DESIGNING INTERACTIVE MEDIA

Most young people are surrounded by interactive media. But their engagement with interactive media is often limited to consumption, with fewer opportunities to participate as designers. We see young people playing video games, but not creating their own games. We see young people accessing large repositories of user-generated content, like Wikipedia or YouTube, but not understanding how they might contribute or how new repositories might be developed. We see young people contributing personal and social information to services like Facebook, but without knowing how the infrastructure is (or might be) designed to support control over that information. Young people are readers of computational culture, but are mostly unable to participate as writers of computational culture.

There is an increasing sense of urgency that everyone should be able to participate as writers of computational culture. This need has been expressed by a variety of sources, including computer science education researchers (e.g. Guzdial & Forte, 2005), literary theorists (e.g. Hayles, 2005), and government agencies (e.g. Chopra, 2012), and stems, in part, from a concern that unless we understand how to actively participate in computational culture, we risk being controlled by it:

Everyday life is increasingly regulated by complex technologies that most people neither understand nor believe they can do much to influence. The very technologies they create to control their life environment paradoxically can become a constraining force that, in turn, controls how they think and behave. (Bandura, 2001, p.17)

In order to support young people’s development as designers, not just consumers, of interactive media, they need access to tools and community. To this end, the Lifelong Kindergarten research group at the MIT Media Lab, with support from the National Science Foundation, has developed a programming environment, called Scratch, that enables young people to create their own computational media – interactive stories, games, animations, and simulations – and share their creations online. The Scratch website
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(www.scratch.mit.edu), launched in May 2007, has become an active online community, with more than a million registered members sharing, discussing, and remixing projects (Resnick et al., 2009). There are more than 2.5 million projects on the Scratch website, and each day members (mostly ages 8 to 16) upload approximately 2500 new Scratch projects to the website – on average, two new projects every minute. The collection of projects is incredibly diverse: interactive newsletters, science simulations, virtual tours, animated dance contests, interactive tutorials, and many others, all programmed with Scratch’s graphical programming blocks.

Scratch follows in the constructionist tradition – an approach to learning that emphasizes the importance of constructing, building, making, and designing as ways of knowing, “that knowledge is not simply transmitted from teacher to student, but actively constructed by the mind of the learner. Children don’t get ideas; they make ideas” (Kafai & Resnick, 1996, p. 1). This builds on constructivist assumptions that learning does not happen through a process of transfer or acquisition, but rather that it is a process of a learner constructing new models and understandings that are connected to the learner’s existing structures and models (Duffy & Cunningham, 1996; Scardamalia & Bereiter, 1991).

Constructionism is grounded in the belief that the most effective learning experiences grow out of the active construction of all types of things, particularly things that are personally or socially meaningful (Bruckman, 2006; Papert, 1980), that are developed through interactions with others (Papert, 1980; Rogoff, 1994), and that support thinking about one’s own thinking (Kolodner, 2003; Papert, 1980). These four aspects of constructionism – learning through the activities of designing, personalizing, sharing, and reflecting – are key activities of young people participating as designers of interactive media with Scratch.

TEACHER RESOURCES

Much of the early use of Scratch took place in homes and after-school settings, and many of the initial participants came from home environments that encouraged and supported creative explorations with technology. But in recent years, a growing number of schools have started to include Scratch in classroom activities. The adoption of Scratch in schools is essential for broadening and diversifying the community of young people who are participating as computational creators, moving beyond early adopters and connecting opportunities for learning across informal and formal settings.
To further the inclusion of Scratch in schools, we ask: *what support do teachers need in order to facilitate young people’s development as creators of interactive media, and engage them in activities of designing, personalizing, sharing, and reflecting?*

Scratch is used in a variety of settings – across disciplines, from computing studies to language arts to science to visual arts, and across ages, from kindergarten to college – and by educators who have varying levels of familiarity with Scratch and computational creation. In order to support this diverse range of disciplines, audiences, and experience levels, a variety of professional development opportunities have been designed that educators can access in multiple ways.

