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# Virtual Reality, Children, and Dinosaurs

**Nancy A. Jennings**

**Tony Liao**

**Laura Dell**

**Chris Collins**

University of Cincinnati  
Cincinnati, OH 45221, USA  
Nancy.Jennings@uc.edu  
liaotc@ucmail.uc.edu  
laura.dell@uc.edu  
chris.collins@uc.edu

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## **Abstract**

This research will examine the use of Virtual Reality (VR) with young children using educational age-appropriate Science, Technology, Engineering, and Mathematics (STEM) media content in a non-formal learning environment. A special game based on the show called *Dino Dana*, an educational television program about prehistoric creatures targeted to children ages 4-7 years, will be created in collaboration with the show's producers, Sinking Ship. *Dino Dana* features two sisters who interact with dinosaurs using their imagination. The show is shot live-action, and the dinosaurs are animated using computer generated imagery (CGI) technology. The game is based on *Dino Dana* and involves Dana having different adventures with different dinosaurs.

## **Author Keywords**

Virtual Reality; Children; STEM; Computer generated imagery; presence.

## **ACM Classification Keywords**

K.3.1: Computer Uses in Education; J.4: SOCIAL AND BEHAVIORAL SCIENCES

## **Introduction**

With tremendous growth in virtual reality (VR) in the consumer market, early adopters are likely to use VR

devices and content in their daily lives. Since children are often early adopters of technology, it is expected that VR will reach this audience quickly and widely. As with each new technology, the same questions about the effects and uses of VR are being asked, particularly about children. To date, far more VR research has been conducted with adults than with children. While the primary focus has been on VR within various medical and clinical settings with older children and teens, Bailey and Bailenson [1] contend that VR has “unique affordances” that spread beyond these setting and encourage extending the research on VR and youth into everyday life experiences. As such, this study will provide a richer understanding of the use of VR in the lives of children in a number ways: 1) to expand the range of use from medical settings and practices to everyday household use for education and entertainment; 2) to explore VR use in young children who may have different expectations and experiences with media content and devices than older children and teens; and 3) to employ an interdisciplinary team of experts in children’s media, child development, communication, and technology with an industry partner in children’s media production to test and improve content for children.

### **VR Affordances and Previous Research With Children**

Biocca and Delaney [2] define VR as “the sum of the hardware and software systems that seek to perfect an all-inclusive, immersive, sensory illusion of being present in another environment, another reality” (p. 63). VR headsets cover the eyes, headphones cover the ears, and the external world becomes invisible to be replaced by the sights and sounds conveyed through the technology: “Such a world may mimic the

properties of some real-world environments, either existing or fictional; however, it can also exceed the bounds of physical reality by creating a world in which the physical laws ordinarily governing space, time, mechanics, material properties, etc. no longer hold” [10, p. 1321]. This immersion lends itself to a variety of opportunities.

The primary focus of VR use with children has capitalized on this sense of immersion as a means to block the external environment. VR has been used to distract pediatric patients as they undergo painful medical procedures [11]. For children with Autism Spectrum Disorder (ASD), this immersion can be particularly helpful to remove confusing and competing external stimuli [13]. As such, blocking the external environment should afford more focus on the experience inside the immersion and enhance learning.

In addition, VR allows for the ability to create content in a controlled environment. Vera and her colleagues [13] contend that with VR, content creators can manipulate the immersive setting to change size, shape, and color of objects and, in particular, adapt the learning environment to the sensory profile of the child. As such, VR should create a controlled learning experience.

Children’s uses and experiences with media content and devices. Media and technology continue to be influential in children’s lives. There has been a five-fold increase in ownership of tablet devices such as iPads in 2 years (2011 (8%) to 2013 (40%)) among families with children age 8 and under [3]. Technology holds a dominant place in the lives of children today, yet many

of the same principles from earlier media platforms still apply.

### **Science of Learning**

Hirsch-Pasek and her colleagues [7] contend that a limited amount of educational apps are developed with a focus on how children learn and suggest that to put the “education” back in “educational apps”, developers need to orient their goals on the four pillars of learning: 1) Active learning “minds-on”; 2) Engagement in the learning process; 3) Meaningful learning; and 4) Social Interaction. VR has the capacity to stand on these pillars.

### **Children’s Learning From Educational Media**

Fisch’s capacity model is composed of “three basic elements: processing of narrative, processing of educational content, and the distance (d) between the two—that is, the degree to which the educational content is integral or tangential to the narrative...” [4, p. 144]. The closer the educational content is to the narrative, the deeper the processing of the content. VR tightens this gap never before possible.

### **VR and Characters**

Children form parasocial relationships (one-sided interpersonal relationships that resembles real-world relationships) with media characters [8]. These relationships serve as a bridge that narrows the gap between content and narrative. Children have a deeper learning experience from characters with which they have a parasocial relationship [9]. These characters can draw viewers into the educational content and transport them closer to the content for a richer learning

experience. This can be magnified within an immersive VR setting.

### **Potential Risks/Limitations**

With potential VR opportunities, concerns have risen regarding the safety and use of VR with children, particularly young children. Most of the popular consumer VR headsets are recommended for use with older children [6]. However, companies have been unable to explain these age restrictions, and scholars speculate that this has to do with the lack of research on short and long term implications of VR on children [6]. This is particularly pressing given that the educational benefits of AR and VR tools still need more rigorous study across age groups: “Compared to studies of more mature technologies in education (e.g. multimedia and web based platforms), research of AR applications in education is in an early stage [...]. To provide more evidence on the educational values of AR, controlled and comprehensive evaluation studies that include a large sample and valid instrumentation are needed” [14, p. 47].

### **Method**

Children (ages 6-8 years) will participate in a VR gaming experience as an extension of the children’s television show called *Dino Dana*.

Parents will bring their child to the facility to participate in the study. Children will be escorted to an interview space prior to the VR experience. While the child is participating in the study, parents will be asked to complete a short survey.

Each child will complete pre-game survey/interview. Questions will be read aloud to children and visual aids will be provided to assist children with the questions. This initial interview will take about 10 minutes.

Following the interview, children will be escorted to a VR gaming area. The child will be introduced to two other research assistants who will help with the VR equipment. One research assistant will be the "Wire handler" and will manage the wire/tether that is attached to the VR set from the computer. Another research assistant will be the "Child handle" and will stabilize the child if the child appears to be falling or stumbling. In addition, this research assistant will be observing the child for sweating and verbal comments requesting to stop.

Children will then participate in the *Dino Dana* VR gaming experience for no more than 15 minutes. Within the VR experience, each child will visit a museum, Dana's bedroom (the hub of the game), and interact with 2 different dinosaurs.

During the VR experience, two sets of observations will be obtained: 1) a computer capture of what the child sees within the VR experience; and 2) a video recording of the child in the VR headset and their behaviors during the VR experience.

Following the VR experience, children will be interviewed about their experience and about their enjoyment of the VR experience. This interview will also be video recorded to capture open-ended responses. The post-game survey/interview will take about 20 minutes.

Parents will complete a questionnaire regarding their child's interest in dinosaurs, their family's media habits at home including use and access to different types of media platforms, their child's outdoor experiences and museum experiences, and basic demographic information.

Overall, the child interview and VR experience will take about 45 minutes. The parent survey will take about 10 minutes to complete.

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