GEEK AS A CONSTRUCTED IDENTITY AND A CRUCIAL COMPONENT
OF STEM PERSISTENCE

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The fields of science, technology, engineering and mathematics (STEM) have long been the bastions of the white male elite. Recently, academia has begun to recognize gender and ethnic disparities. In an effort to expand the recruitment pool for these STEM fields in college, various efforts have been employed nationally at the secondary level. In California, the latest of these efforts is referred to as Linked Learning, a pedagogy that combines college preparation with career preparation. The current study is investigating the connection between what has been referred to in current scholarship as "Geeking Out" with higher academic performance. The phenomenon of “Geeking Out” includes a variety of non-school related activities that range from participating in robotics competitions to a simple game of Dungeons & Dragons. The current project investigates the relationship between long term success in STEM fields and current informal behaviors of secondary students. This particular circumstance where Linked Learning happens to combine with "Geeking Out" is successful due to the associated inclusionary environment. Methods included a yearlong ethnographic study of the Center for Advanced Research and Technology, a Central Valley school with a diverse student body. Through participant observation and interviews, the main goal of this research is to examine the circumstances that influence the effectiveness found in the environment of the Center for Advanced Research and Technology.
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DESCRIPTION OF APPLIED THESIS PROJECT

Compounding on previous research data gathered at the Center for Advanced Research and Technology (CART), which links participation in the Lab Schools offered and subsequent academic successes, this research seeks to examine a possible explanation for the readily visible success rates of this program. Geeks have often been portrayed as a high achieving subset of the student population that has a strong connection with science, technology, engineering, and mathematics (STEM) interests; this study assesses that notion. This research examines “Geek” as a socially constructed identity and its relation to student success in STEM fields. In recent years, the U.S. representation in STEM fields has fallen rather sharply to other nations’ increases. This can be exemplified in the drop in percentage of students who initially pursue STEM majors and those who ultimately graduate from a STEM degree program. The purpose of this project is to outline the components/aspects/traits of identity that are conducive to success in STEM so as to increase participation of U.S. students in STEM fields by appealing to student interests. Geeks, in particular, are a complex identity that can include a variety of activities and preferences; there are also various sub-types of Geeks. As such, they may be participants in a variety of activities, to include: gaming (table-top or video), computers, programming, and the like.

Geek:

An identity category that is marked by interest-driven practices; individuals who are identified as smart, different, or creative, who generally exist at the margins of social worlds; these individuals structure their peer network and friendships around interest driven engagements, rather than focusing on social relations. (Mizuko et al. 2009)

CART:

The most comprehensive, state-of-the-art education reform effort at the secondary level to date, CART combines rigorous academics with technical, design, process, entrepreneurial, and critical thinking skills. CART serves a wide range of students from Fresno and Clovis School Districts. Designed as a high performance business atmosphere, the program is organized around four career clusters:
1) Professional sciences
2) Engineering
3) Advanced communications
4) Global economics (Center for Advanced Research and Technology n.d.)

For the purposes of this study, there are two measures of student success: GPA in all STEM courses taken by the student participants and continuation into the second year of a STEM degree program.
CONTEXT OF WORK

There has been a great deal of interest in science, technology, engineering, and mathematics (STEM) persistence. In addition, there have been some forays into what develops interest into the various fields, particularly: personality traits. Interests in securing underrepresented populations’ participation in STEM programs have begun to come to the forefront as well. However, there have been few inquests into the socially constructed identities of students as a potential component of their persistence in STEM field educational trajectories. This project seeks to fill that niche, while simultaneously answering some of the questions that could lead to a wholly new understanding of how to address the struggle that the United States faces to compete in the STEM race.

In their paper, Stiles and Brady discuss California as magnet for migrants from various origins, drawn her by opportunities that the Golden State has to offer (2007:2). This inevitably leads to an influx of students for the Californian educational system, at all levels from primary to post-secondary and beyond. With only 65.60% of all students completing public high school and 45.26% going on to college, the strain on the system can be readily seen (Stiles and Brady 2007:25). In a quote from the Neumark and Fountain forecasts, Stiles and Brady “indicate [that] extensive growth in the demand for workers with baccalaureate and advanced degrees” is projected over the next twenty years” (2007:18). California may be outstripped by future demands for highly educated workers, and so the state needs to invest more heavily in education (Stiles and Brady 2007:31). In America, it can be readily seen that there is such a disparity in STEM field education. Brown and Campbell state in their 2009 article that “inadequate preparation in mathematics and science have created a deficit of qualified workers and will continue to generate a widening disparity for the United States in the global industrial
workplace” (255). It seems as though there needs to be a patch put over the ever-widening breach before California and the whole Unites States becomes inundated by the need for a more intrusive intervention.

STEM inclination and STEM persistence has been a topic of debate, often arising from various camps that include a myriad of reasons for persistence and inclination in STEM, particularly relating to personality traits, inherent ability, and component that are more under the facilities of students to control, such as attendance (Kokkelenberg and Sinha 2010; Wagner et al. 2012; Eris et al. 2007; Ehrenberg 2012; Tseng et al. 2011; Dollinger et al. 2008; Marra et al. 2007). There seems to be a general assessment that, much like other majors, success in STEM fields is related to the big five personality traits: conscientiousness, openness, agreeableness, extraversion, and neuroticism (Costa and McCrae 1992; Komarraju et al. 2009). Additionally, there are various outside factors that range from family composition, to financial aid availability, to the highest education level of a student’s parents.

E.E. Brown examines why many adolescents, particularly female and minority students, choose not to pursue careers in math, science, and technology. The argument that the “pipeline,” leading to the production and increase of undergraduate engineering and STEM (science, technology, engineering and math) related degrees by underrepresented student populations (which include female and AALANA, African American, Latin American and Native American, students), has become more of a “funnel.” It is these notions that I have sought to address specifically in my own research. After five decades of affirmative action-oriented programs and laws, there is still a disconnect at most major research colleges and universities between the number of these students entering into the various STEM related disciplines as freshmen and the total number that successfully complete the baccalaureate STEM degree. Current programs
address superficial/peripheral issues related to diversity (i.e., recruitment), but not the underlying sociological and anthropological aspects that lead to real solutions with permanent results (i.e., increased retention and graduation rates along with a more pluralistic campus environment where diversity is respected, celebrated and embraced in the STEM disciplines). Thus, Brown suggest that a “multi-contextual” model that emphasizes the latter will ultimately bridge this disconnect and achieve the more desirable "affirmative outcomes" that previous affirmative-action-oriented initiatives were originally put in place to accomplish.

Whalen and Shelley, in a 2010 study of STEM majors, indicate that “when students perform well and are adequately funded, while in pursuit of their degree, the likelihood that they will persist to graduation is greatly increased. For underrepresented groups (female, ALAANA), there needs to be a consistent policy effort in developing a social field where success is not just some fanciful dream, but a solid reality experienced for the STEM intended” (Whalen and Shelley 2010: 55). With this in mind, there is a common notion of women being taken less seriously or performing poorly in STEM education (Cheryan et al. 2011; Modi et al. 2012). This comes as the Girl Scouts reports heightened interest in STEM fields from their membership, in the same report, it is noted that while most girls think that they are “smart enough” there is a sense of gendering STEM as “boy subject[s]” (Modi et al. 2012: 11, 19).

Grehan, Flanagan, and Malgady enter new notions into a model of STEM persistence, including notion such as: emotional intelligence and participation in “internships.” They also posit various interventions to support performance and bolster interest in completing a program, such as: mentoring by advanced peers, academic advising, and career counseling “for students who may not be suitable for the field” (Grehan et al. 2011: 327). In a study of Chinese university students, Li-Fang Zhang added a notion of hardiness to this list of traits exhibited by successful
students, with regard to their commitment to pursuing their trajectories when confronted with adversity (2011).