The ScratchEd professional development model involves several key components. First, there is an online community for educators working with or interested in Scratch, called ScratchEd ([http://scratched.media.mit.edu](http://scratched.media.mit.edu)). More than 5000 educators have joined ScratchEd in the first two and a half years since its launch in August 2009, and educators have shared hundreds of stories and resources, as well as asked and answered thousands of questions. To accompany the ScratchEd online community activities, there are face-to-face and online gatherings where teachers can gain a deeper understanding of Scratch and constructionist approaches to learning; these include monthly introductory workshops for educators new to Scratch, meetups for educators with some Scratch experiences, and webinars that are recorded and shared on ScratchEd. Finally, there are resources for teachers to use when introducing Scratch to students and when conducting workshops for their colleagues. For example, a curriculum guide for Scratch was released in September 2011, and was downloaded more than 16,000 times in the four months following its release. Accessing and exploring these resources is made as easy as possible by connecting announcements to other channels, such as email, Twitter, and Facebook.

The role that teachers occupy in their professional development is a central consideration for designing support and activities. Many professional development opportunities treat teachers as consumers, neglecting fundamental understandings about how people learn, as evidenced by language like “teacher training.” As Papert (1993) argued,

> Although the name is not what is most important about this concept, it is curious that the phrase “teacher training” comes trippingly off the tongues of people who would be horrified at the suggestion that teachers are being trained to “train” children. (p. 70)
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For designers of professional development opportunities, teachers must be respected as learners. Teachers need to be treated as designers of learning environments, not merely agents enacting a vision, following a prescription for pedagogy. Teachers need to be treated as co-designers of their learning experiences in professional development. The ScratchEd approach is to create opportunities for teachers to engage in the same designing, personalizing, sharing, and reflecting activities that are essential for young people as designers of interactive media.

DESIGNING, PERSONALIZING, SHARING, REFLECTING

Designing, personalizing, sharing, and reflecting are integrated in all aspects of the ScratchEd approach to teacher professional development – from the design of the online community, to the face-to-face and virtual gatherings, to the resources. For the remainder of this case study, we use the monthly meetups (which are attended primarily by K-12 classroom educators) as one example of how these activities are supported in our professional development.

The monthly meetups began in December 2010. They emerged as a “next-step” space, after several years of hosting introductory Scratch workshops for hundreds of Scratch educators, as a way for educators interested in Scratch to connect with their peers, learn more about working with Scratch in a classroom setting, and share their experiences. The meetups are three hours in duration, take place on Saturday mornings at the MIT Media Lab, and are structured into three parts. Part one involves networking and introductions, in which people get to know each other – or given the number of repeat attendees – to get caught up. Part two consists of self-organized breakout sessions. The group (which ranges in size from 10 to 40 people) collectively negotiates different tracks of learning, focus, and activity, and then breaks out into smaller groups to pursue those interests. Part three, which occurs over lunch, involves reporting out from the breakout groups, sharing experiences in a Show & Tell format, and general group updates.
Designing

At a recent meetup, the group had just finished the networking activity, and it was time to organize the activities for the rest of the session. “OK,” one of the meetup hosts said to the group, “this is always the most chaotic time of the meetup. What suggestions do people have for what they’d like to achieve today?” People started to call out suggestions: “I want to learn how to use the pen blocks!” “Can someone help me understand variables?” “How are costumes different from sprites?”, “I developed an assessment that I’d like some feedback on.” “Oh, that reminds me of a resource that I found and wanted to share and get reactions from the group.” Julie, an educator who has attended numerous meetups, volunteered to lead – in collaboration with Sarah, another meetup regular – a session combining several of the suggestions that were focused on learning more about how to create with Scratch. They developed a breakout group that supported participants’ explorations with Scratch through a design challenge of building a project given a particular constraint. While this subgroup met and worked on Scratch projects, another subgroup discussed strategies for helping kids get started with Scratch, and one person spent time planning an upcoming workshop he was hosting for his colleagues.

