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## Abstract

There is a global issue concerning the disparity in educational achievement associated with the socioeconomic status of students, known in the U.S. as the Achievement Gap. This Achievement Gap highly correlates with what has been called the Opportunity Gap for professional careers. This paper discusses this Opportunity Gap and how the University of Nebraska Omaha (UNO) is addressing the gap at a local level through summer STEM camps. Specifically, this paper looks at the increase of social capital of the participants of the UNO and Girls Inc. Eureka-STEM! summer camp through the development of instructional relationships between underserved girls ages 12-14 and UNO's Institutional Agents, namely the Mathematics student camp leaders who were also pursuing teacher certification. A new assessment approach through the use of Social Network Analysis (SNA) was used to determine the quantity and strength of supportive ties formed. Results suggest this assessment method is very promising and that supportive ties are indeed formed. Discussions concerning the importance of social capital for underserved girls are included.

## Introduction

The phrase, "minding the gap", historically in the United States refers to raising awareness of train passengers of the space between the train door and the station platform; this gap is necessary to allow for the movement of the train without scraping the station platform. Globally in education, there is an unnecessary and impeding gap that has been "minded." This gap is known as the Achievement Gap and describes the general trend of children in poverty who consistently perform worse within education measures than their advantaged peers (Heilbronner, 2014). In the U.S., students from lower income families consistently perform worse when compared to their "better-off" counterparts. In addition, U.S. African and Hispanic Americans consistently perform worse on common forms of academic measures when compared to their White counterparts (Ladson-Billings, 2006; Lee, 2002; Reardon, 2011). Traditionally, the focus on narrowing the Achievement Gap has been on the measurements themselves, which is comparable to simply "minding the gap" to raise awareness rather than fixing the gap itself. In order to fix this Achievement Gap, it will be necessary to determine various social relationships as well as instructional causality. According to the Schott Foundation for Public Education, there is indeed a strong correlation between the Achievement Gap and the inequality in access to quality resources all children need in order to be academically successful. This presence of disparity to access necessary resources based on race, ethnicity, gender, and/or socioeconomic status (SES) has been dubbed the "Opportunity Gap."

One major social issue that may be partially explained through an Opportunity Gap perspective is the lack of qualified personnel within the Science, Technology, Engineering, and Mathematics (STEM) workforce. While this lack of qualified STEM workforce is an issue around the world, specifically, the U.S. needs to increase the number of undergraduate students that receive STEM related degrees by 34% in order to keep up with the demand for STEM professionals and to maintain international competitiveness. It is especially important to consider the Opportunity Gap when examining the disparities of participation by women and minorities within STEM fields. While females and members of minority groups constitute roughly 70% of college students, they only constitute 45% of students that receive undergraduate STEM degrees in the U.S. It is necessary for the effectiveness and competitiveness of our national economy to foster success among women and underserved groups within STEM because increased diversity contributes to the enhanced ability of the entire STEM workforce. Not only is increased diversity important for organizational innovation, but minorities will account for more than half of the national population by the year 2050, which leads to the assumption they should account for more than half the national STEM workforce by the year 2050 (RW.ERROR - Unable to find reference:280; Holdren & Lander, 2012; Museus, Palmer, Davis, & Maramba, 2011).

**Universities and the Development of Social Capital**

Universities can often address the STEM Opportunity Gap through the instructional and support resources that they provide. Usually, the term resource implies things associated with traditional forms of capital such as human, manufactured, and financial capital. Some universities have traditionally addressed the Opportunity Gap by increasing the quality of STEM educators they produce, an example of human capital. A major type of capital that is often overlooked but exists intrinsically among universities and the communities they serve is social capital (Martinez & Fernández, 2004; Museus & Neville, 2012; R. D. Stanton-Salazar, 2011). Social capital exists in the socialization networks formed through the relationships of the members of a community through which information is spread. Many universities have partnerships and programs that include K-12 students and STEM awareness and experiential opportunities. These partnerships and programs are important sources of social capital for individuals and communities through the forging of relationships between university personnel and the participants.

