iDesign:
Developing Technological Fluency through Culturally-Relevant Game Design

YEAR 1 REPORT

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EXECUTIVE SUMMARY

Introduction

This report is the year-end process evaluation for the first year of the *iDesign* project, a three-year, National Science Foundation ITEST-funded project to teach serious game design and programming skills to adolescents. *iDesign* takes an innovative approach to increasing underrepresented youths' motivation toward and interest in STEM activities by infusing *culturally relevant pedagogy* (Ladson-Billings, 1992, 1995) into the game design curriculum. Once completed, the yearlong after-school curriculum and accompanying professional development materials will prepare educators to introduce students to principles of serious game design in clubhouse settings.

A major objective of the project is to help youth aged 11–14 develop technological fluency and engage in creative, technology-rich activities using skills and practices that are applicable in school and future STEM-related careers. Led by principal investigators at Hofstra University, the project is especially concerned with broadening participation in STEM-related fields by developing a curriculum and fostering supportive and collaborative informal learning environments that engage the interests of young people from groups often underrepresented in STEM areas, such as girls and members of non-dominant and low-income communities. Therefore, a key goal of the *iDesign* project is to familiarize middle and high school students from non-dominant groups with ways they can prepare themselves to move forward in science and technology in high school and eventually in college majors and career paths.

The project achieved many of its intended outputs in its first year, including:

- Delivery of a complete course of six professional development sessions;
- The creation of half of the projected 30 lessons for the final curriculum;
- Recruitment of teachers from schools that include large numbers of youth from targeted populations;
- Retaining approximately 75% of the teachers it recruited and adding three more teachers who will begin in the second year; and
- Teacher delivery of at least 75% of the available instructional material to approximately 120 students.

Participating teachers are enthusiastic and excited to continue their participation in the second year. In interviews, many commented on the high quality of the curriculum and professional development activities and are eager to contribute their own knowledge of teaching practices as the curriculum development continues. All of the teachers noted the value of creating a program of activities for informal environments in which students who are underrepresented in STEM fields have opportunities to build skills and practices by linking their own cultural experiences to digital game design.

The Education Development Center, Inc.'s Center for Children and Technology (EDC | CCT) is the project evaluation partner and conducted a process evaluation of the first year activities between October 2013 and June 2014. The goal of the evaluation—the first of three over the term of the project—was to analyze the initial development and implementation of materials and activities and assess whether the logic model/theory of action was implemented as planned and whether it produced the expected outputs.

Year 1 project activities

To accomplish their objectives, the project leaders invested their resources in three broad sets of materials and activities during the first year: (1) Development of a culturally responsive serious game design curriculum for students in grades 6–9; (2) Development of accompanying professional development materials for teachers and summer training institutes for youth leaders; and (3) Teacher-led implementation of the game design curriculum in the second and third years of the project. Global Kids, Inc., a non-profit educational organization for global learning and urban youth development based in New York City, is partnering with Hofstra to develop the *iDesign* curriculum.

Process evaluation questions

This report addresses the following four questions:

Q1. What resources were committed to the project?
Q2. How were the proposed activities implemented?
Q3. How many activities were completed and how many participants engaged in them?
Q4. In what ways do the completed development and research activities contribute to the ongoing development of the intervention?

Sites and participants

The project recruited eight public middle and high schools in New York City and Nassau County, Long Island to participate in the first year; five launched clubhouses. Of the 13 teachers recruited, ten led after-school clubhouses between January and June 2014 at the five sites. Approximately 120 students in grades 6–9—~100 boys (83%) and ~20 girls (17%)—participated during the first year. Nearly 60% (n=70) of the students were in the 6th grade; 38% (n=46) were in the 7th and 8th grades; and 6% (n=7) were in the 9th grade.[1] The majority of the sites serve youth from populations that are typically underrepresented in STEM-related academic programs and careers.

Data collection and analysis methods

EDC | CCT evaluators used the following methods to collect data:

1. Student attendance records for after-school clubhouse meetings and teacher attendance records for Saturday teacher training sessions

[1] All numbers are approximations, thus they do not add to 100%.

2. Evaluator observations of clubhouse activities and professional development activities during teacher trainings
3. Surveys delivered after teacher trainings
4. Interviews with teachers

We used descriptive statistics from surveys and attendance records to quantify the amount of participation and number of activities completed (Q1–Q3). To analyze the degree to which the development and research activities contribute to the project objectives (Q4), we conducted a thematic analysis of observation and interview notes and open-ended responses to the surveys.

Findings

Q1. What resources were committed to the project?

- Due to the United States federal government shutdown from 10/1/2013–10/16/2013 and a delayed release of grant funds from the National Science Foundation, the project started two months later than expected.
- During a series of working sessions, the Hofstra leadership applied their own expertise in the areas of educational technology, pedagogy, and computer science, along with the youth programming expertise of Global Kids, to create a part of the curriculum and professional development materials. EDC provided feedback on drafts of materials when they were shared.
- With the support of two graduate students, Hofstra faculty built the pilot version of the *Playbook,* the online content management system for *iDesign* clubhouses.
- Global Kids provided space and materials for the Saturday teacher training workshops between November 2013 and May 2014.
- Hofstra supplied each site with materials to support the curriculum activities.
- Global Kids invited all *iDesign* participating youth to its annual Youth Leadership Conference in April 2014.

Q2. How were the proposed activities implemented?

- The project team met as a group for two hours (face-to-face and virtually) six times from October 2013–June 2014, for a total of 12 hours.
- At least one of the Hofstra principal investigators met with Global Kids curriculum developers once or twice a month from October 2013–April 2014.
- At least one of the Hofstra principal investigators met with the graduate students weekly to design and develop the *Playbook* and edit the curriculum.
- Global Kids delivered six, 4.5-hour professional development sessions on Saturdays.

Q3. How many activities were completed and how many participants engaged in them?

- Six public middle schools and two public high schools from New York City and Nassau County, Long Island served as clubhouse sites; five sites ran clubhouses through the end of the school year.

- Thirteen subject-area teachers (8 female, 5 male) in grades 6–9 were recruited to participate in the project; one teacher withdrew in early 2014 and two did not start clubhouses in the first year. Thus, a total of 10 teachers ran after-school clubhouses at least part of the school year between January and June 2014.
- Participating teachers received a total of 27 hours of professional development during six Saturday training sessions between November 2013 and May 2015.
- Approximately 120 students in grades 6–9—~100 boys (83%) and ~20 girls (17%)—enrolled in the *iDesign* clubhouses at the five sites that participated through the end of the first year.
- A median of 13 students per site attended at least 16, 90-minute clubhouse meetings between January and June 2014 (for a minimum total of 24 hours).
- The project developed the pilot version of the *Playbook;* a fully functioning version will be available to teachers and students beginning in summer 2014.
- One site (Herricks Middle School) sent eight students to the Global Kids conference.
- The project created 13 of the projected 30, 90-minute lessons.
- All teachers reported they had completed at least 10 lessons and the majority reported they had completed 12 of the 13.
- The project recruited an additional 3 elementary and middle school teachers, all of who will begin with the second year summer institutes in July 2014.

Q4.In what ways do the completed development and research activities contribute to the ongoing development of the intervention?

- Lessons and activities that included game design and game play were the most successful from teachers' perspectives. These activities had (1) clearly defined objectives; (2) ways for students to see the effects of changes they made on the games; (3) peer-generated feedback they could use; (4) opportunities to share ideas with others; and (5) a consistent focus on games and game play.
- The game design lessons satisfied most teachers' desire to lead activities that had clear goals, endings, and that did not require significant technical expertise to implement
- As currently conceived, the curriculum and professional development materials assume that teachers can master individual segments of the serious game design program and that they are able to link those segments together to deliver a seamless experience for their students. This was not true for participating teachers.
- Three challenges prevented teachers from implementing the extant curriculum in ways they felt were most beneficial to their students and that satisfied the project objectives as they understood them: (1) Uncertainty about the project's overall objectives; (2) Perceptions of a lack of coherence among the curriculum components and with the professional development activities; and (3) Unclear

guidance on how to use specific strategies to integrate the curriculum components and specific skills in *Scratch* and computer programming.

Recommendations for Year 2

- ***Recommendation 1. "Glue the pieces together":*** Consider running the three core curriculum components—design, research, and development—concurrently, rather than serially, to enable teachers and students to link them conceptually through practice from the beginning of the clubhouses and professional development sessions.
- ***Recommendation 2. Provide unifying goals and make them explicit:*** Use the National STEM Video Game Challenge—or something similar—as a goal toward which teachers and students can work. This type of goal can instigate backwards planning from the submission dates.
- ***Recommendation 3. Help teachers navigate the tension between a clubhouse and a classroom:*** By integrating the design, research, and development activities earlier in the activities, teachers might be in a better position to manage their students' expectations about the work/play ratio.
- ***Recommendation 4. Consider using a studio-based model in the PD and the clubhouses:*** By ensuring that design, research, and development activities are included in every lesson, students will have opportunities to create, critique and share feedback, and re-design regularly.
- ***Recommendation 5. Make the PD and curriculum more teacher- and student-friendly***
- ***Recommendation 6. Share draft materials more frequently***

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SECTION I. INTRODUCTION

About the *iDesign* project

iDesign teaches serious game design and programming skills to adolescents to help them develop technological fluency and engage in creative, technology-rich activities using skills and practices that are applicable in school and future STEM-related careers. As ITEST[†] *Strategies* grantees funded by the National Science Foundation, the project leadership's main objective is to develop and implement a scalable, 30-week after-school game design curriculum that uses project-based methods to give youth opportunities to build skills and practices that enable them to conceptualize and create serious games based on topics in which they are personally invested. With ongoing professional development, trained educators in the project will help youth use those experiences as catalysts for thinking about future academic and career trajectories. *iDesign* is especially concerned with broadening participation in STEM-related fields by developing a curriculum and fostering supportive informal learning environments that engage the interests of young people from groups that are frequently underrepresented in STEM-related fields, such as girls and members of non-dominant and low-income communities.

Led by investigators at Hofstra University, *iDesign* takes an innovative approach to increasing underrepresented youths' motivation toward and interest in STEM activities by infusing *culturally relevant pedagogy* (Ladson-Billings, 1992, 1995) into the game design curriculum. Once completed, the yearlong after-school curriculum and accompanying professional development materials will prepare educators to introduce students to principles of serious game design in clubhouse settings. Concurrent to the design activities, students brainstorm and investigate issues and topics they feel have personal import, or that are relevant to the various communities in which they live and participate. By using programming strategies and the mechanics of game play to express their perspectives, or to attempt to persuade others toward their understanding of how people, places, and things might influence events, youth have opportunities to use computational thinking practices to express and share their views on topics that matter to them.

The primary design technologies for the teacher professional development and youth clubhouse activities are *Scratch*, a free programming language and online community created specifically to introduce 8–16 year olds to computer programming; and *Gamestar Mechanic*, a digital game and online community that familiarizes youth with principles of game design and systems thinking.

Year 1 of the three-year project concluded in June 2014 and the second year begins in July 2014 with two, one-week summer institutes. New and continuing teachers will

[†] Innovative Technology Experiences for Students and Teachers

convene on the Hofstra University campus in Hempstead, NY during the first week for professional development on game design and programming, as well as to practice routines for helping students conceptualize, design, and develop serious games based on problems and issues they identify and analyze through research. In the second weeklong institute, a small group of students from each clubhouse will advance their skills in game design and development, in addition to training to become student leaders and mentors to new students in the second year.

Overview of the report

This report is the year-end process evaluation for the first year of the *iDesign* project and addresses the following questions:

1. What resources were committed to the project?
2. How were the proposed activities implemented?
3. How many activities were completed and how many participants engaged in them?
4. In what ways do the completed development and research activities contribute to the ongoing development of the intervention?

Following an explanation of the project's logic model and theory of change, we briefly discuss the conceptual framework that informs the design of the curriculum and professional development materials; describe the data collection and analysis methods and provide evaluator credentials; review the project activities; and synthesize our findings under headings derived from the logic model. We conclude with recommendations for how to use findings from this evaluation to make adjustments to the program implementation beginning with the summer 2014 student and teacher institutes.

Definitions

Several terms used throughout this report should be defined to assist in interpreting the report's findings:

- *Computational thinking:* Wing (2006) argued that computational thinking, "involves solving problems, designing systems, and understanding human behavior, by drawing on the concepts fundamental to computer science. Computational thinking includes a range of mental tools that reflect the breadth of the field of computer science" (p. 33).
- *Culturally relevant pedagogy:* Gay (2010) defined culturally relevant teaching as "a means for unleashing the higher learning potentials of ethnically diverse students by simultaneously cultivating their academic and psychosocial abilities (p. 21).
- *Gamestar Mechanic:* A digital game and online community that familiarizes youth with principles of game design and systems thinking

- *Game design elements:* In *Gamestar Mechanic,* there are five basic game design elements: Space, Components, Mechanics, Goals, and Rules
- *Scratch:* a free programming language and online community created specifically to introduce 8–16 year olds to computer programming
- *Serious game:* Abt (1970) defined serious games as those that "have an explicit and carefully thought-out educational purpose and are not intended to be played primarily for amusement" (p. 9).
- *Technological fluency:* According to Resnick, Rusk, and Cooke (1998), technological fluency includes knowing "how to use technological tools, but also knowing how to construct things of significance with those tools. A technologically fluent person should be able to go from the germ of an intuitive idea to the implementation of a technological project" (p. 266).

Project logic model and theory of change

The chronic underrepresentation of women and individuals from non-dominant and high-poverty communities in science careers, activities, and interests (U.S. Census Bureau, 2013) necessitates innovative approaches to providing members of these groups with educational experiences that could help inspire them to participate in those fields. A key goal of the *iDesign* project is to familiarize middle and high school students with ways they can prepare themselves to move forward in science and technology in high school and eventually in college majors and career paths, thereby contributing to a more diverse STEM workforce. According to the project's implicit theory of action, a systematic approach to serious game design, with the support of trained teachers, enables youth to practice important STEM skills and use their experiences as opportunities to imagine careers in STEM-related professions.

A major hypothesis of the project is that classroom teachers from a variety of subject areas, but who are familiar with the project principles, comfortable with curriculum concepts and activities, and knowledgeable about game design tools and computer programming following professional development will be more successful in improving students' technological fluency skills in an informal setting. Consequently, students' successes with game design and development should contribute to greater awareness of STEM-related careers that value those skills, more confidence in their ability to imagine themselves in one or more of those professions, and sustainable interest in pursuing a STEM academic or career trajectory. Figure 1, below, illustrates the logic model that guides the project, as well as the plans for process, formative, and summative evaluation.

