

Impacts of the *HackHealth* After-School Program: Motivating Youth through Personal Relevance

Beth St. Jean (bstjean@umd.edu)

Natalie Greene Taylor (ngreenetaylor@gmail.com)

Christie Kodama (ckodama@umd.edu)

Mega Subramaniam (mmsubram@umd.edu)

College of Information Studies, University of
Maryland, College Park, MD 20742 (USA)

Dana Casciotti (dana.casciotti@nih.gov)

U.S. National Library of Medicine
Bethesda, MD 20894 (USA)

ABSTRACT

After-school programs are uniquely situated to attract and engage youth in a variety of interest-driven activities that ensure that each individual youth's personal interests are nurtured. In collaboration with school librarians at five middle schools in the greater Washington D.C. metro area, we developed and implemented an after-school program, *HackHealth*, which aims to increase disadvantaged middle school students' interest in science and health, their health and digital literacy skills, and their health-related self-efficacy. Based on data collected from the 63 youth who have participated in *HackHealth* over the past two years (as well as their parents) through surveys, participant observation, pre- and post-interviews, and focus groups, we investigate why these youth joined *HackHealth*, the health-related topic each one selected to research during the program and the reasons for their choice, and the perceptions of participants and their parents regarding the short-term outcomes of participating in the program. The importance of building on youths' personal interests and ensuring the personal relevance of both content and skills in attracting and sustaining youth participation and engagement in after-school programs is discussed.

Keywords

After-school programs, digital youth, health literacy, digital literacy, interest-driven learning, health information seeking, youth information seeking, personal relevance, middle school students, motivation, outcomes, self-efficacy.

INTRODUCTION

During the middle-school years, youth tend to become less motivated to learn (Harter, Whitesell, & Kowalski, 1992). Research suggests, however, that it is the context of learning rather than inherent age-related attitudes that influence motivation (Anderman & Maehr, 1994; Wigfield,

Eccles, & Rodriguez, 1998). Thus, building on the interests of youth to increase their desire to learn is essential when designing programming for this age group. The breadth of ways in which interest interacts with motivation creates both challenges and opportunities for educators to design interesting, useful, and effective programs.

Among adolescents, health topics are common Internet search topics. According to the Pew Research Center's Internet and American Life Project, nearly one-third of 12- to 17-year-olds search for health information online (Lenhart, Purcell, Smith, & Zickuhr, 2010). *HackHealth*, an after-school program funded by the National Library of Medicine (NLM), is designed to help middle school students navigate the Internet to fulfill a personal health information need. The goals of the program are to increase youths' interest in health and science, their health and digital literacy skills, their health-related self-efficacy, and their understanding of the crucial connections between their everyday (health and information) behaviors and their ability to maintain their health and prevent disease. Over the past two years, we have worked with school librarians to develop and implement the *HackHealth* program in five middle schools, three of which are designated Title I schools (i.e., at least 40% of the students come from low-income families).

During *HackHealth*, school librarians, in conjunction with researchers at the University of Maryland, lead one- to two-hour weekly sessions for approximately 8 to 12 weeks. During each session, we emphasize various information and health literacy skills, such as conducting effective Internet and database searches, assessing the credibility of online information, and carrying out the steps of the research process. The central focus of the program is to help participants to investigate their own health interests, whether it is information they personally need, information for a family member, or information they want simply out of curiosity. At the close of the program, participants attend a closing party at the University of Maryland and demonstrate what they have learned through a presentation in the media of their choice. Past participants have presented faux-news broadcasts, plays, digital comics,

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PowerPoints, and adapted lyrics to popular songs to share what they learned about their topics. For additional information about the *HackHealth* program and the specific types of teaching approaches and learning activities we use, please see our Website (<http://hackhealth.umd.edu/>).

In this paper, we draw on the data we have collected from the 63 students who have participated in *HackHealth* so far to discuss their reported motivations for joining *HackHealth*, the health topics they chose to research during the program and their reasons for selecting these topics, and the short-term outcomes that they and their parents reported had resulted from their participation in the program. More specifically, the following research questions are addressed:

RQ1: What motivates participants to join the *HackHealth* program?

RQ2: What topics do *HackHealth* participants choose to investigate? Why?

RQ3: What are the perceptions of participants and their parents regarding the short-term outcomes of participating in the *HackHealth* program?

RELATED FRAMEWORKS

In this section, we first discuss the outcomes that have been found to result from after-school programs, as well as the links that have been found between the type of motivation young people report for joining an after-school program and the outcomes they subsequently reported. Next, we provide a brief overview of interest-driven learning and how it has been found to influence young people's motivation to participate in such programs and the outcomes they subsequently report.

Links between Type of Motivation Reported for Joining an After-School Program and Reported Outcomes

Some research suggests that youth who participate in "Out-of-School Time" (OST) programs, including academically-focused after-school programs as well as other activities that promote overall child development of youth ages 6-18, have better outcomes than youth who do not participate, such as higher grades, more school engagement, and positive social development (American Youth Policy Forum, 2003; Harvard Family Research Project, 2004). Understanding why youth participate is important to developing effective programs, recruiting participants, promoting engagement, and fostering positive outcomes. Youth report a number of reasons for participating in after-school programs, such as friends, fun, learning, skill development, and safety (The Forum for Youth Investment, 2004).