By focusing on developing diversity in faculty members in the recruitment process of universities, Bilimoria and Buch’s article on increasing diversity in STEM, presents the ADVANCE program of the U.S. National Science Foundation (NSF). This program is aimed at advancing the representation of women and minority in STEM educational trajectories. Their discussions cover the typical recruitment process for faculty members in institutions in which involves characteristics that impedes diversity within a faculty including passive recruiting, time-limited, and non-inclusive. Bilimoria and Buch tackle the need to take best practices in faculty searching as part of the ADVANCE recruiting efforts including the need for training of the faculty, a model of on-going recruitment, and aligned process of searching (2010). This previous work underlines the importance of investigating the deficits among universities’ recruitment of minorities in STEM fields. As a study of how to best promote interest in STEM fields earlier on during the academic careers of those best suited for STEM education, particularly those under-represented minorities, there is much importance to bolstering American participation in STEM fields, and the first line of implementation an accurate representation of population diversity in the faculty.

Supporting undergraduate achievement in STEM educational trajectories is paramount to ensuring our nation's continued scientific and technological advancement. In this quantitative study, Espinosa examines the effect of precollege characteristics, college experiences, and institutional setting on the persistence of undergraduate women of color in STEM majors and also investigates how this pathway might differ for women of color in comparison to their white peers (2011). She utilized hierarchical generalized linear modeling (HGLM) to examine the
experiences of 1,250 women of color and 891 White women attending 135 institutions nationwide (Espinosa 2011). Her results revealed the paramount role of women's college experiences. When women of color persisted in STEM, they had frequently engaged with peers to discuss course content, joined STEM-related student organizations, participated in undergraduate research programs, had altruistic ambitions, attended private colleges, and attended institutions with a robust community of STEM students. Negative predictors of persistence include attending a highly selective institution.

Similarly, in her 2010 article, Griffith strove to show inequalities fostered during prior educational experiences that increase retention of STEM programs with regard to under-represented minorities, particularly women of color. Another source of attrition of under-represented minorities in STEM fields occurs during college, many students switch from their planned major to another, particularly so when that planned major was in a STEM field. A worrying statistic in Griffith’s work shows that persistence in one of these majors is much lower for women and minorities, suggesting that this may be a leaky joint in the STEM pipeline for these two groups of students. As this paper uses restricted-use data from the National Longitudinal Survey of Freshmen (NLSF) and the National Education Longitudinal Study of 1988 (NELS:88) to examine which factors contribute to persistence of all students in STEM field majors, and in particular the persistence of women and minorities; not all of it can be replicated here. Although descriptive statistics show that a smaller percentage of women and minorities persist in a STEM field major as compared to male and non-minority students, regression analysis shows that differences in preparation and the educational experiences of these students explains much of the differences in persistence rates. Students at selective institutions with a large graduate to undergraduate student ratio and that devote a significant amount of spending to
research have lower rates of persistence in STEM fields. A higher percentage of female and minority STEM field graduate students positively impacts on the persistence of female and minority students. However, there is little evidence that having a larger percentage of STEM field faculty members that are female increases the likelihood of persistence for women in STEM majors. These results suggest that the sorting of women and minorities into different types of undergraduate programs, as well as differences in their backgrounds have a significant impact on persistence rates.

Drobnis scrutinizes the impact of a female-only environment on students’ attitudes towards and thoughts of future involvement in computer science. Her study was directly involved with the computer science faculty of the school and the female student population, and to some extent the male students in the computer science classes. Through discussions of the potential of a learning environment of diversity, notions of what diverse learners are capable of becoming as talented professionals in science, technology, engineering, and mathematics (STEM); Roberts assesses the current crises that embodies the needs of minority communities. He notes that “they need opportunities to develop” (Roberts 2010:11). Similarly, J. Roberts stated that “just as in generations past, there are talented students from every demographic and from every part of the country who with hard work and with the proper opportunities will form the next generation of STEM innovators” (Roberts 2010:10). In his paper, Roberts describes diverse learners and recommends steps necessary to recognize potential talent and provide appropriately challenging learning opportunities to develop them to optimum levels.

A particular method of activating both innate student interest in STEM education trajectories and general interest in educational goals, linked learning is a major focus of this research as a component of student success. As a newer educational paradigm, it has not become
widely adopted in our public education system. CART is one such institution that is certified as a linked learning school in California. Accordingly, CART is one of a few unique instances of a program fully dependent on linked learning strategies.

In examining Richmond et al.’s notion of linked learning as a functional pedagogy in preparing students for success in life, the twenty-first-century American high school needs to shift its focus from preparing for college or career to achieving college and career readiness for every student. In some areas of the country, progress is being made on this front. One of the most comprehensive efforts is the linked learning initiative in California (formerly known as Multiple Pathways), a reform model aimed at improving high schools by connecting strong academics, demanding technical education and real-world experience in a wide range of fields, such as engineering, arts and media, biomedicine and health. By setting up students for success in the full array of options after high school, linked learning seeks to bridge the college-career divide that has long characterized the American education system. California, with its rich history of reform, has been an incubator for the beginnings of the linked learning movement. And as a microcosm of the larger United States, the work there offers important lessons for stakeholders addressing the national high school crisis. This brief details the linked learning movement in California, developed in response to poor and inequitable student outcomes, as it continues to garner interest and develop a growing base of evidence. The discussion lays out the rationale for the linked learning approach and the ways in which it seeks to address the need for rigorous, engaging educational options toward the goal of college and career readiness for every student.

By examining certain classroom practices the fall under there premise of linked learning, particularly thru the use of video-conferencing and other technologies that are used in the workplace, Jones et al. showed that “geeking out” in the classroom though the use of technology
was a boon for health professional education. The influence of interactive videoconferencing (IVC) on health professional educational outcomes between Canada and Hong Kong students was examined (Jones et al. 2010). Three formats were compared with respect to the instruction of two circumscribed intensive care topics. The formats included international video-linked (VL) tutorials in combination with web-based tutorials (VL + WB), web-based tutorials only (WB), and conventional classroom tutorials (C) (Jones et al. 2010). Physical therapy students were assigned to one of the three groups at each site where the learning outcomes included grades and evaluation of the learning experience. Instructors provided written feedback on their experience with the instructional formats. Grades were comparable across instructional groups at both sites with the exception of one question for the HK group. The VL + WB groups valued learning from international peers. VL learning outcomes appeared to be comparable to conventional formats and may augment students' learning satisfaction. Modifications are recommended to accommodate differences in the language proficiency of students. The instructors acknowledged that preparation for VL tutorials was unique and challenging. Further research targeted at cross cultural interaction via IVC is needed to determine whether quality of learning outcomes are topic dependent. Cross cultural IVC appears to be both a distinct teaching as well as learning experience for health professional students.

In developing the groundwork for the assumptions and assessments laid out in this paper. Pertinent areas of the academic context need to be brought to the frontline. Particularly, notions that are of importance to developing the case that CART has any positive affect on the pursuit of STEM field education trajectories, such as: how socially constructed identities are socially constructed, the concept of a “Geek” identity, and framing the issues surrounding why students continue to pursue STEM field education trajectories, or persistence. The essential notion of this
research has been to identify a Geek identity, as it is performed by CART students, and verify a purported connection to success in STEM field education trajectories.

There is a vast corpus of work on the notion of identity as it relates to adolescent development, and recently work has been done in relating those developments to the construction of a coalescent, adult identity. There is a strong sense that these identities are conceived as a direct result of socialization and the individual’s psychological need for both “separateness” from the society at large and “belongingness” within a specific community. These identities can be indicative of various form of cultural expression: gender/sex, race/ethnicity etc.

Identity is the basic notion of one’s sense of self. It both defines the boundaries of each individual from the other, and blurs the lines in an attempt to fashion a sense of belonging. This is often underscored by the notion of identity construction being linked to an individual’s life history (Schafter 2005; Serafini and Adams 2002; Baumeister and Muraven 1996; Adams and Marshal 1996; Kroger 2008; Ewing 2005). Attaining an identity in a modern culture is entwined with notions of consumerism and “media bombardment”, these play a critical role in adolescents “individuating from their parents and identifying with their peer groups” (Deutsch and Theodorou 2009: 230). Furthermore, this “acquisition of material goods” is associated with increased social status, and ultimately: agency (Deutsch and Theodorou 2009: 233).

Additionally, Karen Cerulo’s article “Identity Construction” notes that it is impossible to frame identity without framing where individuals are, themselves, framed by their networks that exist increasingly in cyberspace, and “new communication technologies (NCTs)” are developed (1997:397; Papadimitriou 2009:1332). By creating a nexus of “non-linear interactions,” our youth are increasingly subjected to such “recursive publics” as chat rooms, online gaming, etc. (Papadimitriou 2009:1331; Kelty 2005:203). And it is in these places that Geeks flourish (Ito...
This study centers on notions of a Geek identity and how it relates to STEM successes.