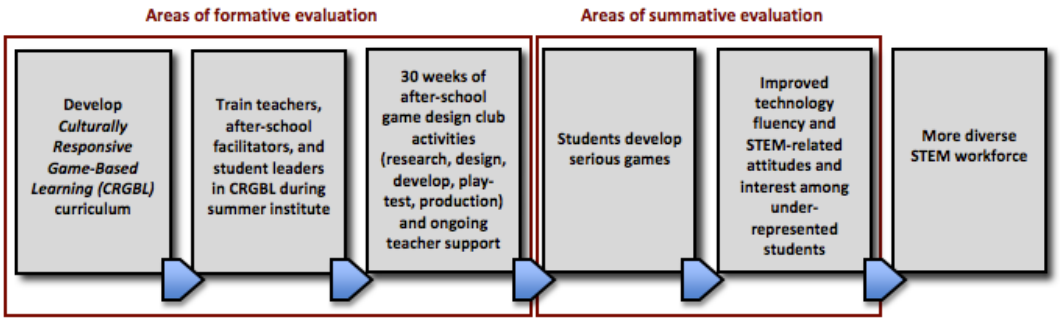


Figure 1: *iDesign* project logic model

Conceptual framework

Culturally relevant pedagogy. Culturally relevant pedagogy enables learners to bridge experiences in their own cultural context to classroom learning activities. As argued by Ladson-Billings (1995),

> Culturally relevant pedagogy rests on three criteria or propositions: (a) Students must experience academic success; (b) students must develop and/or maintain cultural competence; and (c) students must develop a critical consciousness through which they challenge the status quo of the current social order. (p. 106)

With the goal of achieving equity in education, culturally relevant teaching provides opportunities for students from non-dominant communities to use experiences in their cultures and environments outside of school to make sense of what they learn in school. In this frame, school is an extension and reflection of the community in which it exists, rather than an isolated institution that requires its learners to check their unique cultural perspectives at the entrance.

Game-based learning. Making video games may have the potential for learners to design boundaries across game design elements through self-exploration and engagement with an academic topic. Through the analysis of video game players' interests in games, and their attractions to computer programming, Turkle (1984) identified an attraction between the two:

> When you play a game, you are the player in a game programmed by someone else. When children begin to do their own programming, they are not deciphering someone else's mystery. They become players in their own game, makers of their own mysteries, and enter in a new relationship with the computer, one in which they begin to experience it as a kind of second self. (p. 92)

As the theoretical framework of constructionism emerges when game-based learning is paired with computer programming, it parallels project-based teaching and learning as an avenue for game making.

Computational thinking. The term "computational thinking" includes concepts commonly found in the field of computer science but that are adopted through other contexts of making and creating in programming environments (Guzdial, 2008; Wing, 2006, 2008). *Scratch* is a visual, object-oriented programming language that enables students to learn computational ideas through design-based approaches (Resnick, 2002; Resnick, 2006; Resnick, Rusk & Cooke, 1998). To practice computational thinking means not only understanding computational concepts such as "loops," "conditionals," "events," and "sequences," but also to engage in computational practices. The practices are programming "habits of mind," which include:

- *Experimenting and iterating:* Develop a little bit, try it, and develop some more
- *Testing and debugging:* Make sure things work and find and solve problems when they arise
- *Reusing and remixing:* Make something by building on existing projects or ideas
- *Abstracting and modularizing:* Explore connections between the whole and the parts

SECTION II. EVALUATION METHOD

This report describes and analyzes project activities for the first three components of the logic model (Figure 1, above): (1) Develop a culturally responsive game design curriculum; (2) Train teachers and student leaders during teacher trainings and summer institutes; and (3) Implement a 30-week after-school game design curriculum. The details of these first-year activities are listed in Table 1, below.

Table 1: *iDesign* project activity overview: Year 1

1. Develop a culturally responsive game design curriculum >>>>>>	2. Train teachers and student leaders during teacher trainings and summer institutes >>>>>>	3. Implement a 30-week after-school game design curriculum
▪ Hold project team meetings ▪ Develop curriculum materials and activities ▪ Develop the "Playbook," the *iDesign* content management system	▪ Recruit sites and teachers ▪ Develop teacher training materials ▪ Provide professional development on: principles of game design; playing *Gamestar Mechanic*, and programming with *Scratch* ▪ Provide professional development on culturally relevant pedagogy	▪ Recruit students ▪ Run clubhouse routines ▪ Run student activities ▪ Use Playbook to track student work and progress

Process evaluation questions

As noted, the report answers the following four questions:

Q1. What resources were committed to the project?
Q2. How were the proposed activities implemented?
Q3. How many activities were completed and how many participants engaged in them?
Q4. In what ways do the completed development and research activities contribute to the ongoing development of the intervention?

A process evaluation is not summative. That is, this report does not measure program impacts. Rather, it describes and analyzes the initial development and implementation of the project resources and assesses whether activities in the logic model were implemented as planned and whether they produced the expected outputs. The goal is to improve the likelihood that the *iDesign* leadership achieves its third year impact objectives by verifying that project implementation proceeds as planned and, when it does not, to make recommendations for how to improve it or make changes to the theory of action.

Data collection and analysis methods

Process evaluation uses descriptive research methods to compare the intended program implementation to the one that occurred (Stufflebeam & Shinkfield, 2007). EDC | CCT evaluators used the following methods to collect data about Year 1 program implementation:

1. Student attendance records for after-school clubhouse meetings and teacher attendance records for Saturday teacher training sessions
2. Evaluator observations of clubhouse activities and professional development activities during teacher trainings
3. Surveys delivered after teacher trainings
4. Interviews with teachers at the end of the year

The evaluators and other project team members observed teaching routines and student activities in each clubhouse at least once between January and June 2014 (see Appendix A for the observation protocol). EDC also observed all six Saturday teacher trainings between December 2013 and June 2014 and administered online surveys to teachers at the end of each session (see Appendices B and C). Finally, we interviewed teachers—individually and in pairs, depending on the site—at the end of the year (Appendix D).

We used descriptive statistics from surveys and attendance records to describe the amount of participation and number of activities completed (Q1–Q3). To analyze the degree to which the development and research activities contribute to the project objectives (Q4), we did a thematic analysis of observation and interview notes and open-ended responses to the surveys (Saldaña, 2013).

In addition to this year-end report, EDC evaluators submitted a process memo to the project leadership in January 2014, which described activities from the first three teacher training workshops and made suggestions for additional activities in future workshops (Appendix E).

Evaluator credentials—About EDC | CCT

Since 1981, the Center for Children & Technology (CCT) has been at the forefront of creating and researching new ways to foster learning and improve teaching through the thoughtful implementation of new educational technologies. CCT is the New York City office of Education Development Center, Inc. (EDC), a global nonprofit organization headquartered in Waltham, Massachusetts, that creates learning opportunities for people throughout the world, empowering them to pursue healthier, more productive lives. Since its inception, CCT has instigated, investigated, and informed new approaches that foster learning and improve teaching through the development and thoughtful use of educational technologies. CCT's philosophy is that research is genuinely valuable only if it yields information that can improve program and practice. Because of this, CCT has a strong track record of partnering on educational technology initiatives with many different types of organizations.

SECTION III. PROJECT IMPLEMENTATION

Overview

In this section we answer the first three evaluation questions (page 6, above) by describing the project activities. In Section IV, we answer the final question about whether and how activities contributed to *iDesign* project implementation.

As detailed in Table 1 above (page 6), the three main activities for the first year were to: Create the curriculum (a collaboration between Hofstra faculty and Global Kids developers); deliver teacher professional development (led by Global Kids); and implement the curriculum in after-school clubhouses (led by teachers). The shutdown of the United States federal government in October 2013 delayed the curriculum development and the professional development trainings by approximately two months. Consequently, curriculum development did not begin formally until late October 2013; teacher professional development began in November 2013 and ran through May 2014; and the after-school clubhouses began in January 2014 and concluded in June 2014.

The ongoing *curriculum development* entails collaboration between Hofstra and Global Kids to adapt an existing curriculum, *Playing 4 Keeps,* which trains urban youth to think critically about social issues and use game designs to express them. Hofstra added teaching routines to the existing serious game design activities to support teachers' efforts to help their students use elements of game design (such as the manipulation of game features and storytelling) and their programming skills to develop games that incorporated topics that mattered to them. By May 2014, the project created 13 of the projected 30, 90-minute lessons.

Global Kids led six, daylong *professional development* sessions between November 2013 and May 2014. The goal of these sessions was to introduce teachers to the weekly curriculum activities; to have teachers experience the activities as their students would in the clubhouses; to introduce them to game design principles and culturally relevant pedagogy; and to familiarize them with the technologies students would use to create their games. Finally, the teachers led the *curriculum implementation* between January and May 2014 in weekly after-school clubhouses.

Project team

iDesign is led by three faculty members from Hofstra University: Dr. Roberto Joseph (Principal Investigator; Educational Technology); Dr. Eustace Thompson (Co-Principal Investigator; Teaching, Literacy and Leadership); and Dr. Xiang Fu (Co-Principal Investigator; Computer Science). Global Kids, Inc., a non-profit educational organization for global learning and urban youth development based in New York City, is partnering with the Hofstra faculty to develop the *iDesign* curriculum. Global Kids staff have expertise in developing programs to help youth use digital

technologies to express themselves and participate in communities as local and global citizens.

Two other organizations support the project. The New York State After-School Network (NYSAN) is responsible for connecting the *iDesign* project to their coalition of after-school and community-based organizations across New York State and nationally and to provide the project leadership with insight into best practices and helping it to disseminate lessons learned. Finally, EDC | CCT serves as the external evaluator on this project and is responsible for conducting all phases of the evaluation.

Recruiting procedures and participant data

Site recruiting. Table 2, below, contains overview information about the participating schools, including student demographic data. Six middle and two high schools in New York City and Nassau County, Long Island participated in the first year. In all cases, the project leaders chose schools because they had existing relationships with the administration and because the schools have a significant population of students from non-dominant communities. Global Kids has a unique relationship with the High School for Global Citizenship (HSGC), as it founded the small high school in 2004. Students at HSGC have opportunities to participate in programs that have a theme of global citizenship. The majority of these schools serve populations of youth who are typically underrepresented in STEM academic programs and careers.

Table 2: Participating school sites

Site	Location	Teachers[‡]	Type	Grades	School demographic data	% of students eligible for free or reduced-price lunch program
J.W. Dodd Middle School	Freeport, NY	Georgia Lambrinos, Kristen Wrigley	Public, Suburban	7–8	54% Hispanic; 38% Black; 7% White; 1% Asian or Asian/Pacific Islander	61%
Herricks Middle School	New Hyde Park, NY	Ashley Vertucci, Larry Sinacori	Public, Suburban	6–8	52% Asian or Asian/Pacific Islander; 41% White; 6% Hispanic	5%

[‡] **NB:** This version of the report is for **INTERNAL PURPOSES ONLY.** All identifying information for participants and sites must be removed before distributing the report beyond the project leadership team. A second version of the report will replace the names of people and places with pseudonyms.

Site	Location	Teachers‡	Type	Grades	School demographic data	% of students eligible for free or reduced-price lunch program
High School for Global Citizenship (HSGC)	Brooklyn, NY	Beth Hiskey, Mark Stillwell	Public, Urban	9–12	89% Black; 8% Hispanic; 1% American Indian/Alaskan Native; 1% Asian or Asian/Pacific Islander	64%
Lawrence Road Middle School	Hempstead, NY	Marsha Williams	Public, Suburban	6–8	55% Black; 43% Hispanic; 1% Asian or Asian/Pacific Islander	66%
P.S. 109	Brooklyn, NY	Joanne Burgos, Marianne Moyer	Public, Urban	K–8	76% Black; 21% Hispanic; 2% White; 1% Asian or Asian/Pacific Islander	85%
Turtle Hook Middle School	Uniondale, NY	Catherine Visconti	Public, Suburban	6–8	50% Black; 21% Hispanic; 2% White; 1% Asian or Asian/Pacific Islander	56%
Uniondale High School	Uniondale, NY	Anil Gangji, Jonathan Gosset	Public, Suburban	9–12	58% Black; 40% Hispanic; 1% Asian or Asian/Pacific Islander	45%
Westbury Middle School	Westbury, NY	Nasser Borno	Public, Suburban	6–8	62% Hispanic; 36% Black; 2% White; 1% Asian or Asian/Pacific Islander	86%

Teacher recruiting. After meeting with the Hofstra faculty in summer and early fall 2013, school and district administrators identified teachers whom they thought would be interested and qualified to lead the clubhouses. Thirteen middle and high school teachers (8 female, 5 male) attended the second teacher training session (four teachers were unable to attend the first workshop) at the Global Kids office in New York City in November 2013. Of those, one teacher (Turtle Hook Middle School) left the program in early spring 2014 because the time commitment exceeded her original expectations and three participated (Westbury Middle School, Uniondale High School), with varying frequencies, only in the professional development sessions because their clubhouses will not begin until September 2014. Consequently, 10

teachers ran afterschool clubhouses for at least part of the school year between December 2013 and June 2014.

The project succeeded in recruiting seasoned teachers from a variety of subject areas. Of the 13 who participated in the second teacher training (four were unable to attend the first training), a majority (n=8) taught STEM subjects (Biology, Chemistry, Earth Science, and Math). But the group also included three Social Studies teachers, two Technology teachers, and one Art teacher. The total group comprises primarily veteran teachers: the majority (n=10) has taught for nine or more years (4 of them teaching for 15 or more years), while three have taught for one or two years. As their highest degree earned, 10 of the teachers hold a Master's degree; two hold a Bachelor's degree; and one holds a Ph.D.

All teachers received a per session rate for each hour they participated in the project, to a maximum of $3500.00. The project also reimbursed teachers for any out-of-pocket expenses they incurred, such as for snacks for students or travel expenses into New York City.

In online surveys following the first and second training sessions, the teachers noted a variety of reasons for their interest in participating in the project, but all comments suggested at least one of four primary motives: improving their students' skills with technology or problem-solving (n=4); co-constructing a curriculum with other educators (n=3); engaging their students with a technology such as digital games (n=3); or improving their own technology skills (n=3). Example comments include:

- *I know my students are interested in gaming and coding, so I would love to provide them with support to access this material. I also appreciate the idea of tuning students towards (academic) computer skills earlier in their educational careers, for reasons of both motivation and professional skills. I am also excited to learn more about programming myself.*
- *Being able to develop and form the program as we go along*
- *I think that brain storming with other professionals and students will help broaden the base for which this program is designed*
- *This program will force students to think outside of the box versus using a "cookie cutter" approach to finding an answer to a problem. Many students in my district are taught how to take a test. This is an entirely different aspect of learning.*
- *I think that participation in* iDesign *will benefit me in that I will learn new technology concerning game design and be able to work with and teach students about something of interest to them (gaming) and eventually work with colleagues so that they too can do the same for the students in a fun and interesting ways.*

The teachers also responded to a survey question about potential challenges they might face when teaching the curriculum. Here, teachers' comments tended to express concerns about one of three topics: their own perceived lack of technology skills (n=4);

lower literacy and/or problem-solving abilities among their student population (n=4); or a lack of adequate resources or support from the project leadership (n=4). Example comments include:

- *I fear that some of the activities, vocabulary, and tasks on the websites may be too difficult for the lower level reading and math students we have in our district.*
- *My students often need a lot of scaffolding to reach their objectives, so I am interested to see what level of support students need to make their own games. I am hoping my co-club leader and I stay far enough ahead of the students technologically for the club to run smoothly, or are well informed enough to help students problem-solve.*
- *At the moment, the greatest obstacle seems to be many questions that we have about the actual structure of the program and how it will be implemented.*
- *The challenges may be possibly the lack of adequate resources available to me or my students in implementing the program 'correctly'. Also, the possibility that I may not be available for a crucial future workshop.*

Teachers' previous technology experience. While all of the teachers reported using some form of technology in their regular instructional practices, most commented that they used it for routine purposes such as displaying notes on a SMART Board or assigning digital games for drilling, rather than for student-driven activities such as digital storytelling or video production. An exception was the Technology teacher, who uses production-oriented activities and materials, such as Lego Mindstorms, with her students regularly. The majority (n=8) reported they had some experience with computer programming, but only two indicated they had used specific programming languages, such as Java or Pascal. The rest reported using HTML and Cascading Style Sheets (CSS) (n=5) or JavaScript (n=1) to maintain personal or school web pages. Three of the teachers indicated that they had experience with at least one of the two primary technologies students use in *iDesign: Scratch* (n=2) and *Gamestar Mechanic* (n=2), though none of them had used these with students before the project. In face-to-face interviews with seven teachers at the end of the year, three of the seven said they were "uncomfortable" or "very uncomfortable" with using technology for instructional purposes. The other four teachers expressed varying levels of comfort.

