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Mission HydroSci

Designing a Game for NGSS

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Abstract

Mission HydroSci is a game-based 3D virtual environment for supporting student learning related to water systems and scientific argumentation. Scientific argumentation is a central epistemic practice within science and necessary for the kind of science learning envisioned by the *Next Generation Science Standards* (NGSS). Our poster discusses our progress in year 1 of a funded project to develop a game for middle school science as well as presents critical lessons learned.

Introduction

The recently developed *Next Generation Science Standards* (NGSS Lead States, 2013) provides a vision for science teaching and learning in the 21st century. Central to this vision is the necessary linkage of disciplinary core ideas, cross-cutting themes, and scientific practices. Based on this framework, the primary focus of science education should be to create opportunities for students to build understandings of the big ideas of science, apply principles that cut across science disciplines such as causal reasoning and scale, and employ scientific practices. Meeting these new science education goals requires rich learning contexts for exploring substantive science ideas through engagement in scientific practices. Virtual learning environments (VLE) can be leveraged to create these rich contexts and gameplay can motivate students to explore and build understanding of core ideas while using science practices to transform these environments and solve problems.

MHS is a game-based, 3D virtual learning environment and curriculum that instantiates the vision of integrating students learning of core ideas (water systems science) with the use of science practices (scientific argumentation). MHS is being developed for middle school science as a replacement unit of about 12 to 15 hours of instructional time. MHS is being developed in Unity and includes narrative-based game play, learning progressions for water systems science and scientific argumentation, a teacher support system, and learning analytics.

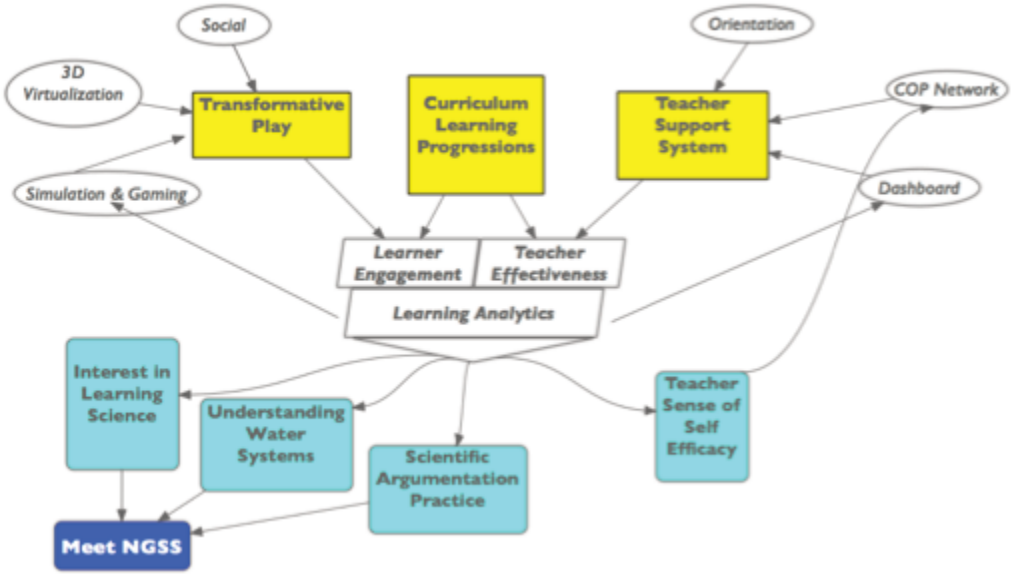

Figure 1. A logic model for how MHS enlists game-based 3D VLE to meet NGSS.

Game Play (brief)

Student-players will be engaged in a narrative about needing to explore, develop and manage water resources on a distant planet in the face of water shortages and subsequent strife on earth. The game play is setup as a series of missions such as exploring and defining the qualities of a watershed, tracking a pollutant in a watershed, and locating and developing an aquifer. These missions are the context and methods for meeting learning objectives and building understanding about water systems. As they undertake these missions the student-players are given construction, investigation and exploration tasks through which they acquire data. For example in a pollutant-tracking task they traverse the terrain of a watershed placing sensors at various points in the river and stream systems. The output of these sensors and their placement locations along with information collected from various non-player characters or resource materials become data and evidence for use in arguing where and how to eradicate the pollutant or for arguing that the problem has been solved and the mission can continue. Figure 2 shows some sample elements of the MHS environment.