Whether through joking relationships or outright harassment, social worlds (or fields), have a modifying effect on our identity construction, adherence, and expression (Eves 2004; Pascoe 2005; Føysand and Jakobsen 2007; Splitter 2007; Pascoe 2005; Peal-Eady 2011; Ghaziani 2011; Dewit et al. 2012). In this case, it is often the bully that subjects Geeks to harassment based on assessments of the Geeks’ interests. This will subsequently set those individuals down a road that compounds and “congeals” their expressions into a solid identity (Brubaker and Cooper 2000). Intragroup ridicule can be less damaging, as it is often in jest, and used to position one’s self in relation to a general stereotype, effectively realigning an individual’s attributes and values to that of the cultural expressions of a collective identity (Queen 2005; Hogg and Reid 2006; Tonso 2006; Fløysand and Jakobsen 2007; Levitt and Schiller 2004; Eves 2004; Hochschild 2010).

While many identities remain important throughout the adolescent developmental process, the identity of note in this research is that of a Geek identity. There has been some research done on the notion of a Geek culture and to some extent the behaviors associated with Geeks. For the purposes of this research, a Geek is defined as someone fulfilling the definition of geeking out, as set forth in the work of Mizuko Ito et al. both in the findings of “Living and Learning with New Media: Summary of Findings from the Digital Youth Project” and her seminal text on these, in which she describes increasing echelons of behavior surrounding interest driven practices culminating in what she refers to as “geeking out.” Where the prior two levels indicate more of a cursory interest, geeking out is marked by a greater intensity of interest, longer-lived, and being extended to a serialized activity (Ito et al. 2008; Ito et al. 2009).
In his dissertation, Jason Tocci addresses notions of a “Geek culture”, that the respective identity is merely an indicator, “represent […] a newly visible dimension of identity” that “demonstrates how dispersed cultures can be constructed through the integration of media use and social enculturation in everyday life” (Tocci 2009: v). He also discusses the notion of a modern affectation of Geek identities, as part of a development in the consumer market, making it more desirable to be seen as a Geek (Tocci 2009:3). He describes the Geek means of identity development as “othering” around “what Geeks do with media” and establishing “a sense of collective identity, commonly shared values, and discourses of authenticity” Tocci 2009: 10).

As with most identities, a Geek identity is not born overnight, but is a coalescence of the experiences of each adherent, usually stemming from peer harassment aimed at normalizing a notion of not “trying to get good grades” (Tocci 2009: 21). He frames a situated expression of being smart, with an acceptable “in-class” arena, and an unacceptable “playground” arena (Tocci 2009: 25). Geeks are often initially identified as an “other” by non-Geeks before assimilating into Geek culture or adhering to a Geek identity (Tocci 2009: 28). Geek culture is also represented as a “community of practice” and may present a “valuable resource” for girls in gendered, US high schools (Tocci 2009: 32; Bucholtz 1999: 211).

For this research, I examined the connections between identity adherence and success in STEM education. In order to do this, the social identities among students who participate in CART needed to be identified and catalogued. The relationship between these social identities and notions of a Geek identity also needed to be understood. Finally, any interventions that CART provides needed to be analyzed for their contributions to the construction of a Geek identity, in as much as they are related to success and persistence in STEM fields.
FIGURE 1. CART student ethnicities ($N = 1165$).

FIGURE 2. CART student gender representation ($N = 1165$).

CART is an external component of secondary education, and is a cooperative effort between Clovis and Fresno Unified School Districts. It is a certified linked learning facility. And reports itself as “the most comprehensive, state-of-the-art education reform effort at the secondary level to date” (Center for Advanced Research and Technology n.d.). CART stresses a
combination of rigorous academics with various skills that are pertinent to the students’ workplace goals. This particular institution serves a diverse student body from both Fresno Unified and Clovis Unified School Districts. It was conceived as business-centered atmosphere with an emphasis on high performance at CART and each student’s home institution. It is organized around four career clusters: professional sciences, engineering, advanced communications, and global economics.

After meeting with CART administration and expressing my interest in their facility as a potential site for research into Geek identity and STEM success, the CEO noted a desire for research on CART’s unique production of success. In so far as I was interested in the confluence of Geek identities and STEM success, CART is interested in assessments of their education methods. For CART, this research was to be an assessment of the strategies that led to their effectiveness.
PROJECT DESIGN

This was a cross-sectional study composed of participant-observations, survey work and interviews among the Center for Advanced Research and Technology (CART) students and CART graduates. Online surveys were completed by CART alumni from the past year to round-out this study. This study examined the following questions:

1) What are the social identities among students who participate in CART?
2) How are those social identities related to notions of a “Geek” identity?
3) Does CART provide any interventions that contribute to the construction of a “Geek” identity?
   a. How are these interventions related to success and continuity in science, technology, engineering, and mathematics (STEM) fields?

The project seeks to fulfill these three objectives:

Objective I: By examining the socially constructed identities among CART students in the Game Design lab, this research forms a baseline for a cross-sectional comparison, noting their interest in pursuing Science, Technology, Engineering, and Mathematics (STEM) degree programs.

Objective II: By examining the prevalence of the identities among CART graduates that are more closely related to STEM successes, this research data is compared with the baseline gathered from CART. Furthermore, continuance data regarding participation in STEM degree programs is compared to identity expression.

Objective III: Examine how these identities are constructed at CART, analyzing informal and formal education settings as a starting point, as that notion correlates to stronger academic performance.

For the purpose of this research, identities are seen as intrinsically linked to STEM continuance and STEM inclination. Participant-observations serve as the basis for most of the
assessments made in this research. Further data were gathered by surveys and interviews aimed at directly responding to the above questions and objectives. The primary question is elucidated through operationalized definitions of the variables identity and STEM persistence. The secondary question is answered through a tertiary operationalized variable, STEM inclination. This quantitative data is used to substantiate assertions based on qualitative data.

Surveys

Geek Identity Questions

- Do you think you are a Geek? [Yes = 1; no = 0.]
- Do others think you are a Geek? [Yes = 1; no = 0.]
- Define MMORPG. [Success = 1; failure = 0.]
- Define RAM. [Success = 1; failure = 0.]
- Name three d20 based RPGs. [Success = 1; failure = 0.]
- A Will Save is based on what ability score? [Correct answer = 1; incorrect = 0.]
- How much space is a Tb? [Correct answer = 1; incorrect = 0.]
- What is adamantine? [Correct answer = 1; incorrect = 0.]

The resultant scale would show how much the individual ascribes to a Geek identity, 0 as “not a Geek” and 8 as a “full Geek.” The initial question would denote a social Geek or a technical Geek.

STEM Inclination

- Are you currently interested a STEM degree program? [Yes = 1; N/A = 0; no = -1.]
- Do you participate in activities related a STEM field? [Yes = 1; no = -1.]
- Have you been successful in science courses (B+ or A grade)? [Yes = 1; N/A = 0; no = -1.]
• Have you been successful in math courses (B+ or A grade)? [Yes = 1; N/A = 0; no = -1.]

• Have you been successful in engineering courses (B+ or A grade)? [Yes = 1; N/A = 0; no = -1.]

• Have you been successful in technology courses (B+ or A grade)? [Yes = 1; N/A = 0; no = -1.]

The resultant scale would show how inclined the individual is to pursue a STEM degree program, a -6 would be “least likely” and a +6 would be “most likely.” Students who answer “no” to the initial two questions would be “not inclined to pursue a STEM degree program.” A “yes” to the second question would indicate a non-academic interest in STEM fields.

**STEM Persistence**

• Do you currently pursue a STEM degree program? [Yes = 1; no = 0.]

• Do you participate in activities related a STEM field? [Yes = 1; no = 0.]

• Did you complete your first year in a STEM degree program? [Yes = 1; no = 0.]

• Did you complete your second year in a STEM degree program? [Yes = 1; no = 0.]

• Did you complete your third year in a STEM degree program? [Yes = 1; no = 0.]

• Will you pursue a STEM degree program next term? [Yes = 1; no = 0.]