Teachers' previous experience using games in the classroom. The majority (n=12) reported using games in their teaching practices before participating in the project. Of those, seven included *Jeopardy*, a quiz game-approach for content knowledge review, as an example. Two of the 12 noted that they used games for purposes other than drilling. One teacher wrote, "I have implemented math games through the Everyday Math program as well as a variety of other board games, card games, & trivia games as visual and tactile components to help with community building, social skills, and academic concepts." And a social studies teacher reported using digital games such as *Do I Have a Right?* and *Argument Wars,* which include some opportunities for problem solving about American civics issues and problems. None of the teachers had designed games of their own in the past.

Teachers' previous experience with culturally relevant pedagogy. Five of the 13 teachers reported that they had prior experience with culturally relevant pedagogy. The following quotes exemplify the two ways the teachers described their use of the instructional practices. The first two quotes, from the Art teacher and an English teacher (both high school teachers), suggest exercises that might link the instructional activities to lived experiences among actual cultures and communities. The other two quotes appear to make more surface-level connections between behaviors, without necessarily exploring meaning:

- *I have developed art lessons based on the art and philosophy of the Black Panthers. The themes with that lesson touched upon activism within the community. I am currently developing a lesson based on Martin Luther King's six principles of non-violence. I will modify a past lesson based on the work of Keith Haring, whose work references a number of the principles of non-violence.*
- *I was trying to make my English curriculum more about how students perceived the world and how they could make a change, that they could change things and have an opinion about the world.*
- *In my school, we are encouraged to present culturally-relevant lessons especially during periods of time such as Hispanic Heritage Month and Black History Month*
- *Because I teach in a culturally diverse school students have certain restrictions on how or when they can study and if they can or cannot use television or Internet access.*

Explanations from the eight teachers who did not have previous experience with culturally relevant pedagogy suggest one of two orientations toward the term: a "critical consciousness" orientation (n=4), or a "multicultural" orientation (n=4). Following are two example quotes from both, respectively:

- *I believe "culturally-relevant pedagogy or curricula" means curriculum with a social conscience that looks at pressing social issues that affect our world and, ideally, our students. Students might consider issues of race, class, and privilege and would learn to think critically about the world around them.*
- *I think that culturally relevant pedagogy & curricula involves social and cultural situations and challenges that are prevalent amongst some communities in NYC. The development of a curriculum or project that can help address some of theses issues for today's youth.*
- *Differentiating instruction, adding items/term/vocabulary from cultures represented by the students in the classroom to make topic more relevant to them.*
- *It might mean having a curriculum that touches on certain cultures or standards. In my classroom, it might be one where any particular aspects of my students' culture will be tapped into when they are creating their own content or doing a project.*

Student recruiting. Of the five sites that ran clubs through the end of the year, two were selective about student participation (J.W. Dodd and Lawrence Road Middle Schools) and three (Herricks Middle School, P.S. 109, and High School for Global

Citizenship) allowed all interested students to participate, though the HSGC administration limited eligible students to the 9th grade. During interviews, the teachers discussed a variety of methods for recruiting students. At J.W. Dodd Middle School, for example, the school administration selected 20 students (10 boys and 10 girls) whom one teacher identified as, "the top of the top." The school principal told the students that attendance was mandatory (pending parental permission) and teachers told them "it was an honor to be here." In contrast, Herricks Middle School recruited 70 students—64 boys and 6 girls—following one morning announcement over the school PA system. One teacher commented that, "We decided not to turn anybody away, especially since there were kids that neither of us had worked with before."

During follow-up interviews, all teachers reported that they made special efforts to recruit girls into the program, including "identifying the gamer girls" and speaking one-on-one with girls from their classes who they thought would not be intimidated. With one exception (Freeport, where attendance was mandatory), all sites noted the challenge of recruiting and retaining girls into the program, primarily due to perceptions that "gaming is a boy thing" or because, "at this age, it's all about who you associate with and most girls don't want to be associated with the gamers."

Approximately 120 students (80% of the target goal of 150 students in the first year) in grades 6–9 enrolled in the *iDesign* clubhouses at the five sites that participated through the end of the first year. In total, there were approximately 100 boys (83%) and 20 girls (17%). Nearly 60% (n=70) of the students were in the 6th grade; 38% (n=46) were in the 7th and 8th grades; and 6% (n=7) were in the 9th grade.[§] Though four of the five clubhouses lost between 20–60% of their total number of students between December 2013 and June 2014, most consistently maintained an average of at least 50% of their original number of students. Table 3, below, lists student attendance data for each site.

Table 3: Student attendance data

Clubhouse site	Grade level of clubhouse students	# of teachers at site	Maximum # of students reported at site	Approximate end-of-the-school-year attendance at site	Average # of students in attendance per meeting at site	# of students returning to site for Year 2
J.W. Dodd Middle School	6th grade	2	20 (10 boys, 10 girls)	16 (8 boys, 8 girls)	13–14	Unknown
Herricks Middle School	6th–8th grades (primarily 6th)	2	70 (64 boys, 6 girls)	20 (15 boys, 5 girls)	40	~50

[§] All numbers are approximations, thus they do not add to 100%.

Clubhouse site	Grade level of clubhouse students	# of teachers at site	Maximum # of students reported at site	Approximate end-of-the-school-year attendance at site	Average # of students in attendance per meeting at site	# of students returning to site for Year 2
High School for Global Citizenship	9th grade	2	7 (4 boys, 3 girls)	3 (1 boy, 2 girls)	5	3–4
Lawrence Road Middle School	7th grade	1	20 (18 boys, 2 girls)	11 (10 boys, 1 girl)	15–16	Unknown
P.S. 109	8th grade	2	6 (6 boys, 0 girls)	6 (6 boys, 0 girls)	4	Unknown

Summary of recruiting procedures and participant data. In the first year, the project recruited a group of 13 largely veteran teachers from eight urban and suburban public middle and high schools in New York City and Long Island. Seven of the eight schools have large populations of youth from non-dominant and relatively low-income communities, the populations of students with whom the project is especially concerned. Most of the teachers' primary subject areas are a STEM discipline, but there are several whose subjects are social studies or art. Most of the teachers use technology routinely in their instructional practices, but they tend to limit its use to teacher-centered activities such as content presentation, rather than for student-centered production purposes. Only a small percentage have previous experience with computer programming and none have experience with game design, though many use games—primarily trivia—to review content with their students. Thus, most teachers expressed some comfort with using technology with their students, but very few used it innovatively.

The teachers expressed a variety of reasons for their interest in the project, including opportunities to improve their use of technology for instructional purposes, a chance to co-construct a new curriculum with peers, and improving their students' problem-solving abilities. Less than half the teachers indicated that they were familiar with culturally relevant pedagogy. Those who were familiar with the term expressed either an interest in connecting classroom activities to culturally informed meaning making processes germane to their students or a more surface-level orientation toward "teaching about" specific cultural practices. For teachers who were unfamiliar with the term, the descriptions suggested either an approach to integrating a focus on social justice issues into instruction or, similar to the "teaching about" frame, or "including cultural practices" to make content more relevant to students.

Approximately 120 students (100 boys and 20 girls) in the 6th–9th grades participated in the *iDesign* clubhouses at the five sites that ran programs through the end of the year. Student attendance was sporadic throughout the year, but most sites maintained at least 50% of their students over the seven months of the first year.

Project Activity 1: Curriculum development

The Hofstra leadership team and Global Kids staff developed 13 of the projected 30, 90-minute weekly lessons for the *iDesign* curriculum in the first year (See Appendix G for the final curriculum map). As we indicated above, the basis for the *iDesign* curriculum is an existing curriculum for urban youth called *Playing 4 Keeps,* which trains youth to think critically about social issues and use game designs to express them. As currently conceived, *iDesign's* intended curriculum[**] comprises three core components: Culturally relevant pedagogy; Principles of game design and game-based learning; and Computer programming. The target "culturally relevant game design" skills and practices that the project seeks to build among participating youth are at the end of the sequence of these three components, assuming increasing mastery of increasingly complex skills and practices over time. The design practices are the project's implicit "technological fluency" objectives. Figure 2, below, illustrates how the curriculum sequences activities within the components with respect to the target skills and practices. Below we summarize each of the core components.

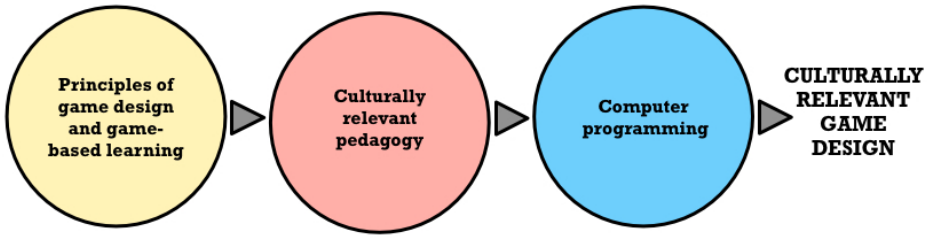


Figure 2: Three curriculum components of the culturally relevant game design program

Principles of game design and game-based learning. Game design is the central activity with which the project intends to develop technological fluency. The *iDesign* curriculum uses design activities to engage youth who might be interested in digital games but otherwise put off by STEM content; to help them build systems thinking skills; and to connect design experiences in the clubhouses with an awareness of the potential to repeat those kinds of experiences in future careers or academic paths. The curriculum includes two broad sets of materials to support the game design activities: Non-digital materials for brainstorming game design ideas and *Gamestar Mechanic.* As a general framework with which to structure the stages of game design, Global Kids introduced teachers to the following format: *Think > Design > Play Test > Change.*

Global Kids included paper-based and physical activities throughout the early lessons for participants to do with partners or in teams to introduce teachers (and ultimately their students) to basic game design principles. For example, in one activity, teachers and students changed one feature of *Tic-Tac-Toe* or *Rock, Paper, Scissors* to experience how the alteration changed the entire game. During the teacher trainings, Global Kids

[**] Porter and Smithson (2001) defined *intended curriculum* as, "curriculum standards, frameworks, or guidelines that outline the curriculum teachers are expected to deliver" (p. 2).

also demonstrated storyboarding and flowcharting activities to familiarize the teachers with methods for drafting and iterating game designs.

The second tool for learning game design principles is *Gamestar Mechanic,* a digital game about how to make games. In the online game, players assume the role of "mechanics" whose job it is to fix broken games in the game world; that is, they play the role of game designers. Figure 3, below, pictures the game's editor screen. For any broken game—and, eventually, new games that players have created—a player adjusts at least one of the five game design elements: Goals (a player's objectives); Rules (permissible actions); Space (the setting); Components (the game objects); and Mechanics (play actions). Players switch between Edit and Play mode (as illustrated by the toggle switch in the upper-left-hand corner of Figure 3) as they make adjustments to elements and test their effects on the game. Youth can save their original games to the *Gamestar Mechanic* web site for others to play and comment on.

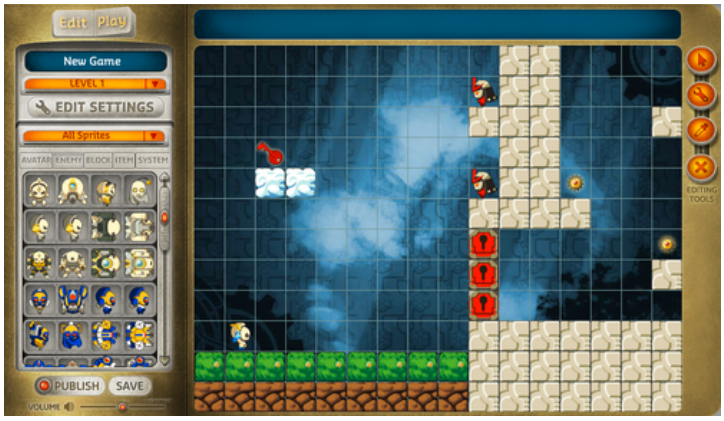


Figure 3: *Gamestar Mechanic* editor interface

Culturally relevant pedagogy. The second component of the curriculum is culturally relevant pedagogy. The goal of these teaching practices in the *iDesign* curriculum is for teachers to implement activities that help their students achieve academic success and build cultural identity *simultaneously* (Gay, 2010). The project takes its definition of culturally relevant pedagogy from Ladson-Billings (1992, 1995), who defined it as,

> A pedagogy of opposition…not unlike critical pedagogy but specifically committed to collective…empowerment. Culturally relevant pedagogy rests on three criteria or propositions: (a) Students must experience academic success; (b) students must develop and/or maintain cultural competence; and (c) students must develop a critical consciousness through which they challenge the status quo of the current social order. (p. 160)

Academic success includes the "literacy, numeracy, technological, social, and political skills in order to be active participants in a democracy" (p. 160). Cultural competence "requires that students maintain some cultural integrity… the teacher use[s] it as a bridge to school learning" (pp. 160–161). Lastly, the goal of critical consciousness

requires that "students must develop a broader sociopolitical consciousness that allows them to critique the cultural norms, values, mores, and institutions that produce and maintain social inequities" (p. 162). In short, culturally relevant pedagogy is a set of teaching practices that minimizes the distinctions between students' "in school activities" and "out of school activities" by using the latter to help students think about the former, while maintaining academic rigor.

To help participating youth begin to progress toward those three goals, Global Kids staff included several types of activities for teachers to lead with their students, including watching videos that focused on social justice issues, such as racial segregation; playing existing serious games about a range of issues, including poverty and climate change; and researching topics on which to design games. Additionally, during one training session, the professional developers led a discussion of Ladson-Billing's (1995) article, "But That's Just Good Teaching! The Case for Culturally Relevant Pedagogy" and Freire's (2000) *Pedagogy of the Oppressed,* two works that discuss teaching practices intended to help learners achieve critical consciousness. We provide specific examples of the activities in the sections on teacher training and curriculum implementation below.

As illustrated in Figure 2 (page 16) culturally relevant pedagogy is the "middle section" of the curriculum. That is, following several weeks of focusing on game design principles using *Gamestar* Mechanic and other activities, the curriculum activities shift toward a "research" phase (lessons 6–8 in the curriculum map in Appendix G). During this segment, students spend time on the Internet during the after-school meetings identifying and researching the topics they will represent in their games.

