

## **One Planet Education Network (OPEN) Title I Research Criteria**

One Planet Education Network (OPEN), through its design and research collaboration with Quest Atlantis (QA), submits all its 3D virtual learning environments to rigorous empirical design studies. This serves not only to document the strengths of each unit, but to also identify necessary changes in subsequent design iterations. Before a QA learning mission can be made available to students it first is tested in numerous classrooms, in a variety of demographic settings, and must show evidence of significant gains in areas including learning, motivation, domain content and domain tasks, as well as qualitative and affective measures.

Quest Atlantis systematically employs empirical methods in its data collection and research implementations. This includes rigorous data analyses that are adequate to test the stated hypotheses and justify the general conclusions drawn. The attached research summary (below) demonstrates our rigorous research methodologies, which provide reliable and valid data across evaluators and observers. In the case of qualitative or ethnographic research elements, observations are documented in multiple modalities (including video, audio, interviews, document analysis, etc), coded systematically, and submitted to inter-rater reliability across multiple measurements and different investigators.

Our research methodology is typically either an experimental or quasi-experimental design (due to intact nature of school classrooms). In the case of intact classrooms, all students within that class are randomly assigned to different conditions, and control classrooms or groups are used where that is non-detrimental to student learning and outcomes.

Quest Atlantis research is consistently published in the highest peer-reviewed journals, and authored by some of the brightest researchers in the field. We include ample evidence to meet the high rigor of the academic scientific community, to allow for replication, and to promote the building of sound theory and its application to learning contexts.

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The following research summary is one recent instantiation of the methodologies described above. For additional and more extensive examples, please see any of our published articles in their entirety (see references).

### **Mesa Verde Unit**

#### **General Approach and Rationale**

This study examined two classrooms as they participated in the virtual Mesa Verde National Park, a virtual world created within the 3D MUVE of Quest Atlantis. In all two classrooms, the study included quantitative measures of learning, as well as ethnographic measures (Stake, 1992) of motivation, engagement, and virtual presence (akin to immersion). The research measures were both qualitative and quantitative in nature, including traditional written assessments, and ethnographic and observational data techniques. Consistent with Ann Brown's (1992) notion of design experiments it combined a naturalistic school setting with theoretically-driven research questions in two iterations of

the curriculum (out of the larger design experiment trajectory). These questions served to measure local contextual experiences with an eye towards informing theory and raising avenues for further design iterations and future theoretical research avenues.

### **Participants**

Participants included students from two urban public classrooms. Two of those classrooms consisted of 7th grade students from an urban Southern middle school (N= 49). This school has a predominantly African-American population (62%), with Hispanic (20%) and Caucasian students (20%) represented equally. Approximately 37% of these students receive free or reduced lunch. Students participated as part of their daily class experience over the course of seven days. Groups in this study were based upon intact classrooms. All students and teachers had experience in Quest Atlantis previously. The urban students had completed an introductory mission (three day duration) and one additional Quest (one day duration). The rural students had completed the introductory mission as well as a week-long mission in Quest Atlantis (Ingolstadt). All teachers involved have participated in QA's professional development training, although they were not given training specific to the Mesa Verde unit. The urban teachers have 1 year of QA experience. Teachers were given a Mesa Verde Unit Plan to guide them in providing classroom activities and discussions to enrich the computer guided experience.

### **Curricular Standards**

The pre and post test were designed to address the standards covered in the Mesa Verde curriculum. These standards correspond to the social sciences standards as indexed by McREL (a national repository of state standards), as well as meeting the curricular standards as provided by the Mesa Verde Educational Program ([http://www.nps.gov/archive/meve/edu\\_resources/curriculum\\_standards.htm](http://www.nps.gov/archive/meve/edu_resources/curriculum_standards.htm), accessed 11/24/08) and geared for 4<sup>th</sup>-7<sup>th</sup> grades. The curricular experience was designed for students from grades 4<sup>th</sup>-7<sup>th</sup> with the teacher being able to emphasize different aspects and to change expectations of submitted work dependent on grade level and ability. Teachers and students agreed that the difficulty level was appropriate for their grades. Reading level for the text within the 3D world is approximately 6<sup>th</sup> grade. However, the implementation was carried out successfully in classes with grades from 4<sup>th</sup> to 7<sup>th</sup>. Teachers supported the notion that this curriculum could be done in a variety of grades, suggesting that the expectations for their written submissions would change accordingly, but the curriculum itself was applicable for 4<sup>th</sup>-8<sup>th</sup> grades with limited scaffolding to support younger students in reading some content.