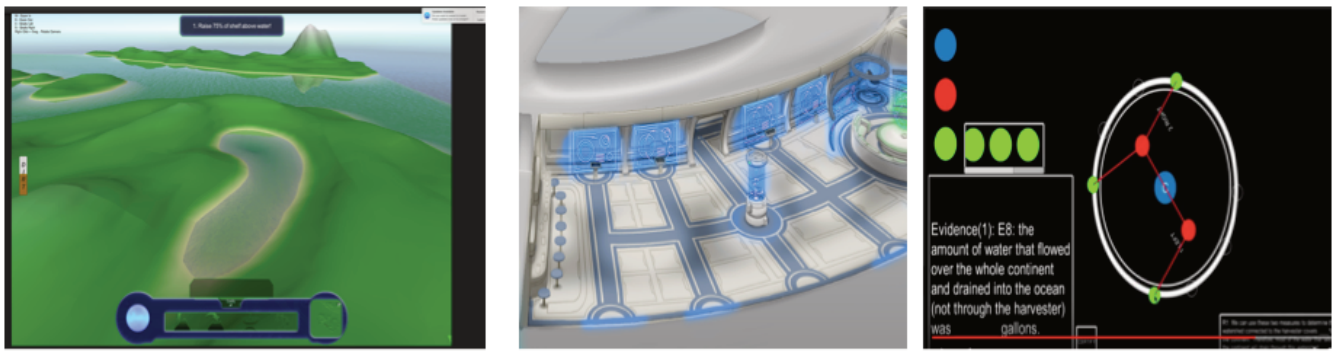

Figure 2. From left to right, a simulator for shaping and investigating watersheds, concept art for parts of the spaceship, and a mechanism for connecting claims, evidence and reasoning.

Lessons Being Learned

In the short space of this 2-page poster prospectus we will limit our discussion to 2 key lessons. The first lesson is in the need for strong and persistent communication/feedback between the various sub teams of the project. As with many software development projects we began with a flexible but document driven process. The various sub teams would be responsible for generating design documents which would advance in technical detail until they specified the software to be produced. Unfortunately the coding, art development and narrative work for our 3D VLE has been rather time consuming and the sub teams contributing to the design were not getting feedback in sufficient time to understand how to design the next elements. This feedback process is critical for curriculum designers to see and understand what is possible and what are the implications of various design decisions. We knew that MHS was a co-construction and iterative task among curriculum, game narrative, art work, software development and analytics, but we were not being as successful as we needed for each element to get feedback for improvement and taking on the next challenge. We are taking several steps in response to this need for process improvement. We are redesigning some of the aspects of MHS so they will be easier and more rapidly developed. We are including more cognitive walkthroughs of the game play elements at earlier points in development so the full team can see and discuss what is being said and what is being heard from within the design documents. And finally, we are placing more emphasis on getting artwork rapidly into the process, from sketches that curriculum team members might make of river systems to 3D artwork being developed for representations in the game. These changes are helping to make feedback and communication in our design process more rapid, more targeted and more visual.

The second lesson addresses the need for developing a huge amount of artwork along with needing that artwork in early visuals used in the design process, storyboards, and quality assurance testing as well as having it ready for usability testing when kids will actually experience the game. The problem with only having art products ready for usability testing is that their integration with other elements of MHS, such as how well they represent the curriculum concept or how they shape the experience of the player cannot be understood until far down the road. Our approach to improving this process is to see the artwork more as a process than as a product and moving it through various iterations from concept art to initial 3D representation, to more and more textured versions.

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References

NGSS Lead States. (2013). *Next Generation Science Standards: For States, By State*s. Washington, DC: The National Academies Press.