A Networked, Media-Rich Programming Environment to Enhance Informal Learning and Technological Fluency at Community Technology Centers

NSF-ITR grant (ITR-0325828)
Final Report, November 2008

Research and Education Activities

The results from this NSF project have greatly exceeded our expectations. In our initial proposal to NSF five years ago, we laid out plans to develop a new programming environment, called Scratch, to enhance technological fluency at community technology centers in low-income communities. The dissemination and impact of Scratch has extended much further than we expected. Hundreds of thousands of children around the world are now using Scratch to program their own interactive stories, games, and animations – and learning important mathematical and computational ideas in the process.

Perhaps most striking is the vibrant online community that has developed around Scratch. We made it easy for people to upload their Scratch projects to the shared Scratch community website (http://scratch.mit.edu) with the click of a single button (labeled "Share!"). On the website, we provided ways for community members to interact with one another's projects within a standard browser, discuss and comment on one another's projects, and download the programming code from one another's projects.

These features have led to an explosion of activity on the Scratch website. Since the public launch of our Scratch software and website in May 2007, more than 5 million unique visitors have come to the Scratch website, and more than 500,000 people have downloaded the (free) Scratch software. More than 260,000 Scratch projects (with a total of more than 6.5 million programming scripts) have been uploaded to the website. A new Scratch project appears on the website every two minutes on average (more than 700 new projects each day).

Scratch has received recognition from the educational research, computer-science, and design communities. In the past year, Scratch was awarded two prestigious awards: the Eliot Pearson Award for Excellence in Children's Media (from the Eliot-Pearson Department for Child Development at Tuft University) and the Prix Ars Electronica in the Digital Communities category (Honorary Mention). Scratch has been featured in a wide range of publications, including New Scientist, the Economist, New York Times, Chronicle of Higher Education, Edutopia, and Scholastic magazine. Also, Scratch was selected as a Promising Practice for "increasing gender diversity in IT" by the National Center for Women and Information Technology (NCWIT).

In previous annual reports, we discussed activities of the first four years of the project. NSF granted us a fifth-year no-cost extension to focus especially on dissemination activities. In this final report, we will focus especially on dissemination activities.

1. Scratch@MIT Conference

On July 24-26, 2008, the MIT Media Lab hosted the Scratch@MIT conference, billed as "the first conference focused on the ideas, applications, and joys of Scratch." We invited educators, researchers, developers, and other members of the worldwide Scratch community to come to MIT to:

- share stories of how Scratch is being used in homes, schools, and community centers
- participate in hands-on workshops, to learn new Scratch techniques and strategies
- discuss research examining how and what kids learn with Scratch
- explore future directions for Scratch with members of the MIT Scratch Team

When we announced the conference, we had no idea how many people would be interested. We were very pleased by the response. We received 89 proposals for sessions at the conference and accepted 57 of them. We set a maximum registration limit of 300 participants, and we sold out more than a month before the conference. Participants came from 32 different countries.

We received very positive feedback from conference participants. Many participants said that they were excited to meet and share ideas with "kindred spirits" who shared not only an interest in Scratch but also shared values and visions for educational reform.

We greatly appreciated a supplementary grant from the National Science Foundation, which enabled us to offer free travel for 10 participants, free registration for 30 participants, and discounted registration fees for 70 others (at a reduced fee of $175 instead of full registration fee of $325).

For more information, see the conference website at http://scratch.mit.edu/conference . The conference program (with abstracts of all sessions) is available online at http://scratch.mit.edu/conference/Scratch_Final_Program.pdf

2. Translation and Internationalization

Initially, we developed Scratch software in just one language: English. But we quickly received requests from people around the world, asking for versions of Scratch in their languages. So we set up an open-source process for translation, enabling volunteers from around the world to help with the translation (see http://info.scratch.mit.edu/Translation). For each new language, translators need to provide translations for several hundred words and phrases that are used in the Scratch application.