The keys to social capital are typically the networks of relationships present and how well those networks allow for the transmission and interpretation of information throughout life. The problem with networks is that their orientation differs among varying socioeconomic strata, contributing to the Opportunity Gap. Working class community networks are based on scarcity and conservation while middle class community networks are based on increasing access to opportunities. Using the Stanton-Salazar analogy, middle class networks can be thought of as a freeway of opportunity that allows members to move about and access opportunities. In general, if you are not a member of the network, you typically do not have access nor mobility throughout the freeway of opportunities, and hence the inequality (R. Stanton-Salazar, 1997).

An effective vehicle that allows for use of the opportunity freeway is an educational experience that is "strategic, empowering, and network-enhancing" (R. Stanton-Salazar, 1997). The University of Nebraska Omaha (UNO) and Omaha Girls Inc.'s Eureka-STEM! program strives to be such a vehicle. Girls Inc. is a nonprofit organization that exclusively serves young women and their motto is "Inspiring all girls to be strong, smart, and bold". The entire program involves five years with the first two years focused primarily on the UNO summer camp and the following three years consisting of mentoring and externship experiences facilitated through Girls Inc. Participants in the UNO Eureka-STEM! summer camp are 8$^{th}$ and 9$^{th}$ grade underprivileged girls. The girls spend their 4-week camp on UNO's campus engaging in various activities led by UNO faculty and students that promote STEM learning, physical activity, and well-being. The over-arching goal of the UNO and Omaha Girls Inc.'s Eureka-STEM! program is that the participants will later be interested in and perhaps pursue careers in STEM and in general achieve increased academic success (Reed, 2015).

Although the UNO Eureka-STEM! program is a great "vehicle" to traverse the opportunity freeway, inexperienced travelers (underserved youth) still need directions once they are on the freeway. In order to navigate the opportunity freeway, directions and advice are needed just like in any geographic trip. In this scenario, social capital is like an atlas or "Google Maps", providing these necessary directions when accessed. It has been argued that Institutional Agents play a role in the development of social capital of students and therefore their academic achievement. Institutional Agents can be defined as "high status, non-kin agents who occupy relatively high positions in the multiple dimensional stratification system, and who are well positioned to provide key forms of social and institutional support " (R. D. Stanton-Salazar, 2011). Institutional Agents have been repeatedly shown to increase the social capital and therefore the academic achievement of minority college students. Examples of university-level Institutional Agents for underserved youth at university programs include professors, instructors, advisors, graduate students and university undergraduate students such as Noyce students, who are on preservice teaching scholarships from the U.S. National Science Foundation or NSF (Goddard, 2003; Martinez & Fernández, 2004; Museus & Neville, 2012; R. Stanton-Salazar, 1997).

Specifically within the UNO Eureka-STEM! program, a majority of the college students that participate and fulfill the role of Institutional Agents are involved in a nationwide program funded by the NSF called the Robert Noyce Scholars program. This program is designed to increase the quality and quantity of STEM teachers in high needs schools. These Noyce students are freshmen and sophomores and have shown an interest in teaching STEM. Throughout the UNO Eureka!-STEM! camp, these Noyce students enhance the networks of the UNO Eureka-STEM! participants by providing resources that may not have been available prior to this experience. The participants are currently embedded within various social networks developed throughout their lives and based on their experiences. These social networks are important factors in the development of their members because they are the means through which important information is conveyed. In general, the networks with healthy human development resources typically lie within the ties developed through family-and community-based networks. The networks associated with academic and career resources lie within the ties developed

through high-status Institutional Agents such as college faculty and students. Herein lies the opportunity gap that most working class individuals experience, a lack of opportunity to develop these networks due to either an absence of a vehicle to access the "freeway" or help navigating the freeway (R. Stanton-Salazar, 1997; R. D. Stanton-Salazar, 2011).