In a 2006 review of research on organized youth activities, including those offered through community-based organizations and after-school programs, Mahoney et al. found that young people (aged 9-19 years old) from diverse racial/ethnic and economic backgrounds most commonly reported intrinsic motivation to participate. Intrinsic factors included enjoyment in the activity; desire to spend time

with friends and activity leaders; and opportunities to develop skills and increase self-efficacy. Youth rarely cited parental pressure or long-term educational/career goals as their main reasons for participating (Mahoney et al., 2006).

Berry & Lavelle (2013) investigated whether motivation to join an after school program among 277 low-income sixth through eighth graders was tied to self-reported social outcomes (autonomy, trust in staff, self-efficacy, and prosocial behavior). Motivation to join was classified as "self-joined" or "other-joined" and was measured at pre-test and post-test. The majority at both pre- and post-test reported intrinsic motivation, or self-joined (63% and 54% respectively). The most frequent extrinsic (other-joined) reason reported for participating was parental encouragement (23% at pretest and 26% at posttest). The authors found that self-joined students reported significantly higher autonomy, trust in staff, self-efficacy and prosocial behavior than other-joined students and these results were consistent over time. The authors then investigated how switching motivational reasons for joining (from self- to other-joined or other- to self-joined) between pre-test and post-test influenced social outcomes. Students who were consistent in reporting internal motivation to join had significantly higher trust in staff and self-efficacy than students who changed to external motivation (self-joined to other-joined). Meanwhile, students who changed their reported motivation from external to internal (other-joined to self-joined) had higher self-efficacy and trust in staff than students who were consistent in their external reported motivation. Thus, perceived internal or intrinsic motivation to join a program can change over the course of participation and can impact program outcomes.

Once involved in an organized program, youth's motivation and engagement in the program can be fostered even if they were not initially intrinsically motivated to join the program by encouraging them to make a personal connection to the program. Dawes and Larson (2011) used a grounded theory approach to longitudinally explore engagement among 100 diverse youth aged 14-21 involved in organized programs. Youth described developing a personal connection with the program by integrating their personal goals with the goals of program activities, such as learning for the future, developing competence, and pursuing a purpose.

Influence of Interest-Driven Learning on Motivation to Participate and Reported Outcomes

Leveraging students' interests is central to motivating participation in after-school programs, as mentioned above (Dawes & Larson, 2011). By engaging students in topics they find interesting and relevant, the principles of interest-driven learning suggest that they will be self-motivated to explore these topics at a deeper level (Azevedo, 2013; Edelson & Joseph, 2004). The connected learning framework suggests that learning that is peer-supported, interest-powered, and academically oriented encourages all youth to find and explore their passions (Ito et al., 2013).

The concept of interest can be considered as motivation for a specific domain or topic (Hoffman, 2002; Greeno, 2006, as cited in Azevedo, 2013). Edelson and Joseph (2004) also point to the inherent usefulness of interest-driven learning, as the learner recognizes the ways in which the new knowledge can bring them pleasure, answer a concern, help form their identity, help them to reach their life goals, or satisfy their curiosity (p. 168). Further situational motivators are explained as context-based motivation (Edelson & Joseph, 2004). As Azevedo (2011) concludes, “Long-term engagement...is only partly explained by whatever connection the person might have to the specified content. Indeed, a person’s extended participation in a practice follows from the continuous satisfaction of various parallel and interacting motives...” (p. 179) Wigfield, Eccles, and Rodriguez (1998) echo this sentiment with their summary of Hidi & Baird’s 1986 findings that situational interest can be promoted through “personal relevance, novelty, activity level, and comprehensibility” (p. 77).

Edelson and Joseph (2004) find that there are many inherent benefits in using interest-based motivation to design learning contexts. Leveraging interest can lead to mastery of goal orientation, increased persistence and effort, and better connected knowledge (p. 166). Situational interest, generally considered more fleeting and short-term, can also evolve into deeper interest-level motivation with the right contexts, such as when allowing for youths’ preferences in how their interest is manifested (Azevedo, 2013) or by carefully designing the learning environment (Ito et al., 2013). This again echoes the findings of Dawes and Larson (2011) that even if interest is not a primary motivator for joining a program, interest can be developed.

There is a robust literature on youths’ learning motivations (Anderman & Maehr, 1994; Wigfield et al., 1998), the impacts of connected and interest-driven learning (Ito et al., 2013; Rafalow & Larson, 2014), and ways to leverage interests in designing programs (Edelson & Joseph, 2004). In this paper, we connect motivation to both interests and outcomes, exploring the motivations and reactions of a diverse group of students to the *HackHealth* after-school program.

METHODS

Throughout the *HackHealth* program, we use a variety of methods to recruit participants, to collect data from them, and to analyze this data.

Recruitment

Over the past two years, we have worked with five school librarians in five different middle schools in the Washington DC metro area. Each librarian recruited 6 to 10 students for the *HackHealth* program by asking the school principal to make an announcement, visiting health classes, asking for referrals from health teachers, and/or talking to students who come in to the library. An honorarium of \$100

was offered to the family of each participant for the first year. This was lowered to \$50 for the second year.

