

Adventures in Computing for Teens: Revitalizing a Summer Exploration Camp

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Abstract.

In 2008, the IPFW Computer Science Department redesigned its summer computing camp in an effort to attract greater participation. Previous offerings had targeted high school students and emphasized Java programming. These camps were organized similarly to a traditional course: Daily lectures on language features followed by laboratory assignments. Little interaction occurred between instructor and participant or among the participants themselves. The new design took a significantly different approach. Java was jettisoned in favor of Alice. Students in grades 8-12 were invited. Lectures were replaced by short tutorials, demonstrations, and follow-the-leader exercises. Enrichment activities, such as videos on computer science milieu and presentations on educational and career opportunities, were integrated with daily programming adventures. Participants were encouraged to explore and experiment with Alice and show each other what they could do. All participants completed an individual project which they demonstrated to family and friends at the end of the camp. The redesigned camp has been received enthusiastically, recording the highest levels of participation since being first offered in 2000.

Introduction

The IPFW Department of Computer Science, largely on the initiative of a single faculty member, offered its inaugural summer computing camp in June, 2000. Christened the Summer Program in Intensive Computer Education (SPICE), it targeted high-school students who desired “the opportunity to sharpen their computer skills in programming, writing software, and to explore a computer-based career.” It also promised to give participants the ability to create games or websites of their own design. Response was modest; a total of 12 participants signed up with all grade levels represented. The camp was organized into 10 half-day morning sessions and met in the Department's computer laboratory. These sessions were organized similarly to a traditional course in computer programming: Wide-ranging daily lectures that covered a plethora of programming concepts and Java language features followed by laboratory assignments. For the most part, participants were left on their own to solve the programming problems; little intentional interaction occurred between instructor and participant. Likewise, the participants, who were all strangers to one another and tended to be introverted, seldom communicated.

Most of the campers soon became overwhelmed by the complexity of the material and discouraged by lack of success in completing the laboratory exercises. As a result, the pace of the camp had to be slowed to almost a crawl during the second week, and little material on Java features for gaming or web technology was covered.

Except for a substantial reduction of material and addition of less ambitious programming problems, SPICE utilized this organizational model for the next seven years and experienced a modest amount of success. However, as interest in computing waned at the high-school level, fewer and fewer students were eligible to benefit from SPICE, and it, too, suffered declining enrollments. In 2007, it became evident that a new approach had to be taken to reach out to students who might not want an enrichment program, but an exploration one.

SPICE and ETCS Outreach

While remaining firmly rooted in the Computer Science Department, in 2002 SPICE was grafted into the then newly created IPFW College of Engineering, Technology, and Computer Science (ETCS) Outreach Office. The Office was founded in order to centralize coordination and support for a variety of outreach activities initiated by faculty. With its mission to build awareness, interest, and self-efficacy in engineering, technology, and computer science among K-12 students, the Office organizes, promotes and partially funds project-based educational experiences for pre-college youth sponsored by constituent departments. Funding for outreach programs is generated yearly from 30-35 northeast Indiana businesses and professional organizations. These organizations often also supply volunteer judges and members who serve on various event planning committees.

The Office has established a highly successful K-12 outreach presence in northeast Indiana. An estimated 3500 students, 800 adult volunteers, and 1100 observers participated in IPFW outreach events last year. In addition, 105 schools from northeast Indiana and over 50 counties were represented in at least one event. Outreach activities include statewide championships (Indiana FIRST® LEGO® League Championship, Indiana Future City® Competition), regional competitions (Northeast Indiana Regional Science and Engineering Fair), career days (Middle School Career Days), and summer exploration camps (Girls Leading Others, VEX Robotics, Adventures in Computing for Teens nee SPICE, Math and Science Camp, Physics Camp).

The Office strives to offer engaging and challenging events and camps that generate excitement while encouraging youth to expand and explore STEM (Science, Technology, Engineering and Math) skills. Programs also involve exposure to community professionals as presenters or mentors. All of the competitions provide youth with opportunities to earn recognition, special awards, scholarships, and potentially advancement to higher levels of competition. Highly motivated youth can engage in multiple outreach activities at the university and develop a sense of direction, self-confidence, and enthusiasm toward doing well in school in order to pursue these fields of study later in their academic careers. This outcome correlates with the broader university mission to provide educational service to northeast Indiana communities. Outreach programs thus serve as both a mechanism for community service and a method to acquaint youth with the university environment.

