Wii Can Do It: Using co-design for creating an instructional game

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Abstract
There are many children for whom learning is difficult if they need to remain still. The Nintendo Wii, with its motion-controlled sensors, can support learning experiences that enable children to be physically active learners. This paper presents the methodologies and results from a multi-day, co-design session at the University of Maryland's Human-Computer Interaction Lab. The goal of the sessions was to design an instructional game that leveraged the Nintendo Wii's motion controls to teach about U.S. National Parks.

Keywords
Children's technology, co-design, cooperative inquiry, educational video games

ACM Classification Keywords
D.2.2 Design Tools and Techniques: Evolutionary Prototyping

The Need
Children with attention deficit disorder (ADHD) are often categorized as restless and have trouble focusing in class and, yet, can often concentrate on video games[13]. Winebrenner [14] describes different strategies for working with "twice-exceptional" students—students who are gifted in some areas and
have learning disabilities in others. One strategy is to build movement into learning tasks through in-class activities and to incorporate hands-on experiences because "manipulation of objects often helps these students better understand concepts when they are transferred to more abstract applications within content areas" [14, p. 135].

There are also many children who have not been classified with special needs, but can also be thought of as kinesthetic learners who need and excel at learning by moving [15]. Gardner [6] outlined a number of intelligences that can be used to classify intellectual competencies, one being "bodily-kinesthetic.” The challenge is that few educational technologies have adequately addressed this need to learn and move.

Until the Nintendo Wii, the majority of video games were designed for a control pad, joystick, or keyboard and mouse combination. Recent games like Dance Dance Revolution (DDR) and Guitar Hero broke new ground by creating specialized controllers: DDR used a dance mat and Guitar Hero used a controller in the shape of a guitar. The Nintendo Wii introduced motion-controlled devices to the consumer market. Games designed for the Wii often require the players to move around in some way. This type of kinesthetic play is currently being used in a learning game installation in Sweden [7]. However, this installation is an interactive floor and does not use motion-sensing controllers.

Although kinesthetic game play and learning is being studied, the literature lacks any study of motion-sensing controllers and instructional games. With the Nintendo Wii being the most popular of the modern-generation video game consoles at 18 million sold in the United States since 2005, the availability of motion-sensing controllers in homes has never been higher. Combined with an increasing interest in instructional video games [10, 12, 3, 1, 9], there is an opportunity to understand and evaluate motion-controlled, instructional video games.

**What we did**

We began to address this need with three design sessions working with children at the University of Maryland's Human-Computer Interaction Lab. The Kidsteam group is made up of nine children, ages seven to eleven years old. There are four boys and five girls in the group, and one boy and one girl have been labeled as having challenges with attention and focus. The main method of design was Cooperative Inquiry [5].

**Methods**

The chosen method of co-design was Cooperative Inquiry. Cooperative inquiry relies on adults and children working together as design partners to create low-tech prototypes. Those prototypes are redesigned iteratively until they are implemented into a high-tech prototype. That prototype then receives feedback from the design partners and an iterative cycle continues. Cooperative inquiry is different from informant design because, in informant design, the children are only consulted on occasion and "ultimately adults are still in charge” [4, p. 18] In cooperative inquiry, the children participate in the design of the technology throughout its life cycle.

On day one of the study, the participants were divided into pairs based on perceived age and gender. The participants took turns playing Wii Sports on the video game system. Each pair was given approximately ten
minutes of play time. In those ten minutes, the participants chose a Mii, a kind of avatar, from a list of pre-configured options and played tennis against each other. The participants were video recorded playing the Wii. When not playing with the Wii, the participants wrote in their journals about their favorite video games.

![Figure 1. Participants playing Wii Sports.](image)

After the play and journaling sessions, the group participated in a feedback session. In this session, the participants were asked to write what they liked, what they didn’t like, and design ideas about their Wii experience. Each idea was written on an individual sticky note and placed on a white board as the participants filled them out. The individual ideas were organized and clustered into like categories. When the participants were finished with their feedback, the group debriefed and discussed the trends in the opinions and ideas.

On day two, the participants designed their own instructional video games using low-tech prototyping techniques. The participants were asked to design an instructional game using the Wii that would teach someone about something related to the U.S. National Parks or some historical events. The participants were grouped into three teams, with a minimum of two children and one adult per team. The participants used "Bags-of-Stuff", large plastic bags filled with arts and craft supplies like construction paper, beads, glue, yarn, and Styrofoam.

After the low-tech prototyping session, the participants met to discuss each other’s ideas. Summaries of each game were written on the white board and “Big Ideas” - common trends in participants’ ideas - were identified.