Data Collection

We use a variety of quantitative and qualitative methods to collect data from our participants. Each of these methods, including the week when the instrument is generally administered as well as the types of data collected through the instrument, are briefly described in Table 1 below.

Method	Week	Types of Data Collected
Initial Survey	1	<ul style="list-style-type: none"> Demographics (age; race/ethnicity; parent occupation and educational attainment) Computer/Internet access/use Experience and perceptions regarding acquiring health info. Health-related self-efficacy (e.g., perceived ability to find, understand, assess, and use online health information)
Pre-Interviews	1	<ul style="list-style-type: none"> How they heard about program Why they want to participate How they can tell whether they can trust online information How comfortable and confident they feel using the Internet
Card-Sorting	2	<ul style="list-style-type: none"> Beliefs regarding usefulness of various sources of health info.
Participant Observation	All	<ul style="list-style-type: none"> Identity-related indicators (e.g., interest in health, attitudes, motivation, self-efficacy) Health/digital literacy skills Perceptions of the program
Post-Interviews	Last week	<ul style="list-style-type: none"> Perceived learning Changes in motivation or confidence in looking up or using health-related info. Changes in beliefs regarding ability to impact one’s health How participating affected them in their daily lives Interest in participating again?
Focus Groups (two separate focus groups – one with participants and one with their parents)	Two to three weeks after the program ends at the school	<p><u>Students</u></p> <ul style="list-style-type: none"> Thoughts about the program Favorite memories Describe program to friends Recommend to friends? Benefits of participating Suggestions for improvement <p><u>Parents</u></p> <ul style="list-style-type: none"> Thoughts about the program Recommend to other parents? What child got out of program Has participating been helpful for your child? Why/why not? Suggestions for improvement

Table 1. Data Collection Methods

Data Analysis

A mixture of quantitative and qualitative data analysis techniques are used to analyze all of the different types of data we collect throughout the *HackHealth* program. Microsoft Excel and SPSS are used to analyze the quantitative data, while QSR NVivo 10 is used to analyze the qualitative data. Codebooks for qualitative data analysis are developed both deductively, based on our goals for the *HackHealth* program, and inductively, based on an ongoing analysis of all of the different types of data that we have collected from participating students to date.

FINDINGS

In this section, we first provide some background information about our participants, including demographic information, information about their computer/Internet access, degree of interest in health, health-related self-efficacy, and future career plans. We then present our findings that relate to each of our three research questions.

Participants

As mentioned above, we have run the *HackHealth* program at a total of five schools over the past two years – three schools the first year and four schools (two repeated) the second year. Across all schools for both years, we have worked with a total of 63 participants. Approximately 70% of our participants are girls. Participating students are in fifth through eighth grade and range in age from 10 to 15 ($M = 12.6$; $SD = 1.06$). Our group of participants is quite diverse in regard to race/ethnicity. Table 2 shows the distribution of our participants by age and by race/ethnicity.

With regard to computer and Internet access, 52 (83%) participants indicated they have one or more computers at home that they use to access the Internet. Our participants reported being very confident about their ability to use the Internet, averaging 4.3 ($SD = 0.8$) on a 5- point scale from '1' ("Not good at all") to '5' ("Very good"), but they were somewhat less confident about their knowledge and abilities specifically relating to seeking, understanding, assessing, and using health-related information. However, they expressed a great deal of interest in learning about health topics ($M = 4.6$, $SD = 0.6$) and in working to maintain or improve their health ($M = 4.5$, $SD = 0.7$) [5- point scale from '1' ("Not at all") to '5' ("Very")].

Participants named a variety of careers they would like to pursue. Forty (63%) participants listed at least one health-

By Age	By Race/Ethnicity
10: 1 (1.6%)	Hispanic or Latino: 26 (41.3%)
11: 9 (14.3%)	Black or African-American: 20 (31.7%)
12: 15 (23.8%)	Multiple: 8 (12.7%)
13: 23 (36.5%)	Asian: 4 (6.3%)
14: 11 (17.5%)	Other: 3 (4.8%)
15: 1 (1.6%)	White: 1 (1.6%)
Blank: 3 (4.8%)	Blank: 1 (1.6%)
Total: 63 (100%)	Total: 63 (100%)

Table 2: Counts of Participants by Age & by Race/Ethnicity

related career, such as doctor ($n=12$; 27%), nurse (7; 16%); pediatrician (7; 16%); veterinarian (7; 16%), and surgeon (5; 11%). Other careers mentioned included actor, astronomer, author, game designer, lawyer, Marine, professional athlete, singer, YouTuber, and U.S. President.

In the following sections, we describe the findings that relate to each of our three research questions. Please note that we use here the pseudonyms chosen by each student.

RQ1: What motivates participants to join the *HackHealth* program?

Participants' reasons for joining *HackHealth* fell primarily into six categories: (1) desire to learn; (2) desire to maintain or improve their (or a family member's) health; (3) desire to prepare for a future health-related career; (4) past participation in *HackHealth*; (5) general desire to join an after-school program; and (6) for the incentive money.

