Desert Adventures Learning App Prototype for Children – Using Xcode Swift to Create and Analyze m-STEM in Outdoor Settings

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Introduction

While many mobile applications have been developed for adult visitors to parks, museums, and nature centers, very few programs exist that are specifically designed to meet the needs of children and youth in informal science settings. During the recent Covid-19 pandemic, the use of remote learning had become particularly important due to impacts on park and museum interpretation programs for schools and youths. Many national park programs have used educational technologies such as Zoom to provide outreach to facilitate learning with schools and other young visitors (De La Rosa, 2020, sec. 22). However, there is a need to provide remote educational enrichment and learning to young visitors at sites within museum and outdoor setting as well through the use of mobile technologies and educational apps. The purpose of this research poster is to present a conceptual model the researchers designed for m-STEM that young people (ages 8-12) wanting to learn more about desert plants, animals and geology can use in local desert settings and other natural environments. In addition to describing how the Swift app was created, an analysis of the design strengths and limitations including possible future use of educational apps similar to the *Desert Adventures* app the researchers created for this project.

M-Learning for Children in Real World Environments

The adoption of mobile technologies by children has increased rapidly in the past decade from approximately 50% in 2010 to more than 97% in 2020 (CSM, 27). Within this same time frame, the number and variety of ways young people can use mobile devices for learning about nature and science both informally through photo/video activities and specialized apps such as the *Junior Ranger App* from the National Park Service, *Bird Guide* from the Audubon Society, and *MO Outdoors* from the Missouri Department of Conservation has increased though many are still primarily designed for adult users. As a result, and still quite surprisingly given the rapid explosion of remote educational technologies launched during the pandemic, there still a significant gap in the design and use of mobile apps that existed in previous studies. (Hammond-Todd, 2018). The purpose of this research was to develop a conceptual model that could serve as an educational platform for further design and testing with young visitors to parks and other natural environments.

Designing Mobile Activities for Young People

The design philosophy used for this project is simple: design for your audience. Audiences for this application will range from educators to young people. First and foremost, the app will be designed for young visitors aged 8-12 years old. Because of the limited timeframe available for this research, the app was created as a conceptual model that could be shared and discussed with educators and young people in future research. However, our work was still inspired by the work of Druin(2009), a leading scholar in the world of mobile learning who emphasizes the important role that young people play in mobile design. For now, the app prototype has been designed for ease of use by young people. Another goal of this research was to create an application that educators and coders could use to design educational experiences together. This would allow teachers of all disciplines to create mobile experiences for their students with relative ease. Due to the limited nature of the research, this must be examined more thoroughly in the future.

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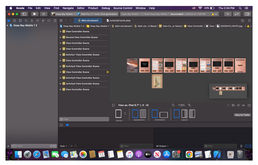
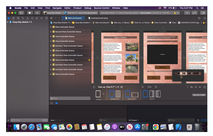
Sample XCode Screenshots of the Desert Adventure App for iPads

The Desert Adventure iPad app was created using XCode 12.1.1. The educational app is designed for 8-12 year old visitors to use at the Red Cliffs Desert Reserve located near St. George, UT. The mobile app has three outdoor learning activities about desert animals, plants, and rocks. Using photography and video prompts.



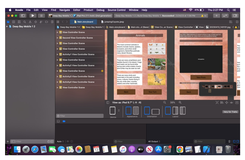
Mobile Activity #1 Plant Activity



The first mobile activity is a plant station where young visitors learn about 5 common desert plants that include text and photos. Once they learned about the plants, app users would be encouraged to find, photograph and identify one of the plants in the park.

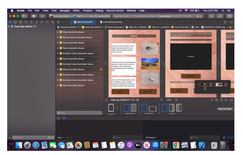
Mobile Activity # 2 Animal Activity

The second mobile activity is an animal station where young visitors learn about 5 common desert animal and animal sign activities that includes text and photos. Once they learned about animals and their signs app users would be encouraged to find, photograph and identify common animals, tracks, scat, etc.