In the context of Scratch, teachers act as designers at multiple levels. They are designers of computational media (like their students) and designers of learning environments (for their students). The meetups serve as a space to support both of these activities.

As designers of computational media, teachers often want to learn more about particular features of Scratch (as in the vignette above) or develop strategies for making projects. Teachers vary in their experience with Scratch, and in how comfortable they feel with their own level of experience. Some teachers are unwilling to work with Scratch until they have attained what they feel is a reasonable level of mastery. Other teachers feel more comfortable with the (ideally) open-ended nature of Scratch design activities, and see their role less as the “one who knows” and more as the “one who helps.” As Margaret, a high-school art teacher said about the role of an educator who works with Scratch:

It would be good if the teacher feels that they can say, “Well, I don’t know.” Because there’s no way you’re going to be able to answer all [your students’] questions. I don’t know how to do some things, but I feel OK as long as I can sort of know where to get help.
As designers of learning environments, teachers often share their lesson and unit plans with each other, comparing their strategies for designing learning environments – how much structure to provide, what roles people play in the environment, and which resources to make available. The meetup itself becomes an exercise in the design of learning environments, with the teachers participating as co-designers of their professional development experience. The ScratchEd team, which hosts the professional development, provides an outline (day, time, 3-part structure), a place, and food, but the teachers fill in the details, designing learning experiences for themselves and their colleagues.


**Personalizing**

In a breakout session about assessing Scratch projects, Theresa (an educator who runs an after-school Scratch club for middle-schoolers) suggested that the group look at a Scratch project rubric for middle-school students she had found on the ScratchEd website. Carter, who was using Scratch with his 7th-grade math students, liked the rubric, but said that he would need to add dimensions to the rubric that covered content – the mathematical concepts he was interested in weren’t covered. Julie, who was using Scratch with 10th-grade computer science students, also liked the rubric, but said that she would need to modify it to include more advanced computer science concepts.
and practices. Inez, who was currently working with 2nd-grade students, liked the rubric, but couldn’t imagine her students using it for self-assessment—the language was too sophisticated, and her students weren’t fluent writers yet. Some of Carter’s students also struggled with writing, he said, and the group brainstormed ways of dealing with that particular challenge. Adrien, a research intern with the ScratchEd project, wondered if having the kids record audio responses to the rubric prompts (instead of text) would be a good approach. Carter didn’t think that would work with his students because he didn’t have access to good microphones, but Inez was inspired. That month, Inez experimented with having her 2nd-graders record their project development reflections.

Scratch’s ability to fit into a wide variety of settings attracts a diverse array of teachers. Although introductory workshop activities are usually structured in a way that keeps the learners pursuing a collective learning goal, meetups are structured to provide participants with opportunities to define and pursue learning goals that suit their individual contexts. Meetups are not one-size-fits-all, offering multiple pathways and engaging the diversity of participant perspectives. This diversity often leads to new ideas and inspiration, through the process of looking across ages and across curricular areas. Personalization is further supported by providing access to resources that educators can remix and customize. All of the resources that the ScratchEd team develops are shared via the ScratchEd online community and are Creative Commons licensed.
Sharing

Twelve people signed up for the Show & Tell component of the meetup. Jessica shared a project that one of her students had created and asked for feedback from the group. Robert presented an activity to support his students’ explorations of the Cartesian coordinate system with Scratch. Laura described how she worked with a music teacher to record her students singing and how the students incorporated the mp3s into Scratch projects. Jackie catalyzed the group of teachers by talking about her experiences working with the Scratch online community, which many teachers feel they are unable to bring into their classrooms. Drawing on her experiences as an English major, Jackie argued that it was essential for students to share their work with each other and the world. She talked about some of the challenges that she faced, and how she dealt with those challenges. She told the group, “My middle-schoolers are mostly inspired by the feedback they get from their peers and the gratification they get from sharing their projects in such a public way.” Some of the teachers who had been unwilling to experiment with the website were inspired by Jackie’s story and followed up with her for further conversation.