The current version of Scratch (version 1.3) supports more than 40 languages. Users can simply go to the Language drop-down menu, select a new language, and all of the Scratch programming blocks are immediately changed to the new language. See Figure 1 below for a screen-shot of the Scratch interface with Japanese programming blocks – and the drop-down menu showing a list of other possible languages.

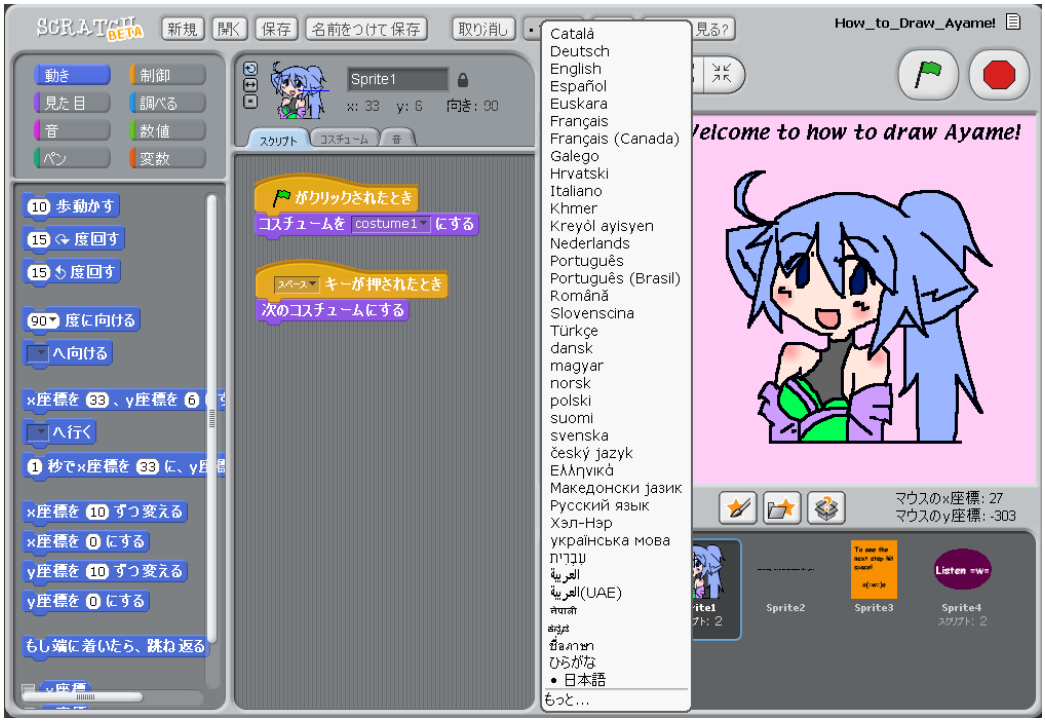

Figure 1
Scratch interface with Japanese programming blocks –
with drop-down menu showing other possible languages

With this system, it is easy for children in different countries to share and collaborate on Scratch projects. A child in Tokyo could create a Scratch project using Japanese programming blocks, and upload the project to the Scratch website. A child in New York could download the project, view the programming blocks in English, make changes to the project, and upload the revised project to the website. The child in Tokyo could view the revised project in Japanese programming blocks.

People in other countries are also translating the Scratch support materials, such as the Getting Started Guide, Reference Guide, and Scratch Cards. The Scratch website provides the source files for of these support materials, and people around the world are free to translate the files, and share the translated versions on the Scratch website. Versions of the support materials are now available in 20 languages.

We are also exploring strategies for internationalization of the Scratch website. Currently, there is just one Scratch website, hosted on a server at the MIT Media Lab. We provide translations of the website menus into several languages. But there is a bigger problem: Almost all of the comments and discussion forums on the site are in English (and there is no easy way to translate them). So the website is not very inviting to people who speak other languages. Our current plan is to establish an international network of Scratch websites, with each website serving a different language, culture, or geographic region. For example, we are collaborating with a university in the United Arab Emirates to establish an Arabic version of the Scratch website (see below).