Desire to Learn

The most common reason participants joined *HackHealth* was to learn more about health. For some, this desire was more general in nature, as the student just wanted to learn more about health and/or the process of conducting research. For example, Queen Pam said, "I wanna learn more about health and why do people get these diseases." Jay the Greatest similarly stated, "I want to know more about... the sickness people get... I'm interested in finding out how it's being caused." Deathstroke said he joined *HackHealth* "because I wanna learn new things about researching and health." Chocolate Rain similarly said that she joined *HackHealth* because she wanted to learn and that "being a better researcher will help me in the future." The vast majority of participants, however, sought to learn about a particular health condition that they (and/or a family member) have experienced. For example, Coffee Ice Cream joined to find out more about her grandmother's kidney cancer. Little MarMar joined because "some of my family members, they have diabetes, high blood pressure, they've suffered from stroke, some of them have had cancer, and I just want to learn more about health topics." Jazzy Jay stated, "I'm interested in being here because I really do like... medicines and health and learning about stuff... My grandfather, he has type 2 diabetes, but I wanna understand why – how did he get it and all that stuff."

Desire to Maintain or Improve Health

Some participants expressed the hope that their participation in *HackHealth* would enable them and/or their family members to maintain or improve their health. The Blue Anime, for example, said that she thought *HackHealth* would be "a really good way to find out more researches so me and my dad could stay healthier." Gabriela similarly described, "My uncle has HIV, some of my family have diabetes, so I want to learn more about it so I could stay healthy and not have those illnesses."

Some participants joined *HackHealth* because they were hoping to help others (not necessarily just family members)

with the same medical condition as them. For example, Natsu Dragniel said, “Well, I wanted to help people who have medical problems, like a heart monitor, ‘cause I have one... I wanted to help out people who have brain cancer because my grandpop... died of brain cancer... I don’t like to see people pass away, it kind of hurts my heart.” Phenomenal, who was diagnosed with type 1 diabetes at the age of 2, similarly stated, “I think... if I have some help, I’ll be able to figure out how I can cure people who have diabetes, so then nobody will have to suffer what I suffer.”

Desire to Prepare for a Future Health-Related Career

As mentioned above, many participants plan to go on to health-related careers. Some participants join *HackHealth* because they believe it will help them to explore and/or prepare for these careers. When asked why she joined *HackHealth* again this year, Ana Lynch explained, “So lately I’ve been thinking about my future career and my dad told me since, like my race, we can’t really afford [medical care] sometimes, so I decided I wanted to be a doctor and maybe help out the families who really can’t pay.” Little MarMar similarly explained that she joined because “I like want to be a doctor or a nurse or something.” Gabriela said that *HackHealth* “sounded interesting because I want to be a computer engineer, but... if that doesn’t work, I wanna be a doctor, like in a children’s hospital that helps kids, a pediatrician, so it sounded interesting to me.”

Past Participation in HackHealth

A few participants joined *HackHealth* because they or another student they knew had participated last year. For example, Ms. Sterious explained why she joined *HackHealth*: “Well, I liked it last year... I also like the snacks.” Chocolate Rain explained, “Well, I took it last year... and I was really excited to take it again. I wanted to see... what new you guys would have done this year, and to learn more, do a different topic, and explore my horizons.”

General Desire to Join an After-School Program

Less commonly, participants joined *HackHealth* simply because they wanted to join some after-school program. As Hopekeeper put it, “I’ve never actually been in an after-school program so I wanted to try something new.” However, she then specified, “I like health because it’s really important to me... I like to learn things.” Fazbear Fever similarly explained, “I just wanted to stay after school ‘cause I had nothing at home to do.” However, he went on to say that he joined *HackHealth* because “I wanna learn... to like get to college.”

Desire to get the Incentive Money

Some participants joined *HackHealth* because of the incentive. However, several participants said that although this was their initial motivation to join, it was not what kept them coming back. For example, when asked why he had joined *HackHealth*, Mr. Science Guy replied, “Honestly, at first, I did just want the hundred dollars, but then I realized it’s not all about the money, it’s actually fun.”

Asthma	Heart attacks / heart disease
Bad organs	Heart monitors
Bone and muscle pain	HIV/AIDS
Brain damage	Hyper-/hypo-thyroidism
Brain disorders	Kawasaki disease
Brain functions	Leukemia
Brain surgery	Migraines
Breast pain	Peptic ulcer
Bronchitis	Polycystic ovary syndrome
Bunny pregnancy	Polio
Cancer (including brain, breast, heart, lung, & stomach)	Prescription drugs
Comas	Self-harm (cutting)
Developmental disabilities	Sickle cell anemia
Diabetes (type 1 and type 2)	Sports injuries
Drug abuse	Stress
Dyslexia	Tonsillitis
Ebola	Vaccines
Effects of smoking on lungs	Water on the brain

Table 3: Topics Selected by *HackHealth* Participants

RQ2: What topics do *HackHealth* participants choose to investigate? Why?

The topics *HackHealth* participants choose to research cover a very wide gamut (see Table 3). Topics relating to the brain, cancer, heart attacks/disease, asthma, diabetes, and sports injuries have been among the most common.

Participants generally chose a particular health topic because (1) they have the particular health condition; (2) one of their family members or someone else close to them may have, has, or had (and, in some cases, died from) the condition; (3) they want to prevent and/or cure the health condition; (4) they saw the condition mentioned within the context of their everyday lives; or (5) they are just curious.