These standards include Geography (migration, settlement, adaptation to environment, cultural diffusion and interaction), History (change and continuity, timelines, tools & technology, emergence of civilizations, agricultural societies) as well as Art (pottery, petroglyphs, jewelry, etc) and issues related to the sciences of Anthropology and Archeology. Some examples of these curricular standards include:

- Knows the ways in which human systems develop in response to conditions in the physical environment.
- Students understand how economic, political, cultural, and social processes interact to shape patterns of human populations, interdependence, cooperation, and conflict.
- Students know the characteristics, location, distribution, and migration of human populations.
- Students understand the effects of interactions between human and physical systems and the changes in meaning, use, distribution, and importance of resources.
- Knows reasons for the growth and decline of settlements
- Understands what archaeological evidence reveals about the social and cultural conditions of agricultural societies

- Knows the effect of new tools and other objects on early farming settlements
- Knows ways in which technology and society influence one another
- Students know and understand interrelationships among science, technology, and human activity and how they can affect the world.
- Knows that language, stories, folktales, music, and artistic creations are expressions of culture
- Students understand that because of the condition of scarcity, decisions must be made, influenced by incentives about the use of resources and that these choices involve costs.
- Students use a variety of tools and techniques to measure, apply the results in problem solving situations, and communicate the reasoning used in solving these problems.

### **Curriculum**

The Mesa Verde Unit provides students with an opportunity to travel back in time to learn more about the Ancestral Puebloan people who inhabited an area in the American southwest over 1400 years ago. Students are first contacted by Lorisa, a modern day Hopi woman, who is haunted by dreams and images after neglecting to speak up on behalf of her ancestral history. She invites Questers to travel to Mesa Verde to help her to understand the meaning behind the strange images. Students learn how the land shaped these people, as much as they shaped the land which they inhabited, as they experience both life in the pueblo and the conditions which eventually led to the evacuation of the place the Ancestral Puebloans called home for over 700 years. Questers come to understand the importance of community, gain an appreciation of the rich art and culture of this civilization, and learn how the Ancestral Puebloans overcame the physical constraints of the land through the development of tools which allowed their community to thrive for so long.

Finally, students begin to understand the importance of creating and sharing stories as one means of communicating a history, and a life, as they learn that the images in Lorisa's dreams were actually part of a petroglyph which tells the story of this rich and beautiful civilization. Working with Ranger Larry, students share what they've learned as they understand both the importance and challenges of maintaining a National Park. Through participation in the unit, students (a) learn how the land can shape people just as much as people can shape the land; (b) understand how successful societies sometimes grow in a manner that challenges sustainability; (c) learn that civilizations are able to overcome physical constraints through the development of tools and technology; (d) realize that people develop art as an expression of their culture; (e) gain an appreciation for stories and the power they hold for preserving and communicating history and culture as it relates to both ancient civilizations and our own; and (f) understand the importance of preserving the rich history and culture of the Ancestral Puebloan people.

### **Measures and Instrumentation**

#### **Learning Gains**

Measures included quantitative assessments and ethnographic techniques for gathering observational and qualitative data. Learning gains were measured by a pretest and posttest, which were the same test for all classes. The questions were generated from the curricular standards covered in the Mesa Verde curriculum in Quest Atlantis, as stated above. The two educators involved in this implementation were given a copy of the pre/post test and examined the test for face validity. A copy of the pre/posttest is available. A rubric was created to analyze all open-ended responses. This rubric was used in scoring all pre and post tests by two independent raters, and results were submitted to measures of interrater reliability, with  $\alpha = .86$ . The four Quests from this mission were also scored by each teacher for class credit. These Quests reviewed by the research team for their depth of disciplinary content, inquiry-based reasoning, sense of virtual presence, and application to real-world scenarios. Final results for the

one North Carolina class in which pre-post data was collected, show that students had statistically significant improvements from pretest ( $M = 7.10$ ,  $SD = 3.62$ ) to posttest ( $M = 19.45$ ,  $SD = 4.38$ ),  $t(19) = 19.8$ ,  $p < .01$ .

