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Adolescent Girls' Influencers in Cybersecurity Education and Activities

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ABSTRACT

Individuals are influenced several times a day by society, family, friends, and circumstances. Influencers strongly affect adolescent's decision making related to activities, classes, and career choices. Middle school is a key time when girls tend to explore or turn away from the STEM field. Through a qualitative survey research, we have discovered influencers appear to play a role in motivating and encouraging girls to explore the cyber fields.

Keywords

adolescence, cybersecurity, influencers, gender, technology, education

INTRODUCTION

Middle school is a pivotal time for student's decision making and exploring new opportunities. It is a time when students are greatly influenced by society and their contacts. During these years, students tend to have a decline in motivation and performance as they transition from elementary school (Midgley et al. 1989). Research shows that motivation and performance can depend on the characteristics of the learning environment and can even be maintained or improved with attention given to the environment (Anderman and Midgley 1997). The environment of middle school students includes factors of influence, which will be explored in this research.

As girls enter middle school their social group fluctuates and girls tend to reassess their academic abilities (Pajares and Schunk 2001) through their the widely expanded social reference group, coupled with the shift in evaluation standards. Consequently, perceptions of academic competence typically begin to decline during middle school (Harter 1996; Midgley et al. 1989). This shift in perceptions creates the feeling of belonging uncertainty for girls as they seek areas of study where they feel they belong. Research has shown that these societal level factors have influenced female student's career choices and commitment to a particular field (Shih et al. 1999; Steele and Ambady 2006).

The CISSE framework shows that community, influence, social media connection, increase in self-efficacy, and education are promising practices to anchor girls in a cybersecurity career path (Rowland 2018).



Figure 1: CISSE Model (Rowland 2018)

Building upon Rowland's CISSE Model, this research will evaluate and explore the influencers using qualitative research methodology to discover the influencers of middle school girls from their own perspective.

BACKGROUND LITERATURE

Promoting STEM at Middle School Age

Evidence suggests that girls become uninterested in computer science during adolescence, and that waiting to engage female students until high-school tends to be too late (LeClair and Pheils 2016). Adolescent girls are more likely to withdraw from subjects they do not feel confident in or like they belong (Margolis and Fisher 2003). A 2017 survey by Microsoft found that young girls in Europe become interested in STEM subjects around the age of 11. Girls lost interest around the age of 15. "Conformity to social expectations, gender stereotypes, gender roles and lack of role models continue to channel girls' career choices away from STEM fields," said psychology professor Martin Bauer of the London School of Economics, who helped coordinate the survey of 11,500 girls across 12 European countries (Petroff 2017). Once interest is lost, it doesn't appear that girls ever rebound. The underrepresentation of girls and women in cybersecurity and computer science has a unique set of challenges. Research shows girls tend to express less confidence and rate their computer knowledge lower than boys, however achievement levels are similar (Cooper 2006; Moorman and Johnson 2003; Shapiro and Williams 2012). Girls also perceive the computer science field as masculine, 'geeky', and isolated (Cheryan et al. 2013; Margolis and Fisher 2003; Shumba et al. 2013).

When individuals are in a state of belonging uncertainty, they may notice threatening cues that may otherwise be overlooked (Kleck and Strenta 1980; Mendoza-Denton et al. 2002). Young girls interested in computing notice the cues of conformity to social expectations, gender stereotypes, and gender roles. Middle school is a time when girls expand their social group and reassess their academic abilities (Pajares and Schunk 2001). Influential factors often pull girls into particular social or academic groups. The unique challenges girls face cause them to lose the motivation to explore and perform well in the cyber sciences.

Role models and Influencers

Research shows that female role models positively impact women in typically male-dominated fields (Grabisch and Rusinowska 2010; Young et al. 2013). Role models increase a woman's implicit identification within the field, while decreasing the implicit gendered stereotypes. Limited access to female role models in the information system profession reinforces the image of the field (Catherine Ashcraft 2012), which is still male dominated. Girls need to have inspiring female teachers to provide role models of influence for girls. Girls who have inspiring teacher are 73% more likely to go into computing (2016a).

Adolescents state that parents are the most influential people in their lives when it comes to career choices, however they lack confidence in their parent's ability to guide them in a cyber-related career (2016c). Many parents are simply unaware of the career opportunities in IT and are not equipped to guide their child's interest in IT. A recent report by Bayer found that 31 percent of parents don't feel confident enough in their STEM knowledge to help their children engage (2018).

Rowland's research showed that adolescents "relate cybersecurity workers to those within their range of influence; whether that be a parent, a teacher, or a tv personality. The image they relate to is changing from past studies where the image was a nerdy, white, male. The image given by the participants included computer focused, smart, professional looking – basically anyone" (Rowland 2018, pg 32).