Because they have the selected health condition

Several *HackHealth* participants chose to research a health condition they currently have or have had in the past. For example, Cherry Marshmallow, who has sickle cell disease, chose to research bone marrow transplants for people with sickle cell because she has this condition and wants to know more about it and why she is in pain all the time. Similarly, Agent Chicken Wing chose to research Kawasaki Disease to find out “if my ancestors had it and that’s why I got it.” Phenomenal selected type 1 diabetes “because that’s a type of disease that I have... I want to learn about it... so I can make sure I can make myself healthy, to protect myself, and to make sure that I can have a healthy body.”

Because a family member or someone else close to them may have, has, or had the condition

Many participants selected their particular health topic because a family member may have or has the condition. For example, Chocolate Rain selected dyslexia because she thinks her sister has it and she wants to know how to overcome it. Betty Boop chose to research diabetes because it runs in her dad’s family. She wanted to find out how to help her grandma (who has diabetes) get healthier and how “to cancel out diabetes”.

Some of our participants chose to research a disease that had taken one of their loved ones. Star Wars, for example, picked cardiology because one of her mom's close friends died at 29 after having a stroke. She wanted to understand how a young, very active person can die from heart disease. Nunu chose to research breast cancer because a good friend of her mom's had recently died from it. Similarly, Nuya researched cancer, seeking to learn "what you can use to stop cancer from spreading." Her aunt had recently died after an 8-year battle with cancer. Huppy Puppy chose to research water on the brain. Her little sister had died from this condition three years earlier and she wanted to understand what it is and why it happened.

Because they want to prevent or help heal the condition

Another common reason underlying participants' choice of topic was a desire to prevent a particular health condition, whether in themselves, their loved ones, or in the general population. Ana Lynch, for example, chose to research the causes of breast cancer in order "to see/make sure I am not do[ing] thing[s] that may make me receive breast cancer." Lola Ram researched Ebola – more specifically, "what we need to protect ourselves... thinking about ways to not catch it." Tia focused on the cause of her grandfather's death – heart attack. She wrote, "I want to learn how to prevent myself and family to have heart attacks." A few participants sought to help not just their family members, but also the broader population. For example, Andy Sixx researched self-harm because many kids engage in this behavior and she wanted "to make them stop hurting themselves." Mr. Science Guy chose to research HIV/AIDS because he wanted "to find out why and how people get it... how to prevent it." He explained, "I want to learn about this because lots of people die each year because of it."

Because they saw the condition mentioned within the context of their everyday lives

Some participants selected their health topics because they heard about them through television, a book, class, or a health-related brochure. Tiny, for example, wanted to research sickle cell anemia because she watched a movie in which a girl had this condition. Ms. Sterious wrote, "I think I want to do mental disability... I was reading this book... about this 37-year-old guy who has mental disabilities... His co-workers were making fun of him and I just felt really sad... I just want to learn more about it, and see why people with mental disabilities are treated lowly, 'cause they're like humans, too." Fazbear Fever wanted to research whether smoking affects your lungs "'cause I heard it from my class." Marleny selected polycystic ovary syndrome because she saw a brochure about ovarian disease at her mom's doctor's office.

Just because they are curious

Several participants selected their topic just out of curiosity. One D Lover, for example, stated: "I'm really curious about brain cancer and have a lot of questions... I want to know how close scientists are to finding the cure of cancer." Jerry

researched comas because he wanted to know how you might be able to wake someone up from a coma. Jay The Greatest wanted to research breast cancer: "I just wanna explore it... know more about it." Kira wanted to research how the brain "affects everything in your body." When asked why, she replied, "I was always curious about this."

RQ3: What are the perceptions of participants and their parents regarding the short-term outcomes of participating in the *HackHealth* program?

Two or three weeks after the culmination of the *HackHealth* program at each school, we conducted follow-up interviews with the participants as well as (separate) focus groups with them and their parents in order to elicit their thoughts about the program. In the following subsections, the different types of short-term outcomes identified by participants and their parents are described.

Participants' Perceptions of Short-Term Outcomes

Participants mentioned several different things they felt they got out of *HackHealth*, including: (1) becoming more interested in science and health as they learned more about their own and other students' health topics; (2) using what they learned about their (and other participants') topics to help family members and friends; (3) learning about health behaviors that can help in preventing or managing their selected health conditions; (4) finding out about trustworthy websites they can turn to for health information; and (5) learning more about how to conduct searches, select search results, and assess the credibility of online content.

Several students said that participating in *HackHealth* made them more interested in science and health as they learned more about their own and others' health topics. Mr. Science Guy, for example, said: "[*HackHealth*] was fun to me – it was very entertaining... It motivated me to take science a better way because at first, I didn't like science or care about it. But then I realized this is my life, so it's basically learning about myself, so that's what encouraged me." Majesty stated, "I'm not this type of person that just regularly looks stuff up, but the program helped me to want to know more about health and stuff." Captain, who researched Alzheimer's disease, stated, "I feel like... I've learned more... I learned there's a lot of brain diseases that can come up." He continued, "If one of my family members... get it [Alzheimer's], I'm going to be the one like researching more information about that... so I can help them, like beat the disease."