Computer programming. The final component of the *iDesign* curriculum is computer programming. While youth can create their own games using *Gamestar Mechanic,* the ability to create original games or game functionality is limited to the features installed in *Gamestar.* By design, there is no programming interface, as the game was developed to be a design primer, rather than to be a development primer. To build technological fluency, however, youth need to proceed from knowing "how to use technological tools…[to] knowing how to construct things of significance with those tools" (Resnick, Rusk, and Cooke, 1998). Thus, in its current iteration, the curriculum is sequenced for youth to advance from basic design principles in *Gamestar* to more complex programming in the *Scratch* environment.

Scratch is a visual programming language created by the MIT Media Lab's Lifelong Kindergarten group specifically to enable youth to practice computational thinking through design-based projects. Figure 4, below, illustrates the *Scratch* interface. *Scratch* employs building blocks (or, alternatively, puzzle pieces) as a visual metaphor for how developers construct programs. Youth insert blocks (pictured in the first two columns in Figure 4) and change parameters to create "scripts" (pictured in the second column) that control "sprites" (in this example, the cat pictured in the third

column). In principle, and with practice, youth are able to begin creating the complex scripts (or programs) that constitute a digital game. Because it is an online community, youth can save their creations on the *Scratch* site, share them with others, and give and respond to feedback.

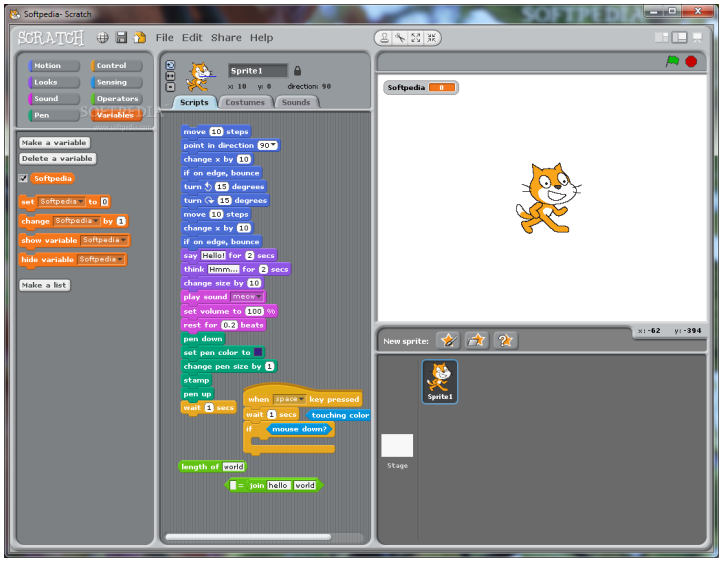


Figure 4: *Scratch* programming interface

Global Kids dedicated several hours during each of three teacher-training sessions to introducing *Scratch.* In general, a professional developer modeled *Scratch* programming activities in front of the group using a projector, and then teachers worked individually or in pairs to perform the tasks.

Developing the Playbook. The *iDesign Playbook* is the online content management system for the project. All curriculum materials are included on the site, which will be free and open to all educators upon registration. Once completed, the *Playbook* will include functionality for teachers to group students and send them messages; to take attendance; to create online journal questions and "exit ticket" questions; and to monitor participants' progress on activities such as game design and note-taking for research topics. Students will be able to provide links to their games; form groups; take notes; and communicate with their peers in the clubhouse. The Hofstra leadership introduced teachers to the *Playbook* prototype during one of the teacher training sessions, though it was not available for their use during the first year.

Project Activity 2: Teacher training

Format of the workshops. Due to the U.S. federal government shutdown during the first two weeks of October 2013, the official grant award from the National Science Foundation was delayed, as was the funding to begin program activities. These delays led to a significant change in the format of the teacher training workshops: Sessions were held all day (9:30AM–3:00PM) on six Saturdays during the school year (two in November and one in December 2013; one each in March, April, and May 2014) at the

Global Kids office in New York City. Each session began with breakfast at 9:00, the day's activities began at 9:30, and teachers broke for lunch from 12:00–1:00, for a total of 4.5 hours of training per session (and an approximate total of 27 hours of professional development between November 2013 and May 2014). Most of the teachers live in Nassau County, Long Island and commuted at least one hour each way to the Saturday sessions in Manhattan.

Because Hofstra and Global Kids developed the teacher training sequence to mirror the clubhouse curriculum implementation, teachers experienced the activities in three "chunks," just as their students did. Appendix G (page 60) contains the curriculum map as it was presented to teachers: The "orange chunk" came first in the sequence, introducing the principles of game design; the middle, "grey chunk" focused on culturally relevant teaching practices and student research; and the final, "green chunk" introduced *Scratch* and, during the last training, a geo-locative game design tool called *TaleBlazer.* The chunks correspond to the teacher training sessions described in Table 4, below.

For each workshop, teachers sat at a U-shaped table, each with his or her own Wi-Fi-enabled Apple laptop computer provided by Global Kids, and faced forward toward a screen for overhead projection. Every session combined lecture and presentation by one or two Global Kids professional developers; question and answer periods; individual and group game design activities on the computer or with other paper-based materials; practice activities in *Gamestar Mechanic, Scratch,* and *TaleBlazer;* watching videos about social justice issues or game design; and discussion about the curriculum, particularly activities that would occur in between the scheduled teacher trainings. During four of the workshops members of the Hofstra leadership team spoke to the teachers about project requirements or upcoming events, in addition to leading them through *Scratch* activities and introducing them to the "Playbook," the *iDesign* content management system. In the final professional development meeting, the teachers in attendance reported on their students' progress to date.

Table 4, below, summarizes the activities for each of the six workshops and includes teacher attendance. While attending the workshops was mandatory for participation in the project, the number of teachers regularly in attendance decreased over the course of the school year. While teacher attendance was 100% at the second session and 92% at the third, regular attendance dropped following a three-month gap in the trainings between December 2013 and March 2014. At the 4th-6th sessions, teacher attendance percentages were 58%, 42%, and 50% respectively.[††]

Global Kids professional developers regularly reminded teachers that the project's goal was to move youth away from being "consumers" to "creators" of games. The workshop formats reflected this objective, as most activities (which teachers would

[††] The total number of participating teachers was reduced from 13 to 12 in early 2014.

take back to their students in the clubhouses) were designed to lead to a teacher- or student-made product. Initially, Global Kids planned to deliver three workshops in fall 2013, a weeklong summer institute for teachers, and a weeklong leadership academy for students in summer 2014. Following the third workshop, however, during which teachers first practiced with *Scratch,* Global Kids and Hofstra determined that they would add three additional workshops because most teachers found *Scratch* challenging to learn.

Table 4: Dates, attendance, and content summaries for teacher training workshops

Teacher training #	Date and times	# of teachers in attendance	Summary
1	11/16/2013 9:30AM–3PM	9	Introduction to project goals and expectations of participants; Project team introductions and overview of roles; Introduction to *iDesign* curriculum; Overview of Global Kids youth development principles **Content focus:** Elements of a game **Activities:** Remixing Tic-Tac-Toe and Rock, Paper, Scissors, Grow-a-Game cards
2	11/23/2013 9:30AM–3PM	13	Introduction to game design practices **Content focus:** Game design practices **Activities:** Complete a game design worksheet and discuss flowcharting; Iterate game designs in *Gamestar Mechanic;* Discussion of the role of stories in games
3	12/7/2013 9:30AM–3PM	12	Introduction to *Gamestar Mechanic* and *Scratch* user interfaces; Introduction to the *iDesign* "Playbook" (content management system) interface **Content focus:** Overview of *iDesign* curriculum (weeks 1–5) **Activities:** Activities in *Gamestar Mechanic* and *Scratch*
4	3/15/2014 9:30AM–3PM	7	Play and analyze examples of social impact and serious games; View video and turn observations of video into game design concept; Further exploration in *Scratch* **Content focus:** Social justice issues; game design practices **Activities:** Game brainstorming and critiquing exercises; Create sprites in *Scratch*
5	4/26/2014 9:30AM–3PM	5	Discussion of cultural relevance; Discussion of Freire's *Pedagogy of the Oppressed;* Researching a topic for serious games; Discussion of Campbell's "The Hero's Journey" as a framework for creating story arcs in games; Analyzing *Toy* Story using "The Hero's Journey"; Introduction to the structure of the *Scratch* programming language **Content focus:** Cultural relevance; research; "The Hero's Journey" **Activities:** Exploration of *Scratch* interface; share-outs on progress in *Scratch*
6	5/7/2014 9:30AM–3PM	6	Discussion of geo-locative games and the relationship between physical space and stories; Teacher updates on status of student work **Content focus:** The importance of space in games **Activities:** Play a geo-locative game outdoors; Introduction to *TaleBlazer*

Scratch instruction. During the *Scratch* training sessions, Global Kids staff urged teachers to see themselves as *Scratch* mentors to their students, rather than as experts. They encouraged them not to feel "the pressures of becoming an expert" because "most of your kids are going to get it faster than you, anyway." The format of these sessions typically included step-by-step tutorials by a Global Kids professional developer standing in the front of the room. Teachers watched as the trainer stepped through the processes and then attempted to replicate the activity on their own computers. A Hofstra graduate assistant and an additional member of the Global Kids staff usually circulated among the teachers as they practiced with *Scratch,* answering their questions or, sometimes, taking the computer from the teacher and completing the activity as the teacher watched. Sometimes the training sessions went quickly—as one Global Kids developer commented, "We're trying to cover a lot of ground and we don't have a lot of time"—while others allowed more time for the teachers to work in groups to complete an activity in *Scratch.*

Project Activity 3: Curriculum implementation

Lessons taught. Of the seven teachers whom we interviewed at the end of year, all indicated that they implemented the curriculum as far as lesson 10 ("Elements of *Scratch:* Sprites") and the majority reported that they completed 12 of the 13 existing lessons. Thus, most students had opportunities to play and make games in *Gamestar Mechanic;* participate in the "hands-on" game design activities; and create a sprite in *Scratch* and adjust some parameters. During the end-of-year interviews, three of the teachers at two sites (Herricks and HSGC) discussed *Scratch* games that two students (one at each site) created. Because the teachers did not have access to the students' user names, however, we were unable to review the games with the teachers. According to the teachers, the majority of students did not progress far enough in *Scratch* to create a game.

The teachers all reported that they implemented the same routines Global Kids staff modeled during the trainings, though they made small adjustments to specific lessons depending on their own and students' needs. All teachers noted that the lesson plans are detailed and easy to read. The teachers at two sites added additional materials to the activities (Lawrence Road Middle School and J.W. Dodd Middle School) to provide structure for student work. Finally, all of the teachers discussed significant changes they made to one or two of the core activities: the research phase and *Scratch* programming.

Teachers' and students' access to technology. All teachers had access to at least one school computer lab (two labs in the case of Herricks Middle School), though one pair of teachers at J.W. Dodd Middle School ran their clubhouse at a nearby elementary school in the district because they thought the program was limited to 6th graders only; there were only 7th and 8th graders in their building. Participating students worked individually on computers and in pairs and groups when doing paper-based and physical activities. Although we did not collect data specifically about students'

access to technology outside of school, most teachers reported that student access was mixed: some students had computers at home, others did not. All sites met once a week for 90 minutes after the school day was over.

Student activities. Every site provided 10–15 minutes at the beginning of each clubhouse for snacks, which typically left 60–75 minutes for activities. All of the teachers noted that their students enjoyed the hands-on activities, such as "remixing" *Tic-Tac-Toe* and *Rock, Paper, Scissors.* Teachers noted that the students often had mixed feelings about the serious games recommended by Global Kids, as they were not always as fun as students expected games to be. Three of the middle school teachers mentioned that they would periodically ask their students "what they thought the games were about" as a way to engage them in thinking about serious game topics, though none of them mentioned discussing game mechanics with students as they played. Several teachers supplemented the curriculum activities by introducing their own materials. For example, one teacher found an online version of *Tic-Tac-Toe* for her students to use during the remixing activity; another brought in construction paper and markers for one of the paper-based game design activities.

Gamestar Mechanic. Among the 6th–8th graders, *Gamestar Mechanic* was the most popular activity. One middle school teacher commented, "They loved *Gamestar* more than anything else. They were more interested in those games than the other games." Another teacher said that several of her students played through many of the levels at home, in between the clubhouse meetings. During clubhouse observations, we noted several students who became very excited about their progress with completing quests and obtaining their "license." As the youth we observed realized that completing in-game quests gave them opportunities to acquire new sprites (or objects they could use in their own game designs) they became more excited about undertaking new quests.

Although the *Gamestar Mechanic* web site includes extensive materials for teachers, none of the teachers whom we observed used them. Global Kids reviewed the materials briefly during a training session, but did not focus on them as part of the *Gamestar* activities. Additionally, members of the Hofstra team told teachers that they would create teacher accounts for them (which would enable teachers to create class rosters online and track their students' progress), but teachers never received any information about the accounts.

Most teachers allowed their students to play *Gamestar* at their own pace during the clubhouse meetings. Students regularly looked at and played each other's games and made comments about their likes and dislikes. Several of the teachers whom we observed would ask students about how they were using specific game design elements as they walked around the lab. Only one teacher had a formal game critique session, however, during which students commented on design elements and made suggestions for change.

Scratch. Many of the students whom we observed also enjoyed using *Scratch.* The two high school teachers commented that their students preferred *Scratch* to *Gamestar,* mostly because the former was "too easy and you couldn't do that much." All of the teachers explained that they followed the Global Kids instructional routines very closely when they introduced *Scratch* to their students because they were less comfortable with its features. One exception was the high school teacher with previous programming experience. We observed her working closely with one student who wanted to make a game on climate change. The student chose a question-and-answer format for the game. As she constructed her scripts in *Scratch,* the teacher answered questions about where to find specific blocks and gave her feedback during testing and debugging. None of the other teachers worked as closely with students, however, partly because there were too many students for whom to provide individualized attention and partly because they did not know enough about *Scratch* to respond to those kinds of questions.

Many students did progress in *Scratch* beyond where their teachers were in the curriculum. As one middle teacher commented, "The kids are already doing stuff that I didn't say to do. That's fine, but I wish I was a little bit more confident about it." But with the exception of the high school student (whose game was very basic, according to her teacher), none of the students whom we observed either created a game in *Scratch* or connected game design elements with "game-like" functionality. During our interview, another teacher remarked, "I still don't know how to make *Ayiti*…I think the teacher training could be more balanced, with more introduction to game mechanics and creating video games. Introducing game mechanics earlier would have helped; understanding the concepts of game creation, rather than front load it with content of the game." She suggested that she might have been able to help her students connect the game elements in *Scratch* if she had been prepared.

SECTION IV. DISCUSSION

Overview

In this section we synthesize and analyze our observations to answer the fourth evaluation question: *In what ways do the completed development and research activities contribute to the ongoing development of the intervention?* The goal is to provide insight into whether and in what ways the project activities—curriculum development, professional development, and curriculum implementation—contributed to *iDesign's* long-term goals. In Section V, we make recommendations for changes to future project activities based on this analysis.