RESEARCH DESIGN

The research design utilizes Qualitative research techniques and open-ended interviews for data collection. The interviews allowed for understanding of the phenomena within real-life contexts (Berg 2004). This study addresses the real-life context of middle school girls' experiences and influences as related to cyber sciences. Open coding using Atlas.ti allowed for exploration and focus on a smaller number of interviews to help illuminate, clarify, and deepen the understanding of middle school girls perceptions towards cyber and the influences that affect decision making (Neuman 2002). Fourteen in-depth interviews were conducted. Participants were middle school

girls from Midwest middle schools. The coding of text allowed the researchers to quantify how often themes are addressed in a text.

FINDINGS

The top influencers that have emerged from the interviews are family, school and groups/community. These findings reinforce the literature review and extend the findings in these areas. The top influencers are displayed in Figure 2: Influencers of Adolescents. Our analysis below elaborates on each influencer and reveals the preliminary data insights.

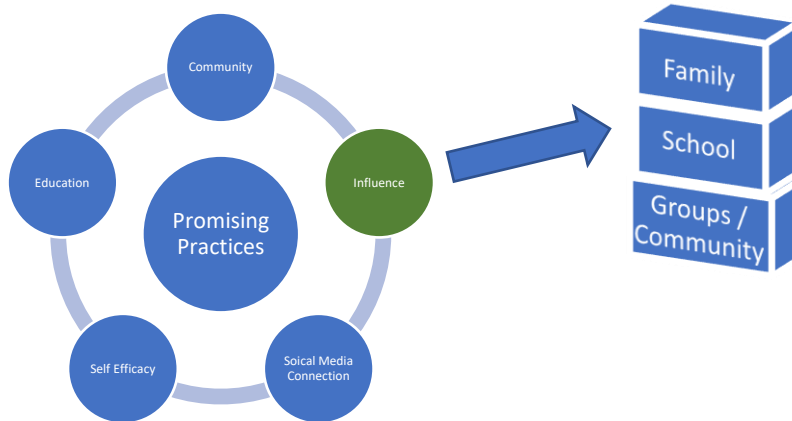


Figure 2: Influencers of Adolescents

Family

Family influence includes parents, siblings, and extended family. The interviews revealed that parents and siblings are highly influential in determining adolescent activities.

P1 shared that she joined wrestling (primarily a male sport) because she was influenced by her brother.

"I would always go to wrestling tournaments with my brothers, so that kind of inspired me to join wrestling, watching them all the time. I thought my brothers were really cool and they seemed to enjoy it."

P3: *"My mom inspires me to do things. She always wants me to do the best that I can."*

P4 also had an experience of being influenced to start a primarily male activity and discovering that she enjoyed it: *"When I was little my dad would always bring home ducks he shot and I started to like that and now I hunt all the time."*

School

Teachers, coaches and curriculum were combined into this school category. Teachers influence students through teaching style and personality. Coaches influence students to work hard and try new things. Public school curriculum influences adolescents through selection of subjects either through pre-selected classes or self-selected. In middle school, most often the courses are pre-selected for the student.

P7 (when asked about a role model): *"One of my teachers at school – she's my science teacher, she's also my cross country coach and she's really nice and she's just one of my role models. And she is just so nice and happy all the time and she inspires me to be happy all the time."*

P2: *"Well, my math teacher was really kind, and he knew how to talk to different people to make them understand. He, like, knew people. And my computer teacher, she just—she taught me a lot. So, like—I don't know. She just, she always sees the good things in the darkness, you could say."*

Groups / Community

Social groups, educational groups, and sports teams influence and motivate students in their selection of extra-curricular activities.

P10: *"I feel good because I feel like I'm on a team and I like being with a team and supporting them."*

P9: *"I'd rather work with other people to get like different opinions."*

Findings and Conclusion

There is an opportunity to influence adolescent girls to engage in STEM education and consider STEM careers. The importance of identifying the influencers and providing the influencers with the preparation and materials to advise and educate at the middle school level is key, increasing the confidence necessary to encourage development of environments conducive to further exploration of opportunities in cyber fields.

LIMITATIONS AND CONTRIBUTIONS

Our next analysis steps will be to identify the sub-categories under each influencer areas and propose a more detailed model of Influencers of Adolescents. Our goal is to provide recommendations to influencers to assist middle school girls to consider cybersecurity as they define their education and career opportunities. By identifying influential factors, motivation and performance can be improved. Results have implications for educators, researchers, and policy makers aiming to increase the representation of girls in cyber.

The exploratory study is limited in due to the small sample size.

CONCLUSION

There is a severe shortage of personnel in the cyber sciences field that will take several decades to accommodate. Women are largely under-represented in cyber degree programs and the profession. Recruiting and retaining woman has been a persistent problem at universities and within the industry. The Bureau of Labor Statistics states that "employment of computer and information technology occupations is projected to grow 12 percent from 2014 to 2024, faster than the average for all occupations." (2016b). The recruitment and retention of students in the cyber field is critical to achieve the workforce necessary to meet projected demand. In particular, increasing the number of female students provides a great opportunity to expand workforce talent, diversity and contributions.

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