Figure 2
Arabic version of Scratch website, developed in collaboration with researchers in United Arab Emirates

3. Scratch Technology Extensions

One of our long-term goals is to establish Scratch as an international standard for introductory computer programming, so that people can use Scratch to create all types of dynamic, interactive content on all types of computing platforms. Towards that end, we have worked on several different extensions of the standard Scratch application:

Scratch Sensor Boards. With these boards, people can use physical sensors to control their on-screen Scratch creations. For example, a student might program a racing game on the screen, then create a physical steering wheel (connected to the Scratch Sensor Board) to control the behavior of the on-screen car. For more information on Scratch Sensor Boards, see http://info.scratch.mit.edu/Sensor_Boards

Mobile Devices. We have created prototype versions of Scratch running on mobile phones and other mobile devices. For example, you can use Scratch to program an animation of a birthday cake, and send it to a friend's mobile phone as a birthday greeting.

Robotics. We have developed prototype versions of Scratch to control different robotic devices, so that Scratch can control objects in the physical world as well as on screens.

Immersive Virtual Worlds. We have developed a prototype version of Scratch to program objects in Second Life. See http://web.mit.edu/~eric_r/Public/S4SL/

4. Partnerships

To accomplish our ambitious, long-term goals for Scratch, we need to establish partnerships with many different organizations, to support future development and dissemination. Below is a listing of some of the initial partnerships that we have formed:

Intel: We are collaborating with Intel on the development of a special version of Scratch for the Intel Classmate PC, a low-cost laptop designed especially for use by students in the developing world. We are also collaborating with the Intel Foundation on the development of educational materials to support the use of Scratch in after-school centers in low-income communities.

Microsoft: We are collaborating with Microsoft on the development of a Silverlight version of the Scratch webplayer, and also on the development of educational materials to support the use of Scratch in classrooms.

Samsung: We are collaborating with Samsung on a version of Scratch to run on Samsung mobile phones – and a website where people can share their Scratch-mobile projects with one another. See http://softboard.samsungmobile.com/

Nokia: We are collaborating with Nokia on the development of a version of Scratch to run on Nokia mobile devices (particularly, the Nokia N810). We are also collaborating with Nokia on the development of new educational activities that take advantage of the special affordances of mobile devices.

NEC: We are collaborating with NEC on the development of a version of Scratch to control the behavior of NEC's PaPeRo mobile robot.

OLPC: We are collaborating with One Laptop Per Child (OLPC) on the development of a version of Scratch to run on the OLPC XO laptop, designed specifically for children in the developing world. Scratch is included as part of the standard software package on the XO laptops sold through OLPC's "Give One Get One" initiative.

PICO: We are collaborating with Playful Invention Company (PICO) on the distribution of the Scratch Sensor Boards, connecting Scratch projects to physical-world sensors. See http://www.picocricket.com/picoboard.html

5. Presentations and Workshops

As part of our dissemination effort, we have made presentations about Scratch at many conferences and symposia. Below is a list of some of our Scratch-related presentations during 2008 (in addition to our presentations at the Scratch@MIT conference, described above):

Brennan, K. (April 2008). Sowing the seeds for a more creative society. Invited lecture, Open World Learning, Denver, Colorado.

Brennan, K. (June 2008). Programming and Beyond: Enabling Creative Learning through Scratch. Invited speaker, Science and Engineering Workshop for Teachers, MIT, Cambridge, MA.

Brennan, K., & Monroy-Hernandez, A. (June 2008). Scratch. Invited panelist, Creativity and Media Literacy Forum, Berkman Center for Internet & Society, Cambridge, MA.

Brennan, K. (September 2008). Scratch. Invited speaker, Winchester Professional Development Day, Winchester, MA.

Brennan, K. (September 2008). Scratch. Invited keynote, Women in Games, University of Warwick, England.

Brennan, K. (October 2008). Illusions of ambiguity: Signaling presence and representation of gender identities on a programmable media website for young people. Association of Internet Researchers conference. Copenhagen, Denmark.