### **Interviews**

Students completed self-reports, personal interviews, and were observed by researchers during the learning process. The teachers were also interviewed as experts in the field, as well as individuals who know these students personally and are sensitive to their various levels of engagement in learning. Interviews, both impromptu and structured, served to inform the emerging assertions. Structured interviews were conducted on the last day of the implementation and recorded and transcribed in their entirety. The protocol of questions for both teacher and for students has been used in multiple research implementations and found to be reliable.

### **Additional Qualitative Data**

In addition to the interview protocols, the qualitative methodologies for data collection also included observation, documentation, and document analysis. This type of data helps the researchers identify the strengths of the unit, create potential hypotheses for further study, and identify changes needed in our subsequent design trajectories. For the entirety of the implementations in the two classes, researchers observed and kept field notes of their observations. All of the class implementations were recorded both on audio and video tapes. Document analysis included an examination of the written assignments, Quests, reflections, and chat logs.

#### Summary of Qualitative Data Collection Methods:

Interview data:

- Student and teacher structured interviews (see attached for full interview protocol)
- Daily researcher debriefing
- Discussions and conversations with students as they engaged the curricula

Observational data:

- Ethnographic field notes
- Video camera footage of all class sessions
- Audio recording of group work
- Multiple observers

Documentation:

- Chat logs
- Written assignments
- Transcripts of video and audio files
- Student reflections

### **Qualitative Interpretations and Excerpts**

Extensive documentation and ethnographic observations resulted in multiple sources of data, which emerged around several themes. The following excerpts were selected as being representative of the messages which were communicated repeatedly and in several data forms, triangulating as key findings of this study.

**Domain Content and Activities.** The teacher interviews supported the notion that this unit was multi-faceted and effectual both in **domain content** and in **domain-based tasks**. For example, a teacher summarized the key lessons learned:

“This unit taught the students about archeology, artifacts, and anthropology, a specific ancient culture and the science of preserving it. They definitely learned a lot through reading, writing, and problem-solving, which are huge parts of QA. Using the facts that they learned in the world, they could explain someone else’s viewpoint, which is really critical at this age. A lot of them do not have the schema to respond to writing prompts; they don’t know which information to give or write about. With QA they’re able to gather that information and use it, and feel really good about what they are writing.”

The teachers particularly appreciated the reading in this unit, and how it becomes a part of the game, a means towards success, rather than some arduous assignment.

“We can’t complain about the reading. The more, the better, and we love that about QA. It took my kids a couple of to figure out that they *had* to read; they can’t just skip over information and expect to get it, like they often do in school. They are 7<sup>th</sup> graders, and they usually don’t like to read. But here reading becomes part of the bigger game, and they know they can’t solve the story without reading.”

**Student Ownership and Authority.** Most importantly, several teachers commented on **student ownership of learning** in this unit. For example, a 7<sup>th</sup> grade teacher commented:

“I think this unit puts the kids into a position of power and authority in their own learning. They are positioned as experts, and asked to share their opinions. They couldn’t just get the answers from us, as teachers. And this taught us teachers something also; we tend to be overly generous in giving the students answers. What we saw here is that they can figure it out on their own, and they weren’t overly frustrated. They didn’t quit. They were happy and very eager to keep working at it.”