Due to the importance of fostering increased social capital for underserved youth through the development of networks associated with academic and career success, this article addresses the following question:

***How can the increase in social capital of underserved girls due to interactions with Noyce students during the UNO Eureka-STEM! summer camp be determined?***

**UNO Eureka-STEM! Summer Camp**

The UNO Eureka-STEM summer program is designed to provide middle school girls with engaging, hands-on, experiential learning opportunities that expose them to engaging and quality STEM learning experiences. Problem solving, engineering design, logic, creativity, personal expression, teamwork, and physical fitness are all important aspects of the program. Daily activities include a Personal Development Hour, STEM instructional engagement sessions, lunch, and physical fitness and swimming, all of which are supported by the presence and support of Institutional Agents, particularly the Noyce students. From the time the girls arrive on campus in the morning, to dismissal in the late afternoon, Noyce students and hourly student workers (non-scholarship summer work study positions) are there to converse with, share lifelong learning stories, brainstorm solutions to design problems, be lab partners with, laugh and build rapport with, and assist with questions the girls have related to the STEM content and skills being taught. They are there to help the girls with the daily tasks of the camp, as well as be a safe adult to build relationships with and to overcome fears of college.

For the Eureka schedule, the Personal Development hour is the first session the girls attend in the morning. This hour is essential to educating the whole child, with sessions on careers, college expectations, the dangers of drugs and alcohol, suicide prevention, sex education, and much more. These sessions, while sometimes sensitive and taught by specialized populations (such as a nurse for some topics), help the girls to identify resources and support systems, as well as to provide mentoring and networking opportunities.

Following the Personal Development hour, the girls are split into two distinct groups, Rookies (brand new to the UNO program) and Vets (returning from a previous year), for the first STEM session of the day. The girls are split so as to provide differentiated instruction, as well as keep class sizes smaller for activities such as hands-on chemistry and geology labs. Other content areas include robotics, coding/programming, high altitude ballooning, mathematics stations, biomechanics, rocketry, bioinformatics, and e-textiles. A Vet will not receive the same instruction as they did as a Rookie. If for example, a Vet is in a robotics session, that session will be more advanced and include more programming than it did her first year in the program. These sessions are generally taught by faculty members on campus, as well as by local certified teachers. Again, the Noyce students are there to assist the girls' in their learning and work through problems together. A second STEM session is repeated after lunch, and can be a continuation of the morning session, or can be a totally different subject area. This variety keeps the girls engaged and working on multiple projects within a single week.

A critical component of the Eureka program both nationally and at UNO is the physical fitness and swimming part of the day. The girls switch between swimming and physical activities daily after the completion of the STEM sessions. Learning how to swim is not only fun, but can prove to be life-saving and illustrate STEM principals such as buoyancy. Other physical activities include rock wall climbing, basketball, choreographed dancing, yoga, team games, and many others. Exercising the body as well as the mind makes the UNO Eureka!-STEM summer program a well-rounded summer camp. STEM concepts are also integrated into the fitness instruction such as monitoring and calculating heart rate, hydration, and nutrition. Noyce students and student workers are often seen joining the girls on the volleyball or basketball court, encouraging fair play, teamwork, and modeling a passion for health and well-being.

**Noyce Students and UNO-Eureka STEM!**

As the above section highlighted, the participating girls were constantly engaged in different STEM-related activities and introduced to a variety of UNO Institutional Agents during the four-week intervention. A major subgroup of the UNO Institutional Agents for the intervention are the Noyce students. Noyce students are freshman and sophomore college students that are interested in pursuing a teaching career in Math and have

received a scholarship to do so. Each year, six Noyce students dedicate six weeks of their summers to help create, prepare, and implement the Eureka camp STEM learning materials and lessons with supervising faculty members of UNO. Not only do the Noyce students get the experience of preparing and implementing inquiry based lessons with the UNO faculty, they also undergo culturally responsive teaching training provided by Girls Inc. and UNO faculty. This training allows for the Noyce students to be better prepared when working with the underserved girls participating in the camp, who are typically African American, Hispanic, and/or first generation college. With the amount of contact hours that the Noyce students have with the girls (roughly 160 hours), and the opportunity for fun and engaging activities to do together, the girls begin to steadily build relationships with the Noyce students that are positive, appropriate, and mutually beneficial. Building trust and rapport with the girls is a highlight of working the UNO Eureka-STEM camp.

