew they wanted to go to college and go to college for STEM specifically. In interview schedules for both Group 1 and Group 2, I also asked these participants why they applied to ANSEP. This indicated their initial motivations for applying to ANSEP.

I also asked each participant about the self-determination theory elements of autonomy, competence, and relatedness. For autonomy, I asked participants: “During ANSEP Precollege, did ANSEP let you use self-direction to guide your own actions?” For competence, I asked participants: “During ANSEP Precollege, did ANSEP allow you to believe that they can be successful in school and/or do they offer positive feedback?” For relatedness, I asked participants: “During ANSEP Precollege, did ANSEP allow you to feel like you belong here?”

In the middle of all three interview schedules, I switched gears. For Group 1, I switched from asking about which parts of ANSEP motivated them to asking if ANSEP did anything to demotivate them from taking more mathematics and science courses in high school. For Group 2, I switched from asking about what motivated them and why they applied to ANSEP to what did they think ANSEP could have provided to help motivate them to take more mathematics and science courses in high school. I asked questions about their motivations and de-motivations also to bring in elements of the self-determination theory of motivation. This was so when I
analyzed the interviews, I could look for both intrinsic and extrinsic responses as well as elements of autonomy, competence, and relatedness.

**Artifacts**

I also collected as artifacts the notes I took during each of the interviews. I took notes on the responses from the participants on the questions. During group interviews I asked the participants to come up with lists of their ideas. I wrote down these responses either on the board or as notes on the interview schedule. Where necessary, I took pictures of the lists on the board and also kept these as artifacts.

**Analysis Procedures**

I hired a transcriber to transcribe my interviews. After receiving all of the transcripts from the transcriber, I used NVivo a qualitative analysis computer software package to listen to each interview and correct the transcripts for spelling and wording errors. I then put the transcribed data into NVivo, which I used throughout the rest of the analysis process. I coded the transcripts and artifacts line-by-line. I employed a first cycle coding process and then a second cycle of coding, as discussed below. My research question directed all of the coding. Because I was the only coder, there was no need to check for inter-rater reliability.

The first cycle of coding included “Simultaneous Coding” which are two separate coding techniques: “Evaluation Coding” and “Themeing the Data”\(^48\). “Evaluation Coding” are used to develop “non-quantitative codes to qualitative data that assign judgments about the merit, worth, or significance of programs or policy”\(^48\). I used “Evaluation Coding” to develop codes that consider the evaluation of ANSEP Precollege components. I use positive (+) and negative (-) symbols at the beginning of many of the codes to correspond to the coding as being positive or negative about ANSEP.

Saldaña\(^48\) explains that “theme” can be many things including a category, domain, and unit of analysis. During the first cycle of coding, the “theme” I looked for constituted elements from the self-determination theory of motivation. Saldaña\(^48\) argues that “themes should be stated as simple examples of something during the first cycle of analysis, then woven together during later cycles to detect processes, tensions, explanations, causes, consequences and/or conclusions” (p. 177). I used “Themeing the Data” to develop codes based on elements of the self-determination motivation theory. Examples of first cycle of analysis included codes that pertain to who or what was motivating or demotivating them to take more mathematics and science courses in high school and towards success in school. I used positive (+) and negative (-) symbols at the beginning of many of the codes to correspond to the coding as being motivational or being demotivation.

Saldaña\(^48\) describes “Analytic Memos” as “a place to ‘dump your brain’ about the participants, phenomenon, or process under investigation by thinking and thus writing and thus thinking even more about them” (p. 41). “Analytic Memos” are also can act as a ”prompt or trigger for written reflection on the deeper and complex meanings it evokes”\(^48\) (p. 42). Examples of “Analytic Memos” that Saldaña\(^48\) provides includes reflections about personal connections to the data,
Reliability and Validity

According to Creswell\textsuperscript{49}, triangulation is “the process of corroborating evidence from different […] types of data […] in descriptions and themes in qualitative research” (p. 259). The researcher then examines each type of data to find evidence to support the theme\textsuperscript{49}. I collected three different data types for this study: individual interviews, group interviews, and artifacts. These types of data were used to triangulate to validate my finding because this “means that the researcher determines the accuracy or credibility of the findings”\textsuperscript{49}. Triangulation “ensures that the study will be accurate because the information draws on multiple sources of information” and “in a way encourages the researcher to develop a report that is both accurate and credible”\textsuperscript{49}.

Simon\textsuperscript{50} argues a review done by experts can improve my study and make sure the data I collect answers my research question. My committee chair and the rest of my committee are my panel of experts and they review my research design, findings, and conclusions. Using a panel of experts increases my research construct validity and increases the likelihood that the individual and group interview questions measured what they are intended to measure.