Members of the MIT Scratch Team attend the meetups to learn about educators’ experiences and to offer support and guidance: technical advice, project ideas, resource connections. But teachers offer a different and important form of support and guidance, with greater legitimacy when talking about Scratch in the classroom. The power of personal testimonials from fellow teachers has supported great learning moments for meetup participants, which is why the Show & Tell component is a part of every meetup. Teachers get ideas from each other, find collaborators, and cultivate confidence to experiment and try new things. The more than 50 recorded Show & Tell videos are some of the most popular resources in the ScratchEd online community, and have been viewed thousands of times.

Reflecting

“Let’s start today,” one of the meetup facilitators said, “with reflections on the past month.” Handing out red, yellow, and green sticky notes, the facilitator asked everyone to write down something that they felt great about (the green), something that they felt ambivalent about (the yellow), and something that they felt not-so-great about (the red) in their teaching practices. The room fell silent as people thought about the red, yellow, and green of their month. After a few minutes, people shared some of the successes and challenges they had experienced. The red, yellow, and green reflections served as a basis for designing the rest of the meetup, identifying areas of group expertise, as well as areas for further development.

Reflection – the process of stepping back, assessing what is known and what is to be known – is often neglected in the hectic activities of a busy educator’s teaching practice. Teachers need opportunities to reflect on their practice, to talk about their successes and challenges, to get feedback and fresh perspectives on their experiences, and to be asked questions about their ideas. The meetup structure is designed to include multiple points of reflection: reflecting on one’s teaching practice (as illustrated by the preceding vignette), reflecting on one’s learning experiences in the breakout sessions (through reflective reporting over lunch), and reflecting on the meetup itself (through exit notes and ScratchEd forum posts).
DESIGNING FOR DESIGNERS

To broaden participation in computational creation with a tool like Scratch, its inclusion in school-based activities needs to be supported. Teachers are powerful collaborators in working toward this goal and the ScratchEd team has been studying how to support teachers – creating spaces of learning, exploration, and opportunity that respect teachers as learners and designers. These spaces are co-developed by researchers and teachers following the same design principles that are advocated for young designers of computational media:

- **Designing**: Teachers need opportunities that treat them as designers of learning environments – ideally supported by involving participants as co-designers of their own professional development experiences.

- **Personalizing**: Teachers come from a variety of settings and need to make connections to their personal interests and contexts.

- **Sharing**: Teachers need to hear from other teachers about their experiences. Shared, first-hand experiences have greater authenticity and legitimacy than experiences communicated by someone outside of that lived experience.

- **Reflecting**: Teachers need opportunities to critically reflect on their methods in order to assess where they are and where they would like to be.
Working within a co-designed or participatory model of professional development presents challenges. There is, for example, always a tension between promoting ideas about how Scratch might ideally be used, and connecting with educators’ needs and approaches. In early meetups, there was also some confusion about the meetup model – it represented an approach quite different from the professional development that most educators are accustomed to. Over time, educators are taking greater ownership of the meetup space, as a regular format for the meetups is cultivated and the culture of trust and risk-taking required for this type of learning is developed.

These professional development activities are assessed through observation of – and conversations about – what teachers are doing and saying. Are teachers designing, personalizing, sharing, and reflecting? Are teachers returning to participate in the collaborative, co-constructed space? Are teachers learning more about Scratch, making connections to new ideas and to each other, and sharing their experiences? Most importantly, however, is the degree of iteration. Success is when teachers are able to be iterative in their practice, trying new things based on something they learned at a previous session. Success is when members of the group, as a professional development collective, are iterative in these co-designed opportunities and structures – taking the best of previous meetups, making connections between the different professional development opportunities, and designing new learning experiences together.

**Acknowledgements:**
This material is based upon work supported by the National Science Foundation under Grant No. 1019396. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author and do not necessarily reflect the views of the National Science Foundation.

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