## Method

In order to document and investigate the development of social capital among the participants and the Noyce students participating in the UNO Eureka-STEM! summer camp, a Social Network Analysis (SNA) was conducted through the use of a survey which was administered a total of five times throughout the camp. "The social network perspective is one concerned with the structure of relations and the implication this structure has on individual or group behavior and attitudes" (Carolan, 2014). There are two levels within networks that SNA can be used to examine, attributes of the overall networks and attributes of the networks' individual nodes (members). This article highlights the use of SNA to investigate the development of perceived relationships between the participants and the Noyce students overall, which focuses on the network level. The individual contributions to the overall network are beyond the scope of this study.

The participants of the Eureka!-STEM program at UNO were underserved girls who ranged in ages 12-14 years, or entering 8$^{th}$ or 9$^{th}$ grade the following Fall Semester. During the summer of 2016, there were 30 incoming 8$^{th}$ grade participants and 23 incoming 9$^{th}$ grade participants. There were 8 total Noyce students that worked with the camp throughout the four weeks. A total of 7 of the 8 Noyce students were interns. This means that they were freshmen/sophomores selected to participate in multiple educational experiences throughout the summer of 2016 and continuing throughout the academic year of 2016-2017. One Noyce student was a Noyce scholar, which means a junior or senior college student that has received a $15,000 scholarship per year to major in math, obtain a teaching credential, and commit to teaching for at least two years in a high needs school district (NebaskaMATH omaha noyce partnership.2016).

When examining a network's relationships through SNA, the correct term to use is "tie". A tie is the name of the connection from one node (member) to another node and specifically this study focused on ties that are formed through behavioral interactions based on the level of questions asked. When looking at a range of possible levels of ties, tie strength is also being examined. "The strength of a tie is a (probably linear) combination of the amount of time, the emotional intensity, the intimacy (mutual confiding), and the reciprocal services which characterize the tie" (Granovetter, 1973). There are two generally recognized kinds of tie strength within social network studies, weak ties and strong ties. Weak ties facilitate the access to instrumental resources such as help on immediate, task related questions. Strong ties facilitate the access to expressive resources such as help on achieving future goals or personal advice (Carolan, 2014; Granovetter, 1973). Both types of ties are supportive in nature, but they are also distinctive based on the types of resources available through their development. This study was concerned with how the girls participating in the camp perceived the levels of support they garnered from the Noyce students at both levels, weak and strong and are collectively termed "supportive ties" in this study. This study does not look at reciprocating relationships as perceived by the Noyce students; the ties are referred to as "arcs" because they are directed from the participants to the Noyce students and not reciprocated (Carolan, 2014).

In order to determine the quantity and strength of supportive ties developed throughout the UNO Eureka-STEM! program, a brief and periodic survey was utilized. Data collection for the survey was carefully coordinated with the Girls Inc. organization. Time was set aside every Thursday morning during the camp for camp participants to complete the pen and paper survey. Members of the research team were then tasked with the facilitation, distribution, collection, and analysis of the surveys. No Institutional Agents were involved in the facilitation, distribution, collection, or analysis process. Each participant in attendance on the days the surveys were given completed the survey for a maximum total of 5 times during the four weeks and self-reported their perceived level of interaction with each Noyce intern/scholar listed. The first time they completed the survey was early on Day One of the summer program. They then completed the survey every Thursday for the next four weeks of the program. The intended focus of the survey was to determine the strength of

supportive ties as perceived by the participants with regards to each Noyce student based on the level of questions participants felt comfortable enough to ask the Noyce students. The survey questions were designed to examine the highest level of interaction representing strong perceived trust and therefore a deeper relationship and the lowest level of interaction representing not knowing that Institutional Agent, particularly for this article, the Noyce students (DuBois & Silverthorn, 2005). The survey was organized in a roster format consisting of the names of the Institutional Agents the participants would encounter throughout their program at UNO. There were four different interaction levels the girls could select when considering each Noyce student listed. Each participant could only select one option per Noyce student per survey. The four options are listed below:

1. I have never met this person (no idea who they are);
2. I know who this person is but haven't had a conversation with them;
3. I have asked this person for help on how to do some of the activities during the sessions;
4. I have asked this person for personal advice, which could include my future or my well-being.