**Engagement.** A keen sense of **engagement and motivation** was very evident in all class observations and interviews.

One teacher explained from where some of this excitement stemmed:

“I think originally they got caught up with the fact that Mesa Verde is a real place they could visit, on earth somewhere. It was later when they got into the mission of Mesa Verde that it got even better; that they realized, “Oh Wow! We get to go back in time!” One of them even said to me, “Ms. Smith, wouldn’t this be cool if we had this for all our units? You’re always making comments about how much you wish you could take us back in time to see history, but that a time machine doesn’t exist. Well, now it does!” And I thought, yes, this is really the only way for them to ever experience history.”

Similarly, a 7<sup>th</sup> grade teacher commented on the excitement that the time shift and 3D technology was able to create:

“They are really excited about the time shift element; that was the big excitement, when that happened. This is such an amazing shift of environment, with some things familiar and some things different; I mean, they can see it is the same spot in Mesa Verde, but clearly in a different time period. That was really exciting.

A girl in the 7<sup>th</sup> grade class echoed this excitement when she announced with enthusiasm:

“Hey, we get to go back in time! This is so cool! (With two thumbs up and pumping the air).

One of the **motivating factors** that repeatedly emerged in the observations was the **narrative** driving the Mesa Verde unit. The students took their roles seriously, engaged in them, and were motivated by them. For example:

“The kids really got into Mesa Verde because it was a mission; it had a story behind it. They really love the stories, they love the drama.” – 7<sup>th</sup> Grade teacher.

“I was really focused and serious during this unit, I wasn’t fooling around. I was really into the missions.”  
– 7<sup>th</sup> grade boy

“We are learning the same things we would in class, but it’s a lot more fun than just hearing about them. We get to live that life!”- 7<sup>th</sup> grade girl

All the teachers involved took on their respective roles in the narrative as well, engaging in the missions alongside students. For example, a 7<sup>th</sup> grade teacher noted:

“The first Quest in Mesa Verde, is to write a letter to Ranger Larry, so when I gave feedback, I wrote back as Ranger Larry, keeping with the game. It makes it more fun that way; for me too!”

**Authenticity** of the location seemed to be a strong element of their motivation and engagement as well:

“I thought it was really cool that this place, Mesa Verde, actually exists! I feel like I have already been there, and know my way around. And I think that if I ever visit Mesa Verde, I’ll already know way more about it than most people who visit it in person.” -7<sup>th</sup> grade girl

One of the teachers pointed out that students were all asking their parents if they could go to Mesa Verde in person. This finding is interesting, as some might fear a virtual experience could replace the need to visit. Instead it seems it sparked more interest in the real location, and also interest in protecting these places, as one teacher summarized:

“This is really, really great for the National Parks System. I mean, the kids are all saying now, “Wow, we want to go to Mesa Verde and see this in person!” They are getting really excited about the protected places in America. In order for them to understand why it’s important to save historical places, such as Mesa Verde, the kids really have to have a sense of being there. Here they get to experience it, how it looks and its feels, and this is a huge step forward for that.”

**Immersion or ‘Virtual Presence’** (a sense of ‘virtually being there’) was one of the most monumental findings of this study, both for its ubiquity, and for its role in motivating learning. Students became incredibly caught up in the experience and their roles, feeling as if they were there, and actively participating as first person actors in their own learning. The 7<sup>th</sup> grade teacher summarized it well:

“The sense of immersion is amazing! It’s like taking them on a field trip. They really get the sense of size and grandeur of the place. This isn’t a museum sized place; its huge, and there are canyons, and cliffs, and ruins, and ladders to climb, and here’s their crops. The sense of time, place, and history is a HUGE abstract concept for the kids to get, and only in a site like this can they experience something that profound. I, as a teacher, can’t create that!”

“Their sense of immersion shows up immediately, as soon as they log in and their avatar shows up on the screen; “I’m down in the kiva right now, talking to Lorisa!” or when they emerge in the past, “Wait, this isn’t our usual place. What’s going on here, have we traveled back in time?” They speak about their avatar as if it is them. And it is so interesting to watch them when the technology isn’t working as fast as they want it to; their frustration is so profound! It really throws them, because they are expecting to move just as freely as they do in person; they feel it is them, just in a new place. It always happens quickly in Quest Atlantis, but its particularly strong in this one. They aren’t observing Mesa Verde, they are living it.