Since 2002, the ETCS Outreach Office has provided a number of invaluable services to summer exploration camps. These include design, production and distribution of promotional materials, processing of applications, funds management, onsite logistics, and ad hoc administrative support. This has freed instructional personnel to focus on content design, preparation and delivery.

Revitalizing the Computer Summer Exploration Camp

In 2008, a new faculty member agreed to take charge of SPICE. After reviewing SPICE’s history and recent difficulties in attract participants, an entirely new approach was taken. The first step was replacing the name with a less intimidating one, Adventures in Computing for Teens (ACT). Java was jettisoned in favor of Alice. Participation was broadened to include middle-school students. Formal lectures were replaced by short tutorials, demonstrations, and follow-the-leader exercises. Enrichment activities, such as videos on computer science milieu and presentations on educational and career opportunities, were integrated with daily programming adventures. Participants were encouraged to explore and experiment with Alice and show each other what they could do. All participants completed an individual project which they demonstrated to family and friends at the end of the camp. The remainder of this paper details the design, implementation and evaluation of ACT.

Camp Organization and Content

ACT runs Monday through Friday from 8:00 AM to 4:30 PM. Lunch is provided each day as well as a mid-morning snack break. Daily activities are organized around three major themes: explanation, exploration, and excitation. Table 1 details the distribution of time across these activities for the ACT 2009 camp. Table 2 provides sample activities for a typical day. A single faculty member conducts all sessions.

	Monday	Tuesday	Wednesday	Thursday	Friday
8:00	Orientation	Q/A & Teaser	Q/A & Teaser	Q/A & Teaser	Q/A & Teaser
8:30		Explanation	Explanation	Explanation	Explanation
9:00	Excitation	Excitation	Excitation	Excitation	Excitation
9:30	Explanation	Explanation	Exploration	Exploration	Exploration
10:00	BREAK	BREAK	BREAK	BREAK	BREAK
10:15	Explanation	Explanation	Explanation	Explanation	Exploration
10:30	Exploration				
11:00			Exploration	Exploration	
11:30	Excitation	Excitation	Excitation	Excitation	Excitation
12:00					
12:30	LUNCH	LUNCH	LUNCH	LUNCH	LUNCH
1:00	Explanation	Exploration	Exploration	Exploration	Exploration
1:30					
2:00					
2:30	Exploration				
3:00					Showcase
3:30					
4:00					
4:15	Preview	Preview	Preview	Preview	Awards
4:30	End	End	End	End	End

Table 1. ACT 2009 Summer Exploration Camp Activity Schedule.

Explanation activities are aimed at learning fundamental programming skills, Alice features, and basic animation techniques for story-telling and video-game construction. These activities include instructor demonstrations, hands-on tutorials, and brief presentations of material from the Alice textbook, *Learning to Program with Alice* [1]. Chapters 1-5 and Appendix A comprise the educational content from the textbook. Just enough explanation is provided to give participants a foothold in new territory; additional learning is accomplished through independent exploration, peer collaboration, and individual help from the instructor. Participants tend to be fiercely independent and have a high tolerance for the trial-and-error method of learning.

Exploration activities give participants the opportunity to gain skill—and occasionally show-off—what they have learned about programming. These activities are a combination of exercises chosen from the Alice textbook or created by the instructor. The exercises are of varying difficulty to better ensure that all campers are able to complete at least one of them per content unit. Participants are encouraged to modify exercise in creative ways. This motivates them to take greater ownership in skill acquisition.

The exploration activities culminate with an animation project, either a story or a video game, which is designed by the participant. The project allows the camper to experience the entire software development process, practice with a variety of Alice features, and express their creativity or indulge their interests. The project activity is introduced after lunch on Monday with a review of past projects. Participants are then asked to brainstorm ideas and then write a half-page description of their desired project. Upon approval, the camper then works independently to create a simple storyboard and bring it to life. The instructor lends assistance as needed.

The projects tend to vary greatly in complexity which is ultimately a reflection of the camper's knowledge level and time commitment. Sample projects from ACT 2009 include: An interactive lunar lander game; a math quest educational game; an animated fairy-tale; a star-wars space chase; and animation of hand-signs from a Japanese manga fantasy series.

