MICRON Innovation Grant
STEM Education Innovations
Final Report

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Phone: 208.664.7010
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Budget Number: KRK001, AMADKB2
Project Name: Digital Innovation Generating New Information Technology (Dign' IT)

Co-Principal Investigator: Terry Soule, College of Engineering

1. SUMMARY OF INNOVATION.

1.1 Purpose

The main goal of the project was to increase digital literacies and promote technological careers for middle and high school girls through a partnership between the College of Education and the College of Engineering at the University of Idaho.

1.2 Implementation

Internship, High School. Five high school Dig'n IT Interns completed a summer-long intensive intern program focused on technology. Through partnerships with local community businesses and organizations interns learned about technology careers in north Idaho. The majority of the internship was spent working with local start-up technology company, iShoutOut. Through this process, the interns worked twenty hours a week in local businesses, with technology experts, and prepared for the Dig'n IT Camp. During the week-long Dig'n IT Camp, the interns each mentored six middle school girls and served as technology experts to facilitate technology activities during the camp. Over the course of the summer, the interns learned from interactions with technology experts and became technology experts as they taught and interacted with middle school campers. The following describes the specific technological components girls learned as they took part in both the internship process and the camp.

Implementation of Middle School Computer Coding Camp. Programming activities during the week-long middle school camp focused on two programming environments: Scratch and Alice. Scratch (www.scratch.mit.edu) was developed at MIT Media Labs as a tool for introducing children to programming (Resnick et al., 2009). The interface uses a graphical, drag-and-drop programming with easy to understand graphical icons representing basic program elements. Scratch has a large on-line community, with a strong emphasis on sharing projects, which emphasizes programming as a cooperative, social activity, with opportunities to share, discuss, and modify programs. Programs can be stored indefinitely and without cost on the Scratch website, allowing participants to log-in from any internet connected computer and continue to develop their projects after the Dig'n IT Camp and Internship ended. Programs can be shared via the Scratch website or embedded in regular webpages, making it easy for participants to present the projects to family and friends. Scratch has simple interfaces for drawing, and incorporating sound and images, allowing users to easily create interesting multi-media programs. Alice (www.alice.org), developed at Carnegie Mellon, is a 3D programming

environment designed for the simple creation of animations, games, and videos (Rodger et al., 2010). Like Scratch, Alice uses a graphical, drag-and-drop programming interface. It is somewhat more advanced than Scratch, with an emphasis on object oriented programming and 3D environments.

Having both Scratch and Alice allowed the twenty-seven middle school participants to choose the level of programming sophistication and complexity they were most comfortable with. Programming activities included designing and writing interactive scenes and games incorporating animated characters that interacted with each other and with the viewer. Participants were given basic program structures to build on to help guarantee that they were able to produce exciting programs that they would be proud to display. In addition, participants had the opportunity to generate and incorporate digital media into their projects. For example, they photographed and edited backgrounds and people, and recorded and edited their own voices and other sounds for incorporation into their projects. This helped to emphasize the creative nature of programming and to illustrate that successful technology incorporates a wide range of skills. The projects were completed in small groups to foster teamwork.

The projects were designed to emphasize the role of math and science in computing and technology. Mathematical constructs to define the position and movement of characters were examined and physical concepts (velocity, acceleration, gravity, friction, etc.) were incorporated into the projects. Programming is a particularly effective medium for understanding these concepts, as participants can easily explore how modifying gravity or friction affects the motion of characters within their programs.

The Dig'n IT Camp included a closing Showcase Celebration in which both interns and middle school participants discussed and demonstrated their work. We also created a camp website (http://www2.cs.uidaho.edu/~tsoule/codecamppages/), which hosts the programming projects, which allowed participants to demonstrate accomplishments to family and friends after the summer programs ended.

2. PERSONNEL AND COMMUNITY PARTNERS/PARTICIPANTS.

2.1. University Partners

Marcee Hartzell, Executive Assistant to the Chief Executive Officer of the Coeur d'Alene Campus
Marcee was instrumental in assisting with curriculum and coordination of the project.

Angie Sowers, Administrative Assistant
Angie was instrumental in assisting with logistical issues related to the project.

Staci Hinz, Internship Coordinator
Staci worked with the interns on a daily basis to oversee successful internship placements. She also maintained a key role in the middle school camp.

2.2 Community Partners

iShoutOut
IShoutOut is a local start-up company that focuses on app creation.

2.3 Participants

Five high school interns participated in the research associated with the project. All five were under eighteen, so names are not included.

Twenty-seven middle school girls participated in the project. All were under eighteen, so names are not included.

3. BUDGET SUMMARY

The majority of the budget was spent on technology for use during the camp and data collection.

