

Sol y Agua Project: Enhancing Middle School Education through Computing with an Emphasis on Simulation and Data Science

Abstract

Sol Y Agua is an educational game created for middleschool students and centered on planning the design of a park. The game teaches them about water sustainability, and complementary environmental issues relating to the relationship between the people living in the Southwest United States region, and the environment's availability of water. The game aims at motivating students to develop an environmentally conscious mindset as well as inspiring them to pursue STEM (Science Technology Engineering and Mathematics) disciplines. The game utilizes the Texas Essential Knowledge and Skills Standards (TEKS) [1] to ensure academic relevancy to the classroom. The game has an emphasis in promoting the demographic of this area and minorities towards developing careers in STEM, where they are largely underrepresented.



Decision Making—Students are challenged to integrate knowledge to choose most efficient landscape items when choosing among different plant for park design.





The game reinforces:

- Data-analytical skills
- Decision-making skills
- Socio-Educational skills [2]

The game makes use of simulations to augment and complement classroom lessons

The game gives access to real-world data, breaking the spatial limitations of the classroom

Approach

Students will be able to make predictions and conclusions using data visualization

Students can make informed decisions equipped with knowledge gained from the data

Students will challenge their perspective through the use of immersive technologies [3]

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Figure 1: Park Design Layout

Figure 6: Watershed map of Hueco Tanks region

Information Overload—Students will be exposed to a variety of information sources, from which they will need to obtain relevant information.

Figure 2: Example page from the plant catalog

Mathematics—Students must use math skills to optimize resource usage learn proper lab safety and procedures apply the scientific method to comtypes.



Figure 7: Tree shade visualization

Data Visualization—Students will be able to access various form of data visualization to help with the information overload.

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Figure 3: Personal Protective Equipment Diagram

Safety and Procedures—Students will before entering virtual lab.

Data Gathering—Students will gather, **Research**—Students will learn how to retrieve, analyze, and record actual waplete science activities using the virtual ter sample data through virtual lab exlab that simulates science experiments. periments.





Figure 8: Plant attributes and necessities analysis

Data Analysis—Students will be able to generate conclusions and gather relevant data by using data analysis.



Figure 9: Water atrophy visualization

Data Interaction—Students will interact with real-time data to make informed decisions.

Future Work

- Project is in Prototype Stage. Educators will conduct Beta Testing in the classrooms.
- •Evaluators will collect feed-
- back and usage data from students and educators.
- •Development team will modify game based on evaluations.
- The development team will incorporate new activities derived from the TEKS standards.
- The development team will evaluate the possibility of expansion to other regions and other languages.

Figure 4: Measuring the pH Level in water samples

Figure 5: Analysis and recording of pH levels

Figure 10: Water sources across time

Information Evolution—Students will be able to discern changes in data across time.

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References:

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[2] Gardner, R. C. (1988), The Socio-Educational Model of Second-Language Learning: Assumptions, Findings, and Issues. Language Learning, 38: 101–126.

[3] E. Klopfer, 'Authentic Outcomes', *Augmented Learning*, pp 129-146, 2008.