Option 1 was included in the survey to ensure the participants selected at least one option for each of the Noyce students listed on every survey. Option 2 was included to indicate that the participants were aware of that person but had not yet sought any type of support and as an intermediate option between options 1 and 3. Option 3 was included to indicate a perceived weak tie due to the immediate, instrumental nature of support sought. Option 4 was included to indicate a perceived strong tie due to the long-term and/or personal, expressive nature of support sought.
Numerous considerations were made while designing this survey and various professional education professors from UNO and educational specialists at Girls Inc. edited the survey to address validity and administration considerations. The survey was specifically designed to be one page in length, roster format with descriptions for each Institutional Agent's main purpose in the program, and four varying interaction level options to choose from. The goal was to develop a survey that encouraged minimal item non-response while allowing for optimal relational diversity through a minimum amount of questions. It should be noted that in the instructions for the survey, the word "relationship" was not used because of its possible perception of a romantic nature. It is also best to use specific descriptions of interactions in order to minimize the different interpretations of the levels of interactions (De Lange, Agneessens, & Waege, 2004). Initial drafts of the survey were reviewed by the research team members and various edits were made, which resulted in the four interaction levels as stated above.

With the purpose of examining the development of supportive ties between the participants and the Noyce students involved during the UNO Eureka!-STEM program, the first step was determining if supportive ties had indeed been formed. The Excel spreadsheet software program Add-In known as NodeXL was used to examine the supportive ties formed. Each participant's responses for each survey were entered into NodeXL which provided metrics used to determine the amount of supportive ties formed, and the level of supportive ties formed. This was accomplished through comparing results from Survey 0 taken on day one of the summer camp, and Survey 4 taken on the last Thursday of the summer camp.

The calculations used to determine the development of supportive ties throughout the program were arcs (total number of unidirectional ties reported), out-degree density (the proportion of reported unidirectional ties compared to the total possible unidirectional ties), and out-degree density percent (reflects the out-degree density as a percent where 100% would indicate all respondents selected that level). Because the surveys were not reciprocated and unidirectional, it was necessary to determine the out-degree density of the participants because the population size of the participants taking the survey changed depending upon the day the survey was given. In order to do any type of comparisons, a density metric is necessary because it reflects the proportion of supportive ties reported compared to the possible supportive ties that could have been reported had all participants selected those levels. Because the number of participants that completed the surveys on any given day was different, the actual number of supportive ties would not be comparable. Results are displayed in Table 1 and Figure 1.

## Results

Table 1 shows the supportive ties metrics as determined using NodeXL when comparing the results of the Pre-camp (N=44) and Post-camp (N=41) surveys as reported by the participants for the Noyce students. All levels show an increase in arcs, the out-degree density metric, and related out-degree density percent. Levels 2, 3, and 4 combined have an increase in total arcs from 31 to 255; an increase in density from 0.0881 to 0.7774; and an increase in percent from 8.81 to 77.74. Levels 3 and 4 have an increase in total arcs from 3 to 212; an increase

in density from 0.0085 to 0.6463; and an increase in percent from 0.85 to 64.63. Level 4 only has an increase in total arcs from 0 to 76; an increase in density from 0 to 0.2317; and increase in percent from 0 to 23.17.

Table 1. Pre-Camp and post camp interaction level metrics

| **Interaction Level** | **Pre-camp Supportive Ties Reported N=44** | | | **Post-camp Supportive Ties Reported N=41** | | |
|---|---|---|---|---|---|---|
| | **Arcs** | **Out-Degree Density** | **Out-Degree Density Percent* (%)** | **Arcs** | **Out-Degree Density** | **Out-Degree Density Percent* (%)** |
| **Levels 2, 3, and 4** | 31 | 0.0881 | 8.81 | 255 | 0.7774 | 77.74 |
| **Levels 3 and 4 only** | 3 | 0.0085 | 0.85 | 212 | 0.6463 | 64.63 |
| **Level 4 only** | 0 | 0 | 0 | 76 | 0.2317 | 23.17 |