Expense	Budgeted	Spent
Student Equipment and Materials		
Video Camera Equipment (4 Sets: Camera, Tripod, Memory Card, Case)	$2,000.00	1841.37
Digital Cameras (4 Digital Cameras)	$1,000.00	1073.39
360° Audio Recorders (4 Audio Recorders)	$600.00	2946.56
Flash Drives to Save Computer Programming (30 x $15)	$450.00	0
Wacon Tablets (4 x $100) [http://www.wacom.com/en/products/pen-tablets/bamboo]	$400.00	0
Website Creation/Hosting for sharing programming projects	$1,500.00	0
Faculty Materials and Support		
Conference Travel for Dissemination (PI)	$1,000.00	473.80
Conference Travel for Dissemination (Co-PI)	$1,000.00	0
Mileage to/from Moscow, Coeur d'Alene for PI/Co-PI (2 Trips each)	$400.00	0
Data Collection and Analysis Support		
Data Transcriber	$2,000.00	5514.88
Summer Data Collection Assistant (80 hours/$15.00/hour)	$ 1,200.00	0
Workstudy Employee for Data Assistance (2013-2014), Coeur d'Alene	$3,000.00	2700.00
TOTAL REQUEST	**$14,550.00**	**$14,550.00**

4. EVALUATION OF PROGRAM OBJECTIVES AND GOALS.

The purpose of the research was to understand how high school and middle school girls perceived and used technology, how they considered technology related to careers, and how they felt supported with technology. The intent was to understand how participating in an eight week internship (high school students) or a one week camp (middle school students) contributed to students' understandings of technology. The purpose of these two programs was to orient students with computer programming, application development, tech-related careers, and other technological aspects of computer science.

4.1 Goals

The program had the following goals: 1) Increase perceptions about technology use, technology in society, and technology related careers, 2) Develop technology skills in girls (middle school and high school), 3)Support technology related learning through a mentorship model, 4) Create a sustainable summer program that can be implemented annually.

4.2 Research Questions

Data were collected to asses the following research questions:

1) How does participation in a summer technology experience influence perceptions about technology use and technology careers?
2) What technology skills do girls develop through participation in a summer technology experience?
3) How does a mentor model support technology development?
4) What components of the Dig'n IT Internship and Camp were successful and sustainable for use in future years? What could be improved?

4.3 Metrics

Project evaluation occurred through mixed methods research (Creswell, 2009). Data collected included:

a) Interviews: The high school interns participated in open-ended interviews five times during the eight-week process.

b) Workshop/Class Recordings: Video and audio recordings were taken during each day of class or workshops for both groups. The purpose was to understand how the students perceived technology as they work with technology.

c) Technology Survey: Students in both groups took a technology survey to assess their technological skills at the beginning of the program and at the end.

d) Student Data: Student work was collected throughout the project when it specifically applied to technology use.

e) Evaluations: Participants completed evaluations.

Qualitative data were transcribed and analyzed using constant comparative methods (Corbin & Strauss, 2008).

4.4 Findings

Data from the project are currently be analyzed. The following are preliminary findings. More extensive data analysis will continue.

Research Question 1: How does participation in a summer technology experience influence perceptions about technology use and technology careers?

Interns. Data indicate that participation in a summer technology experience positively influenced perceptions about technology use and technology careers. One intern commented, "Before this experience I had no idea how apps were made or how designers worked at technology companies. I think I will consider majoring in some type of graphic design program using computers." Of the five interns, all five indicated that the experience had introduced them to new technology experiences and that the opportunity had increased their likelihood of seeking a technology-related career. One intern, who initially planned to be a veterinarian said

that after the program she, “Now have a new understanding about the technology that is necessary for operating a successful business,” and that she would, “definitely invest in and learn web design to promote her business.”

Each intern completed a final PowerPoint presentation with slides describing the summer. The slide in figure 1 is one intern’s reflection on her experience at iShoutout.

Figure 1. *Slide from one intern’s final presentation*

Middle School Girls. Of the twenty-seven middle school girls who attended, their perceptions about technology changed from the beginning of the camp to the end. They noted having an increased understanding of careers in technology. Additionally, the middle school girls were asked to draw a picture of technology on the first day and last day of camp. On the first day, the pictures were typically of appliances or televisions. On the final day, many of the pictures were of computers and programming software, indicating a shift in their understanding of technology possibilities. Data from the videos from the middle school camp continue to be analyzed.

Research Question 2: What technology skills do girls develop through participation in a summer technology experience?

Interns. Data indicate that the interns had increased knowledge with specific hardware devices including: projectors, document cameras, speakers, video cameras, cameras, and tablets. They had increased knowledge specific to app development, computer graphics, Scratch, and Alice. They were able to use computer programming for two-dimensional and three-dimensional computer programming.

