Revised Evaluation for ScratchEd Proposal

Prepared by Education Development Center (EDC)

Introduction

At the theoretical heart of the ScratchEd project is the premise that design-based learning environments provide developmentally appropriate learning experiences that directly address the fragile knowledge often produced by more didactic instruction in computational concepts (Papert, 2000; Resnick, 2002; Resnick, 2006). EDC's revised evaluation plan is designed to investigate whether the types of teacher professional development activities proposed in the ScratchEd proposal help teachers learn how to use design-based teaching strategies in their practice, and to see if these practices in turn support the development of students' computational thinking.

The evaluation will address two main research questions:

Q1. Do teachers who participate in ScratchEd professional development experiences change their use of Scratch in classroom instruction to create design-based learning opportunities? More specifically, do they move closer to using teaching strategies and techniques for understanding and evaluating the development of computational thinking, in three key areas:

a) instructional planning as they prepare to implement Scratch experiences in their classrooms

b) coaching or feedback interactions with students during learning experiences

c) assessment of students' thinking, use of computational concepts, and processes in the student projects

Q2. Do the students of teachers who participate in the ScratchEd PD activities show evidence of developing an understanding of computational thinking concepts and processes?

The evaluation will be designed to answer the research questions above and also to create a set of evaluation tools that can be integrated into the ScratchEd online resources so that they can be used by teachers and PD providers to support reflection. Our evaluation approach involves working with the project team – and in some cases the participants themselves – to create opportunities where artifacts that will normally be produced (lesson plans, student work on projects, classroom interactions, reflection journals or postings) are amplified for the purposes of the evaluation to show evidence of the development of computational thinking concepts and practices, as described in the framework created by the project developers.

It is our contention that tools and procedures that allow for reflection around these artifacts benefit not only the evaluation but the very process that ScratchEd intends to facilitate. Thus they benefit the participants as well as the researchers. If deemed successful they can become

elements used in ScratchEd itself going forward, providing sustained benefit beyond the evaluation study.

Instruments

We will work closely with the project team to create a set of instruments that assess whether teachers have understood the design-based approach to using Scratch in the classroom and whether they have understood how to recognize and evaluate the development of computational thinking in their students. We will use these instruments with a sample of ScratchEd participants at multiple stages of the project, to look at growth over time, and to determine whether levels of engagement in ScratchEd PD activities are associated with the level of impact.

1. *Teacher experience and Scratch experience survey*: This will be a brief survey that asks the respondent some basic questions about their teaching experience and how they have used Scratch in their teaching.
2. *Lesson plan artifact-based interview protocol*: This protocol will ask the teacher to bring in a lesson plan that involves Scratch and samples of student work from that lesson. They will be asked to describe the teaching strategies they use in their Scratch lesson, and to describe how they evaluate the student work. Responses to this interview will be coded to assess whether they understand the designed-based learning approach, whether they integrate key design-based strategies into the lesson, and whether they understand the kind of computational thinking development Scratch is intended to support.
3. *Classroom observation protocol*: This protocol will be closely aligned to the lesson plan interview protocol, and will be used to determine if the teacher uses design-based learning strategies in their teaching.
4. *Student work interview protocol*: The existing Scratch program has a sizable collection of study projects. We will work with the project team members to select student work samples that exemplify the use by students of key computational concepts and practices. We will pull together a common set of artifacts that explore teacher understanding of these elements. This protocol will ask teachers to comment on specific aspects of one example of a high-quality student work sample and an average-quality student work sample. Responses to this interview will be coded to assess whether the respondent can evaluate evidence of the development of computational thinking.
5. *Student sample rubric*: This rubric will be used to evaluate how well the work produced by a sample of students of the 20 teachers in the evaluation demonstrates the development of computational thinking. The student work will include not only a final product, but artifacts around that product, such as online discussions between the student and teachers or peers, and drafts of the product with student commentary about what changes were made and why.
6. *Student artifact-based interview protocol*: This protocol will be used with a sample of students from 10 of the teachers in the evaluation as they talk about their work sample. It will be aligned with the student sample rubric to assess whether students' reflections on their work show evidence of developing computational thinking abilities.

The instruments that evaluate student work (namely the *student work interview protocol*, the *student sample rubric*, and the *student artifact-based interview protocol*) will be aligned with the computational thinking framework developed by the MIT project team (see separate document). This framework will be used to determine whether the teachers can evaluate and/or students demonstrate a growing understanding of core *computational concepts* and an ability to engage in *computational practices*.

Addressing Research Question 1: Changes in Teacher Practice

To answer the first research question about the impact of ScratchEd PD offerings on teacher practice and knowledge, we will gather data from teachers at multiple stages of the project. The initial ScratchEd conference in the summer of 2010 will serve as the initial data gathering opportunity for evaluation participants. On the website about the conference we will provide information about the evaluation and what would be involved, and the incentives we will offer. From among all conference participants who provide contact information, we will purposefully select 20 teachers who represent a range of grade levels and teaching contexts to take part in the evaluation. Because it is likely that teachers who are interested in attending the conference are already using Scratch in their classroom, we will first request that the evaluation participants bring to the conference an example of a lesson plan that involves Scratch and samples of work students have produced as part of that lesson.

When the teachers arrive at the conference, the evaluators will have them take part in interviews in which they:

- Complete the *teacher experience and Scratch experience survey*
- Respond to the *lesson plan artifact-based interview*
- Review examples of student Scratch projects and answer *student work interview* questions

Over the two years of project implementation, the evaluators will collect data about which PD activities these 20 teachers participate in, building a profile for each evaluation participant. We will conduct the *lesson plan artifact-based interview* (using new lessons created by the teacher) and the *student work interview* (using different student samples) after the first year and second year of the project. The data from the successive administrations will be analyzed to determine if there is evidence of teacher change over time.