Mobile Activity #3 Rock Activity

The final mobile activity is a rock station where young visitors learn about three types of rocks found in the desert including sedimentary, igneous and metamorphic rocks. Once they learned about the rocks, users would be encouraged to find and photograph one of the rocks found in the park or outdoor site.



App Being Run on an iOS Device

Overview of the Desert Adventure App We Developed

This prototype has three short mobile activities (desert plants, animals, and types of rocks) that students could informally complete while visiting the Red Cliffs Desert Reserve or other sites near St. George, Utah. It is also important to note that more activities could be added by future programmers and educators. The current app prototype is also a closed that is capable of operating offline system (an important feature in areas with limited connectivity) and stores all user data on the device in order to protect the privacy of young users. The researchers would like to explore changes to this in future research as connectivity may be important in sharing learning data with families, schools and science educators in park or museum interpretation programs.

There are a few ways that the app could be securely connected to national parks or other outdoor facilities. Perhaps, a QR code could be placed at the entry point of the park thus allowing users to only share data with interpretative programs at specific points therefore protecting privacy and allowing users to interact and share their discoveries with family members, teachers and park interpreters or educational staff at other organizations. Closed systems like this prototype can be a simple and economical way to protect user data and limit sharing beyond visitors and their immediate family.

References

Common Sense Media (2020). *The Common Sense Consensus: Media use by kids age zero to eight*. Common Sense Media. https://www.commonsensemedia.org/sites/default/files/research/report/2020_zero_to_eight_census_final_web.pdf

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Druin, A. (2009). *Mobile technology for children: Designing interaction for children*. Burlington: Morgan Kaufman. 353 p.

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Analysis on the Design and Effectiveness of the Mobile App

As illustrated in the screen shots, the researchers were able to create a prototype that features a short video introduction on the app. The three activities contain screens where young people would read about and explore common desert plants, animals and rocks. After young visitors read about each of these topics, the users would then be prompted/encouraged to take a photo of common plants, animal or animal signs, and rocks found at the reserve. The *Desert Adventure* app concludes with a final video reflection about what they most enjoyed learning about using the app in the desert reserve.

This app aims to create a model educational learning tool which allows young people to explore and interact with the real-world environment. Activities in other mobile applications could range from identifying insects in their own backyard to constructing rudimentary robots or other simple engineering activities that could be shared with schools and other educators. This app may have particular value in rural and remote settings where closed systems, limited connectivity, and remote learning are most common. The possibilities are endless and could hopefully open a new portal to enrich the minds of the coming generations. Simplicity is key so that the app can be used on a variety of devices (including older devices) by a wide variety of people.

Conclusion, Key Questions and Next Steps in e-STEM or m-STEM Learning With Young People as Co-designers

As with most research, there were significant challenges and limitations with the development of the *Desert Adventures* app prototype. Funding and coding proficiency for designing educational apps like these can be a significant challenge for parks, museums and other informal science organization including the authors of this research. Participatory design with young people as described by Druin (2009) also requires a significant amount of time for prototyping and full app development. However, there are significant opportunities in this important area of m-STEM as well that were identified in our research. The authors noted that coding and app prototyping, while still being highly technical, is much more accessible than it was even five years ago. The software used in this project is also compatible with a wider variety of mobile devices including older iPads commonly owned by schools, museums, and many families.

In concluding the work presented here, the authors note three key areas where future research is needed. These include:

- *Research that moves beyond design prototyping and involves more young people in informal and outdoor STEM app design.*
- *Research related to the design and testing of mobile learning apps on other platforms such as Android and Python.*
- *Research that explores user safety and security for young people when operating and/or sharing interpretive app data (photos/media) with families, schools and/or parks and museums.*

As illuminated in this poster, it is evident that there is a great deal of educational potential and future research needed within the field of interactive and outdoor-based m-STEM app design that includes numerous research topics university students, coders, and educators can explore at Utah Tech University and other science educational organizations and polytechnic centers.