The resultant scale would show how likely the individual is to continue in a STEM degree program, a 0 would be “least likely” and a 6 would be “most likely.” Students who answer “no” to the final two questions would be “no longer pursuing a STEM degree program.” A “yes” to the second question would indicate a non-academic interest in STEM fields.

**Phases**

This project has been implemented in three stages:
Phase I: Observations, Surveys and Interviews (October 2013-January 2014)

During this phase of the research, I made five visits to the CART campus (i.e. Game Design Lab) per week, gathering participant-observation data and identifying individuals per their interest-driven practices; recruiting, for subsequent interviews, individuals who are identified as fulfilling the conceptual variables smart, different, or creative. These identifications were made by the researcher, the CART facilitators, and by students’ self-identification. Subsequently, the sample of Geeks includes those who fit the research criterion for being a Geek and self-identify as being a Geek, those who fit the research criterion for being a Geek and do not self-identify as being a Geek, and those who simply self-identify as being a Geek. Surveys are presented to students based upon observations made in the initial weeks and covering questions such as: demographics, self-identity, Geek knowledge, academic performance, co-curricular activities, and extracurricular activities. Survey data is examined and major themes are drawn out, these themes are the basis for subsequent interviews. All requisite Informed consent and assent are gathered prior to student participation in semi-structured interviews. These semi-structured interviews covered notions of Academic Performance, Co-Curricular and Extracurricular activities, and identity-oriented knowledge; in order to elicit traits or indicators of success related to STEM successes. In so doing, it is important to interview students, recent alumni, as well as certain faculty and administration to illuminate the scope and effects that CART’s model has on the education of their students.

Phase II: Data Analysis (January 2014-February 2014)

During this phase of the research, I began to examine the collected data. Also, I expanded on major themes noted in the initial phase of the research, based upon data gathered in the latter half of the initial phase of research.
Phase III: Preparation of Deliverables (February 2014-April 2014)

During this phase of the research, I combine the previously gathered data into a concise and digestible report that presents that data in support of my thesis. CART will also receive a presentation based on my findings.

Description of Deliverables

The final deliverable to the Center for Advanced Research and Technology (CART) consists of a written report and a presentation. Both the report and presentation include a discussion of what Geek identity looks like among the students involved in CART. This information highlights certain aspects of CART that are beneficial for students that are inclined to pursue STEM fields, including CART programs can use this data to bolster their existing program “evangelism.” The bulk of the report addresses the following topics:

1) The social construction of identities at CART,

2) Particular traits and behaviors of students who are successful in STEM fields

3) Replicable aspects of CART’s program that lead to the successful behaviors of students in other programs aiming to encourage student participation in STEM fields, such as: a positive, Geek-affirming environment; a focus on getting those students into their fields of interest, etc.
RESULTS

Initial Observation Analyses

*Socially Constructed Identity*

Participants comprised 19 student informants, 20 students in class, and 2 instructors.

Compositions vary from informant to informant. Some students exhibit more than one identity. These identities are socially defined and gained through self-identification. Most identified as some sort of Gamer, in that they spent the vast majority of their free time playing video games, table-top role playing games, or fantasy card games.

*Table 1. Instances of Observed Identities*¹

<table>
<thead>
<tr>
<th></th>
<th>Geek</th>
<th>Nerd</th>
<th>Artist</th>
<th>Gamer</th>
<th>Writer</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>6</td>
<td>1</td>
<td>4</td>
<td>15</td>
<td>1</td>
</tr>
</tbody>
</table>

¹These were instances observed by the researcher and indicate multiple, simultaneous identity expressions.

*General Assessments*

The Center for Advanced Research and Technology (CART) caters to 16 different areas of interest and numerous sub-areas, via student projects. Students typified their level of interest in game design in different ways. Almost all students gained an interest in designing video games from the act of playing video games. Some students came to CART with the explicit goal of getting into the Interactive Game Design lab, which requires a programming or graphic art-related prerequisite to be taken during students’ first year at CART, their junior year. This indicates that students are aware of their interests during their sophomore year, when applications to attend CART are due. Three students did not apply on time, had not been aware of, or had not considered, CART’s offerings. This lead to their first experience at CART in their senior year, requiring them to bypass the prerequisites with a show of previously gathered game
designing, artistic, or programming skill. One student even took an external course through Geekwise Academy, in order to bolster his programming skills.

Observations

On several occasions, students use their reflexivity to provide redress for their classmates’ misbehavior, not “staying on task,” or not “following directions.” This is indicative of the “Geek” students desire to learn and complete their assigned tasks, given a particular level of interest and understanding (or belief) in the relevance of the tasks assigned. Following direction were the focus of several instances of such redress, the students I observed often policed themselves when it came to other instances such as break time and “off task” behaviors, like online or Nintendo DS gaming. This is not to say that some students were not able to control their urge to geek out with gaming in-class. It was nearly an everyday occurrence that a few students would spend large portions (30 to 60 minutes) of the three hours that they would be at CART to research on Magic: The Gathering cards, others would spend equal amounts of time playing or researching online games as “research.” Being an interactive game design course, I do not doubt that the latter held some importance, but this also yields to the notion that the students in question would have been playing the games noted, regardless of a desire to understand them and exemplify those games in their own work. Certain amounts of class time was often devoted to observing and even playing certain games to illustrate particular game design concepts. This gaming would continue into break, either as flash games online (using CART computer terminals), mobile applications, Nintendo DS devices, and even card games, such as: Magic: The Gathering or Cards Against Humanity.

Gaming was a particular aspect that consumed most of the students’ free time, to the detriment of completing homework assignments, in some instances. There was not a day during
my observations where students did not have in-depth discussions of a variety of games, their perspectives on the gaming industry, and opinions on various consoles and other gaming devices. This often led to discussions of their future trajectories within the gaming industry, most students noted a strong interest in pursuing technology careers, if not game development and design related pursuits. Every student in interactive game design was a “gamer” of some sort, including Card gamers, video gamers, or role-playing gamers. One noted an indicator of a “true” gamer, the use of WASD keys instead of the arrow keys, for computer games (so the right hand is free to use a mouse or joystick).

The recurring theme noted by both instructors and students alike, was that the students were “not here for English.” The students who completed all of the rigors to attend the Interactive Game Design lab, and made it through the lottery selection process, were there simply because they had a love of gaming that many thought was only something that could be channeled through creating games of their own. Students have even commented on the rigor of this college preparatory level of senior English, being more difficult than AP Literature and Composition.

Every student noted interest driven practices that go beyond merely “messing around,” and in that sense, they have entered into what Ito calls “geeking out.” As such, all of the students fall under the analytic category Geek, if not actively identifying themselves as such (one student vehemently denied being a Geek, because it held negative connotations for him; another student considered himself a higher order of Geek, with an emphasis on an application of interest and skills towards a career goal: “a Nerd”). One student considered “being a Geek” as a sort of affectation, or farce, and not a real identity. As such, it was difficult for that student to access a “real” Geek versus the contrived Geek. Another student took this a step farther by naming the
“real” Geeks as “Nerds, and those with a passing fancy (contrived Geeks) as Geeks, noting it as a modern affectation.

Both Interactive Game Design (IGD) instructors mentioned “interest driven” activities, and are highly intelligent and creative people; they also have their odd quirks, and these are indicators of Geeks. One instructor indicates being a Geek. The other described a rationale for non-adherence to a Geek identity, which was explicitly for maintaining the dichotomous, teacher-student relationship. Having teachers that geek out with a genuine love of learning, and of their particular area of focus, provides students with examples to follow. This can extend to interpersonal behaviors, as well as means to fashion the student’s own goals and careers.

An administrator, who self-identified as a Geek, noted various means by which he supports his students. Hallway talk provides an opportunity to address positive and negative topics regarding the hundreds of students at CART, with counselors and faculty, even giving his students the occasional “atta-boy/girl” for a well-produced project. Another administrator does not profess adherence to a Geek identity, but falls within the operationalized definition of a Geek is passionate about learning and education. CART maintains various connections with businesses and other institutions in the Central Valley, with the emphasis on creating connections with local businesses, in order to funnel students into their intended industry, for example: the application-focused, Geekwise Academy. CART staff assists in writing programming curriculum

**Student Identities**

I. Geek† (film, art, computer, gamer, etc.)*

II. Nerd†† (higher order of Geek?)*

III. Gamer (Card, videogame, RPG, etc.)*

IV. Anime Aficionado (Naruto, Attack on Titan, Sword Art Online**, etc.)*
Geeks may identify as a subcategory (film, art, computer, gamer, etc.), this indicates their area of interest, and potentially: the key to their interest in science, technology, engineering, and mathematics (STEM).