Middle School Girls. Data indicate that the middle school girls had increased knowledge specific to computer programming with Scratch and Alice. They were able to use computer programming for two-dimensional and three-dimensional computer program. See figure 2 for a two-dimension example:

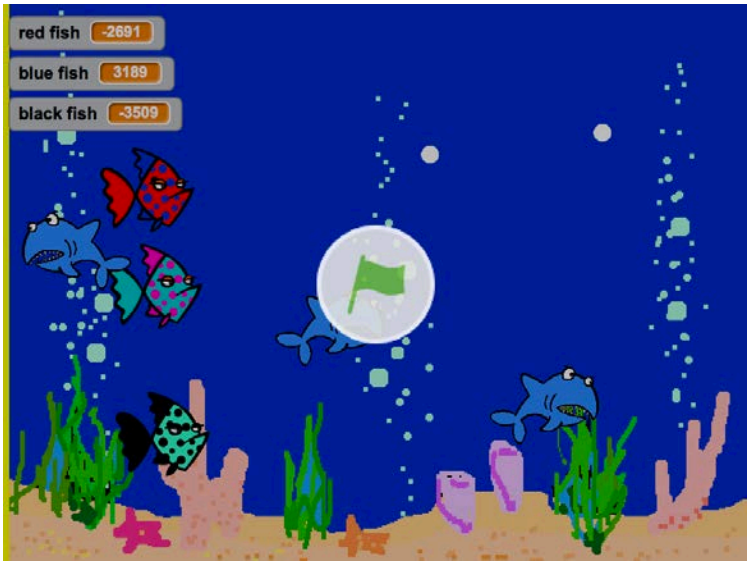

Figure 2. *Screenshot of a two-dimensional computer programming environment*

The middle school girls also created posters to display their learning related to technology. These served as self-reported evidence of their learning. See figure 3 for an example.

Figure 3. *Middle school campers summarized what they learned and prepared presentations for community members, parents, and local technology experts.*

Research Question 3: How does a mentor model support technology development?

Interns. Personnel at local technology companies mentored the interns. Based on interview data, the interns reported significant gains in their understanding of how computer programming works, the process of developing apps, and the use of apps for promotional purposes. They also reported learning about the work-lives of their mentors. One intern commented, "I never knew how much went into app development and how many meetings they have about how to create a piece of technology."

Middle School Girls. The high school interns mentored the middle school girls. On the final evaluation sheets, each middle school girl wrote about her intern. The comments in figure 4 represent the campers' perceptions of the interns as mentors.

18. What was your favorite thing about your mentor/intern?

I have to chose my favorite thing ?!?!
Everything about her is amazing.

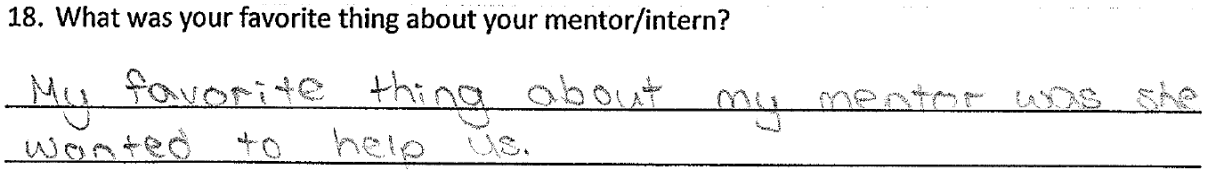

Figure 4. Two representative samples of student work when asked about their mentor.

Two main themes in the campers' data on mentoring were a) the mentors' willingness to help b) the mentors' kindness and patients as they learned something new. It was evident that the middle school girls felt comfortable approaching their mentors and considered them sources of information during the week-long program.

Research Question 4: What components of the Dig'n IT Internship and Camp were successful and sustainable for use in future years? What could be improved?

> **Interns.** The size of the internship project (n=5) was sustainable and worked well for working with one business. One suggestion for improvement was to expand opportunities to work with additional local technology businesses to provide different perspectives and opportunities for learning about different technology initiatives.
>
> **Middle School Girls.** Similarly, the size of the middle school camp (n=27) was sustainable given the resources. The middle school girls had some difficulty learning two programming languages: Scratch and Alice. The suggestion was to focus on only one language, specifically Scratch, in later iterations. This would provide opportunities for more in-depth learning on one program, as opposed to covering too much content with the inclusion of two.

5. RELATED EXTERNAL PROSPOALS SUBMITTED/FUTURE EXTENSIONS.

5.1 External Proposals

Following the successful implementation of this project. External support was sought for another year of the Dign' IT program. The Idaho State Department of Education awarded $38,000 for the continuation of the middle school girls' camp, the intern project, and an added teacher component. In the added teacher component, eighteen high school teachers participated in a week-long program to learn how to incorporate computer programming into their mathematics classrooms. The funds provided by the Micron Innovation for this initial project have resulted in the expansion of the project and funding from outside sources.

5.2 Dissemination

Findings from this research were presented at the STEM Innovation Conference:

> Amador, J., & Soule, T. (2014 May). Digital innovation generating new information technology. A presentation at the STEM Innovations Conference, Boise, ID.

An article reporting these findings is in press in the journal , *Mathematics Teaching in the Middle School*:

Amador, J., & Soule, T. (2014, December, in press). Girls build vectors from Scratch. *Mathematics Teaching in the Middle School.*

5.3 Press

An article focused on describing the work associated with the project was published in the Coeur d'Alene Press and the project was covered on the KCRA news in Spokane, Washington.