On day three, the participants were placed back into their groups with different adult partners and used Mixing Ideas [8] as the main method of design. Each team worked on combining their ideas into one cohesive idea that would be presented to the larger group. Once the teams presented, the common trends were identified and the group began to come up with one design for an instructional video game.

**Results**

**Play Session and Feedback Discussion**

Observation of the play session revealed some difficulties in using the Wii controller as a mouse, the communication trends of the participants, and the importance of the avatars to the participants. The feedback session that followed the play experience was equally valuable in identifying the likes, dislikes, and design ideas that the participants had.
The observation of the play experience showed that the participants had some difficulty in using the Wii controller as a mouse. Before the games started, the players were asked to choose tennis from the menu using the Wii controller as a mouse. Unlike a traditional computer mouse, the Wii cursor does not stay on the screen if the controller is moved outside of the bounds of the screen. This led to some participants’ difficulty in choosing a menu option because they could not calibrate themselves to the display. The participants had a similar experience in choosing an avatar. However, once the Wii controller was used in an analogous way to the real sport, the difficulties seemed to end after practice. See Figure 1 for an example of the participants playing.

Participants were very open to talking to one another during the play session. The players would often talk to each other as the game went on, although at first, they spoke with the researcher overseeing the Wii. The topics of conversation were usually centered on the game or some shortcoming of it. As the groups rotated through the game play and went on to the journaling activity, the journalers quickly finished so they could come back and watch. The observers gathered around the participants and talked with each other and the players. They cheered and jumped even though they were not playing.

The participants were very interested in the avatars as well. The Wii enables users to create simple avatars, called Miis, and use them in some games. Because time was limited in our session, the participants chose from a list of pre-designed Miis. The appearance of the Mii has no effect on the performance in the game. It seemed as if the motivating factor in Mii selection for the boys was how silly the character looked, while the girls usually chose characters that had some physical similarity to themselves. The male participants often commented on the appearance of the Miis in the game. In the feedback discussion, participants mentioned that they wanted more realistic Miis.

According to the feedback discussion session, the most liked part of the play experience was moving and doing the action that was in the game.

Low-tech Prototyping
On day two of the research study, the participants were asked to design an instructional game for the Wii that would teach someone about either national parks or historical events. We chose that topic because most members of the Kidsteam group had prior knowledge of national parks due to a previous project.

The most common trend was the idea of time travel to historic events, although each group had a different idea of what to do while in the past. One group had the idea of helping the historical figures in some way, while another group wanted you to play the role of a historical figure, and finally, the third group wanted you to play the role of someone in the historical times, for example, a World War II soldier. One group designed a game in which you needed to help the Wright Brothers build their first plane by finding and gathering parts. Because the instructional game was being designed for the Wii, motion control was prevalent in the designs. In one design, the players would take on the role of early explorers and use a dance pad or motion controllers to perform a traditional ceremonial dance in order to gain the trust and cooperation of the Native Americans they meet. In another design, the players would take control
of a sailing ship by using the Wii controller as a steering wheel while another player would use the Wii controller to aim cannons at rocks.

The idea of interacting with people in the games was also very important. Whether you were being the historical figure, or assisting the figure in a historic event, the groups all designed interactions with others. In one example, the player would go back in time and help Lewis and Clark find their guide, Sacajawea. Most of the designs allowed for multiple, cooperative players in the game.

Finally, some of the groups thought that there should be a quiz. One participant designed a game that was a trivia contest and the whole game was a quiz in which you won jewels. Another group added the quiz to the end of the time travel game.

After the groups had a Mixing Ideas session on the third day, three distinct games began to take shape. The game designs were so similar, the larger synthesis went relatively quickly. The group agreed that the game would have the following attributes: A character that you create, time travel with a time machine, missions to complete in historical times, reward system, use of motion controllers in an analogous way.

One thing that was missing from the final design was cooperative play, although the previous days’ observations identify it as an important attribute to their instructional video game.

Lessons Learned and Future Work

Thus far in the design process, we learned the following four approaches to design with Wii controllers:

- Children very much enjoy choosing avatars, but easier menu controls need to be developed.
- Wii experiences are very social, so the interface and content should engage multiple audiences.
- Time travel seems a compelling way for children to learn about history and social studies issues.
- The Wii controller enables movement for users that doesn’t have to be about sports, but adventure and missions to solve.

The next step is to create a low-tech prototype in the form of storyboards. We will take the designs of the team and illustrate the game with a paper prototype. The paper prototype will include the opening screens, one mission, and the rewards mechanism. Each time the motion controllers are to be used, there will be an inset picture on the storyboard of the actions to perform at that point. An interactive prototype will then be built.

As the game play becomes more mature and stable, the prototype may be used in other research studies like instructional efficacy, learner satisfaction, or a design analysis comparing the original ideas with the final design.
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References