Nerds are a type of Geek, though not all Geeks can be characterized by the social definition of Nerd, nor will all Geeks identify as such. Likewise, Nerds may have a similar distaste for being “called a Geek.”

*These categories are often intertwined by subject matter (Pokémon is a card game, but also represented in various series of anime and videogame)

**This particular anime links back to gaming via the nature of the animated series, revolving around a core concept of a game that players can not readily escape.

Interview Analyses

Table 2. Interview Informants

<table>
<thead>
<tr>
<th>Informant #</th>
<th>Age?</th>
<th>Academic Standing</th>
<th>Ethnicity</th>
<th>Gender</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>18-24 years old</td>
<td>Senior</td>
<td>Caucasian</td>
<td>Male</td>
</tr>
<tr>
<td>2</td>
<td>12-17 years old</td>
<td>Senior</td>
<td>Asian or Pacific Islander</td>
<td>Male</td>
</tr>
<tr>
<td>3</td>
<td>18-24 years old</td>
<td>Senior</td>
<td>Caucasian</td>
<td>Male</td>
</tr>
<tr>
<td>4</td>
<td>18-24 years old</td>
<td>Senior</td>
<td>Caucasian</td>
<td>Male</td>
</tr>
<tr>
<td>5</td>
<td>12-17 years old</td>
<td>Senior</td>
<td>African American/Latino</td>
<td>Male</td>
</tr>
<tr>
<td>6</td>
<td>12-17 years old</td>
<td>Senior</td>
<td>Hispanic or Latino</td>
<td>Male</td>
</tr>
<tr>
<td>7</td>
<td>18-24 years old</td>
<td>Senior</td>
<td>Caucasian</td>
<td>Male</td>
</tr>
<tr>
<td>8</td>
<td>12-17 years old</td>
<td>Senior</td>
<td>Caucasian *</td>
<td>Male</td>
</tr>
<tr>
<td>9</td>
<td>12-17 years old</td>
<td>Senior</td>
<td>Asian or Pacific Islander</td>
<td>Female</td>
</tr>
<tr>
<td>10</td>
<td>18-24 years old</td>
<td>Junior</td>
<td>Caucasian</td>
<td>Male</td>
</tr>
</tbody>
</table>

*Respondent stated “Vanilla”; this response is considered Caucasian for the purpose of this research.

The entire notion of linked learning is an integral component of CART’s program, as their goal is to provide students with the various skills that will help them become employed. Whether or not students attend college, students that successfully complete a CART program will have the opportunity to gain various skills, then have those skills verified and certified upon their completion. CART offers various certification programs to their students and the local
community, these programs remain free for their students, and range from Microsoft Office
certifications to wildlife rehabilitation.

More often in the English portion of the course, the students are given assignments that
align towards general STEM interests. The interactive game design component is “the reason the
students are [in the lab]”, so no alterations are readily required to augment their leaning or their
interest. This is not to say that there are not any alterations present, those that are readily visible
are to incorporate aspects of a “linked” curriculum that extends both from Interactive Game
Design to English, as it does from English to Interactive Game Design. These alterations a
visible in the writing assignments that students are required to do in the interactive game design
component of the lab.

Furthermore, most students “are not here for English,” as the teacher for that section puts
it. So that aspect of the students’ CART experience had to be altered, reflecting the interests of
the students in attendance. Generally speaking, there was not a day during my observations
where the English component did not have students exercising their math skills or utilizing basic
concepts of physics and engineering to expand their critical thinking skills. Even the core texts
themselves surrounded notions of engineering (Glimmer, and To Engineer is Human), and
underscored this sense of relevance of the curriculum.

This is not to say that the students in the Interactive Game Design class did not continue
to dislike English, or that the instruction always fed into their particular interests. Having to
balance both the Interactive Game Design lab and the Product Development/Robotics Lab, there
were many instances where the relevance was lost on the Interactive Game Design students I
observed. However, the more talkative of the students (Informants 1, 8, and 11) were often able
to redirect the discussion to more relevant topics. Informant 3 redirected a conversation of how
inventions alter the universe in which they are invented which leads to further alterations of the invention itself, by opening a discussion of the transistor and its direct effects on the field of computer science. Not only was this not seen as an affront to the English teacher, but she was seemingly aware of this aspect and kept the conversation going along these lines. The English teacher did not get upset or angry about the student reorienting the discussion. Her personal knowledge of the instance in question (i.e. the development of the resistor) gave her the ability to navigate the new discussion area, with relative ease.

Every student interviewed was asked if there was anything that they would “redo” if they had the opportunity. Every student, but one, noted a desire to have begun working harder (being more aware of their end-goals now). Some underscored this notion, by saying that knowing there was a place like CART for them to go to, would have spurred their interest in working harder. Informant 10 noted that there was nothing they would have liked to change, because everything that individual had done up to this point helped fashion the person they were today. This was also not the first time that students were asked to do reflection activities, throughout the year, in both English and Interactive Game Design components, students are asked to reflect on their progress, what they are looking forward to, etc.

Informants 2, 3, 5, 7, and 8 all indicated in their interviews that they have family members that geek out in various areas. Informant 2’s father plays various fantasy RPGs and also supports Informant 2’s interest in developing games, even purporting an interest in doing the same. Informant 3 indicated that while father also has a degree in computer science, the same degree (if not the same emphasis) as Informant 3, both of his parents have been critical of him being “so caught up in his video games.” Informants 5 and 7 indicate that their respective fathers are also gamers, who often play various games with them, at home. Informant 8 identifies both
his father and brother as “movie Geeks” indicating a familiar interest between the three as being the “immersive storytelling” that this informant characterizes himself as being “obsessed with.” Informant 8’s brother is “in college to make movies” indicating a movie nerd, going off of Informant 3’s definition of Geeks and Nerds. Informant 17 indicated that his grandmother taught a course on the use of Adobe Photoshop, indicating her showing him the tech savvy skills she’s developed, as a source of his own experience in using similar programs. It does seem that the “home-based” aspect of identity construction is a vital component. However, with all of the negative attention given to the key component of gaming in this performance of the Geek identity (in some student’s experiences), I am reluctant to say that it is purely a product of either negative reinforcement or the presence of positive Geek role models. I imagine that it is much more complex. Informants 14 and 17 once stated that it was the act of gaming itself that was an integral component to the construction of their identities. They had paraphrasing a line from Christopher Nolan’s 2012 film, The Dark Night Rises, (in unison) saying that they were not adopted by video games, “[they] were born into it, molded by it…”

Furthering the efforts of a linked learning based curriculum, the students are required to wear professional clothing on Thursdays. As most high school students seldom wear this attire, it would (theoretically) be readily evident which students are CART attendees, even on their home campuses. There is also a gradient of sorts, when it comes to the level of business attire students wear: Polo shirts and khakis, collared shirts and slacks, full suits, etc.

In the lab, students work in groups or “companies.” Each company is composed of students who fulfill the various roles (programmer, level designer, artist/graphic designer, report writer, etc.) required of a game design company (indicating the level of consultation with companies in this field). Work can be further divided, as various parts of the projects are
completed and other students seek to augment their skills in game design, even if their initially volunteered-for position indicated their lack of confidence in other game designing skills. Informant 17 volunteered to be his business’s report writer. When his work was finished, he helped out the level designer and graphic designer.

Informants 2 and 5 indicated a particular liking of having Professional Dress Thursdays. Most weeks there was an average of 17 out of the 20 (via daily headcounts) or 86.6% of students in Interactive Game Design that participated in this “dressing out.”