Pawley and Phillips\textsuperscript{51} use Walther and colleagues’\textsuperscript{52} typology of quality strategies to develop a table that shows their quality plan for making the data (Pawley & Phillips, 2014, p. 8, Table 2). Pawley and Phillips\textsuperscript{51} argues that the use of these quality strategies are to “help improve the quality of interpretive research in engineering education” (p. 7). Following Pawley and Phillips\textsuperscript{51} example, I generated a similar table that represented my quality plan for making the data. Table 2 includes my quality plan for making the data.

<table>
<thead>
<tr>
<th>Making the Data Phase</th>
<th>Reflection Questions</th>
<th>Process Plan to Address</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recruiting</td>
<td>How do I make sure I interview the “right” people? “Right” in terms of my explicit criteria (people who identify as Alaska Native and also who have participated or are participating in ANSEP Precollege components) but also “right” in terms of wanting to understand how they describe that ANSEP motivates them to take advanced mathematics and science courses in high school.</td>
<td>• Ask participants for self-identification of gender, race, and their participation in ANSEP Precollege both in recruitment phase and interview phase. • Diversity interview pool not only with respect to gender and race but UA campus, ANSEP Precollege components, and other theoretical salient characteristics.</td>
</tr>
</tbody>
</table>
Interviewing

Do the participants tell me (the researcher) anything “useful” (in terms of me answering my research questions) through their stories, based on their responses and my prompts?

- Articulate concerns or other thoughts about the data through “Analytic Memos”.
- Become comfortable with the interview schedule to be able to ask appropriate follow-up interview questions during the interviews.

Processing Data

Did I collect and transcribe what the participants tell me accurately? Did participants report their perceptions as they desired?

- Collect transcripts while re-listening to interviews.
- Request my panel of experts read through my transcripts and correct, change, or otherwise comment on what participants said.

Pawley and Phillips\textsuperscript{51} developed a table that maps their analysis steps (p. 13, Table 5) to Walther et al.’s\textsuperscript{52} topology of quality strategies table (p. 640, Table 1). Following Pawley and Phillips’ example, I generated a similar table to map my analysis steps to Walther et al.’s\textsuperscript{52} typology of quality strategies (p. 640, Table 1). Table 3 includes my analysis steps mapped to Walther et al.’s\textsuperscript{52} typology of quality strategies (p. 640, Table 1).

### Table 3. Analysis Steps Mapped to Walther et al.’s\textsuperscript{52} Topology of Quality Strategies (p. 640, Table 1)

<table>
<thead>
<tr>
<th>Description</th>
<th>Making the Data</th>
<th>Handling the Data</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Validation:</strong> How can we improve the research findings’ capacity to appropriately capture and represent aspects of the social reality observed?</td>
<td>I present data collection method for collective scrutiny to my panel of experts.</td>
<td>I document research insights mapped to “Analytic Memos”.</td>
</tr>
<tr>
<td><strong>Theoretical Validation:</strong> Do the concepts and relationships of the theory appropriately correspond to the social reality under investigation?</td>
<td>I have designed the interview protocol to facilitate inquiry into the concept of self-determination theory of motivation.</td>
<td>I regularly return to the conceptual framework to see how I might situate my data (“Analytic Memoing”); I describe my understanding of the self-determination theory of motivation and my data and their alignment to my panel of experts for their collective scrutiny.</td>
</tr>
<tr>
<td><strong>Procedural Validation:</strong> Which features of the research design improve the fit between reality and the theory generated?</td>
<td>I have built memoing and reflection on the data collection based on interviewer’s self-determination theory of motivation.</td>
<td>I have built “Analytic Memos” into the analytic process.</td>
</tr>
</tbody>
</table>
motivation lens into the analytic process.

<table>
<thead>
<tr>
<th>Communicative Validation: Is the knowledge socially constructed within the relevant communication community?</th>
<th>I have situated my method within a conceptual framework recognized as valuable by multiple research communities.</th>
<th>My process requires I connect my claims to my direct readings of the transcripts. I will write a description of my claims that offer evidence I use to argue each claim, and present these arguments with evidence to my panel of experts for their collective scrutiny.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pragmatic Validation: Do the concepts and knowledge claims withstand exposure to the reality investigated?</td>
<td>I set aside 60 to 90 minutes for each interview, and started each interview with the question “Can you please define for me what motivation is or what motivation is to you?” Which was guided by protocol informed by my conceptual framework of self-determination theory of motivation.</td>
<td>I intend to present my research results to ANSEP and my panel of experts for their collective scrutiny.</td>
</tr>
<tr>
<td>Process Reliability: How can the research process be made as independent as possible from random influences?</td>
<td>I have developed and will follow standard operating procedures for data collection and transcription for consistency. My interview procedures are built on traditional interview practices, follow a standard procedure, and were approved by Purdue University and University of Alaska Anchorage IRB offices.</td>
<td>I will document and submit my analytic processes to my panel of experts for their collective scrutiny.</td>
</tr>
</tbody>
</table>

These techniques have helped improve my study’s reliability and validity.