**Percent reflects the out-degree density in percent form, a 100% would indicate all respondents selected that level.*

Figure 1 provides NodeXL graphic visualizations of the quantity and strength of perceived supportive ties when comparing the results of the Pre-camp and Post-camp surveys for the Noyce students at the levels as indicated. The red arrows represent level 2 ties, the green arrows represent level 3 supportive ties, and the blue arrows represent level 4 supportive ties; level 1 responses are not shown because they do not indicate actual "ties", but rather they indicate a lack of knowledge of that person. As the figure shows, for the pre-camp survey the majority of the ties as perceived by the participants were level 2 which indicates simply knowing who the Noyce students are but not having conversations with them. There is no graph present for the Pre-camp survey level 4 ties because none were reported. When comparing pre-camp surveys to post-camp surveys there is an increase at each level of supportive ties as perceived by the participants. It should be noted that although the number of participant respondents decreased from the Pre-Camp Survey (N=44) to the Post-Camp Survey (N=41) the number of participants reporting supportive ties increased so the increase in supportive ties is not due to an increase in surveys completed.

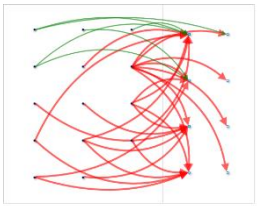
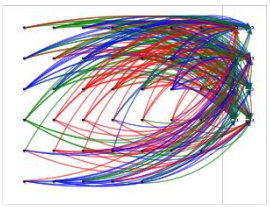
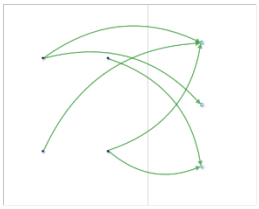
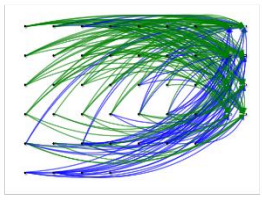
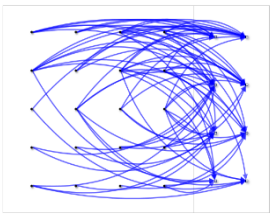
| **Pre-Camp Survey N=44** | **Post-Camp Survey N=41** |
|---|---|
| Levels 2 (red), 3 (green), and 4 (blue)  | Levels 2 (red), 3 (green), and 4 (blue)  |
| Levels 3 (green), and 4 (blue)  | Levels 3 (green), and 4 (blue)  |
| Level 4 (blue) Only ***No Image due to Absence of Level 4 Supportive Ties Reported*** | Level 4 (blue) Only  |

Figure 1. NodeXL visualizations of reported supportive ties

## Discussion

This article highlighted the use of SNA in determining the quantity and quality of participant perceived supportive ties that were developed through a 4-week summer collaborative UNO and Girls Inc. Eureka-STEM! program for middle school underserved girls with Noyce student instructional agents. The importance of such a program is framed through the lens of social capital and the opportunity gap highlighting the absence of access to the "opportunity freeway" for many underserved youth, especially girls and minorities in STEM. The Institutional Agents for the University included Noyce students, which served as guides for the girls not only to access the opportunity freeway but also in navigating the freeway. It is not surprising that there was an increase in the participants' perceptions of levels 2 and 3 which state "I know who this person is but haven't had a conversation with them" and "I have asked this person for help on how to do some of the activities during the sessions" considering the academic nature of the camp. What deserves to be particularly highlighted in the study results is the increase in participant perceived supportive ties at level 4 which states "I have asked this person for personal advice, which could include my future or my well-being". Supportive ties at this level demonstrate strong interpersonal relationships and therefore trust, which is vital to the development of social capital. These ties signify not only the presence of these ties but more importantly that the participants perceived their relationships with the Noyce students as supportive enough to ask for personal advice (Adler & Kwon, 2002).

While these results are very promising, there are some aspects that on first inspection are important observations and that might be worth more investigation in the future. When looking at Table 1, there are significant increases in the quantity and strength of the ties formed but when looking at the data for levels 2,3,4 on the post-camp surveys, it shows the density percent for the Noyce students at 77.74%. This would understandably raise the question "Why isn't this 100%", especially since level 2 includes the option of simply knowing who a person is without having a conversation with them. It should be noted that there was some variability in how much exact time Noyce students spent with each group of girls so there was related variability in access to the Noyce students, which could help to explain the 22.26% density of not knowing those Noyce students.