The seven teachers whom we interviewed at the end of the year all expressed enthusiasm about the project and planned to return for the project's second year. While none knew with certainty, most expected at least a small percentage of the first year participants to return for the second year (the teachers at Herricks Middle School were an exception, as they expected as many as 50 students to return). The majority of students were most excited by the opportunity to play and make games, which was largely what drew them to the after-school program, according to their teachers. The curriculum activities that were aligned most clearly to those interests—*Gamestar Mechanic* and the paper-based and physical game design activities we described above—were the most popular among the youth and their teachers. One teacher's comment about her vision for her students as game creators captured how most of the teachers expressed interest in what their students might achieve in *iDesign:*

> *The idea of being able to create a video game sounds very powerful to them. It sounds interesting to me, the idea that I could walk away and have produced something. The idea of creating something digital, that other kids would want and that they could get credit for, is very exciting.*

The activities that included game design and game play were the most successful from teachers' perspectives. But, as currently conceived, the curriculum and professional development materials expect that teachers are proficient enough to take up the individual segments of the serious game design program and link those parts together to deliver a seamless experience for their students. This was not true for the participating teachers. There were **three challenges** that prevented teachers from implementing the extant curriculum in ways they felt were most beneficial to their students and that satisfied the project objectives as they understood them: **(1) Uncertainty about the project's overall objectives; (2) Perceptions of a lack of coherence among the curriculum components and with the professional development activities; and (3) Unclear guidance on how to use specific *strategies* to integrate the curriculum components, student organizers, and specific *skills* in *Scratch* and computer programming.** In the following sections we discuss the

challenges, in addition to factors for successful activities, using specific experiences from the project's three main components.

Factors for successful clubhouse activities

Most of the teachers commented on the sense of enthusiasm expressed by the Hofstra leadership and Global Kids staff about the project during the training sessions; they found it inspiring and motivating, as well as fortifying when they experienced difficulties with the technologies. In general, most teachers also felt that members of the Hofstra and Global Kids teams were approachable and eager to support teachers during the training sessions. One high school teacher commented, "I liked the workshops overall. I liked how we had time to experiment and try things. I felt it was a respectful environment. I thought they were interactive, which made the day go faster, which is important on a Saturday."

The seven teachers all reported that lessons 2–5 (see Appendix G for the curriculum map), designed to familiarize learners with the elements of game design, were the most popular with their students and the easiest and most interesting activities to lead for teachers. As one teacher said, "Those activities went wonderfully. I brought them right back to our club and carried it out exactly as we did it in the training. They loved the warm-up games and they loved the human barometer thing [a physical design exercise]." Another teacher commented, "It was useful and engaging to have them do physical games before they were on the computers." These were also the activities the majority of teachers most enjoyed during the trainings. They appreciated doing them in groups and did not feel isolated, as some did when working in *Scratch.*

In a survey following the first training, when asked to "think back to a moment during the workshop that was particularly useful in terms of helping you to think about how game-based learning might work with your students," the majority (n=12) identified specific hands-on activities most frequently, including the *Grow-a-Game* activity (students are dealt playing cards that represent game elements and social justice-related issues, which they use to brainstorm a game), *Tic-Tac-Toe* deconstruction, and brainstorming a new game. Most participants felt "somewhat prepared" (n=10) to work with students through the game design process, and attributed hands-on time as key to feeling comfortable with the practice.

The teachers had similarly positive experiences with *Gamestar Mechanic,* though several had questions about its relationship to *Scratch* with respect to the curriculum goals, as we discuss below. One teacher commented that, "They loved *Gamestar,* in some cases that's all they wanted to do." Another said that, "They can just go home and play *Gamestar*. I know they'll do it because they love it, so I'm not even sure we need to take time to do it when we meet." A third teacher commented on her own experience watching her students play and design with *Gamestar:*

> *I really enjoyed when they were making the games in* Gamestar. *It was cool to watch them lean over and be like, "You should change that," giving each other feedback. It was nice to watch, and me being able to say to them, "Does the person playing this know what the ultimate goal is?" Them giving each other feedback is great. That's what's nice about the Edit and Play part, and going over the vocabulary and components of the game and then seeing it in there and then trying it out in there and then having a friend try it out and critique each other. And the critique at the end, them having the pride in showing their games. That's great.*

The hands-on and *Gamestar Mechanic* curriculum activities had several features in common: they had **clearly defined objectives** that could usually be accomplished in one afternoon, often in 15 minutes or less; teachers and **students could typically see the effects of changes they made** to a game element as soon as they played the next round, which generally **resulted in feedback they could use** to make the change permanent or try something else; **they could share those ideas with others** in the form of a re-mixed game and watch them play; and finally, **they were about games and game play,** which was why many of the youth, particularly the 6th graders (nearly 60% of participating youth), became interested in the after-school program.

All of the teachers reported that they were most confident in leading these types of activities with their students, and all but one had any significant previous experience with computer programming. On the surface, the game design activities, including *Gamestar Mechanic,* did not appear to require the kind of technical expertise most teachers felt they needed for *Scratch.* One teacher's comment that *Gamestar* appealed to his students because of the "pre-made things" (i.e., the games) also expressed **most teachers' desire to teach lessons that had clear goals, endings, and that did not require significant technical expertise to implement.**

Teachers' uncertainty about the project objectives

At the end of the year, four of the seven teachers were still uncertain, and sometimes frustrated, about the project objectives. Their comments suggest that the uncertainty related either to the project's overall instructional goals; the specific products students should create; or to the project leadership's expectations about whether the program should be a "clubhouse or a classroom." One middle school teacher commented, "I didn't know what the project was about…I'm still kind of lost, to be honest. As a coach, doing robotics, my end goal is always the end competition. I don't know what that is here."

Uncertainty about instructional goals and student products. Several teachers expressed their uncertainty about the project's instructional goals; how they should assess their students' progress toward those objectives; and how they should reflect on lesson outcomes to determine changes they might need to make. One middle school teacher commented,

> *The students need feedback. That gets me to the assessment—we don't have one. They need to add a closure piece to a lesson. There was no journal; there was nothing for us. I would like a page at the end of the lesson about what I thought about that lesson and what I would do next time.*

Similarly, all of the teachers noted that they regularly observed their students giving each other feedback about their designs, however informally, and that they valued those experiences as instructors. But three of them remarked that neither the curriculum nor the professional development provided them with materials or support to facilitate the exchange of feedback. They also felt unprepared for how to formulate feedback to their students. Game designs and games are not student work products that any of the participating teachers had any experience with assessing.

The same teachers also indicated their uncertainty about the artifacts students should produce by the end of the year. One teacher remarked, "I was thinking we all build this game and then enter it into a cultural relevant competition. I thought it was one big game, everybody working together." Another teacher said that, "After we saw *Ayiti,* [a digital game that was developed several years earlier in the *Playing 4 Keeps* program—youth helped conceptualize the game, which was then produced by professional game designers] I thought that that was what the kids were going to be able to make." Both teachers understood that the youth in their clubhouses would be unable to produce high-quality games given their time and skill constraints, but they felt that they came to the realization on their own, rather than through clear expectations from the project leaders and professional developers.

During two teacher trainings, Hofstra and Global Kids staff mentioned submissions to the National STEM Video Game Challenge (a philanthropically-sponsored program to motivate youth interest in STEM careers) as a goal for the clubhouse youth. Global Kids staff showed a video on the National STEM challenge during the fifth training. But the teachers didn't receive any guidance on how they might use the video with their students and some expressed concerns about *Scratch* and whether their students would be able to use the programming language that was showcased in the video.

Three of the seven teachers' comments did indicate a general understanding of the project's broad objectives, however. When asked "What do you think the goals of the *iDesign* project are" during the end-of the year interview, one of the HSGC teachers remarked that the goal was, "increasing student interest and awareness of programming and the different tech careers that exist, and helping kids see a function for technology, not that it's just about entertainment…And to give a human side to the technology, talking with girls specifically." The other high school teacher said that it was about "introducing socially conscious curriculum and rudimentary science concepts through video games…I'm interested in the social relevant aspect of the program, that's something I incorporate into my art lessons. Going forward that's something I'd definitely like to do." And one of the middle school teachers replied,

> *I do think it's met my expectations in furthering commitment and furthering this notion that you can get a message out or teach a skill in an alternative way that will reach a broad audience…I see the potential for the empowerment. I feel like the empowerment is happening…The kids like it, they come, they're enjoying themselves, they feel proud when they create something, they're helping each other out.*

These comments suggest the teachers' understanding that the project sought to use social justice issues and topics that are relevant to youth as catalysts for engaging in STEM-related practices. The other teachers did not have clear understandings of the goals, however, and were therefore less certain about how to lead their clubhouses.

Uncertainty about project expectations: "Is it a clubhouse or a classroom?" Several teachers remarked that their confusion about project goals began with the first training session, during the discussion about curriculum development. A Global Kids staff member told the teachers that they would be piloting the curriculum in the coming year. When two teachers asked for clarification and wondered whether they would contribute to curriculum development, the staff member responded by saying, "We will provide you with a curriculum and you are going to give us feedback on it. Then we'll improve it." But it was unclear whether the curriculum would be revised for the second year or during the current year. During their interviews, several teachers referenced those comments from the first day and noted their disappointment that they were unable to give feedback on the curriculum, or to make suggestions for how they thought it might be improved. One teacher said, "They said they'd ask for our input, but they never did. They never came back to it."

All of the teachers felt positively that *iDesign* surpassed their expectations about challenge and rigor for after-school programs. But the five middle school teachers made remarks that suggested that a misalignment between their perceptions of the curriculum's level of challenge and their ideas about what an after-school clubhouse should be often led to confusion about how to structure the weekly activities. Remarks from the two teachers at J.W. Dodd Middle School encapsulate the issue:

> *My understanding is that this is a pilot that Hofstra is trying to see if they can get into schools someday. We do have products to show for it, but some days we do have to reel the kids in. I feel the kids are having a good time, they're enjoying what they're doing; it's laid back…This is a club in my eyes… I understand this is a pilot. If this was a curriculum that a school was going to use, it would need to start in the 5th grade and then stretch into the 11th grade.* (Ms. Wrigley)

> *I think this is more of a course where kids are going to learn how to make computer programs. I thought I was going to learn how to make them, with the help of others, and there would be a project at the end that students would have something to show…We have to come to a consensus, the people in charge and the schools, about what the purpose of this club is. Is it fun, play games, or is it they have to learn something?* (Ms. Lambrinos)

Two other middle school teachers indicated that the **school-like aspects of the program—such as research and writing their topics for serious game design—were a significant detractor for many of their students.** One said, "Look, it's after school, and suddenly it starts feeling like school. In school, you'd rather talk then write. But you don't want to write here [after school]." Another commented, "They're here to have fun. For them to have to do research is a turn off." The two high school teachers felt similarly. One remarked that, "We had to have kids on computers as much as we could. We knew that if there were multiple weeks where it was just paper-based, we would lose them. We tried to have them on the computer for 20 minutes."

As we discuss in the section on "cohesion" below, there was a jarring quality to the introduction of school-like features in the middle of the curriculum. All of the teachers reported that student attendance began to drop when the lessons turned away from game design and game play. None of the teachers expressed dissatisfaction with the rigorous goals the project seemed to be setting. Rather, **they felt that a lack of explicit goal setting and discussions about how to assess student work left them unprepared to ready students for the more challenging parts of the curriculum.**

Frustrations with project communication. Five of the seven teachers expressed dissatisfaction about the frequency and clarity of communications from Hofstra and Global Kids. All of the teachers whom we interviewed are veterans, generally prepared for their instructional activities well in advance. Some felt that the project team did not always support them as they tried to work with incomplete materials, which contributed to their discomfort about the curriculum. One middle school teacher commented,

> *In the beginning, the enthusiasm was great. But it marred everything that they wanted to accomplish. They kept saying, "We'll send you this, we'll send you that, you can do this, you can do that." But they never sent it to us. They said they'd send links to videos and resources. They never came. But then, we started getting all these emails. You know what, I'm doing this only for 1.5 hours a week. The emails were all over the place and we didn't get links to things…[Global Kids and Hofstra] promised us some stuff. We never got it.*

Another teacher said,

> *They don't respond very quickly and sometimes not at all. I empathize, I know what that's like and it's a lot. But they said they'd be available. Like the summer training, where I need to choose 3 students. My kids came back, saying "I have summer camp and I need to know what days the thing is." And some kids were like, "Am I gonna be picked up?" I asked, but no one got back to me.*

At the end of the fifth teacher training, we noted that several teachers asked for information about the summer institutes and asked specifically for materials that explained the event to parents and gave them directions to locate the site on Hofstra's

campus. During our interviews, several teachers said that they had yet to receive any information about the event.

Teachers' perceptions of a lack of cohesion among curriculum components and PD

Due to the funding delays we discussed above, the project produced 13 of the projected 30 lessons in the first year. For most teachers, the incomplete curriculum added to their concerns about unclear objectives. More importantly, however, none of the teachers whom we interviewed felt that the existing groups of lessons (see Appendix G) were "fitting" together. One of the high school teachers made a comment about her facilities with *Scratch* that typifies most teachers' perceptions about their preparedness to integrate the three curriculum parts: "We learned lots of things about *Scratch,* **but we never learned how to synthesize those things. We're not confident about how to do that."**

Teachers used the words "glue" and "transition" repeatedly when they talked about the curriculum segments. For example, when asked to explain her understanding of the curriculum goals, a high school teacher said,

> *Overall, I don't think these pieces glue that well. What we got is half-a-year's worth of curriculum and that didn't really glue. There were times that they* [the students] *were brainstorming an issue and they didn't get to follow through with it using the technology. And* Gamestar Mechanic *definitely doesn't translate into* Scratch, *so it's not there yet.*

One middle school teacher's comment about "transitioning" conveyed a similar view:

> *Transitioning is difficult. I'm going through it now, I don't want them to walk away having picked a topic, having done some research on it, and then saying what the challenges are. I don't want them to walk away not having done that. I need more, a better framework for getting them to that research and being able to identify what's really important for them. Even the ones* [students] *that come up with it, they're the kids that you would expect it of, having those good questions. When we did it with [Global Kids] it worked smoothly. But I don't know that the way that was set up whether it's going to work for kids.*

None of the teachers felt fully prepared to help their students move through a sequence of activities that proceeded from game design to research to game development. For example, several teachers remarked that they did not see the relationship between *Gamestar* and *Scratch.* One middle school teacher commented, "The transition from *Gamestar Mechanic* to *Scratch* was non-existent in the PD. We just finished one thing and started the next." Another middle school teacher whose students were all 6th graders said,

> *My question right now for* Gamestar Mechanic *is, "Are we ever going back to it?" The kids loved it and now it's like we're not going back to it. It was so fast. Our kids wanted to play; they wanted to do more. We never had time for them to share and they never got to look at each other's* Gamestar *work. We just moved on to* Scratch.