In addition, we will select 10 of the teachers and conduct classroom observations of their classes, to determine how well teachers' lesson plans reflect what actually takes place in the classroom. This will serve as a validation check on the *lesson plan artifact-based interview* instrument, as well as an additional source of evidence about teacher practice. Because we will have data about the level of participation in PD activities for each teacher, we will be able to determine whether greater levels of participation are associated with different levels and kinds of teacher change.

The *lesson plan artifact-based interview* and the *student work interview* instruments and coding schemes will be made available as self-evaluation tools for ScratchEd participants to use to measure their own growth and fidelity to the design-based learning approach.

Addressing Research Question 2: Changes in Student Learning

To answer the second research question, we will gather and review student work samples, including not only the projects but also student reflection around the projects, online discussions, drafts of the work and student presentations, from the teacher evaluation participants. We will collect the student work samples at multiple points over the course of the project. We will ask teachers participating in the evaluation to bring to the ScratchEd conference what they consider to be one exemplary and one average student work product, and will analyze these samples to determine if they reflect the development of computational thinking.

We will also select 10 teachers to visit and conduct *student artifact-based interviews* as they reflect on their work products, their online discussions, drafts and recorded presentations. This will serve as a validation of the rubric instrument, as well as a rich source of data about students' development of computational thinking skills. Because we will have information about the teachers' levels of participation in PD activities, and about how well they were able to understand the design-based learning approach and how to evaluate computational thinking, we will be able to analyze the student sample data in relation to these data to see if there are relationships among them.

The *student sample rubric* and the *student artifact-based interview protocol* will be made available as self-evaluation tools for ScratchEd participants to use to measure the quality of students work products.

Specific Responses to NSF Comments

NSF comment 1
The promised project evaluation would not answer the most important question: Can a thoughtfully planned program of teacher professional development lead to classroom implementation of the Scratch philosophy with fidelity and effectiveness?

The evaluation questions stated above, and the accompanying design, now specifically address this question.

NSF comment 2
It seems important to explain, in much more detail than your current proposal, the kind of computational thinking that you aim to develop in students.

The MIT project team has developed a more detailed framework describing the computational concepts and computational practices involved in the development of computational thinking (see separate document).

NSF comment 3

It seems important to expand the scope of your planned evaluation work to assess the extent to which appropriate Scratch experience actually develops the computational thinking that you aim for.

The evaluation described above has a much greater scope than the previous one. It focuses specifically on documenting student development of computational skills and teachers' developing understanding of how to support, identify, and evaluate these skills as teachers participate in PD activities.

NSF comment 4

Finally, the project should have explicit benchmarks and metrics to demonstrate that it is meeting those expanded goals.

The metrics we will use will be derived from the computational thinking framework articulated by the MIT project team.

NSF comment 5

Your evaluator could then design a study testing the claim that students whose teachers participate in your special PD activities produce Scratch projects showing evidence of better computational thinking than projects by students whose teachers have not been part of the ScratchEd community.

At this point in time, we think it is premature to attempt to set up a comparison between teachers experiencing ScratchEd and their students' projects and those teachers' students' projects who do not participate. There are too many variables to adequately control and there are not valid ways to set up matched samples of teachers and students across the two conditions, which would be a necessary precondition for any legitimate outcome comparison. In addition, the kind of teacher assignments and student work products created in classrooms using Scratch may not be directly comparable to assignments and products in non-Scratch classrooms.

However, by gathering baseline data about teachers' understanding of design-based learning, and the kind of work produced by their students before participation in the PD activities and comparing it to the same data at different stages of the project, we believe this evaluation will be able to demonstrate change in teacher and student learning over time, if that occurs. In addition, because we will keep track of which activities each teacher participates in, we will be able to see if there is a relationship between the level of participation and the amount of teacher change and student development.

The development of these data collection instruments and processes, if this proposed research shows them to be useable in ways that provide valid assessments of what teachers do in practice and if they have enough fidelity to distinguish reliably between teachers in various stages of understanding and skill in using the computational thinking framework productively, may lay the groundwork for some future research that compares teachers using Scratch and other teachers.

NSF comment 6

They could also study the extent to which students engaging with Scratch from any point of contact do indeed develop the computational thinking and design skills and dispositions that you aim for.

By examining student work and student feedback on their work from students in the classrooms of teachers in the evaluation at multiple stages of the project, we will be able to see if student learning of computational concepts and processes changes over time. Because we will have information about teachers' participation in PD activities we will be able to show relationships between PD participation and student impact, if there are any. Because this is an evaluation of ScratchEd, and not Scratch, we would not look at the work of students who access Scratch from "points of contact" other than through their teachers.

NSF comment 7

The evaluator could also design a study exploring the claim that participation in your special PD efforts will lead teachers to implement Scratch in ways that are more faithful to its design-based learning philosophy and not traditional "instructionist" patterns. The basic aim of such studies would be to test the efficacy of your planned PD activities in changing teaching practice and improving student learning, two aims that do not appear to be addressed by the evaluation plans of your original proposal.

We believe that the evaluation design described above will address this point. By collecting data at multiple points in the program that shows the level of teachers' understanding about how to develop design-based assignments, how to engage in classroom instruction that reflects design-based learning strategies and how to evaluate the development of computational thinking in students, we will be able to see if teachers change their practice, and if their understanding of computational thinking changes, over time. In addition, by examining student work and student feedback on their work at multiple stages of the project, we will be able to see if student learning of computational concepts and processes changes over time.