Themes

Linked learning is an active pedagogy that is marked by an interest in providing students with experiences which make them career-ready, even if they do not have plans to attend a college or university. In many ways this form of education is capable of refilling the niche that was left when apprenticeships began disappearing. It is readily visible why apprenticeships are not viable in our society of anti-child labor laws and education –experience as the primary basis for employment. In its place, Linked learning can provide students with skills that can have them ready for the workplace as well as college upon graduation, whichever path they choose to follow. This particular method is understandably two-fold, and surpasses apprenticeships, in that students who complete a linked learning program have the specialized training that constitutes experience in a particular field of their interest and the required coursework to continue their education and training in college (if they see fit). In this sense, linked learning functions as a normative pedagogy. In that it provides all students in the program access to the general education requirements of colleges and universities, while simultaneously giving those students the hands-on training to go right into the workforce of their field of interest. Students are ultimately given a true freedom to choose whether or not to pursue college, while not having the
question summarily dismissed and being handed one option or another. Linked learning provides students with the knowledge to make more informed decisions about their futures.

As an extension of the notion above, there is a strong sense of students being exposed to various aspects of the workplace. From professional dress to group work, the common theme of CART is that students are being prepared for an employment-bound trajectory. As the first semester came to a close, and again as the second semester began, the Interactive Game Design instructor mentioned various career paths in the field and what they entailed. The instructor highlighted various positions, such as programmer and level designer, as potential areas of future employment.

English is perhaps the most obvious instance of an interest-driven aspect of student learning, given the recurring STEM themes in that curriculum, but there were three of the five Interactive Game Design projects that indicated this notion as well. Informants 3, 5, and 8’s groups all decided to skip 2-dimensional games, as they had experience with these types of projects prior to attending the lab, they all shared an interest in using a new game designing software, Unity. Unity is used for designing 3-dimensional games, and was written into the second semester curriculum. However, given the level of interest in designing 3-dimensional games that these three groups had, the Interactive Game Design instructor relented and let them pursue their interests accordingly.

The breakdown of the companies indicates the presence of various levels in situated participation and learning. Students who chose to be the report writer were not expected to do as much programming, level design, or graphic design. This could be indicative of both: the individual student’s confidence in their skills (regarding the positions that they did not volunteer for), or their particular interest in the aspect of the project that they did volunteer for. As such,
their experience with the various aspects (programming, level design, or graphic design) could be more limited. They are, apparently, situated farther from the non-existent, or false, core participation of game design, than are students more actively involved the other aspects. However, this level of participation is no less legitimate in the process of gaining game design skills, as they are still exposed to the other aspects of game design throughout the year-long course.

As indicated previously, the students are not attending CART for the college-readiness components, and the respective teachers are ready for this. Students readily participate in passive resistance to the forced completion of these areas where there interest is not driving them. As a result, several students were commonly falling behind in their English assignments, only to flood the teacher’s inbox near the end of the semester. There was a sense that the English instructor did not want to let them fail, but noted that there was a lack of urgency about the way students turned their work in, often attempting to re-create something that has very little meaning to them, at this point.”

In response, the teachers for these seemingly ancillary courses format their courses to appeal to the students interests. English involves various aspects of math, science, and engineering to peak their interests, there are also aspects of history and various other subjects (ass appropriate) that indicate a global curriculum. Student learning is often dictated by their current knowledge needs and interests at the time, while ultimately feeding into a common core of curriculum. The English course discussions often revolve around a student oriented discussion, which may or may not, successfully orient a discussion of the text or unit core. Students’ discussions were often the basis of classroom discussion on the frontiers of the gaming world, a major focus of the Interactive Game Design lab. On several occasions, they were shown
YouTube videos that either demonstrated the use of a particular game design software, “showreels” (a game design version of a portfolio), or new advances in gaming technologies.

The class is taught via a pedagogy that is not restricted to a specific cultural orientation. The Interactive Game Design instructor is of a different (non-Caucasian) ethnicity than the English instructor, and the latter of the two is female. In this context, it becomes more apparent that this class is taught via a multicontextual model that appeals to the lab’s low context majority males and the high context female and African American, Latin American and Native American (AALANA) students (Brown 2011:327). A CART administrator stated in an email communication that while “student’s do not really graduate from CART, 100% of their seniors were on track for graduation.” The difficulty in finding parking for the spring semester’s Showcase event and the congested labs and atrium, indicate the level of familial and community interest in the students’ work. For seniors, this event was the culmination of their efforts at CART.

The identities below are less a description of individual identities, but more of the different aspects that compose each student’s individual means of identification. The multifaceted identities that include gaming, anime interest, filmmaking are often indicative and components of an overall Geek identity.” Each aspect can be represented to varying degrees, or not at all. However, as one would expect, the Geeks in the Interactive Game Design lab all share an interest in some form of gaming.

**Geek (Film, Art, Computer, Gamer, etc.)**

Indicators: Gaming (Card, videogames, online games, mobile games, etc.), anime interest, extensive knowledge on a unique subject area (film, games, etc.)
Most students indicated a strong interest in gaming, often crossing perceived boundaries, indicating the more fluid nature of gaming. The limiting factor for developing an interest in any one type of gaming was associated with the cost to play. Most students were not employed, and not all parents supported these gaming interests, potentially related to the expensive nature of gaming. While several students indicated extensive knowledge of this particular aspect, this was not a common area across all students who identified as Geeks, especially, when considering the socially requisite component of extensive and intensive series knowledge. Most students, who indicated an extensive history of gaming, also expressed an expansive knowledge of particular game series, methods of gaming, and the like. Students with strong interests in other aspects of the Geek gamut, indicated similarly extensive knowledge (film: functional knowledge of video editing programs, anime: extensive knowledge of various series).

Survey Analyses

Due to the small sample size of both the student and alumni survey participants, it is not possible to determine statistical significance. However, the descriptive aspects of the survey are still valuable. Utilizing an operationalized definition of Geek, there is an indication of extensive performance of the Nerd inclusive, Geek identity.

As seen in Figure 3, there is a clear majority of students who identify as Geeks or Nerds. Similarly, there is a majority of students who note that this identity is apparent to others. Indicating, students have encountered others who have expressed this assessment (see Figure 4).
FIGURE 3. Responses to “Do you think you are a Geek or Nerd?” (n = 19).

FIGURE 4. Responses to “Do others think you are a Geek or Nerd?” (n = 19).

While, those exhibiting a distinguishable Geek identity are present throughout the GPA gamut, they are more heavily clustered near the top end of the scale and received the highest reported grades. This may indicate a more specified interest, a limited history of a spurred interest, and that only two of the students courses are directly associated with their career interests and general trajectory. See Figure 5.
FIGURE 5. Overall GPA compared to Geek or Nerd identity adherence (n = 13).

Some students indicate as far back as their primary grades, as having identified themselves under the Geek category. Others indicated instances as late as high school, remaining nascent, even until critically considering themselves in their respective interviews before identifying as Geeks. Various other indicators, included; obsession level of “playing” games or watching anime, an understanding of the term, even peer judgments can play a vital role in identifying as a Geek. In this sense, the adherence to the Geek or Nerd identity can precede awareness of the identity itself and be associated with various other identity components in a sort of hodge-podge. See Table 3.
Table 3. *When Do Students Indicate Awareness of Being a Geek? (n = 19)*

<table>
<thead>
<tr>
<th>Informant #</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>When i displayed an obsessive amount of interest in technology.</td>
</tr>
<tr>
<td>2</td>
<td>(no answer)</td>
</tr>
<tr>
<td>3</td>
<td>About 5th grade</td>
</tr>
<tr>
<td>4</td>
<td>(no answer)</td>
</tr>
<tr>
<td>5</td>
<td>(no answer)</td>
</tr>
<tr>
<td>6</td>
<td>When it was discussed in the meeting</td>
</tr>
<tr>
<td>7</td>
<td>When i started spending more than 36 hours a week playing video games and being on the computer.</td>
</tr>
<tr>
<td>8</td>
<td>Like fourth grade-ish. I invented a card game with some pals and some girl called me a Geek, and I thought, &quot;Yeah, I guess I am&quot;</td>
</tr>
<tr>
<td>9</td>
<td>Freshman Year</td>
</tr>
<tr>
<td>10</td>
<td>7th Grade when i started to get into computers</td>
</tr>
<tr>
<td>11</td>
<td>High School</td>
</tr>
<tr>
<td>12</td>
<td>when i found out how fun role playing games are and video games</td>
</tr>
<tr>
<td>13</td>
<td>when i started playing lol</td>
</tr>
<tr>
<td>14</td>
<td>(No Answer)</td>
</tr>
<tr>
<td>15</td>
<td>Pretty much as soon as the meaning of the word made sense to me</td>
</tr>
<tr>
<td>16</td>
<td>I can't say</td>
</tr>
<tr>
<td>17</td>
<td>(No Answer)</td>
</tr>
<tr>
<td>18</td>
<td>When I [began] to act quirky in the most random of moments or when I [began] to make comments that are defined as &quot;nerdy&quot; jokes.</td>
</tr>
<tr>
<td>19</td>
<td>The day i spent all night playing Minecraft and watching Anime from 9 to 7.</td>
</tr>
</tbody>
</table>

Four students directly identify as Nerds and two as Geeks. These students specify a disparity between the two identities, and base them along line of application to academics and, ultimately, a career. The various other students all indicate components of the Geek identity, thought, there was a “no answer” and various forms of “I don’t believe in labels.” One student even went so far as to use an alternative spelling of “Nerd.” Several students indicated identity
components that do not readily appear in the Geek identity, such as: gendering, ethnicity, group affiliations, and expressions of masculinity. See Table 4.

