When Play Works: Turning Game-Playing into Learning

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ABSTRACT

Current research on technology development for children focuses on children's roles as design partners helping to set high level goals or exploring prototypes and interfaces. In this project, we investigate whether game modification toolkits enable children to build games themselves rather than turning their ideas over to expert developers. Using an accessible toolkit for the game *Neverwinter Nights*, we invited seven children between the ages of 12 and 14 to design and build their own games. We analyzed their plans, the games, and their reflections on the experience to explore what our participants discovered about the roles of developers and players, how their experience as builders differed from their experiences as players, and what they perceived to be the benefits of building rather than simply designing or playing games. Our results show that children can master modification toolkits and that there may be value in encouraging children to build rather than simply play computer games.

Categories and Subject Descriptors

H.5.2 **[Information Interfaces and Presentation]**: User interfaces – *Evaluation/ methodology*; K.3.1 **[Computer and Information Science Education]**: Computer uses in education – *Collaborative learning*;

Keywords

Children, computer games, learning and education, game design, collaborative work

INTRODUCTION

> ***Seymour Papert:*** *The deep contribution of the computer to education comes from its being a constructional material as well as an informational medium. Children can use it to make far more complex and intellectually rich constructions. It allows a shift in balance from learning mostly by being told to learning far more by making and doing* [8].

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Much of the current research involving children and new technologies revolves around children as design partners. Working to develop designs, test technology, and suggest revisions, children as design partners improve the technologies they consume as well as gain educational benefits from the experience [1, 9, 12]. Consistently, the focus of such research is to look at children only as designers. While the adults may share in the design processes, the children do not take part in the actual building of the technology; they are instead players and analysts after the fact.

In her conclusion to "Learning about 'Learning through Design'," Kafai prompts us to examine the benefits gained by children actively building instead of just playing with or using technologies others build for them [6]. In this project we focus on moving beyond engaging children in designing technologies by enabling them to construct complex but playable computer games for themselves.

Based on Robertson and Good's GameMaker workshop, we chose the *Neverwinter Nights* (NWN) toolset for our young team members to create their own game modifications (mods) [11]. Rather than exploring the value of game-building as a narrative exercise [4, 11], however, we positioned this study to look at how children would manage the relationship between developer and player. We encouraged our youngsters to focus less on using the game to tell a story and more on constructing games others would enjoy playing.

We took an open approach to letting the children design and build their mods: we wanted the children to focus on the benefits they discovered through their experience. Here we present a case study with children as the builders and designers of games. This open-ended approach allows us to investigate some preliminary answers to these questions:

- What do children discover in their new roles as builder and designer?
- How does their experience of building games differ from their experiences playing and consuming games?
- Aside from benefits that researchers can observe externally, what benefits do the children perceive from the building experience?

RESEARCH DESIGN

To explore how young participants respond to an invitation to expand their roles from co-designer and co-researcher to developer, we provided the children with tools we thought they could learn quickly and invited them to develop and build a game with those tools. We observee how participants planned activities, managed technical challenges, and organized the work of a team.

NWN is a role-playing game supporting both individual and multiplayer gameplay. Players move characters around in a 3D environment and interact with other players, with computer-generated characters, and with objects in the environment. The NWN toolkit for modding has many characteristics of a good construction kit for children [10]. It allows an author to drag and drop elements into a gridded 3D space and create a new NWN game level as well as add complex scripted interactions into the game.

Researchers met with the seven participants on Saturday mornings for 6 weeks. Of each three-hour meeting, an average of 90 minutes was spent on this project, with a total of approximately 9 hours devoted to work on the games. The four boys and three girls who participated in this project are all regular members of our ongoing intergenerational design team [9] and are all between 12 and 14 years old. One was new to the design team this year while the other six have participated in collaborative inquiry projects for the last two to four years. Thus they are accustomed to working together to brainstorm and to solve problems but they have never before been asked to develop their design ideas themselves.

Researchers framed the project in four steps:

- Demonstrating the game's basics to orient those participants who had not played NWN before
- Providing the participants with time to play a NWN level developed by one of the researchers to introduce many of the basic interactions of gameplay
- Demonstrating the toolkit software navigation
- Providing a short period for individual exploration of the toolkit during which each participant built a small mod to gain experience with the affordances and limitations of the toolkit.

Children formed into three teams of two or three participants. In the first session each team worked with one researcher and was encouraged to develop its own planning and design methods and documents. The next three sessions were devoted to development and the fifth session to testing each game. In the sixth week teams revised their games based on the feedback from testing. Each team presented its work and demonstrated its game to parents and the other members of the intergenerational design team. At the end of the development period, researchers used a semi-structured interview script to discuss the process with each child individually.

RESULTS

Designed as an exploratory study, this project enables us to watch how this group of children plan, execute that plan, seek solutions to technical challenges, and organize their efforts collaboratively. The games themselves together with the planning documents and records allow us to draw inferences about our participants' goals and processes for achieving those goals. The interviews provide us with some insights into what participants thought they had learned and how they felt about the activity. (For additional information about this study, see http://iat.ubalt.edu/kidsteam)

Planning and Products

The original planning documents demonstrated very detailed story and high-level concepts, but little concern with technical issues or limitations of the toolkit (see figure 1). Although no team completed its entire plan within the time allotted for development, they did create complex constructions with multiple levels of play. Each team built a playable game, each game incorporated elements designed by each member, and each one covered a segment of the team's original plans. All levels were more complex than a simple 3D game space: each had engaging player interactions and compound goals. Teams included different interactive elements: enemies that attack players, non-player characters capable of interactive conversations with the player, or henchmen (non-player characters) who could provide aid to human players.