Several participants described using what they learned about their topics to help their family members. Ariana Grande, for example, said, "I told [my father] about getting like heart disease... and then now... he pays more attention to what I say, now he doesn't eat that much." Nunu said she told her family "what can cause breast cancer and the treatments and stuff." Phenomenal described sharing his research about diabetes with his grandmother (who has it): "I started researching about diabetes and sometimes when she calls... or I call her to give her some info about what

she should do and not do.” Some participants shared with family members and friends what they learned from the presentations of other *HackHealth* participants. Chocolate Rain, for example, reported telling some of her friends who were stressing out about school: “At *HackHealth* club... the girl (J. Money) told me that stress can kill... Don’t stress about it, just do something about it!” Similarly, Jaysa described sharing what she had learned from Nunu’s presentation with her mom: “I told her... she used to have breast cancer, so I told her she needs to start doing exercise ‘cause that can prevent [it]... and eating healthier.”

By selecting a personally relevant topic and conducting research on this topic, several participants learned about related health behaviors that could help them (or their family members) to prevent or manage a particular health condition. Jaysa explained: “This *HackHealth* has taught me that... we don’t think too much about them, but the health issues that we have going on can be prevented, so we have to look out for that.” She later explained why she now feels more confident about her ability to control her health: “Because I used to be like ‘I don’t care. Just leave it alone.’ But now you know you could die from not caring... it could get worse or you could even go to a hospital.” Phenomenal, who researched diabetes, said “I found out a lot of things about my disease that could really help me and others in the future... [like] exercising is good, but... if you exercise a lot, it could damage your blood sugar.” He went on to say: “This program... it helped me to realize how important... how serious my disease is so now I have to do whatever I can to help control my diabetes and be able to ensure that I’ll make it to the future.”

Through *HackHealth*, participants also became familiar with trustworthy health-related websites, such as KidsHealth, MedlinePlus, and the Mayo Clinic. When asked what she thought about the *HackHealth* program, Ariana replied, “It helped me learn... when we searched stuff like MedlinePlus and the National Library [of Medicine]... now I know I can go there now.” Similarly, Captain said that he feels like he’s better able to look for health information “because of the *HackHealth* program... they showed us there’s some reliable Internet resources... that are trustworthy...” Star Wars said, “I learned... more reliable sites that I could go on to search about... my topic.”

Several of our sessions focused on helping participants learn how to conduct searches on the Internet, how to select search results, and how to tell whether websites are credible. Several participants emphasized these types of digital literacy skills as something they are taking away with them from the program. Mr. Science Guy, for example, said, “I learned a lot about keyword searching and what types of websites to use, like websites that say .com, they’re not as reliable as ones that say .org, .gov, or .edu.” Tiny said, “I really liked [*HackHealth*]. It really helped me focus on how to find trustworthy websites and how to find more information on your disease by using many websites instead of just one.” Kaylie said that *HackHealth* taught her

“how to look for true sources, information, to see that we could trust it... When you take notes, you first have to see who wrote it... and see if what they said was true and investigate it before you take notes on it.” Acquiring this skill led this student to feel increased motivation and self-efficacy regarding looking for health information. She later stated, “[I’m] more motivated [to look up health information] ‘cause now if something happens... you can just search it up and then you know what you could trust to help.” She also answered positively when asked whether she feels more confident about her ability to control or have an impact on her health: “Yeah because... we practiced here, like how to find information about our projects, like migraines. I think I could be able to search truthful information that could help.” Chocolate Rain described applying the research skills she learned through *HackHealth* to her schoolwork: “In my classes, we’re working on research topics... They want works cited lists and... I’m like ‘Oooh well, this is awesome because I just came out of a club where I learned how to research things and so I might get legit information’.”

Going through the *HackHealth* program led some participants to change how they decide which search results to click on and how they assess the credibility of online information. As Kaylie described: “Before [*HackHealth*], we just press probably the first one or just scroll down or just don’t look for anything and once we find it, we just like write it down. We don’t see like if it’s a blog or a commercial something, so I’m [now more] careful in what I see.” Chocolate Rain said, “Now when I research things, I actually stop and think about... what sources did it cite... should I trust it, should I check and see if... other sites have the same information.” Mr. Science Guy said, “Before I came here, I coulda just went to a website that [was] made by somebody on the street that probably doesn’t know... They say ‘take this medicine’ and then you’re taking the wrong stuff... Come to find out, they were lying.”

When asked if they would recommend to a family member or a friend with a health condition that they search for information about it online, most participants said they would; however, a few specified that they would only recommend specific websites (such as KidsHealth or the National Library of Medicine) or teach them how to do it right. Cherry Marshmallow, for example, said that she would recommend that they look online but pointed out: “They can get a lot of good information, but they’ll have to be careful on which websites they trust. I don’t think I would really have them go to a search engine... I think I’d recommend them like a certain website.” Tiny similarly replied, “Yes, I would recommend the main websites that I used... I would give them the websites that I felt like was more trustworthy.” Jennifer replied, “Sort of. Mostly yes... [but] I think that they won’t do it properly because they just go and search something up and they just click the first one they see.” When the interviewer asked, “So it’s probably

better if you do it since you know?," this student replied that she would teach them how to do it.