This excerpt further illustrates a sense of **'virtual presence'** in the 3D world, and how students become personally engaged in the storyline; this student excitedly stood up in the middle of the computer lab to announce to everyone they were about to meet one of the virtual characters they had heard much about:

"Hey, Everybody! Everybody! We get to meet Lorisa! She is really here! She is really here in person, and we get to meet her!" -7<sup>th</sup> grade boy, talking about a woman in the 3D world.

"I am so pretty as an Ancient Puebloan! Check me out!" -7<sup>th</sup> grade girl, after her clothes had changed from going back in time.

"When I was making my own shoes and grinding corn, I felt like I was really there doing it, not some animated character." -7<sup>th</sup> grade boy, describing his sense of 'being there'.

The students were actively creating their own learning, as they engaged in their roles. They lived a day in the life of the ancient people and learned many valuable lessons, that can only be gained experientially:

"Wow, they had to work so hard just to get through the day! They had to cope with the environment and learn how to survive with nature and with one another. I mean, how they lived....It really took an entire village!" -7<sup>th</sup> grade girl

"I couldn't have lived back then. It was too much work; plus I couldn't live without my technology!" -7<sup>th</sup> grade boy

"They really had to learn to live together and with nature...they had to learn how to be a tribe together. Community was really important." -7<sup>th</sup> grade boy

"They're learning about their lifestyle, even the lifespan; they discover that the girl they met in the previous generation had passed away at the really old age of 30! Well, yes, if you're hauling water, day in and day out, and making your own pottery, and growing your own food, and living in the time of herbs, rather than medicines, yes, your lifespan would be shorter." -7<sup>th</sup> grade teacher

**Storytelling and Oral Histories.** One of the ancient activities that really captured student attention and imagination was when they learned about **storytelling** and how their oral histories were captured on petroglyphs. They were guided in how to interpret these glyphs, and then asked to write their own story and draw their own glyph. The unit here connected into something that teachers and students both agreed isn't usually taught in schools, yet incredibly valuable. One 7<sup>th</sup> grade teacher summarized:

"I think we have really lost the art of story-telling. When the mission asked students to write their own family story, their first response was, "I don't have a family story!" So I asked them what they talk about when they get together with their families, any funny conversations, or ongoing stories they share, and they said no, they really don't have those. There are so many other things that fill their lives now. They have so much instant gratification in other ways now that they really don't have to make up stories anymore. They can just turn them on."

"The students were really intrigued by the petroglyphs, and by interpreting them. They were talking even with people who weren't in the Mesa Verde experience. They would stop and ask their friends

(showing the petroglyphs), “Hey, what do you think this means?” They were really trying to problem-solve and make those connections between their own life, their own story, and the petroglyphs they were interpreting in QA.”

**Personal Connections.** In relating their lives to the lives of the Ancient Puebloans, the students began to see them as real people, and notice the similarities they shared. One teacher shared this experience: “One of the girls in my class has Chinese heritage and she made a great connection. She said, “In our old stories, people don’t use medicines, they use herbs for medicines rather than those from a doctor’s office. These ancient people must have used herbs for their medicine too!”

In closing, these are some of the comments provided when students were asked what they felt was the **most important thing they learned in this unit:**

“That the land shapes the people and the people shape the land.”

“I thought that Native American lived a very plain and simple life. But when I read their stories, and saw their craftsmanship, I thought that they lived a very unique life.”

“If you work hard for something, it will really payoff.”

“We can appreciate the ancestors of the Native Americans who were first here in this country, their rich culture, and we can appreciate our own ancestors.”

Similarly, when asked about their **favorite aspects of this unit**, students repeatedly responded with the following: its real location, authentic activities (‘watering the crops with my own handmade pot’, ‘making my own shoes’, ‘helping Puebloans prepare their meal’, etc), the graphics and beautiful places, ‘creating my own story’ and ‘the petroglyph of my own life’, and that ‘it makes you feel like you are really there’.