Another area of concern or consideration occurs when examining Figure 1; there are still many level 2 relationships reported on the post-camp surveys. This indicates some participants didn't report their interactions with some of the Noyce students as supportive in any manner whether instrumental or expressive. There are many reasons for these reported "non-supportive" ties such as the failure to recognize names as presented on the survey, or the desire to complete the survey quickly which could lead to inaccurate responses, or the lack of motivation to complete the survey accurately. While all of these are plausible reasons, it must also be considered that these respondents did not perceive ties as being of the supportive nature as would have been indicated by levels 3 and 4. The next iteration of this study during the next summer will attempt to provide more rigorous controls for these considerations as well as to expand the study to look at STEM faculty as well as Noyce student interactions.

## Limitations

Several limitations in the study are important to mention. The first limitation is essentially in the nature of a pilot process and the acknowledgement that further research is required to validate the usefulness of the method presented and its generalizability to other youth STEM camp contexts and interventions. However, the overall process and results of this pilot do suggest that this method is relatively promising for understanding the social networking dynamics of a STEM intervention. A second limitation is the somewhat variable nature of the amount of contact time amongst the participants and the University Institutional Agents (namely the Noyce students) in the wide range of intervention sessions, which should be taken into consideration in future research. It is important to note however, that the diversity of STEM sessions also appeared to be an operational strength of the camp as it was helpful in keeping the camp participants engaged and interacting. The third potential limitation is concerned with the possibility of the effect of tie multiplicity from individual participants who may have more outgoing personality traits. Future studies may want to consider some measure of the instructional agent personalities, to better understand the overall core nodes and dynamics of the emergent social network.

## Conclusion

In general, for this study, which was essentially a pilot use of SNA for better documenting and understanding a student's summer STEM camp experience, the future of SNA and supportive tie formation evaluation appears to

be promising for investigating the interactive context of summer STEM camp youth interventions. The data presented in this article demonstrate some of the powerful analytics available through SNA. It should also be noted that the analysis employed in this study is not yet common in the literature but the authors do see significant potential for the technique. This study introduces the development of a method for ascertaining not only the number of relationships formed between individuals within a STEM learning environment, but also specifically the strength of supportive relationships formed based on the level of questions summer camp participants feel comfortable enough to ask. This appears to be a very promising method when trying to determine the social capital contribution of Institutional Agents for underserved youth and will continue to be utilized and improved.

The implications of this study also highlight not only the need for supportive relationships to be formed between the University Institutional Agents (Noyce students) and the youth participants themselves but also how to assess these formations. In the near future of the Eureka camp, SNA will be used to investigate how subcategories of Institutional Agents such as Noyce students (and their demographic categories) compare with one another in order to determine areas of strength and possible growth. Raising awareness of the importance of these relationships and identifying areas of strength and possible growth will help to better understand and to improve the relationships formed. It should also be noted that in addition to the SNA survey, future research will include focus groups and/or open-ended questions as to how the observed relationships helped the girls and in determining why the end result was not 100% for levels 2-4.

## Recommendations

Finally, a few general recommendations for other STEM researchers were apparent to the authors. From this research it appears that universities might be well advised to incorporate college aged students in their summer youth camps in order to not only provide richer experiences for the college students by additional help within an activity but also to provide individuals with whom the participants can develop meaningful relationships in order to increase their social capital. The researchers witnessed many anecdotal and quite encouraging conversations between the college students and middle school students and the college students seemed to form a personal degree of rapport that could escape an older instructional agent. Future studies, including ours, will strive to retrieve some qualitative information along these lines with participant interviews and focus groups. Finally, it would seem that through opportunities such as developing networks with Noyce students that makes programs such as the UNO Eureka!-STEM camp more successful, an important social networking vehicle may be gained for these first generation students to access to the opportunity "freeway" that may have eluded their parents and that can continue to support them as they traverse this new freeway. The Noyce students also appeared anecdotally to develop increasingly positive and encouraging teaching related relationships with the participants, which may well increase their own social capital and allow access to previously unavailable teaching-related experiences, skills and resources. This may perhaps improve both the participants' and the Noyce students' chances of navigating the STEM opportunity freeway and ultimately help them to become experienced travelers.

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