A few participants, however, said that they would not recommend to their family members and friends that they look online for health information. Andy Sixx, for example, said, "No.... because online you're not sure if they made it up... If you look in a book... it shows you the author, the date, and everything so like you're able to trust that and nobody made up the book." Mr. Science Guy similarly said, "Well, sort of yes and no... Yes because that's one of the main resources that I would go to, and no because you could also look in books 'cause you know doctors... made those books so you don't have to be like 'who made this?' 'cause the author is on it already." Star Wars emphatically stated, "No because my family is very... they don't know if it's reliable or not and they'll... You know how people just read something and they're like 'Oh my god, that's true!' and I'm like 'Oh my god, that's not true!' and then they're stuck doing stupid rituals, like 'Oh my god! Let me put something on my head!'"

When asked whether they would recommend the *HackHealth* program to other kids, all participants said they would. Ariana Grande, for example, said, "Yeah. If they tell me they wanna be like a doctor, work in the medical field... I could say that they could learn more stuff about health." Mr. Science Guy said that he would describe *HackHealth* this way: "It's a fun program that will give you extra help in science and health classes... It will better improve your knowledge of that subject." Jaysa agreed: "*HackHealth* is entertaining and it helps you learn more about your topic or if you want to learn more about a disease." Tia similarly replied, "I would [recommend *HackHealth*] because my friend, she has diabetes, so it would be really nice for her to research more on that." Phenomenal stated, "Yes... 'cause it gives... information about something you don't know and you can save someone else's life."

Parents' Perceptions of Short-Term Outcomes

The parents of *HackHealth* participants identified several benefits their child (and sometimes family members, as well) realized from their participation in *HackHealth*, including learning a lot while also enjoying themselves; having something more productive to do with their free time; receiving assistance in thinking about and preparing for future careers; and being motivated to share what they had learned with them and sometimes to even change their health behaviors and/or influence others to do so.

Many parents emphasized that their children learned a lot and enjoyed participating in *HackHealth*. As one parent put it, "[*HackHealth*] motivated her... She learned a lot from this program. Very good, very nice." Learning empathy for people suffering from a health condition was one particular type of learning mentioned by participants' family members. As one participant's older sister explained, "That's a good thing that they're learning about these types of diseases and cancer. They're not too young... A lot of

the sicknesses that you didn't see until the later years are now in them... and they learn about it. They can say, 'Oh, I know what that is', and they can also be a little bit more empathetic to the child who's actually going through it." Several parents emphasized that their children enjoyed *HackHealth*. One parent said: "You can see the enthusiasm in the children with this program. They don't feel obligated to have to do this – this is something that they want to do. They volunteered for it and they take pride in that. You can see that it's a good program just because when they come home, they satisfied with it."

Many parents also felt that *HackHealth* gave their children something more productive to do with their time. One parent said, "I would recommend [*HackHealth*]. I saw that my daughter is learning how to search good health information. Instead of being home watching TV, she's at school learning more. Now she wants to be a pediatrician." Mr. Science Guy's mother said, "I think [*HackHealth* is] a great way to get younger kids involved in health... It keeps them busy – not just busy like doing anything, but it keeps them busy with what they are really interested in, which is health. So I think this is a great program."

Another benefit commonly mentioned by parents was that participating in *HackHealth* helped their children to think about potential future careers and to become more confident about and motivated to pursue their dreams. As one parent described, "It also gives them the experience of – when you have a child go to high school and they say, 'What do you want to be when you grow up?' – it gives them that experience early, so that they can plan accordingly." For some, participating in *HackHealth* led them to consider a health-related career. For example, one parent said, "He always wanted to go to Howard [University] and be in law, and then when he got [to] *HackHealth*, he said, 'I want to do child psychology.'" For others, participating in *HackHealth* provided the impetus for them to pursue their dream. One mother said, "It gives [my daughter] the push more. She's always told me that she wants to be a pediatrician... Being enlightened, being exposed to the experience has given her the courage to pursue that."

The connection between *HackHealth* and the University of Maryland also was perceived to be beneficial by many parents. The fact that *HackHealth* was run by professors and graduate students at the university, along with the opportunity to come to campus to present their final projects, provided participants with feelings of excitement and pride. As one parent said, "The fact that the program [the closing party] is being held at a university, it kind of motivates them. It's not like, 'Oh, I'm presenting a project at my school.' It's 'I'm presenting a project at University of Maryland College Park.' They take pride in that." Another parent said that *HackHealth* is "like a mentorship. They get to look up to you all and see the things you do, as college students, college professors, it gives them something to look forward to." Yet another parent pointed out, "The fact

that it's here in the University of Maryland – it just makes him want to continue with his education.”

Another benefit commonly mentioned by parents was that their children would come home and share what they had learned and that this information sometimes led the student (and/or his/her family members) to change their health behaviors. One parent explained, “[*HackHealth*] broadens his knowledge... he's very conscious with what he does... He transfers that to what he does, especially with his eating. He knows what he wants to eat, what is nutritious, what is better for him and what is not. So it's very good.” Another parent described going grocery shopping with her child after *HackHealth*: “She's telling me ‘No, mommy, I want to drink water instead of this... You shouldn't be doing that – did you look at the sodium content?’ It's just chips!” Mr. Science Guy's mother described his exhortations, “We need more fruit in this house. We got to go to the farmer's market and get some more fruit!” Some parents described the participant's siblings adapting new health behaviors as well. For example, Mr. Science Guy's mother said, “I have a 7-year old son that follows everything [he] does... He doesn't want to eat this and he doesn't want to eat that because [Mr. Science Guy] said that we need more fruit in the house. It really makes me, as a mother, step back and take a look at what is in my cabinets.”