Table 4. How Do the Students Identify? (n = 19)

<table>
<thead>
<tr>
<th>Informant #</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>I identify myself as a nerd.</td>
</tr>
<tr>
<td>2</td>
<td>Somewhat who dresses really nice to keep up appearances.</td>
</tr>
<tr>
<td>3</td>
<td>NERD</td>
</tr>
<tr>
<td>4</td>
<td>I would identify myself as a casual gamer.</td>
</tr>
<tr>
<td>5</td>
<td>As me</td>
</tr>
<tr>
<td>6</td>
<td>Introverted filmmaker.</td>
</tr>
<tr>
<td>7</td>
<td>I really don't know since I hang out with people from some many different categories.</td>
</tr>
<tr>
<td>8</td>
<td>A Geek. A Bad*ss. A Creative Monster. A Man</td>
</tr>
<tr>
<td>9</td>
<td>I am a student who is diligent and attentive. I am responsible with turning in work and know when to bring up topics when asked or when the time is right. I learn faster and enjoy more hands-on experience.</td>
</tr>
<tr>
<td>10</td>
<td>Geek</td>
</tr>
<tr>
<td>11</td>
<td>Nerd, Programmer, Boy Scout</td>
</tr>
<tr>
<td>12</td>
<td>I identify myself as James and there is no one like me.</td>
</tr>
<tr>
<td>13</td>
<td>Nurd [Nerd]</td>
</tr>
<tr>
<td>14</td>
<td>Someone who looks at thing differently.</td>
</tr>
<tr>
<td>15</td>
<td>Just your average student trying to get through school. A gamer.</td>
</tr>
<tr>
<td>16</td>
<td>Mexi-Can male at 5&quot;something that is interested in learning about people and plays alot of games</td>
</tr>
<tr>
<td>17</td>
<td>(no answer)</td>
</tr>
<tr>
<td>18</td>
<td>Quirky, fun, imaginative, unique</td>
</tr>
<tr>
<td>19</td>
<td>an Otaku/Gamer.</td>
</tr>
</tbody>
</table>

Compounding on the previous data, Students at this point were asked to directly identify themselves as Geeks or Nerds, if either. Then, they were asked to critically consider their behaviors in the eyes of others to determine if they might appear that way, regardless of their
self-assessments. Most instances show a direct correlation to each other, however, in four instances this does not occur. One student does not view himself as a Geek, but imagines that others do. Three students view themselves as Geeks, but imagine others do not.

### Table 5. Student Operational Definitions and Personal Identifications (n = 19)

<table>
<thead>
<tr>
<th>Informant #</th>
<th>Do you think you are a Geek or Nerd?</th>
<th>Do others think you are a Geek or Nerd?</th>
<th>Are you currently interested a STEM degree program?</th>
<th>Operationalized Geek - n:9</th>
<th>Operational STEM Inclination - n:6</th>
<th>IGD Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Minimal Geek - No Responses</td>
<td>3 Somewhat Likely</td>
<td>B+</td>
</tr>
<tr>
<td>2</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>Mostly Geeky</td>
<td>1 Low Likelihood</td>
<td>B</td>
</tr>
<tr>
<td>3</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Very Geeky</td>
<td>5 More Likely</td>
<td>A-</td>
</tr>
<tr>
<td>4</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Minimal Geek</td>
<td>2 Low Likelihood</td>
<td>A</td>
</tr>
<tr>
<td>5</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Mostly Geeky</td>
<td>1 Low Likelihood</td>
<td>A</td>
</tr>
<tr>
<td>6</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Somewhat Geeky</td>
<td>1 Low Likelihood</td>
<td>A</td>
</tr>
<tr>
<td>7</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Somewhat Geeky</td>
<td>3 Somewhat Likely</td>
<td>A-</td>
</tr>
<tr>
<td>8</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Very Geeky</td>
<td>3 Somewhat Likely</td>
<td>A-</td>
</tr>
<tr>
<td>9</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Minimal Geek</td>
<td>3 Somewhat Likely</td>
<td>A</td>
</tr>
<tr>
<td>10</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Somewhat Geeky</td>
<td>3 Somewhat Likely</td>
<td>B</td>
</tr>
<tr>
<td>11</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Very Geeky</td>
<td>4 More Likely</td>
<td>A</td>
</tr>
<tr>
<td>12</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Very Geeky</td>
<td>4 More Likely</td>
<td>B+</td>
</tr>
<tr>
<td>13</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Mostly Geeky</td>
<td>4 More Likely</td>
<td>C+</td>
</tr>
<tr>
<td>14</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Somewhat Geeky</td>
<td>3 Somewhat Likely</td>
<td>A-</td>
</tr>
<tr>
<td>15</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Mostly Geeky</td>
<td>5 More Likely</td>
<td>A+</td>
</tr>
<tr>
<td>16</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Somewhat Geeky</td>
<td>3 Somewhat Likely</td>
<td>A-</td>
</tr>
<tr>
<td>17</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Not a Geek - No Responses</td>
<td>1 Low Likelihood -</td>
<td>A-</td>
</tr>
<tr>
<td>18</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Mostly Geeky</td>
<td>2 Low Likelihood</td>
<td>A-</td>
</tr>
<tr>
<td>19</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Somewhat Geeky</td>
<td>4 More Likely</td>
<td>A</td>
</tr>
</tbody>
</table>

**Totals**

<table>
<thead>
<tr>
<th>Operations</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geeks</td>
<td>13</td>
</tr>
<tr>
<td>Geeks</td>
<td>13</td>
</tr>
<tr>
<td>Interested</td>
<td>8</td>
</tr>
<tr>
<td>Geeks</td>
<td>15</td>
</tr>
<tr>
<td>Inclined</td>
<td>13</td>
</tr>
<tr>
<td>A's</td>
<td>13</td>
</tr>
</tbody>
</table>

### Additional Operationalized Definition Components

1) How much Data can be stored in a Tb?

Most students were able to accurately identify the rough amount of data in a Terabyte, give or take the 24 GB difference.

2) Define MMORPG.

Most students were able to accurately answer this, though, one student gave an example (World of War Craft) rather than expanding the acronym itself. This may indicate a separate context of understanding.
3) Name three d20 based RPGs.

Few students were able to list a full set of three, most indicated knowledge of Dungeons and Dragons and Talisanta.

4) Name three fantasy card games.

Most students indicated the following: Yu-Gi-Oh, Magic: The Gathering, and Pokémon.

5) A Will Save is based on what ability score in the d20-based RPG Dungeons and Dragons?

Very few students identified this correctly, indicating a different focus of gaming to card games and video games.

6) What is Adamantine/Adamantium?

Just over half of the students who took the survey indicated this knowledge, indicating a split in students who played fantasy RPGs with a focus on swords and armor (Final Fantasy series, Marvel, etc.) and those who played other varieties of games that utilize another combat system (Pokémon, Mario, etc.).

What about the Alumni?