Teachers also commented on the challenge of transitioning from game design activities to the research activities. Other than one high school teacher, none of the teachers made explicit references to the *Gamestar* game design principles when introducing *Scratch;* two mentioned that they did not feel prepared to help their students make those connections. Three sites—Herricks Middle School, Lawrence Road Middle School, and HSGC—bypassed the lessons with research activities because they feared many of their students would stop attending. As we noted, attendance did begin to drop as the curriculum transitioned away from design to development. One high school teacher said, "We skipped the research. We knew we'd lose them if we didn't." The Lawrence Road Middle School teacher commented,

> *They had to do that document* [a game design document]*, and I was like, "I'm losing them," so I had them go into* Scratch. *I'd like them to use* Scratch *for a few weeks and then go back to the document. I'd like them to see what kinds of actions can happen in* Scratch *and then take that back to the design document. I'm hoping that works and then we'll go back to the research, but I don't know if that's going to work.*

The second high school teacher noticed the change when the curriculum shifted toward the research:

> *Our kids gave up abruptly. We stopped seeing some kids. Our program was dying out towards the end. Around that time I had one of the best PDs in terms of Scratch, understanding the basics of Scratch: How to understand how to make an interactive character. It's too bad.*

Unclear guidance on specific teaching strategies, learning supports, and programming skills

Teachers' requests for lesson overviews and organizing devices. With respect to the organization of teacher materials on the *iDesign* project web site, several teachers expressed a need for organizing devices, especially an instructional overview, or advance organizer, for every lesson. One middle school teacher commented that, "If we're going to treat this as a curriculum, then we need a real pacing calendar—say that, 'this lesson should be done by week x.'" This remark referred both to her desire to provide her students with more structure, but also so that she could be aware of the material the project leadership expected her to cover between teacher trainings. Both of the teachers at J.W. Dodd Middle School generally felt uncomfortable during the trainings. As this teacher said, "I agree…that it does not make sense to meet with people in other schools. I feel inadequate at those meetings sometimes. Everyone else is ahead of us."

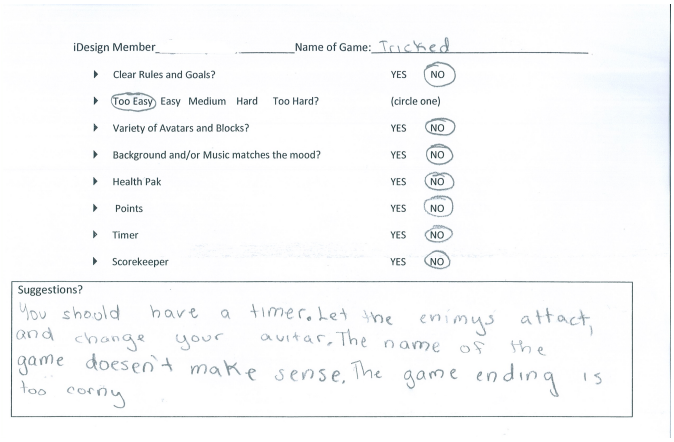
Another teacher said, "I like a syllabus. Like, "Week 1 this is what we're doing. Week 2, this is what we're doing." And so on. This was too sketchy**."** His partner commented that, "I like to know what I'm getting into every week. Tell me what my goal is. Whereas with this, we'll do a little bit of this, a little bit of that. But I was lost…I just felt like if it was more put together it would've been better." The same teacher acknowledged that Global Kids' communications and organizing strategies improved toward the end of the year, however. She said, "Towards the end, when they would send out the 'this is what we're going to cover' messages, 'a heads' up of what we're going to be doing,' I really liked that. It helped me a lot." One of the high school teachers made a similar remark: "The later trainings did a good job of preparing you for the lessons that were coming."

The two HSGC teachers also commented on the need for advance organizers for their students. One noted, "We did try to say to them in every class, 'Here's where I think this is going today.' I don't think that the curriculum does that. We need to be able to say to them, 'We're learning to make this to get to this.' We felt that was really important, but it was missing." The same teacher commented that she regularly spoke with her students—especially the girls when they were present—about connecting the game design experiences to future careers.

Teachers' requests for more student supports. Nearly all of the teachers valued the warm-up exercises that Global Kids led during the first several workshops. As one middle school teacher commented,

> *Little things like the remix are helpful in each lesson. A hook, something to draw them in, some handouts… Any time that they're not at the computer, they're not fans. If they're creating something, they liked the remixing of the game. You need a manipulative, or you need to be on a computer. Even white paper and stickies, walking around the room, wasn't doing it for them.*

Referring specifically to the research activities, another teacher commented, "You only have 60 minutes on task. They need something to organize their work." For a middle school teacher, instructional supports such as handouts, graphic organizers, and warm-up exercises serve at least two purposes: they help students organize their thinking and they serve as devices to manage behavior. With respect to the first, the teachers at Dodd and Lawrence Road Middle Schools introduced their own organizers because they felt these were lacking in the curriculum materials. Figures 5 and 6 below are two examples of materials that teachers introduced.



iDesign Member_____ Name of Game: Tricked

Clear Rules and Goals?	YES	(NO)
(Too Easy) Easy Medium Hard Too Hard?	(circle one)	
Variety of Avatars and Blocks?	YES	(NO)
Background and/or Music matches the mood?	YES	(NO)
Health Pak	YES	(NO)
Points	YES	(NO)
Timer	YES	(NO)
Scorekeeper	YES	(NO)

Suggestions?

You should have a timer. Let the enimys attact, and change your avitar. The name of the game doesen't make sense. The game ending is too corny

Figure 5: Game critique worksheet

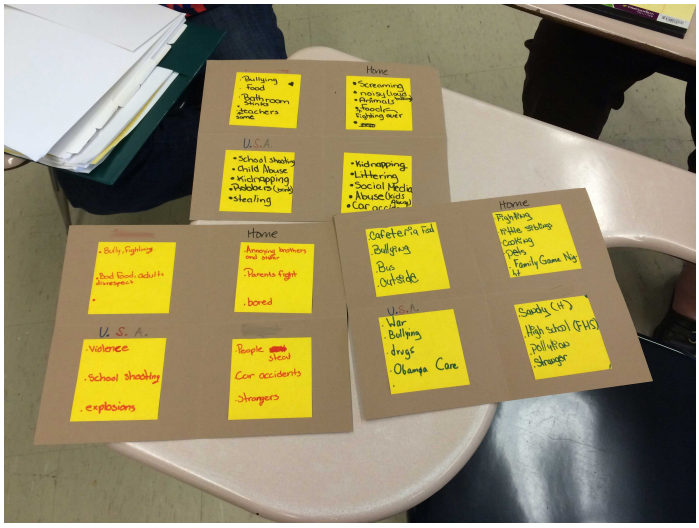


Figure 6: Teacher-produced graphic organizer

Figure 5 is a game critique worksheet the teacher at Lawrence Road Middle School distributed among her students on a day when they were looking at each other's games in *Gamestar Mechanic.* She commented that,

> *I left those trainings feeling wanting: the curriculum was created and then…It's not rocket science, good, the curriculum is very user friendly, you have freedom to do what you want. [Hofstra is] very laid back, saying, "Don't feel tied to this." But I kind of felt like, why not go over it? As opposed to me being like, "Well let me see, what is this about?"…I was flying by the seat of my pants. Kids need something to work with. We can't critique each other's games without having a little piece of paper to mark up. I could've anticipated a little bit more what kinds of handouts that I need. I did it on the fly, but I'm not really an on the fly kind of person.*

She was unaware that she could have used the *Gamestar Mechanic* web site for students to critique each other's games because it wasn't reviewed during the trainings. But critiquing was a very important exercise to her and she wanted a structuring device to help her students to do it well.

Similarly, Figure 6, above, is a graphic organizer created by one of the teachers at Dodd Middle School to organize her students' brainstorming ideas for their serious games. Students worked in groups to identify issues in their homes, school, communities, and across the country that they would be interested in making a game about. They were unable to return to the graphic organizer due to time constraints, but she said that she would have posted it on the board for students to return to and revise ideas or come up with new ones.

Teachers' challenges with learning Scratch programming. For all but one teacher (the high school teacher who had taken one programming course in college), *Scratch* was the most challenging—and in many cases, intimidating—element of the curriculum and workshops. Table 4 (p. 21) includes teacher attendance at the trainings. In their post-workshop surveys, teachers consistently indicated that they were not yet comfortable with the idea of teaching *Scratch* to their students. While the drop in regular attendance at the teacher trainings came after a three-month gap, it also coincided with the workshops that focused most intensely on *Scratch.* Several comments below express most teachers' anxiety about using *Scratch:*

> *During the training, I was completely stuck. Some people picked it up quickly, some didn't. I'm still stuck. Over the summer, I need to give myself a project. For me, it's like a language that doesn't come as naturally to me.* (Art teacher)

> *If you just did a good, hard core training on Scratch, I wouldn't need another body in the room. If I have a good strong understanding of how to create things and of how to troubleshoot…That comes from practice, but you have to have a framework with that. When things get harder, I don't mind saying, "I don't mind doing that together…Let's look at that together. But, I don't feel solid enough right now."* (Lawrence Road Middle School)

> *In December, when I left* [the training] *I was almost in tears. The explanation of when we started* Scratch, *the explanation was so quick, I left thinking what the hell did I just get involved in? I was interested…but I thought, "They're not used to teaching teachers." If I can't learn it then how the hell am I supposed to teach the kids?* (Dodd Middle School)

> *I was shocked to find out that* Scratch *offered a tutorial. I was shocked that we were introduced the way we were–why didn't we know that? It would have been like going to a Bible. I felt like the way we were taught was backwards. I had no problem with* Gamestar Mechanic, *but* Scratch *was so quick. When we introduced it to our kids, we had them use the tutorial. The kids were doing it step-by-step, and they were able to learn from it.* (Dodd Middle School)

As we discussed in the section above on clubhouse implementation, teachers suggested that many of their students did seem to enjoy using *Scratch,* though very few progressed beyond very basic functions in the program. But many of their

teachers were more comfortable "letting the kids do it on their own," rather than lead activities because they were not comfortable with their ability to do so. As we discuss below, their ongoing discomfort with *Scratch* led several to make suggestions for changes in the professional development format and the implicit strategies for teaching *Scratch* in the curriculum.

Teachers' suggestions for new teaching strategies. In a follow-up survey after the third teacher training, the high school teacher with previous programming experience wrote,

> *I wish we had spent a larger proportion of the time working with Scratch over the three days of training. It could also be helpful to more thoroughly frame how coding works—how the computer reads the language and how you need to use logic statements (if/else, etc.) to complete the code. I had taken one programming class before, but I know others were confused by how the code puzzles together.*

In response to that feedback, one of the Hofstra graduate assistants led a detailed discussion—in front of the room with *Scratch* projected on to the board—of *Scratch* programming terms, of the interface, and on basic block functionality. The teachers all responded very favorably. One middle school teacher said, "That intro to *Scratch* was great. The explanation of sprites was really good." But like another teacher, she commented, "Putting it all together was really hard."

Given their experiences with *Scratch,* several teachers felt that more time in the professional development and the curriculum should be devoted to it. One teacher said, "I felt prepared to use *Gamestar Mechanic* and I felt like we spent a disproportionate amount of time on it in the workshops. We needed more time with *Scratch."* Similarly, one of the middle school teachers said,

> Gamestar *is just easier to learn. It wasn't so intimidating. They also have a curriculum on their web site that shows you how to do certain things that I wasn't taught to do. If they already have something on their web site, why not just use that?…But with* Scratch, *give the people that need more help the help. It's not a reasonable expectation to expect teachers to spend that amount of time* [with *Scratch] on their own. They did put it out there that they didn't want people who were that tech savvy. They were like, "Don't worry about it." But not everyone learns the same way. They need to see something up on the board, focusing them. Put up the vocabulary. Let's use the jargon. Let's make ourselves little experts. Let's take more time on it.*

Several teachers also thought that the curriculum should change the sequencing the technology so that *Scratch* was introduced earlier and that students had time to begin to build in it. During a workshop, one teacher suggested, "How about using *Scratch* to get students hooked, and then move on with *Gamestar Mechanic?*" One high school teacher suggested eliminating *Gamestar* from the curriculum, or at least asking students to play with it on their own time. As she said, "I'm not sure it's necessary.

They picked up *Gamestar* quickly and then went to *Scratch.* They had more freedom in that setting. They liked the creativity they were allowed to show. They were trying to find the weird features." But she was very comfortable allowing these older students time and space to explore on their own. The middle school teachers were generally more reluctant and preferred to be able at least to introduce their students to *Scratch.*

SECTION V. CONCLUSION AND RECOMMENDATIONS FOR YEAR 2

Conclusion

As noted, the seven teachers whom we interviewed are enthusiastic about the project goals—as they understand them—and about the commitment of the Hofstra leadership team and the Global Kids professional development staff to the work. All will return for the second year. The *iDesign* project achieved several of its intended outputs in the first year. The project delivered a complete course of six professional development sessions; it created nearly half of the projected 30 lessons for the curriculum; it recruited teachers from schools that include large numbers of youth from populations it targets; it retained approximately 75% of the teachers it recruited and added three more teachers who will begin in year 2; and its teachers delivered at least 75% of the available instructional material to approximately 120 students.

In the broadest sense, the project was slowed in achieving its first-year objectives because of the federal government shutdown in fall 2014. There are additional factors, however, that are within the team's control and that should be considered, as the project's second year begins, when addressing the challenges the teachers encountered. Those factors include implicit assumptions about teachers' abilities to take a curriculum designed primarily for older, high-school youth to learn in more informal settings and apply it under different circumstances, which several of the teachers considered to be more "classroom than clubhouse." Further, the curriculum and professional development formats both assume participating teachers' abilities to integrate three disparate sets of activities (game design, research, and game development), while they have no previous pedagogical experience in these areas.

As indicated, the teachers confronted three broad challenges when implementing the curriculum: (1) Uncertainty about the project's overall objectives; (2) Perceptions of a lack of coherence among the curriculum components and with the professional development activities; and (3) Unclear guidance on how to use specific *strategies* to integrate the curriculum components, student organizers, and specific *skills* in *Scratch* and computer programming. Below, we make six recommendations for ways in whcih Hofstra and Global Kids might make adjustments to the professional development and curriculum to enable teachers to help participating youth achieve the project's intended outcomes of greater STEM interest and participation.

Recommendation 1. "Glue the pieces together"

In Figure 7, below, we propose an alternative graphic (see Figure 2, p. 16) to envision how the project components might "fit" together to help teachers engage their students in culturally relevant game design. As currently conceived, the curriculum sequences three sets of activities in chronological order: game play and design; research; and game development using computer programming. Given that most teachers and their students experienced these components as fragmented, we suggest

that the curriculum components should be portrayed as a series of concentric circles, with "Culturally relevant pedagogy" encompassing all other activities, thus "gluing" them together. Envisioning the curriculum this way allows for concurrent activities in the three component areas, rather than for separate, serial activity.

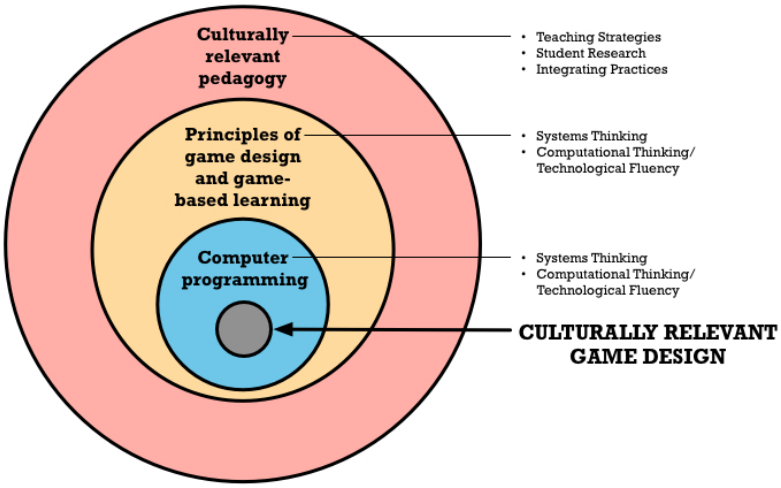


Figure 7: Re-drawn *iDesign* curriculum components

The major goal of the *iDesign* project is to create activities and learning environments where the objectives of culturally relevant pedagogical practices can be operationalized into teachable, observable computational practices through game design. To limit culturally relevant pedagogy either to a strict computational thinking framework or to a game-based learning framework—while continuing to adopt the latter within the activities—is likely to produce weak technological fluency at best, or, at worst, result in gamification of the content area.