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Brennan, K. (November 2008). Scratch. Invited speaker, Massachusetts Computer Using Educators conference, Sturbridge, MA.

Daily, S.B., & Brennan, K. (May 2008). Utilizing technology to support the development of empathy. Interaction Design & Children conference, Chicago.

Maloney, J., Peppler, K., Kafai, Y., Resnick, M., & Rusk, N. (March 2008). Programming by Choice. Urban Youth Learning Programming with Scratch. SIGCSE 2008 Conference, Portland, Oregon.

Peppler, K. A. & Kafai, Y. B. (May 2008). Youth as Media Art Designers: Workshops for Creative Codings. Interaction Design for Children, Chicago, IL.

Peppler, K. & Kafai, Y. B. (June 2006). Creative Codings. International Conference of the Learning Sciences (ICLS2008). Utrecht, The Netherlands

Peppler, K. A. & Kafai, Y. B. (June 2008). New Literacies and the Learning Sciences: A Framework for Understanding Youths' Media Arts Practices. International Conference of the Learning Sciences (ICLS2008). Utrecht, Netherlands.

Peppler, K. A. & Kafai, Y. B. (June 2008). Developing a Design Culture in a Computer Clubhouse: The Role of Local Practices and Mediators. International Conference of the Learning Sciences (ICLS2008). Utrecht, Netherlands.

Resnick, M. (February 2008). Sowing the Seeds for a More Creative Society (invited presentation). University of Costa Rica, San Jose, Costa Rica.

Resnick, M. (February 2008). Sowing the Seeds for a More Creative Society (keynote presentation). Illinois Technology Conference for Educators, St. Charles, IL.

Resnick, M. (February 2008). Technologies for Creative Thinking and Learning (spotlight session). Illinois Technology Conference for Educators, St. Charles, IL.

Resnick, M. (April 2008). Sowing the Seeds for a More Creative Society (invited presentation). MIT Information Technology Conference, Cambridge, MA.

Resnick, M. (May 2008). Sowing the Seed for a More Creative Society (invited presentation). One Laptop Per Child conference, Cambridge, MA.

Resnick, M. (June 2008). Grassroots Creativity: Helping Everyone Become a Creative Thinker (featured presentation). National Educational Computing Conference, San Antonio, TX.

Resnick, M. (June 2008). Sowing the Seeds for a More Creative Society (invited presentation). Schlumberger Education Foundation, Cambridge, MA.

Resnick, M. (July 2008). Sowing the Seeds for a More Creative Society (keynote presentation). Scratch@MIT conference, Cambridge, MA.

Resnick, M. (August 2008). Helping Everyone Become a Creative Thinker (invited presentation). People's Association, Singapore.

Resnick, M. (August 2008). Sowing the Seeds for a More Creative Society (keynote presentation). International Conference on Teaching and Learning with Technology, Singapore.

Resnick, M., Brennan, K, & Rusk, N. (July 2008). Introduction to Scratch (hands-on workshops). Building Learning Communities conference, Boston.

Resnick, M. (September 2008). Sowing the Seeds for a More Creative Society (keynote presentation). Australian Computers in Education Conference, Canberra, Australia.

Resnick, M. (October 2008). Learning Through Tinkering (invited presentation). MacArthur Foundation workshop, Palo Alto, CA.

Resnick, M. (November 2008). Technologies for Creative Learning. BIT Day Conference (keynote presentation), Campinas, Brazil.

Resnick, M. (November 2008). Preparing Today's Children for Life in Tomorrow's Creative Society (keynote presentation). Educational Computing Organization of Ontario annual conference, Toronto, Canada.

Resnick, M. (November 2008). The Future of Learning (invited panelist). Harvard Graduate School of Education, Cambridge, MA.

Rosenbaum, E. (June 2008). Scratch for Second Life. International Conference of the Learning Sciences (ICLS2008). Utrecht, The Netherlands.