**Results**

Preliminary findings suggest that ANSEP precollege academic coursework and social engagement components positively contributed to Alaska Native participant motivation to take and successfully complete advanced high school and college-level mathematics and science
courses while in high school. During the Group 1 individual interviews, each of the participants were asked what most motivated them in high school to take advanced mathematics and sciences courses. Of these 11 participants, two participants initially mentioned ANSEP without prompting, saying that ANSEP definitely helped motivate them to take advanced mathematics and science courses while they were still in high school. The remaining nine participants with minimal prompting stated that ANSEP definitely helped motivate them to take advanced mathematics and science courses while they were still in high school.

Through the analysis, I tried to decipher if Alaska Native ANSEP Precollege students are being intrinsically or extrinsically motivated to take advanced mathematics and science courses. Each of the study participants were asked about their participation in the ANSEP Computer Assembly. The main pillar for this component is for participants to build a computer in order to encourage them to take specific mathematics and science courses in high school to prepare them for 4-year STEM degree programs. Many of the individually interviewed Group 1 participants mentioned the computer was intrinsically motivating rather than extrinsically even though it is expected receiving a reward such as a computer would be extrinsically motivating. This was determined because participants mentioned they enjoyed the experience of building the computer over the experience of keeping the computer, feeling proud that they built the computer, and proudly showed off the computer to their family and friends. It was determined that ANSEP does motivate its participants intrinsically even though the motivation was expected to be extrinsic by the design of the program.

This study also attempted to determine if Alaska Native ANSEP high school students are gaining a sense of autonomy, competence, or relatedness to motivate them to take advanced mathematics and science courses.

In terms of autonomy, participants were asked if ANSEP allowed them to use their own self-direction to guide their own actions. The responses were mixed. Many of the Group 1 participants and a majority of the Group 2 participants indicated that ANSEP did allow them to use their own self-direction to guide their own actions. However, several also felt that ANSEP did not allow them to use their own self-direction to guide their own actions. Many students that mentioned that they felt like ANSEP did not allow them to use their own self-direction to guide their own actions mentioned this because they felt there were more opportunities provided within engineering and fewer opportunities provided within science. They also felt that they should be able to select their own courses within the ANSEP Acceleration Academy and Summer Bridge components.

In terms of competence, participants were asked if ANSEP allowed them believe in themselves and if they received positive feedback. All of the study participants explained that ANSEP allowed them to believe in themselves and that ANSEP also provided positive feedback.

In terms of relatedness, participants were asked if ANSEP allowed them to feel like they belonged at ANSEP and at UAA. All of the study participants explained that ANSEP allowed them to feel like they belonged. It was determined that overall ANSEP allowed participants to gain a sense of autonomy, competence, or relatedness to motivate them to take advanced mathematics and science courses.
This study attempted to determine what it is about its environment that fosters intrinsic motivation. Participants were asked questions about the ANSEP community that it cultivates on the UAA campus during their participation in the ANSEP Precollege components. Many of the participants explained that ANSEP fostered an intrinsically motivating environment. This claim is based on many participants stating they felt like the ANSEP was their second home, they felt safe, and the group study learning helped them learn better. This was determined based on many participants stating they looked up to ANSEP staff, being able to rely on ANSEP peers, and feeling as if they had become part of a family and close knit group of peers with similar life goals and motivations to succeed in life and school. It was determined that ANSEP fosters an intrinsic motivating environment.

Conclusions

Initial findings indicate that ANSEP both directly and indirectly motivated its participants to take more advanced mathematics and science courses while still in high school. This was found by confirming participants are intrinsically motivated by items that would be expected to be extrinsically motivating, overall ANSEP allowed participants to gain a sense of autonomy, competence, or relatedness to motivate them to take advanced mathematics and science courses, and that ANSEP fosters an intrinsic motivating environment. Preliminary findings further suggest that ANSEP precollege components positively contributed to participant motivation to pursue STEM degrees and professions.

The next step for this research is to develop these preliminary findings into detailed significant findings. I will do this by providing several quotes from the interviews to back up each of my significant findings. I will also be able to separate these findings into Group 1 and 2 participants and then triangulate these findings to verify if they are the same or different for each group. I will also use options built within NVivo to run analyses to potentially generate further findings. I am also hoping to generate findings that specifically showcase Alaska Natives’ intrinsic and extrinsic motivations. Knowledge gained from this study should further support the use of longitudinal academic programs to increase STEM degree persistence and graduation.

Limitations

Limitations for this study include that this study focused on interviewing “successful” students (for example, Group 1 students were attending college for STEM degrees and therefore already took sufficient high school math and science courses needed for admissions to college). This study does not incorporate students’ views of “unsuccessful” students, or students who did not pursue STEM degrees. I could include views of “unsuccessful” students but it is outside the scope for this particular study. But interviewing “successful” students could lead to a future study where research to collect data with “unsuccessful” students, who did not end up pursuing STEM degrees, is pursued. Also, I would be considered an “insider” of ANSEP and this could have been a limiting factor for this study because someone who was not an “insider” of ANSEP may have had unbiased views.
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