For participating teachers, the pressing need is to learn teaching practices that support the principles of culturally relevant teaching in technology-rich settings. For students, the goal is not only to learn computational thinking concepts, but also to be in a position to produce a game and use what they know while working on authentic problems. The long-term goal is to use successes—or at least interests—in those computational practices to consider STEM-related careers or academic pursuits beyond the field of computer science.

Waddell's (2014) research on "culturally ambitious teaching" (see Appendix F) suggests a teaching routine to achieve the goals of culturally relevant pedagogy. We recommend including those practices—or something similar—in the *iDesign* professional development activities and curriculum materials. These teaching routines could help youth link computer programming and game design practices with their cultural interests.

Additionally, rather than lead activities serially, as they are developed in the current curriculum map (see Appendix G), we propose that teachers teach them concurrently;

that is, the map should be flipped such that every PD workshop and each weekly activity includes all three components. This model potentially enables teachers and students to make practice-based conceptual links among the three from the beginning of the clubhouse; to start programming and researching topics earlier and making the relationship between the two explicit by storyboarding, journaling, and creating design documents; and to eliminate the challenge of "transitions" between phases.

The following three recommendations are closely related to the first.

Recommendation 2. Provide unifying goals and make them explicit
Several teachers expressed interest in the National STEM Video Game Challenge—or something similar—as a goal toward which their students could work. If the submission dates are not well aligned to the clubhouse meeting dates, consider finding a competition with rolling deadlines, or that has a summer submission deadline.

Giving teachers and students this type of goal can instigate backwards planning from the submission dates. It also gives them a common purpose and could include many activities that are useful in game design careers. Teachers might also have a better idea of pacing and the curriculum developers would have target dates by which students should be engaging in certain practices. But the curriculum must support the teachers in moving at a pace with which submitting a game (or games) is achievable. But to that end, the project must establish realistic expectations about the types of games students will produce. If *Ayiti* is not a realistic example, then teachers should not be asked to use it as one, or as a milestone against which to compare their students' progress

It does not have to be presented as a competition, however. Students should be welcome to work at their own pace alongside those interested in the competition. Teachers will need to support all of them.

Recommendation 3. Help teachers navigate the tension between a clubhouse and a classroom.
By integrating the design, research, and development activities early on, teachers might be in a better position to manage their students' expectations about the work/play ratio, though there is less of a divide between them when the curriculum components are enacted concurrently. Including a common goal such as a competition might also help to make the necessary research and storyboarding activities less school-like and more "work-like." But students should always have time for play in every clubhouse meeting.

Recommendation 4. Consider using a studio-based model in the PD and clubhouses
While Global Kids emphasized a *Think > Design > Play Test > Change* activity model in the current professional development activities, in practice teachers and students

rarely had time to go through the process. But again, by ensuring that design-research-and development activities are included in every activity, students will have opportunities to create, critique and share feedback, and re-design regularly.

Studio-based teaching and learning is a design-centered pedagogy that cultivates students' identities as designers and supports design thinking (Matthews, 2010). Because studio-based instructional practices focus on developing learners' identities, it is a suitable model, given *iDesign's* goal of enabling youth to imagine themselves in STEM-related fields. The instructional format could be similar to an art class. As the participating Art teacher said, "In my style…you introduce a concept and then you have to execute right away. But I'm geared more toward making a product and we didn't do that until much later. I'm more comfortable with the product." But he also commented that, "I need to become more comfortable with the tools, the medium in which kids are creating the product." That is true for all participating teachers. If this type of model is adopted, teachers will need explicit support to provide feedback and foster productive critique regularly, in addition to being more comfortable with the medium than most currently are.

Matthews (2010) outlined seven components of a design studio approach: (1) project-based work on open-ended problems; (2) rapid iteration of design solutions; (3) frequent formal and informal critique sessions; (4) consideration of alternative solutions; (5) the use of precedent in design and systems thinking; (6) the creative use of constraints; and (7) the central importance of design technologies.

Recommendation 5. Make the PD and curriculum more teacher- and student-friendly

Because *iDesign* is not an informal after-school program that uses short, discrete activities that stand alone outside a formal curriculum, all of the teachers with whom we spoke discussed their needs for additional supports to help them with curriculum implementation. We summarize their comments below:

- **The project should define the observable learning goals for every lesson. That is, the names and definitions of the specific skills and practices of "technological fluency" and "computational literacy" should be clear to teachers and students**
- Every lesson should have an advance organizer or overview that explains: how the day's activities connect to previous and future activities; how they are examples of specific game design or programming concepts; vocabulary terms; the daily objectives; observable learning goals; and exit ticket questions
- Every lesson should have "hands on" or "hands busy" activities
- Every lesson should include graphic organizers to support note taking, journaling, sketching, and storyboarding

- Devote more time during a professional development section to familiarizing teachers with game design documents, as those will help teachers and students make connections across the three curriculum components
- Familiarize teachers with the *Gamestar Mechanic* and *Scratch* online communities and encourage them to use them. Both sites contain useful resources for students and teachers. Several teachers and students did use materials from both sites. Create *Gamestar* teacher accounts for all teachers.
- Several teachers expressed concerns about their students' literacy skills and whether they would persist in the research activities. The project should consider curating web-based materials that students might use for research topics. With the participation of the teachers, the project leaders could consider collecting materials that teachers can differentiate based on their students' needs
- Every lesson should have explicit support to help teachers model activities and habits of mind for their students. Similarly, the professional development should allow for teachers to practice modeling the habits of mind that designers and developers use to create digital artifacts, games, and interactive stories, while providing critiquing opportunities to reflect on their own experience.
- **Participating students are at different developmental stages and the project should support teachers needs for materials that are appropriate for the students with whom they are working**
- Dedicate at least two days during the summer institute to revisit *Scratch* with the teachers
- Include additional video throughout the curriculum: One teacher commented, "I feel we could use video and the screen to present the lesson's goals and activities. We introduced elements of the hero's journey, and used the fragments of the toy story, and it was a good lesson, and could teach that with students…Having some sort of video component should be present for most of the classes, and have it presented so we could run with it, and use it as part of the curriculum."
- **Most teachers expressed their concern about the possibility of having two cohorts of students in the second year: a cohort of returning students and a cohort of new students. Given that many teachers are still uncomfortable with the curriculum and technology, the project should develop two tracks for weekly activities: one for advanced students and one for new students. Global Kids should work with the youth leaders to develop the track for new students**

Recommendation 6. Share draft materials more frequently

Finally, all team members should share draft materials, activities, and evaluation components early and often and invite feedback from others.

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APPENDIX A: CLUBHOUSE OBSERVATION PROTOCOL

1. Today's date	
2. Observer name	
3. Site name	
4. # of students (# of girls, # of boys)	
5. # of teachers in the room	
6. Room setup (describe the physical layout of the room)	
7. What lesson # is the teacher leading?	
8. Have students completed the pre-survey? (If not, please refer the teacher to the teacher instructions and have them ask their students to take the survey.)	

TEACHER ROUTINES

1. Describe how the teacher introduces the day's activities. Does s/he make connections to activities from previous lessons? If so, how? Does s/he make any reference to the broader curriculum objectives (for example, explaining how some aspect of today's activities might be an example of "systems thinking" or "remixing")?

2. Is s/he using routines and/or activities from the Global Kids teacher workshops? Which ones? If not, what activities is s/he using?

3. What's the ratio of teacher talk/activity to student talk/activity (In other words, does the workshop feel more teacher-led or student-led?)?

4. How does the instructional routine feel? (e.g., Like s/he's done some planning ahead and is able to keep students moving; Like s/he hasn't planned ahead

but is still able to keep them moving, though maybe without answering questions or introducing the activities very well, etc.)

5. Does the teacher make any attempts at "cultural responsiveness" (not specifically via the research tasks—which they might not have reached)? That is, does she ask questions or prompt discussion that relates to students' interests beyond the clubhouse activities? If so, in what ways?

6. Does the teacher have his or her students use the journals or keep notes? If so, what direction do they give them?

STUDENT ACTIVITY

1. What are students doing during activities? (Are they asking the teacher questions? Each other? Do they seem interested in the activities? Do they talk with each other? About what?)

2. Are students focused on the activities at hand? In what ways? If not, what are they doing? Do some activities appear to be more engaging than others? Which ones?

3. Do students make any reference (in any related terms—that is, we don't expect them to be using academic jargon) to things like "computational thinking skills" or "21st century skills"? If so, how? During what activity?

APPENDIX B: TEACHER TRAINING OBSERVATION PROTOCOL

1. How do the facilitators introduce the activities for the day? Do they set the activities in the context of the broader project goals?

2. Describe the workshop format: Is there lecture? How often do teachers work with hands-on activities? What is the approximate ratio of lecture to activities? How much time for questions and input from teachers?

3. How often do the facilitators stop for reflection, reality checks, and checks for understanding among teachers? How do the facilitators use the feedback during subsequent activities (or to revisit previous activities)?

4. How do the facilitators integrate the day's activities with various parts of the curriculum? In other words, how do they make connections among content, game design, and culturally based pedagogy such that teachers are aware of the connections?

5. If Hofstra faculty or grad students are present, how do they introduce the activities? What do they say the objectives are? How do they connect the objectives to teachers and their students?

6. What do teachers do during the workshop activities? What comments and questions do they have?

7. In what ways do teachers seem to be making connections between the workshop activities and the student curriculum (or what they think the curriculum will be)?

8. What stands out as a particularly useful activity for helping teachers think about using the activities with their students in the after-school program? What stands out as particularly challenging, or as a "lost opportunity"?

APPENDIX C: TEACHER INTERVIEW PROTOCOL

About the teacher	
Can you tell me about how you came to be interested in the project? What drew you to it?	
In your words, say what you think the goals of the iDesign project are. Do you have different or additional goals for your students? If so, what are they?	
In what ways did you think your own experiences, interests, or skills would apply to the goals of iDesign?	
About recruitment	
Can you tell me about the recruitment process for the class? How were the students selected? Did you have certain boys or girls in mind? If so, why?	
Did you specifically try to get girls to join? If so, how?	
What changes would you make to the recruiting process (either the flyers or how you or other adults talk about it with students) for next year?	
What sorts of things, beyond the flyer, do you feel attracted students to enroll in the club?	
What sort of things do you feel might have turned students away from enrolling in the club?	
About the professional development	
Talk about the Saturday training sessions. What did you like? What did you dislike? What was helpful? What wasn't helpful? (Encourage them to be as specific as possible about workshop activities when they explain what they liked/disliked.)	
How well did the workshops prepare you to: a.) Introduce game design elements and use Gamestar Mechanic? b.) Use Scratch; and c.) Practice culturally relevant pedagogy?	

Are there specific aspects of the workshops that you'd like to change? If so, what are they and how would you change them?	
About the curriculum (be sure to have a printed copy of the curriculum laid out for both of you to look at)	
How would you describe "game-based learning" and "culturally relevant pedagogy" to someone who wasn't familiar with the terms?	
Talk about your overall understanding of the curriculum. How do the activities help achieve the project goals, as you understand them? Are there ways in which the curriculum is not helping achieve the goals? If so, please explain how. (Encourage them to use specific examples from the curriculum—give them pens and highlighters in case they want to mark it up.)	
What kinds of changes, if any, did you make to the curriculum? Are there examples where you changed the activities or introduced your own materials or activities? If so, please describe them. Why did you decide to "go off script"?	
Are there any other changes you would make to the current version of the curriculum? (Encourage them to use specific examples from the curriculum—give them pens and highlighters in case they want to mark it up.)	
About *Gamestar Mechanic* and *Scratch*	
How well prepared did you feel to introduce your students to GM and Scratch?	
How often did you look at what students were creating in GM and Scratch? How did you do it? Would you look at individual accounts? Did you have a class account? What were you looking for when you looked at their designs?	
Looking at the activity (or student design)	

Can you walk us through this activity? (Prompts: *How is it introduced? Do students work together or alone? Do student produce a final product?)*	
What do you feel students were learning from this activity?	
Do students receive any handouts and what purpose do they serve?	
From your experience, how does this activity fit within the broad goals of: a.) Games-based learning; b. Cultural relevancy; and c.) Technological fluency?	
In what ways, if any, would you change the activity to improve how well it helps achieve the three goals?	
About student work	
What kind of variation have you seen in student projects?	
Do students share their work with each other? (What does the setting look like? Do they give each other feedback? How?)	
About project communication	
How effectively have the project leaders been communicating with you about aspects of the project? Have you felt supported? Why/why not? Is there something different they can be doing?	

APPENDIX D: SAMPLE POST-WORKSHOP SURVEY

Default Question Block

Please take a few minutes to reflect on today's training. Your responses will help us know which parts of the workshop are most useful and which need improvement. You'll recognize some of the questions from last week, but here we're focusing on your experiences after the first workshop.

Thank you again!

Since last week's training, has your understanding of what "game-based learning" means changed in any way?

- ◯ Yes
- ◯ No

Please describe what's changed in your understanding of "game-based learning" between this week and last:

After today's training, how prepared do you feel to teach game design to your students in the after-school program?

- ◯ I feel prepared
- ◯ I feel somewhat prepared
- ◯ I feel somewhat unprepared
- ◯ I feel unprepared

Please say why you feel prepared or unprepared:

If you had to do it today, please describe how you would explain the game design process that you went through to your students (you can use 3 or 4 of your current students as the target). If you can, describe any places where you think they might struggle.

After today's training, how prepared do you feel to work with your students through developing a project that is

revelant to them in Scratch?

- ◯ I feel prepared
- ◯ I feel somewhat prepared
- ◯ I feel somewhat unprepared
- ◯ I feel unprepared

Please say why you feel prepared or unprepared:

After today's training with Scratch, how challenging do you think it will be for YOU to learn the program?

- ◯ It will be easy
- ◯ It will be somewhat easy
- ◯ It will be somewhat difficult
- ◯ It will be difficult

Please say why you think it will be easy or difficult for you.

After today's training with Scratch, how challenging do you think it will be for YOUR STUDENTS to learn the program?

- ◯ It will be easy
- ◯ It will be somewhat easy
- ◯ It will be somewhat difficult
- ◯ It will be difficult

Please say why you think it will be easy or difficult for you.

Think back to a moment during today's training that was especially USEFUL in helping you to understand some aspect of how to program with Scratch. Please describe the moment and explain why it was useful.

Think back to a moment during today's training that was especially CHALLENGING for understanding how to program with Scratch. Please describe the moment and explain why it was challenging.

Briefly, please describe your understanding of how beginning the student clubhouses with Gamestar Mechanic will help your students become more proficient with Scratch.

Briefly, please describe your understanding of how programming with Scratch will support (if it does) students' computational thinking skills?