Figure 1. Detailed planning document.

How Building Games Differs from Playing Them

The interviews revealed that prior to this experience, our participants had given relatively little thought to the difference between playing a game—an activity with which they were all familiar—and building or designing a game for others, an experience that was new to all of them.

In their plans, all teams created encompassing narratives but when they began to build the space of their games, they discovered that good ones have to give players more scope of action than their narratives had envisioned. As storytellers, they needed or wanted to be able to direct

players' activities. As builders, they had to confront their lack of control over what players' desires and behaviors. Watching others test their games and getting feedback from other teams led two of the three projects to undergo fundamental restructuring, suggesting that playtesting provided important insights into the builder's role.

One team discovered that players could have a different idea of fun. In their original build they had used a large blue dragon that attacked the player relentlessly. Players could not defeat, and had little fun running from, the persistent foe. The builders came to see that successful designs had to focus less on their own stories and more on players' experiences.

A second team had originally created a dungeon specifically for higher-level characters, so that to succeed a player would need to have extensive experience. After the playtesting experience, the team members saw that beginning players could never succeed. The team then changed the dungeon's level to be a more appropriate challenge for lower-level characters.

Figure 2. Screenshot of one team's game.

What Benefits Children See

The interviews yielded intriguing reflections, ranging from new understandings about why people build games for others to new appreciations of the skills involved and the fun they can have meeting and mastering challenges.

Reflecting on their teams' successes, the children expressed a need for more time to complete their projects, but generally felt proud of what they had accomplished so far. As figure 2 shows, the teams created robust and complex spaces and interactions for their games. Most participants seemed interested in continuing their projects. One girl noted that her perspective on game development had changed. Before this experience she said, "I used to think [developing games] was a waste of time. It's because I never liked them… If it wasn't successful, then it was a complete waste of time." When asked if she still felt that way, she continued, "Sort of, but now, not as much. It is worthwhile…. Because, people do play video games for a reason, not because they don't have something better to do. I mean, it's good skills, and it's good a lot of things." She's still not impressed with the process, but feels that it demands serious work and she can understand why some people would want to do it. Echoing Kafai's conclusion that programming can be a tool for personal expression [6], one girl expressed the profound opinion that people can build games to express themselves: "Some people build games to express how they feel, just like any other hobby. So you can see how they build and what they thought of when they made their game."

Reflecting on the skills people gain from making games from their own experience, one boy noted the problem-solving skills involved with translating his initial design into the toolkit and ultimately the final game. Another girl described the teamwork skills she developed during this experience working with two other team members. In fact, successful problem-solving seems to have been a factor in the fun of building. All children described fond memories of particular aspects of their experience. Especially difficult and frustrating problems were described with smiles and they discussed the different solutions they tried as well as what they would try next if there were more build time.

Among the discoveries related to skills was their recognition that iterative testing of their work was essential to success. Through the experience, most children began to realize that builders need to execute and test a small piece of what they've built before moving on to a new part and then having to test a larger segment for problems.

Could NWN Be Used to Build Educational Games

Although we did not constrain the games our participants built in any way, the intergenerational design team has been working with both recreational and educational technologies for several years. As a result, we took this opportunity to ask our participants whether they could imagine NWN used as a platform for educational games. All of our participants expressed doubt specifically because of the violent aspects of the game. They all seemed to have a clear idea of what too much violence would be and were able to describe their own thoughts on too much violence for school as well as acceptable levels of violence. Two of the boys, however, were able to imagine and describe historical applications for NWN as a simulation or experience. One boy elaborated with an example of a colonial simulation that is close to the actual MIT project "Revolution," a NWN mod simulating 1775 Colonial Williamsburg [5].

CONCLUSIONS AND FUTURE WORK

Gee points out that "active, critical learning in any domain should lead to learners becoming, in a sense, *designers*" [3]. Active learning through building takes the process one step further. Kafai's work [6] shows that encouraging children to build games supports the development of

problem solving skills in an open-ended development environment. The complexity achieved in her students' projects over 6 months suggests that with more time and iterative revisions, children can create extensive projects.

Yet, as Robertson and Good also note [11], children need appropriate tools, objects and materials sufficiently accessible and easy to learn so that they can adequately realize their designs. The toolset that comes with NWN may not be ideal for supporting children's work. The learning curve indicates that both interface and functions may need to be revised for children's use. Similar modifications to the Smalltalk programming language into the friendlier Squeak made programming experiences more accessible to children [7]. To make the NWN environment more child-friendly and significantly reduce the learning curve, a toolkit redesign should pay close attention to Resnick's reflections on good construction kits for children [10] as well as be aware of issues with authoring and new media described by Fisch [2].

Our study confirms that with sufficiently accessible tools, children can build satisfyingly complex and playable games. Their experiences suggest that both designing games and building them for themselves provide opportunities for learning problem-solving skills and teamwork. Their experiences also suggest that testing their creations with others can lead these youngsters to a better understanding of the vital difference between creating to express oneself and creating to engage and shape others' behaviors. Our focus on the development of games for others to play provided some suggestive insights into how 'tweens and young teens negotiate the tension between expressing themselves as creators and meeting the needs of others as players of their creations.

To assess more fully what children may learn by becoming their own game-builders, studies with larger numbers of children both in the context of formal schooling and in the more informal contexts of summer or weekend programs will need to be conducted.

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