DISCUSSION

In working with school librarians to design and develop the *HackHealth* program, an early decision was made to let each student select their own topic to ensure the personal relevance of the program for each child and to ensure their continued interest in attending the sessions. This decision has turned out to be of fundamental importance to the success of the program. Most participants join *HackHealth* out of personal interest and tailor their work in the program to maximize its personal relevance to their own situation. As a result, many of the benefits they (and their parents) report from their participation stem from the relevance of the program and its activities to their individual situations.

Nearly all *HackHealth* participants reported one or more intrinsic motivations for joining *HackHealth*, such as simply wanting to learn more about health and/or about how to conduct research and wanting to learn how to maintain and/or improve their own or a loved one's health. However, in contrast to Mahoney et al.'s (2006) finding that youth rarely cite extrinsic factors for participating in after-school programs, many of our participants also mentioned an extrinsic motivation – to prepare for college and/or a future career, particularly one that is health-related.

In selecting a topic to research, the vast majority of participants made *HackHealth* very personally relevant by focusing on a health condition that affects (or has affected) them and/or their loved ones. Our data supports both Hidi & Baird's (1986) early finding that interest can be cultivated through personal relevance and Azevedo's (2013) finding that situational interest can evolve into a

deeper motivation. Our participants remained interested in the program as they selected their own focus based on their personal interests. Furthermore, many reported heightened interest in health as the program went along. For example, when we asked Phenomenal whether he felt more or less motivated to look up health information now that he had completed the *HackHealth* program, he replied, “More motivated... ‘cause in the program we were searching our topics and then for a little while we got really interested and searched and the more interested you got, the more information you get.” Similarly, Jennifer said that she would like to join *HackHealth* again next year and when asked what she would like to do more of next year, she answered, “Learning about health... Health issues are important, but you don't get that interested in them until... someone has it or you... are really interested in it.”

In talking with our participants and their parents following the *HackHealth* program, we found some supporting evidence for American Youth Policy Forum's (2003) findings that youth who participate in after-school programs have better outcomes than those who do not. We have parents' assertions regarding the specific benefits their children derived from participating in *HackHealth*, such as having an opportunity to simultaneously enjoy themselves while learning a lot; spending their time more productively; sharing what they learned and engaging in and/or promoting positive health behavior change among family members; and becoming more motivated, confident, and prepared in regard to attending college and pursuing their career aspirations. We also have evidence from the participants themselves that attending *HackHealth* led to some important short-term outcomes, such as becoming more interested in science and health, learning more about health, becoming familiar with trustworthy online sources of health information; learning how to search the Internet, select search results, and assess the credibility of online content; and applying what they learned to help family members/friends to prevent or manage a health condition.

Our findings need to be interpreted in light of our study's limitations, including a lack of generalizability due to both a relatively small sample size and selection bias. Our findings are limited to the 63 participants at five schools who have joined *HackHealth*, and are not generalizable beyond these individuals. The students who joined (and remained in) *HackHealth* likely differ from other students along a number of important dimensions, such as their motivation to learn; their degree of interest in health; and their ability and desire to join an after-school program. Additionally, the fact that we offered an incentive may have resulted in increased (extrinsic) motivation to join and attend the program. Despite these limitations, we believe our contribution to the literature lies in our identification of the specific motivations that drove students to join *HackHealth* and to select particular topics to research, as well as the short-term outcomes that they and their parents attribute to their participation in the program. It is our hope

that knowledge of these motivations and outcomes can assist others who are designing and deploying afterschool programs with developing successful programs, recruiting participants, promoting sustained engagement, and working toward fostering positive outcomes.

CONCLUSION

Based on our two years of experience running *HackHealth* in five local schools, we have come to learn more about the reasons students join and stay in our after-school program, as well as the benefits that they and their parents report deriving. When students are allowed to work on problems and topics that are personally relevant to them or the people in their lives, they become more motivated to learn and acquire needed information because what they find through their research is perceived as having real, lasting effects on them or their loved ones. In particular, the *HackHealth* program has provided participants with an opportunity to explore and research a health topic of personal interest. This has allowed students to have agency in their learning by giving many of them confidence in their abilities to not only research and find information but also in fueling their desires to learn and pursue careers in health-related fields.

Educators know that motivating and engaging students in STEM content areas can be tricky (Barron, 2006). Students come to school with a wide array of interests that may or may not align with what is being taught in class. Although various motivations led participants to join *HackHealth*, their interest in health increased as they found information that was useful and beneficial to them and their loved ones. We observed that as our participants began to make the connections between their selected health topics and their everyday lives, their intrinsic motivation to learn more about health topics increased, becoming a cycle where motivation and interest drove one another. Motivating students by incorporating their interests and ensuring personal relevance poses both a challenge and an opportunity for both educators and students. In designing activities (whether for school or after-school programs), educators can tap into students' interests and personal situations to create motivating, relevant, useful, and effective learning experiences and environments for them. Additionally, incorporating some choice for students, whether about topic, presentation mode, or some other aspect, can encourage active participation and ensure sustained (or even increasing) engagement.

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