Please share any other thoughts you might have about today's training that will help us improve the teacher workshops.

APPENDIX E: PROJECT PROCESS MEMO: 1/24/2014

To: Roberto Joseph (*iDesign* principal investigator)
From: Francisco Cervantes, Jim Diamond (EDC evaluation team)
Re: Process evaluation memo 1: Teacher training workshops 1–3
Date: 1/24/2014

The purpose of this memo is to share responses from brief online surveys administered after the three *iDesign* teacher-training workshops in November and December 2013 (11/16/2013, 11/23/2013, 12/7/2013). Where useful, we include evaluators' observations from the workshops to provide context for participant responses. Our goals are to:

1. Summarize teacher-generated feedback from the workshops;
2. Frame the survey responses within the project's stated objectives using the current versions of the logic model and theory of action as a guide; and
3. When appropriate, make suggestions for changes to future workshop implementations to support the project's short-term goal of creating a draft curriculum

Participant overview

Professional experience. Fourteen teachers completed the background survey at the beginning of the first workshop, two of whom also identified themselves either as a "lead teacher" or "head of department." They teach in a variety of content areas, including science (n=3), English/ELA (n=2), math (n=2), art, and technology. The majority (n=8) has been teaching in their primary subject area for 9 or more years, while 4 have taught for less than 2 years.

Technology experience. Only 3 of the 14 chose to answer a question about whether they had used *Gamestar Mechanic* or *Scratch* previously: one teacher used *Scratch* as part of graduate work and two have used *Gamestar* on their own time. Most teachers (11/14) have used games such as *Jeopardy* or *Bingo* as part of instruction, typically for quizzing or drilling. None of the teachers have designed their own games before. Seven teachers reported engaging in some form of computer programming: five created web sites, one did basic computer programming using Java, and one took a course on Flash animation.

Experience with culturally relevant pedagogy. Ten of the fourteen teachers were unfamiliar with the term "culturally-relevant pedagogy," but most associated the term with phrases such as "curriculum with a social conscience" or "socially important issues for students in specific places."

Summary of survey responses

In general, after the three workshops most teachers were more comfortable with the idea of teaching game design concepts to their students than programming in Scratch,

though most indicated they felt "somewhat prepared" to teach it and that they would like more time for practice and direct instruction from Global Kids. The teachers were evenly split between their perceptions of how difficult it would be for them and their students to use Scratch, but most indicated they need more direct instruction and practice time using Scratch. When asked "what else you need to know—or would like to know—to begin using game-based learning…" in the after-school program, nearly all (n=13) of the respondents indicated they wanted either more training or to become more familiar with the curriculum. Following are three representative comments:

- *I just want to become familiar with the curriculum and the basics so that I am better prepared to deliver the curriculum and have the students enjoy and learn from the experience of being in the club.*
- *I would like an idea of the scope/sequence of the unit before we begin - how long we will work on each stage of the product.*
- *I feel that I would need more of a starting point and a direction as to where to start and where to go with my students.*

Relationship of teacher workshops to project goals

As modeled for teachers during the full-day workshops, the *iDesign* curriculum comprises two broad sets of computational thinking skills and practices: game design (primarily using *Gamestar Mechanic*) and computer programming (using *Scratch*). Students will learn those practices in the context of afterschool computer clubhouses led by content area teachers who lead activities informed by "culturally-relevant pedagogy." In this project, that pedagogy emphasizes building relationships between course content and students' cultural contexts by researching local issues that matter to students.

The intended learning progression for the skills and practices within the workshop and after-school activities is laid out in the following table:

Computational thinking (computational concepts, practices, and perspectives) **Is learned via the following activities:**		
1. Game design	**2. Computer programming**	**3. Research**
Taught to students and teachers via: *Gamestar Mechanic* *Grow-a-game* cards Deconstructing existing games	Taught to students and teachers via: *Scratch*	Taught to students and teachers via: Culturally-relevant pedagogy (Identifying issues and "translating issues" into games and programs)
Which leads to Serious game design and development and interest in STEM		

In the following sections, we summarize teacher responses beneath the three main curriculum activity areas.

Games-Based Learning

After the first workshop, teachers were asked what "games-based learning" means to them. For most of the participants (n=12), GBL is a different form of content or skill acquisition. For example, one teacher wrote that GBL means "learning academic and social skills through games," while another wrote that it means "learning (acquiring new skills, content, or values) though the use of games." A smaller number of teachers viewed GBL as a method of engaging in problem-based learning. One teacher wrote that GBL means "learning through designing, experimenting, and revising to incorporate feedback in order to solve a problem" and another suggested that it is "a means of teaching and learning that involves visual art, problem solving, and collaboration through the game play concept."

After the second teacher workshop (total number of survey responses=7), four participants stated that their understanding of "games-based learning" had changed due more hands-on practice with games, and GBL materials. The majority (n=5) felt "somewhat prepared" to teach game design to their students in an after-school setting. To improve their preparedness, participants asked for more practice time with the technologies and clarification about the curriculum implementation.

Culturally-relevant pedagogy

After the first workshop, teachers generally attributed being prepared to teach using a culturally-relevant pedagogy due to their experience with a diverse student population and felt that they understood the related concepts. For teachers that felt unprepared, they asked for more examples of "culturally-relevant games" and practice with the use of technology. Others, however, indicated that being exposed to games gave them a better idea of what culturally-relevant pedagogy looks like. Some teachers indicated that they were unclear about the week-to-week activities in the curriculum and their relationship to the goals of culturally-relevant pedagogy.

When teachers were asked "what else do [they] feel [they] need to know—or would like to know—to begin using game-based learning and culturally-relevant pedagogy practices with [their] students in the after-school program," participants asked for more familiarity with the curriculum, and clarity on enactment of activities. Specifically, participants would like more familiarity with technological tools, websites that student's will interact with, programming challenges that users might encounter, and exposure to various types of games.

Research: Connecting issues that kids have identified to game play. The majority felt "prepared" (n=2) or "somewhat prepared" (n=3) to work with students through the research, design, and development process. Several expressed concerns about their students' abilities to engage in research, however. For example, one teacher wrote, "Students have a hard time doing research. They will have a hard time related that to the game design instead of playing the game for only the fun of it." Another

commented that, "The students may struggle with the level of research needed to have a very good handle on the topic chosen."

Technology

While participants generally felt unfamiliar with *Gamestar Mechanic* and *Scratch,* they felt comfortable with the design process as introduced by Global Kids and with helping students enact the activities they participated in during the workshop.

Six respondents answered a question about how prepared they felt to teach with *Scratch.* Three indicated they felt prepared (e.g., one teacher commented, "It will be somewhat easy because I have programmed in *Scratch* before and feel very comfortable with the process") and three felt unprepared (e.g., another teacher commented, "I need more direct instruction and practice"). They asked for more practice time, activities that included problem-solving exercises, or practices to support the use of *Scratch.*

The teachers were also split over how challenging their students might find *Scratch.* Two teachers commented that students would not find it challenging because "it involves having them create their own environment and characters" and "students are more computer savvy and will learn this program faster." Two teachers who noted that their students would find *Scratch* challenging, commenting that "they will need direct instruction" and "Many of the students in my district are reading below their grade level and doing math below their grade level, so I just hope that they will be able to comprehend some of the directions they are asked to complete."

Suggestions

Based on teachers' comments in the surveys and our observations of the workshops, we suggest the following activities at future teacher training workshops:

1. *Share the draft curriculum with teachers and familiarize them with concepts of "technological fluency" and "computational thinking":* Several teachers expressed some confusion about the overall goals of the project. That is, while most understood and were excited by the goal of familiarizing students with *Gamestar* and *Scratch,* many felt unclear about the relationship between those technologies and "culturally-relevant pedagogy." Making the connections between the technology-based activities and technological fluency could help clarify teachers' understandings of the project objectives.
2. *Provide more hands-on time with Scratch while teachers are together and with Global Kids instructors:* Many teachers remarked that they enjoyed the hands-on activities and having the opportunity to have feedback from their peers and from Global Kids. Giving teachers more of the same types of problem-solving activities that their students will have in the after-school program would allow for additional practice with *Scratch,* which several asked for. As one teacher commented, "I wish we had spent a larger proportion of the time working with Scratch over the three days of training. It could also be helpful to more thoroughly frame how coding works—how the computer reads the language and how you need to use logic statements (if/else, etc.) to complete the code. I had taken one programming class before, but I know others were confused by how the code puzzles together." Additionally, by working in groups, teachers might become more comfortable with sharing ideas and feedback, as well as asking questions about the software.
3. *Include one or two activities in which teachers connect research, game design, and Scratch programming.* Several teachers commented that they did not understand how their students would be able to take their research and turn it into a game using *Scratch.* Allowing teachers to practice those activities together during the workshops would provide them with opportunities to ask questions of Global Kids instructors and to begin thinking about how they will help their students engage in making connections between the three areas.

APPENDIX F: CULTURALLY AMBITIOUS TEACHING PRACTICES IN MATHEMATICS[‡‡]

CATP practice		
Academic Achievement. The learning environment has as its focus the CRP tenet of academic achievement. Teachers demand, reinforce, and produce academic excellence in their students; students' skills and abilities are valued and channeled in academically important ways (Ladson-Billings, 1995). Providing structures, templates and academic protocols for students allows them to have a base upon which to build their learning and in turn, will scaffold students to tackle higher-level problems and tasks. Teachers also know that in order for students to be successful in the work that is expected of them, additional work may be needed on a regular basis – in and out of the classroom. Students need multiple opportunities to learn new materials and grapple with challenging ideas while developing perseverance and dedication for their academic endeavors. This additional and focused time can allow teachers to attend to students' academic identities and explore the ways those identities are tied together with their personal and cultural identities (Martin, 2000; Nasir, 2002; Nasir & Saxe, 2003).		
sub category	**Academic achievement**	**The teacher:**
classroom interactions	**Encouraging all students in their academic success; providing space for accolades of academic achievement**	develops a system to provide all students with academic success on their academic levels; offers students consistent, focused and specific feedback on their academic work; provides rigorous and meaningful goals for students to reach and supports all students attempts to reach those goals; describes the outcomes of classroom work habits and behaviors on future outcomes
content inquiry and tasks	**Questioning and probing students on multiple levels (Bloom's taxonomy) and using thinking time to encourage academic engagement**	Uses multiple levels of questioning (Bloom's taxonomy as an example) to solicit student ideas or information and probe student thinking; uses multiple levels of questioning and discussion with students to support learning through modeling
content inquiry and tasks	**Providing activities and tasks of a varying cognitive demand that challenge all levels of students in classroom - memorization, procedures without connections, procedures with connections, doing math.**	considers cognitive demand of work provided to students; uses differentiated instruction methods to allow all students to engage with learning activities that encourage higher level thinking
content inquiry and tasks	**Using multiple forms of assessment to support the learning growth of all students**	continually gathers information/data about students through assignments, questions, interviews, writing tasks, and other means; makes appropriate decisions about such matters as reviewing material, reteaching a difficult concept, or providing something more or different for students who are struggling or need enrichment; provides students with clear and timely feedback on their learning with opportunities for corrections and growth
content inquiry and tasks	**Modeling, comparing, and analyzing problems and solution strategies with students by thinking, reasoning, and justifying**	interactively models problem solutions, games, and tasks to emphasize strategies and thinking; models and compares different strategies when discussing student work; conjectures, reasoning, error analysis, and alternative solutions are discussed; models how to make sense of content ideas, construct arguments, analyze situations, provide evidence and support for conclusions and claims
family, school. community integration	**Creating a two way communication pathway about academic progress between school/classroom and families using multiple forms of communication**	develops consistent forms of family communications, beyond normal school measures, that informs them of upcoming classroom assignments, student grades, conferences, and other classroom needs
learning structure	**Providing work and interaction templates, structures, routines and organizers for students in assignments, communication and behaviors**	develops specific tools, routines, formats, and forms to support organized learning for students; provides consistent examples and reminders for these structures

[‡‡] Waddell (2014)

APPENDIX G: REVISED CURRICULUM MAP, JUNE 2014

Lesson #	Objectives
1 **Welcome to the Club!**	▪ This lesson gives students an overview of the big picture and what to look forward to in the coming months ▪ Students learn each other's names ▪ Introduction to *iDesign* and *Scratch* ▪ Sign up for account in *iDesign Playbook*
2 **Elements of a Game, Part 1**	▪ Students will begin to think constructively about games. ▪ Identify and analyze elements of a game by using *Rock, Paper, Scissors* as an example ▪ Students sign up for individual *Gamestar Mechanic* accounts. ▪ Play if time allows.
3 **Elements of a Game, Part 2**	▪ Further exploration into the elements of a game ▪ Students analyze game elements, using *Tic-Tac-Toe* as an example ▪ Students modify an effect to observe changes to the entire game ▪ Students demonstrate their newly created game
4 **The Game Design Process**	▪ Students are formally introduced to the design process ▪ Students will design a game using the *Prototype, PlayTest, and Change* game design process ▪ Students critique other students' games and provide meaningful feedback
5 **The Game Development Process**	▪ Transition from *design* process to *development* process, where the latter concentrates on creating video games. ▪ Students will develop their first game in *Gamestar Mechanic* ▪ Students identify goals, rules, and obstacles of a game
6 **Culturally Relevant Design**	▪ Introduce the idea of culturally relevant game design ▪ Students play and analyze culturally relevant games ▪ Students design a values based game using *Grow-a-Game*
7 **What Would You Fight For?**	▪ Further exploration into culturally relevant game design. ▪ Students use their knowledge of the game design process and elements of a game to design a game about global, civic, or social issues that are important to them.
8 **Introduction to Research**	▪ Introduction to the design process that will helps students design culturally relevant games ▪ Students conduct research about the issues of their games that they designed from the previous lesson ▪ Utilize Internet-based resources to find information and determine how this info can be applied to the development of a videogame that will educate players about a given issue
9 **Intro to *Scratch***	▪ Students have begun preliminary research about a cause that is important to their game from the last lesson. Now, they will be introduced to *Scratch*, which they will use to make their game. ▪ Students identify parts of the *Scratch* interface ▪ Play and remix games on *Scratch*
10 **Elements of *Scratch:* Sprites**	▪ Students learn to write small scripts and take in depths look at Sprites ▪ Students will refer to their character (*superhero*) from lessons 7 and 8 to experiment with animation ▪ Superhero from game 'introduces' him/herself ▪ Students will design a Sprite, design a background, and make their character 'talk'.

11 **Elements of *Scratch:* Scene**	▪ Sprites interact with the scene and students take their superhero from previous activities/lessons to create movement within the scene ▪ Students will move their character to a specific part of the screen using the coordinate plane on *Scratch.* ▪ Introduce other blocks, which students can use to interact with the background and other components.
12 **Elements of *Scratch:* Putting it Together**	▪ This lesson is a combination of all that has been learned about *Scratch,* so far. Students will use their newly acquired skills to work on the activities in this lesson. ▪ Students elucidate how to make positive changes in their environment by creating scenes and writing scripts in *Scratch.* ▪ Students share projects and give each other constructive criticism.
13 **Story Writing Brainstorm**	▪ Students will learn to collaboratively brainstorm stories and will later apply this skill to the creation of their game. ▪ Students will be able to create a *Scratch* project that tells a story by building on the work of others.