One other note about exploration activities: Each afternoon except Monday and Friday is wholly dedicated to this activity. One might anticipate that this is too long a period of time for teenagers to be focused on one activity. The first offering of ACT did have an excitation activity in the middle of the afternoon, but this was not well-received. Feedback indicated a distinct desire for more time to devote to exploration, specifically to bringing their projects to completion. Not only do most participants remain on-task during this time, they almost universally report spending additional hours at home on their projects or exploring Alice features not covered during the day.

Excitation activities are designed to create awareness of, interest in, and excitement about the field of computing. Such activities are often aimed at dispelling myths about who can become a computing professional and the nature of the computing profession. Participants are often quite surprised to discover how pervasive computer technology is and how even “normal” people (i.e., those who do more than hunch over their computers 24/7) can be successful as computing professionals. Many times these activities include guest speakers, among them a former beauty queen, who share their own stories about how they chose computing as their vocation. Another well-received activity is an interactive poll that explores knowledge and perceptions about computing, e.g., On average, how many text messages are sent by a teenager per month. Results for each question are displayed instantly and serve as a springboard for further discussion.

Sample Daily Schedule	
8:00	Teaser: “Walkin’ Around” Alice program demonstration
8:30	Chapter 3 Tutorial: Using built-in functions and expressions
9:00	Interactive Presentation: “Computer Science: More Than You Think”
9:30	Chapter 3 Exercises
10:15	BREAK
10:30	Chapter 3 Tutorial: Simple control structures
11:00	Chapter 3 Exercises
11:30	Video: “The Machine That Changed The World”
12:30	LUNCH
1:00	Chapter 3 Exercises; Project Development
4:15	Preview of Chapter 4 Content
4:30	End

Table 2. ACT Summer Exploration Camp Sample Daily Schedule.

Several other activities are an integral part of the camp. An hour-long orientation session is held on Monday. During this session the instructor gives an overview of the camp, distributes the Alice textbooks, asks participants to complete a background survey, and gives them the opportunity to introduce themselves. An ice-breaker activity is also done to better acquaint the participants with each other and to create a more friendly and familiar environment.

On Tuesday through Friday, the day begins with a Question and Answer session to clarify or reinforce material from the previous day. The instructor then offers a “teaser” which is an Alice animation incorporating new features and programming concepts for the upcoming day.

The final hour on Friday is dedicated to a project showcase. Participants are invited to introduce and demonstrate their Alice projects. Family members are encouraged to attend. Outstanding projects are given achievement awards—usually movie tickets or restaurant gift cards—and all are given t-shirts and handsome certificates of participation. The camp concludes with a pizza party.

Funding

The ACT budget is approximately \$3,000 for 20 participants. Included in this amount are the instructor’s salary, food, promotional materials, books, awards and certificates. ACT is funded with a combination of corporate grants (Franklin Electric, Inc.) and participant fees. Participant fees are currently \$120 but may be reduced if additional corporate funding is obtained. A small number of camp scholarships are available to support participation by underrepresented groups.

Promotion and Participation

As part of the ETCS Outreach program, ACT is promoted through four formal marketing channels. A description of ACT is included in IPFW’s Continuing Studies Summer Programs booklet, which is mailed to several thousand homes in the nine-county university service region.

Secondly, the ACT trifold is mailed to all former participants and a broad selection of high-school and middle-school guidance counselors. The camp description and trifold are also hosted on the ETCS website. Finally, ACT is promoted at local summer camp information fairs. Of course, ACT is informally promoted by word-of-mouth and the camp instructor always has a trifold handy to share when the opportunity arises.

Renewed promotional efforts and more engaging camp content have resulted in full capacity the last two years and similar participation is expected for 2010. Participants have been drawn from more than 20 different schools including public, private and homeschools. Table 3 profiles age and gender distribution. Of particular note is the participation of younger teens. We view this as an ideal opportunity to foster early consideration of computing as a career and to encourage an academic path that would prepare them for a STEM major (hopefully, Computer Science!) This has also motivated us to design an additional component for ACT 2010 (see Section x below) to attract more teens in grades 10-12. Female participation is disappointing, but consistent with national surveys of women pursuing computing degrees. We plan to reorient some of our promotional materials to improve this situation. Based on a pre-camp survey, all participants are avid computer users with over 90% using the computer for four activities: surfing the internet, word processing, playing games, and social networking. Few of them, however, have any programming experience prior to the camp. They universally have a naïve view of what computing professionals do, who they work for, or what it takes to become one. Finally, though they admit to having little knowledge of programming, they are eager to learn how to create programs, especially those that look and feel like video games.