The distribution of Geek identity adherents shows a similar pattern, with relation to the critical considerations of how others view the respondents. Without complete data from the latter four, it is difficult to develop a level of statistical significance worth mentioning. However, it is apparent that there is a considerable of Geek identity adherents among those who answered the associated sections fully. The drop-off from those adhering to a Geek identity and having an inclination for STEM-trajectories, to those who ultimately persist in STEM programs may have, as-yet undetermined influences (e.g. reduced funding sources, loss of interest, poor experiences, etc.).
<table>
<thead>
<tr>
<th>Informant #</th>
<th>Do you think you are a Geek or Nerd?</th>
<th>Do others think you are a Geek or Nerd?</th>
<th>Are you currently interested in a STEM degree program?</th>
<th>Geek Identity</th>
<th>STEM Inclination</th>
<th>STEM Persistence</th>
<th>Current Degree Program</th>
<th>Junior Year at CART</th>
<th>Senior Year at CART</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>5</td>
<td>Somewhat Geek</td>
<td>3</td>
<td>Likely</td>
<td>6</td>
<td>Most Likely</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Multimedia - Graphics</td>
<td></td>
<td>Multimedia - Advanced Graphics</td>
</tr>
<tr>
<td>A2</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>6</td>
<td>Mostly Geek</td>
<td>3</td>
<td>Likely</td>
<td>0</td>
<td>Unlikely</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>n/a</td>
<td></td>
<td>n/a</td>
</tr>
<tr>
<td>A3</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>6</td>
<td>Mostly Geek</td>
<td>5</td>
<td>Most Likely</td>
<td>5</td>
<td>Likely</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Nuclear Engineering</td>
<td>Biomedical Engineering</td>
<td>Biomedical Engineering</td>
</tr>
<tr>
<td>A4</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>2</td>
<td>Minimal Geek</td>
<td>4</td>
<td>Very Likely</td>
<td>1</td>
<td>Least Likely</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Kinesiology</td>
<td>Bio Engineering</td>
<td>Biomedicine</td>
</tr>
<tr>
<td>A5</td>
<td>No</td>
<td></td>
<td>No</td>
<td>0</td>
<td>Not a Geek - No Responses</td>
<td>0</td>
<td>Unlikely - No Responses</td>
<td>0</td>
<td>Unlikely</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Forensics</td>
<td>Bioengineering</td>
<td></td>
</tr>
<tr>
<td>A6</td>
<td>No</td>
<td></td>
<td>1</td>
<td>Minimal Geek</td>
<td>3</td>
<td>Likely</td>
<td>0</td>
<td>Unlikely</td>
<td>Multimedia: Graphic Design</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Multimedia: Advanced Graphic Design</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A7</td>
<td>0</td>
<td></td>
<td>0</td>
<td>Not a Geek - No Responses</td>
<td>0</td>
<td>Unlikely - No Responses</td>
<td>0</td>
<td>Unlikely</td>
<td>[Computer Science]</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Multimedia Graphics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A8</td>
<td>0</td>
<td></td>
<td>0</td>
<td>Not a Geek - No Responses</td>
<td>0</td>
<td>Unlikely - No Responses</td>
<td>0</td>
<td>Unlikely</td>
<td>Sociology</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Sociology</td>
<td>None</td>
<td>Environmental</td>
</tr>
<tr>
<td>Totals</td>
<td>4 Geeks</td>
<td>3 Geeks</td>
<td>1 “Yes”</td>
<td>3 Geeks</td>
<td>STEM Inclination</td>
<td>2</td>
<td>“Likely”</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
FINDINGS

In the context of the Center for Advanced Research and Technology (CART) (and more specifically, the Interactive Game Design Lab), one might simply “mess around” with game design software, but a consistent, autonomous, high-intensity interest to pursue developing games represents geeking out. CART is an example of an “onground, interest-based community,” which is not to say that this community is relegated to the classroom (Mehthild 1999; Ito et al. 2008: 31). The “networked publics” that CART students engage in offer “a framework for examining diverse forms of participation […] keyed to the broader social relations that structure” their participation, in that students are able to participate (to whatever degree) in that area of a particular field that interests them, while still performing the tasks necessary for each group to succeed (Ito et al. 2010: 346; Ito 2011).

Even though the small sample size denatures any statistical significance, there are several aspects that are important to note. Geek identity adherents are the majority in the surveyed lab, those students perform well in classes that they have a strong interest in. In order to bolster success, students’ interests need to be included in the curriculum, and this is something that CART does to a high degree, due to the implementation of a linked learning curriculum. Of the students that responded to the corresponding sections of the survey, many of the Geeks have a high likelihood of pursuing science, technology, engineering, and mathematics (STEM) education trajectories, when assessed with an operationalized definition of STEM inclination. This last notion is also reiterated in the formal interviews and observational data from everyday discussions and activities.

The results of this study show the historically strong connection between Caucasian males. However, 40% of the interviewees were of non-Caucasian ethnic groups, still indicating
an underrepresentation of individual minority ethnic groups. The presence of one female student in the entire afternoon Interactive Game Design lab was startling, and initially disconcerting. It may be that there is insufficient outreach to female and ALAANA students who are interested in this area of STEM, despite the higher percentage of female students attending CART. The two limitations of this project are STEM persistence correlations and clear associations with ALAANA and female student groups. These have been more elusive, and cannot be fully addressed in this report, due to various factors. While there is data that supports the presence of female Geeks and the inclinations and persistence of Geeks in STEM fields, the survey data is not significant at the prescribed confidence levels. While the current data does not fully explain these incidences, it does call for further research. This is a call that I intend to follow in furthering my academic career.

Ultimately, the crux of what CART provides is a safe-haven. For many students who find themselves ostracized and held on the peripheries of their social fields CART becomes an escape from the difficulties of their home schools. Formal interviews with students and informal interviews with faculty support this. Many of these students identify as Geeks and describe CART as a safe place where they can pursue their interests without fear of peer harassment. For many students who attend CART, it is a sort of catalyst to achieve success (generally, and specifically in CART’s STEM-aligned labs), even perceiving post-secondary education as an achievable goal. This notion of the CART environment as an inclusive, welcoming place, particularly underscores the importance of this notion. Without such an environment, many of these students would not realize their potential or pursue avenues of interest. Not having been made aware of extant, pertinent training programs, these students would be cut-off from success and failed by the public educational system.
DISCUSSION AND PERSONAL REFLECTION

This research was highly informative. I experienced every aspect of the research process, from proposing the research, to seeking IRB approval, gathering data, and ultimately composing a digestible report. The scope of the project would have been better suited to a longer time-scale, but the short-term model was sufficient for the purposes of this research. While certain statistically significant goals were not readily achieved, these are areas of further exploration in my future course of study an inquiry, and I remain confident that after more research the connections between Geeks and persistence in science, technology, engineering, and mathematics (STEM) field education trajectories will be further elucidated.

As a student of an applied program, my project design was modeled after a short-term project and as a consultancy doing affirmation research at the request of an outside firm. My basic understanding of the anthropology of education, compounded on the understanding of teaching and learning processes that shape the minds of students, based on their educational environments. Gathering participants within the scope of the research was difficult, but ultimately successful, given consistent and continued effort. This aspect of research is not to be overlooked or underestimated, it takes a concerted amount of effort to garner participants’ interest and maintain that interest throughout the research process. Research in general is a heady undertaking, but well-worth the effort, when the corpus of collected data is added to the body of knowledge within and outside of our field.

Applied anthropology is an exceedingly useful tool in the hands of a skilled researcher. With it, a plethora of data can be gathered even from a small sample of participants and can be used in the absence of statistically significant survey data. Additionally, it has the power to greatly enhance extant, statistically significant survey data.
I am currently in my final semester of the applied anthropology master’s program at the University of North Texas. My participation in several ethnographic studies can be noted as beginning during my academic career at Fresno State in anthropology, during which I became a Ronald E. McNair scholar. This program, coupled with my undergraduate training, have helped to mold my skills as a researcher. It was during my undergraduate research that I received funding for my initial research into Geeks at the Center for Advanced Research and Technology (CART). This research helped to develop the protocols that are used in this study and others through the Public Institute of Anthropology, based out of Fresno State’s anthropology department. Having several mentors throughout the department has been beneficial in producing inter-subfield correlative inquiry. My current work at the University of North Texas has brought me in on an inquiry on ethnicity-based responses to healthcare services. Additionally, I have increasingly made use of skills in quantitative and qualitative research methods.
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